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Second District Highlights

The Role of Colleges and Universities in Building Local Human Capital

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Colleges and universities can contribute to the economic success of a region by deepening the skills and knowledge—or human capital—of its residents. Producing graduates who join the region's educated workforce is one way these institutions increase human capital levels. In addition, the knowledge and technologies created through research activities at area universities may not only attract new firms to a region but also help existing businesses expand and innovate. These "spillover effects" can in turn raise the region's demand for high-skilled workers.

Policymakers are increasingly viewing colleges and universities as engines of local economic development.[1] The economic success stories of places like Silicon Valley and Boston's Route 128 corridor are driving this trend, as is the transition now under way in most developed countries toward a more knowledge-based economy. Moreover, policymakers, particularly those in declining regions, often covet the presence of academic institutions because they tend to bring stability to area economies and operate in a sector that is less susceptible to contraction during economic downturns than other sectors. Indeed, the "eds and meds" sector actually *expanded* during the Great Recession.

Conventional approaches to valuing the economic activity generated by colleges and universities often focus on direct employment or expenditure effects, along with a multiplier effect to capture indirect and induced outcomes. However, the potential influence of colleges and universities goes beyond these standard effects for an important reason: These institutions can help build the knowledge and skills—or human capital—of a region's people, a critical component of an area's economic success. Indeed, a region with higher levels of human capital tends to have greater amounts of economic activity and more rapid economic growth. In addition, its workers tend to be more productive and earn higher wages.

In this issue of *Second District Highlights*, we explore the ways in which a region's higher education industry helps build regional human capital, focusing in particular on the metropolitan areas in New York and northern New Jersey. We begin by explaining the link between a region's stock of human capital and its economic performance, then discuss the role that colleges and universities play in building local human capital. We show that producing skilled graduates is one way these institutions increase local human capital, although high rates of migration among graduates undercut these increases for much of the country. We then explain how the knowledge and new technologies created through research activities at colleges and universities can help local businesses grow and can also attract new firms to the area—outcomes that in turn boost the demand for high-skilled workers. We conclude with some thoughts on the lessons our analysis offers to policymakers seeking to enhance their region's human capital.

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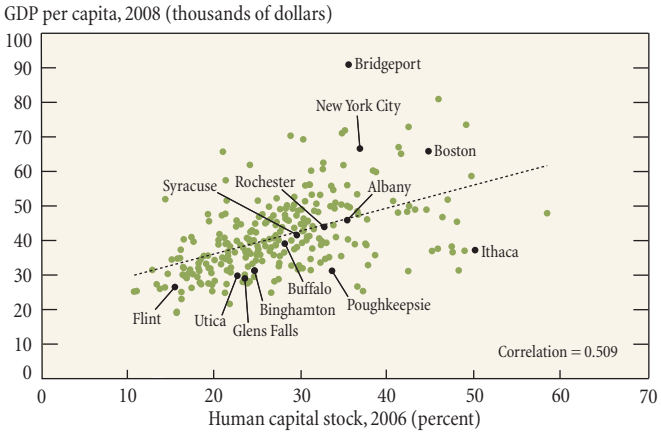
[1] For example, in May 2009, Governor David A. Patterson formed the Task Force on Diversifying the New York State Economy through Industry–Higher Education Partnerships to explore ways to more effectively leverage New York State's colleges and universities. Similarly, in May 2010, Governor Chris Christie established the New Jersey Higher Education Task Force. Task force recommendations were provided in reports issued on December 14, 2009, and January 4, 2011. See http://www.nystar.state.ny.us/sp/09/091214sp.pdf and http://higheredtaskforce.rutgers.edu/, respectively.

Chart 1

Human Capital and Economic Activity



Sources: U.S. Bureau of Economic Analysis; 2006 American Community Survey.

Human Capital and Local Economic Development

It has long been recognized that a person's human capital contributes to his or her economic success. While human capital covers an array of knowledge and skills, a college degree represents a significant block of human capital—and one that is easily quantified.[2] The number of people holding college degrees differs widely across the country and, correspondingly, so does economic activity. Research shows a positive relationship between the share of a metro area's working-age population holding at least a four-year college degree (the most common measure of a region's human capital stock) and its GDP per capita (a standard measure of economic activity).[3]

In Flint, Michigan, for example, only 15 percent of the working-age population has a degree, and its GDP per capita is roughly $27,000 (Chart 1). Meanwhile, in Boston, where nearly 45 percent of the working-age population holds a degree, GDP per capita is $66,000. Within the Second Federal Reserve District—which comprises New York State, northern New Jersey, and a small portion of Connecticut—both New York City and Albany have relatively high levels of human capital and high levels of GDP per capita, while Binghamton, Glens Falls, and Utica rank relatively low on both counts. This correlation, however, does not establish a causal link between human capital and local economic activity. Other factors, such as the density of the urban environment or the amount of physical capital present, may also be correlated with a region's level of economic activity.

