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Can higher education foster economic growth?

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On October 30, 2006, the Chicago Fed will host a conference on higher education's role in economic growth. Speakers will include Richard Lester of MIT, Michael Luger of the University of North Carolina, Ned Hill of Cleveland State, Sean Safford of the University of Chicago Graduate School of Business, Larry Isaak of the Midwest Higher Education Compact, and Randy Eberts of the Upjohn Institute.

For more information on the conference, titled "Can Higher Education Foster Economic Growth?," please visit: www.chicagofed.org/highereducationconference.

Countless observers have suggested that the role of higher education in a knowledge-driven economy has never been more crucial as innovation and human capital are seen as keys to future economic growth. For mature regions, such as the Midwest, it could be argued that colleges and universities might play an even larger role. The region is not likely to see rapid population growth and is home to many mature industries, placing a relatively high premium on innovation for transforming the economy. For the Midwest, it would appear that outsized productivity growth will be needed if the region is to hold its own against competing regions. The question is: Can the university system in the region foster these opportunities?

Not a settled question

Not all observers agree that higher education and economic growth are obvious or necessary bedfellows. On the one hand, prominent studies[1] have reported on the direct and indirect economic impacts of universities on their local communities and regions.[2] However, work by Richard Vedder[3] has questioned whether spending more on higher education necessarily provides larger returns for the local economy. Vedder's work has found that states with higher spending on colleges and universities often fail to have faster economic growth than states with lower spending, even after controlling for differences in other key variables. While Vedder does not question whether higher education is an important ingredient in promoting economic growth, he does suggest that the returns to public investment in higher education may be limited.

Some of this controversy comes about because of the difficulty of measuring the exact contribution of colleges and universities to economic growth. Standard economic base analysis can do a good job of accounting for the payroll, spending, and employment contributions of a university to a community but relies on estimates of economic multipliers to determine the secondary benefits of university activities. Studies have produced a range of multipliers (ranging from 1.0 to 3.1), and estimates of economic benefits are highly sensitive to the choice of multiplier. Perhaps most problematic is that these studies cannot provide any estimate of whether this is the best use of economic assets for a given region. If the university were not in the community, the same land and resources would undoubtedly have been used for some other activity and may have produced a similar or higher level of economic growth. Other studies focus on the influence of universities' outputs

on human capital and technology. These studies examine the role of higher wages received by college graduates in the local economy as reflected in higher tax revenues, consumer spending, and personal savings. Of course, for college towns to capture such benefits, graduates need to stay in the communities where they were educated.

So where does that leave us?

The Massachusetts Institute of Technology (MIT), in conjunction with the University of Cambridge in the UK, has developed an international research consortium to examine universities, innovation, and the competitiveness of local economies. The structure for this joint project (hereafter the MIT project) is to examine how universities can contribute to local innovation. At the core of the work is the belief that local economies succeed when firms are able to respond to changing market conditions by producing new products, services, and production methods. The role of the university in promoting these can take many forms. Most visible are technology transfer programs. Often such programs allow universities to commercialize cutting edge research. This can provide benefits to a local economy through the spinoff of new businesses, but often significant benefits accrue simply by creating a place where talented people in a similar field can meet and discuss their research.

As the MIT project has revealed, the role of universities as a public forum for discussing ideas and as a platform for creating opportunities for firms to apply new technologies to their businesses can be significant. The work has also pointed to the role of universities in education and work force development. To date, the MIT project has found that universities are most successful in influencing economic growth when they are attuned to the economic structure of their local economies. The nature of the industrial transformation in the local economy in large part defines what the best role is for the university to help contribute to change.

Overestimating the importance of technology transfer

Richard Lester, the director of the MIT project, suggests that much of the focus on the role of universities in economic development, in particular technology transfer, has been fueled by a handful of regional transformations, such as Silicon Valley, the North Carolina Research Triangle, and the Boston area, where universities have had highly visible roles in changing local economies.[4] This model envisions cutting edge research leading to the development of patents and licenses, which in turn lead to new technology companies. However, while this model has produced some notable successes, it is difficult to replicate and often fails to produce large-scale success. For example, new university-based business formation represents only 2% to 3% of all new U.S. business starts, and university patents contribute only 3,700 of 150,000 total U.S. patents in a year.