In addition, causality might run in the opposite direction—that is, higher levels of economic activity may be driving an increase in human capital levels if, for example, highly skilled people are attracted to productive places. A recent study by Abel and Gabe (2011) uses a wide variety of data to control for these factors and, through statistical techniques, establishes a causal link between human capital and local economic activity.[4] They find that a 1 percentage point increase in the number of people with college degrees in a given region leads to a 2 percent increase in overall economic activity there.

Higher levels of human capital in a region can contribute to higher levels of economic activity for several reasons. Human capital increases individual-level productivity and the generation of ideas. By extension, a region having more people with higher levels of human capital should have greater economic activity overall. However, the total effect of higher levels of human capital on economic activity is larger than the sum of its parts. The geographic concentration of human capital facilitates what economists refer to as "knowledge spillovers"—the transfer of knowledge and skills from one individual to another. One person may, through observation and communication, learn skills from another; alternatively, the sharing of ideas among individuals may generate new insights that increase the knowledge of the group. When people increase their knowledge in these ways, they create a secondary pathway that increases human capital, which can further enhance regional productivity, encourage innovation, and promote growth.

Other studies have shown that regions with higher levels of human capital also tend to have higher wages, more innovation, faster population and employment growth, and greater prospects for "reinvention" as the economy changes over time.[5] Given the impact of human capital on a region's economic performance, it is important to understand which factors help explain the large differences in human capital levels across metropolitan areas. One such factor is the presence of colleges and universities.

Higher Education Activities and Local Human Capital

In addition to employing a large number of high-skilled workers, colleges and universities have the potential to raise local human capital levels in two other ways. First, and perhaps most obviously, these institutions can increase the supply of human capital by producing skilled labor. Newly minted graduates directly raise human capital in a region if they remain in the area and enter the local labor market. Second, much of the research and development (R&D) activity in the United States occurs at colleges and universities. R&D activities can also raise an area's human capital levels if there are spillovers into the local economy that increase the demand for human capital, regardless of whether that human capital is produced locally or not. Next we discuss these two pathways in more detail.

[2] Recently, researchers have developed alternative measures of regional human capital that use occupation clusters. Others have focused on the knowledge and skills required to perform a job. See, for example, Florida, Mellander, and Stolarick (2008), Bacolod, Blum, and Strange (2009), and Abel and Gabe (2011).

[3] The metropolitan area definitions used here correspond to those provided by the Integrated Public Use Microdata Series (IPUMS) for the 2006 American Community Survey. See Ruggles et al. (2008).

[4] To disentangle causal relationships, economists often use a statistical technique called instrumental variables. This approach requires the identification of variables (referred to as instruments) that are strongly correlated with the potentially endogenous explanatory variable (in this case, a region's human capital stock), but not directly related to the dependent variable of interest (in this case, a region's economic activity). This study considered two instrumental variables meeting these requirements: a region's climate and the presence of a land-grant university within a metropolitan area.

[5] See, for example, Rauch (1993), Glaeser, Scheinkman, and Shleifer (1995), Simon (1998), Moretti (2004), Glaeser (2005), and Carlino, Chatterjee, and Hunt (2007).

Table 1

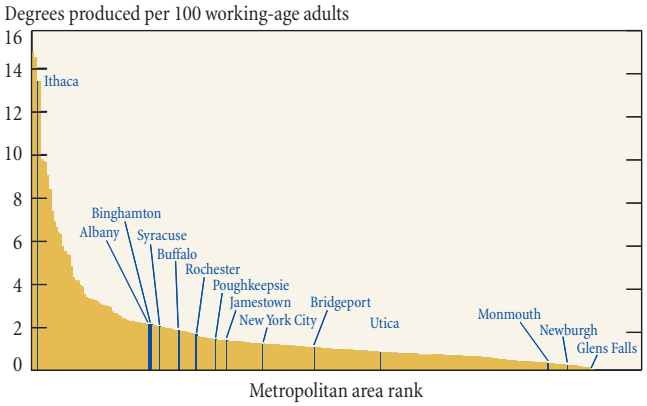
Degrees Produced, 2006

United States			Second District		
Rank	Metro Area	Degrees	Rank	Metro Area	Degrees
1	New York	143,971	1	New York	143,971
2	Los Angeles	89,311	26	Buffalo	13,927
3	Chicago	68,321	32	Albany	12,771
4	Boston	59,032	36	Rochester	11,836
5	Washington, D.C.	48,525	51	Syracuse	9,736
6	Philadelphia	45,986	74	Ithaca	7,495
7	San Francisco	31,604	124	Binghamton	3,507
8	Minneapolis	31,315	128	Bridgeport	3,282
9	Dallas	30,603	145	Poughkeepsie	2,753
10	San Diego	25,905	147	Monmouth	2,693
			177	Utica	1,658
	Average metro area	6,484	194	Jamestown	1,240
			234	Newburgh	656
				Glens Falls	0

Source: Integrated Postsecondary Education Data System.

Chart 2

Intensity of Degree Production



Sources: Integrated Postsecondary Education Data System; 2006 American Community Survey.

The Supply Side: Producing Degrees for the Local Labor Market

Higher education degrees are produced widely throughout the United States, although the numbers vary across metropolitan areas. To examine these differences, we construct a measure of a metropolitan area's production of both four-year and higher degrees, using data from the U.S. Department of Education's National Center for Education Statistics.[6]

Table 1 shows the metropolitan areas that lead the nation in degree production. With nearly 144,000 degrees, the New York metropolitan area ranks first, followed by Los Angeles, Chicago, and Boston. In total, the top ten metropolitan areas accounted for more than one-fourth of all of the higher education degrees produced in the United States in 2006. The average metropolitan area produced about 6,500 degrees in 2006, and more than 70 metropolitan areas out of 284 produced fewer than 1,000 degrees that year. Also shown in Table 1 are the degrees produced in each metropolitan area of the Second District. Together, these metropolitan areas account for 10 percent of all the higher education degrees conferred in the United States. While New York City is by far the largest contributor, several metropolitan areas in upstate New York—such as Buffalo, Albany, Rochester, Syracuse, and Ithaca—produce degrees in numbers well above the average across all metropolitan areas.

To assess the extent to which degree production is large or small relative to a metropolitan area's economy, we construct a measure of *degree production intensity*—calculated as the number of degrees produced in a metropolitan area relative to the number of working-age people. This measure yields the rate of *new* human capital produced in a metropolitan area, scaled for the area's size.

We find that within New York State, Ithaca produces degrees at a very high rate, ranking third overall in the nation (Chart 2). The remaining upstate New York areas generally produce graduates at an above-average rate: Albany ranks highest, and Binghamton and Syracuse are close behind. Buffalo and Rochester produce more degrees in total than the metro areas just mentioned, but when scaled for their size, they rank lower than some of their upstate peers but higher than the average for all metro areas in the nation. By contrast, the metro areas of Monmouth, Newburgh, and Glens Falls rank much lower.

To what extent do higher rates of degree production translate into higher human capital levels? This is a difficult question to answer. At the national level, as colleges and universities produce more degrees, they directly increase human capital levels for the country as a whole. However, this relationship does not always hold at the local level. Indeed, because college graduates are highly mobile, it is not always true that regions producing more graduates will have higher human capital levels, because a complex set of supply and demand factors in the labor market are at work.

First, while college graduates may wish to remain in the area where they obtained a degree, they may be unable to find a suitable job there. In other words, insufficient local demand for human capital may inhibit new graduates' ability to find a job. Second, some college graduates may not be interested in staying in the area, so they would not add to the supply of local human capital. It is common for

[6] The Higher Education Act of 1992 mandates completion of surveys for all institutions that participate in any federal student aid program. The resulting Integrated Postsecondary Education Data System (IPEDS) database captures information from virtually all higher education institutions in the United States. To construct measures of degree production by metropolitan area, we map degree completion information for more than 4,000 higher education institutions to their respective metropolitan areas using Zip code information, aggregating over degree types (bachelor's, master's, doctoral, and professional). Associate degrees are omitted from our analysis because much of the existing literature focuses on attainment of four-year, graduate, and post-graduate degrees to measure regional stocks of human capital. To the extent possible, we have also omitted degrees conferred by institutions that provide primarily online training.

at least one of these factors to play a role in determining where new graduates will ultimately locate.

The importance of migration in determining local human capital levels is illustrated in Chart 3, which shows the production of human capital relative to what can be considered a region's consumption (net increase) of human capital. The chart, which depicts the Second District in the 2000-06 period, indicates that in Ithaca, for example, roughly sixteen new graduates were produced for every net addition of a person with a college degree. Like its upstate New York peers, Ithaca in this period was a net exporter of human capital, producing many more graduates than it could absorb. In contrast, Bridgeport has a value of 1, which indicates balance—that is, for every degree produced, a person with a degree entered the local economy.