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Even from the universities' perspective, licensing revenues often disappoint. In 2003, only 4% of total research and development funds at universities came from licensing revenues, and most of this was highly concentrated at a handful of universities. Lester suggests that technology transfer does have less tangible benefits, such as creating an entrepreneurial culture in the university, but that it may have less of a role in economic development than other university functions that provide human capital and enhance the social capital of a region.

In the MIT model, the focus is on the local firms' capacity and the local industry structure. The university's role goes beyond creating new industries and can focus on the ability of local firms to take up and apply new knowledge to their existing businesses. The measure of success is the ability of local firms to adapt and successfully compete in an ever changing market. At issue is to what degree the local university is actively engaged in helping with this industrial transformation, whether it is through products, services, or the production process. The MIT project has focused on 23 separate locations with industries ranging from mature manufacturing (machinery and automotive) to emerging fields (bioinformatics and optoelectronics). These locations include high tech regions, such as Boston, and less favored mature regions, such as Youngstown, OH, and Allentown, PA. In each case, a different model of economic growth emerged based on a local industry structure. The MIT project identified four basic types of industrial transformation.

- Indigenous creation. This is the case of a new industry emerging that has no prior antecedent in the region. This is often directly related to a spinoff of a technology from a university. While this sort of development can receive a great deal of attention, it is relatively rare.
- Transplantation. In this case, an industry is new to a region, but it primarily develops through the transplanting of an existing industry to a new location, e.g., the development of the auto industry in the South.
- Diversification into related industries. In this case, an existing industry goes into decline, but a related industry emerges that can take advantage of the mature industry's core technology. An example is the emergence of the polymer engineering and manufacturing industry in Akron, OH. As the tire industry disappeared, a new industry was able to capitalize on the understanding of polymers that is key to synthetic rubber tire production.
- Upgrading an existing industry. This entails the application of new production technology that can also lead to the development of new products or services. A study from the MIT project described the revitalization of the

industrial machinery business in Tampere, Finland, as an example of the integration of electronics, control, and communications technologies into a traditional product that benefited the forestry, paper, and transportation industries.

In each of these cases, universities played different roles and provided varying levels of support. Usually the transformation was driven by the individual firm and its interest in remaining competitive. Ideas on how best to compete were gleaned not only from the local university, but also from suppliers, competitors, and internal sources. The sources of university support generally fell into four categories. Often the university was instrumental in providing or enhancing local human capital at either the undergraduate, master's, doctoral, mid-career, or executive level. Universities also increased the local capacity for problem solving. This can include everything from contract research, faculty consulting, and technology licensing to setting up incubators and providing specialized equipment or instruments. An often overlooked function of universities is their simply providing public space and hosting meetings and forums that can bring investors, companies, and academics together. Finally, universities can be a source of codified knowledge, providing comprehensive references on technical standards, patents, and other criteria.

One of the key findings of this project is that no single strategy of university engagement is the panacea for aiding economic growth everywhere. What works is largely determined by the type of industrial transformation that is being attempted. For example, in the case of the creation of a new industry, the key activities support various aspects of new business formation. The university is often a broker between the university's researchers and local entrepreneurs. In the case of transplanted industries, a key university function is producing manpower for the firm and often creating a curriculum and a continuing education program that support the firm's growth. For cases involving the diversification of existing firms, the university can often serve to link firms together, allowing them to consider how the technology might be applied to their businesses. When local firms are attempting to upgrade their technology base, universities can often serve as problem solvers, offering consulting and contract research opportunities.

How does this apply to the Midwest?

In some ways, the Midwest matches up quite favorably to the model of university aided economic development discussed previously. The Seventh Federal Reserve District comprises all of Iowa and most of Wisconsin, Illinois, Indiana, and Michigan—five states that are home to 513 colleges and universities, ranging from internationally renowned research universities to locally focused community colleges. This variety suggests that various higher education institutions are available to help meet the needs of a wide range of firms and economic development goals. For this model of development to work, we must recognize that higher education institutions have different roles and capacities, and it would be unrealistic to expect individual colleges or universities to fulfill all roles. For example, the University of Chicago would be unlikely to focus on meeting the local manpower needs of firms through vocational training; however, through its executive and evening MBA programs, it is able to enhance the management skills available at many local companies. Local community colleges are unlikely to provide the science and engineering know-how that could create new industries, but they are often excellent sources of local labor skills training and can provide meeting spaces and forums for local firms. So, diversity among institutions of higher learning is undoubtedly a strength.

Considering the MIT model, it would appear that the most immediate needs for a mature industrial region would focus on diversifying old industries into related new industries and upgrading existing industries. In both cases, the role of the university is one of facilitator and technical expert, creating linkages across sectors in the economy and providing the expertise and work force to meet firms' needs.

Work by Safford (2004)[5] examines the role of universities in helping two mature industrial centers—Akron, OH, and Rochester, NY—manage structural economic change. In the case of Akron, Safford found that the University of Akron was able to build on its reputation in polymer research to help local firms develop polymer-based industries to help cushion the decline of the tire industry. In Rochester, the University of Rochester and the Rochester Institute of Technology were able to help with the development of higher technology optoelectronic devices, such as lasers, semiconductors, and photonics. Safford finds that the primary impact of universities is often the deepening of social capital. Along this dimension, he finds that Rochester's development has created a stronger local network than that of Akron and may well reap larger benefits.

A final challenge specific to the Midwest is the need for outsized productivity growth to maintain regional health in the face of unfavorable demographics. Studies of U.S. productivity by the McKinsey Global Institute found that from 1995 to 2000, six out of 59 industries accounted for all of the acceleration in U.S. productivity growth and that the top three contributed more than 66% of this total.[6] Interestingly, the top three industries could be characterized

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more as technology users than technology producers. Wholesaling, retail, and securities and commodities trading saw the greatest productivity gains during this period, and this was driven by the application of information management technology and developments in supply chain and warehouse management. A more recent study looking at productivity gains from 2000 to 2003 found productivity growth more evenly distributed, but still concentrated among technology users rather than producers. The sectors included retail trade, finance and insurance, computer and electronic products, wholesale trade, and administrative and support services. This finding suggests that for universities in the region to have the greatest impact on productivity, they will need to focus on helping firms in mature and service industries to use technology better. This further suggests a model similar to that of the old agricultural extension system that linked research and best practices developed at land-grant universities to local farmers. Some attempts have been made to extend this model to manufacturing and services, and perhaps this might deserve more attention.

Conclusion

In the end, a model based on local conditions and higher education's response seems somewhat amorphous. It fails to provide hard and fast rules on what a "best practice" is when it comes to colleges and universities that want to influence local development. However, it does make clear that higher education's contributions to local economies work best when colleges and universities understand what they have to offer and what is happening to the local industrial structures of their economies.

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[1] For example, National Association of State Universities and Land Grant Colleges, 2001, "Shaping the future: The economic impact of public universities," report, Washington, DC, August; Sandy Baum and Kathleen Payea, 2004, "Education pays: The benefits of higher education for individuals and society," College Board, report, available at www.collegeboard.com/prod_downloads/press/cost04/EducationPays2004.pdf.

[2] A recent paper finds that a state's "knowledge stock" (as measured by patents and high school and college attainment rates) is the main factor for explaining its relative per capita personal income. Inasmuch as universities are significant contributors to a state's knowledge stock, one can infer that they have a significant role in economic health. See Paul W. Bauer, Mark E. Schweitzer, and Scott Shane, 2006, "State growth empirics: The long-run determinants of state income growth," Federal Reserve Bank of Cleveland, working paper, No. WP06-06.

[3] Richard K. Vedder, 2004, *Going Broke by Degree: Why College Costs Too Much*, Washington, DC: AEI Press.

[4] Richard K. Lester, 2005, "Universities, innovation, and the competitiveness of local economies: A summary report from the Local Innovation Systems Project—Phase 1," Massachusetts Institute of Technology, Industrial Performance Center, Local Innovation Systems Project, working paper, No. 05-010, December 13, available at http://web.mit.edu/lis/papers/LIS05-010.pdf.

[5] Sean Safford, 2004, "Searching for Silicon Valley in the Rust Belt: The evolution of knowledge networks in Akron and Rochester," Massachusetts Institute of Technology, Industrial Performance Center, Local Innovation Systems Project, working paper, No. 04-002, available at http://web.mit.edu/lis/papers/LIS04-002.pdf.

[6] Diana Farell, Martin Baily, and Jaana Remes, 2005, "U.S. productivity after the dot-com bust," McKinsey and Company Inc., McKinsey Global Institute, report, December, available at www.mckinsey.com/mgi/publications/us_productivity.asp; McKinsey and Company Inc., McKinsey Global Institute, 2001, *U.S. Productivity Growth, 1995–2000: Understanding the Contribution of Information Technology Relative to Other Factors*, report, Washington, DC, October, available at www.mckinsey.com/mgi/publications/us/index.asp.