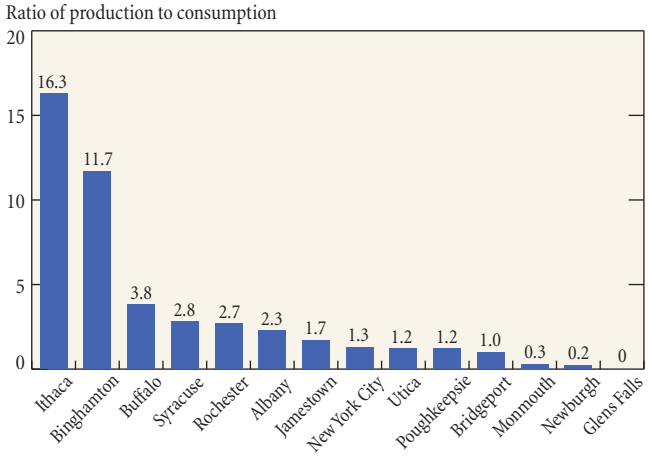
In the other direction, values of less than 1 indicate that some metropolitan areas in the Second District were net importers of human capital. In Newburgh, for example, the rate of degree production was less than the increase in the number of people with degrees. Newburgh, therefore, relies on other locations to supply some of its human capital needs.

Nationally, the majority of metropolitan areas—62 percent—produce more human capital than they consume, while the remaining 38 percent consume more human capital than they produce. Relatively few places are near balance. These patterns suggest that migration plays an important role in the geographic distribution of human capital across the nation.

Given these migration dynamics, to what extent is there a relationship between a metropolitan area's degree production and its stock of human capital? Areas that produce more degrees do indeed generally have a larger stock of human capital, although the relationship is far from one-for-one (Chart 4). Again, it is important to recognize that this positive correlation does not establish causation. Other factors, such as the economic environment or consumption amenities (features that increase the attractiveness of an area, such as parks, historic sites, museums, and beaches), may in fact be influencing both degree production and local human capital levels.

Furthermore, colleges and universities require human capital to produce higher education degrees, so the direction of causation may in fact run in both directions. Recent research by Abel and Deitz (2011) estimates this relationship, using statistical techniques to establish a causal link between higher education activities and local human capital levels.[7] The authors find that a doubling of a metropolitan area's rate of degree production is associated with an increase of 3 to 7 percent in local human capital levels—a much smaller increase than comparable state-level estimates of 32 to 34 percent reported by Bound et al. (2004). While this effect may appear small, it does suggest that an increase in degree production can result in a permanent shift in a region's human capital stock.

Chart 3
Production and Consumption Balance



Sources: Integrated Postsecondary Education Data System; 2006 American Community Survey; U.S. Census 2000.

Consistent with recent research on the geography of human capital by Faggian and McCann (2009), this relatively slight relationship between degree production and human capital suggests that it is not just the supply side of the labor market that matters in determining a region's stock of human capital. Differences in the demand for human capital are also important, and colleges and universities can play a key role here as well.

The Demand Side: Academic Research Benefits Local Businesses

Colleges and universities can help raise a region's human capital levels not only by supplying local graduates, but also by conducting research activities. Indeed, the existence of highly localized spillovers between academic research and innovative economic activity is well documented.[8] These spillovers can alter the composition of local labor markets by increasing the demand for specialized skills and by attracting new businesses, such as start-up firms, seeking access to academic R&D or university-based human capital.

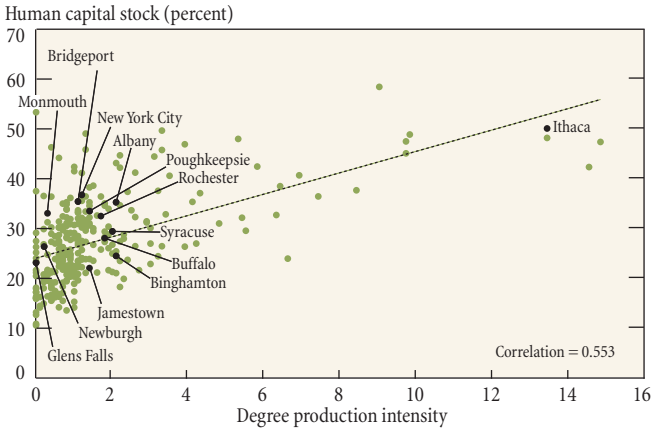
This connection between academic research and local business activity can take many forms. One is when local businesses use university knowledge and research facilities to create products and services. For example, at the University at Albany, a consortium of computer chip fabricators works with the university's research faculty to develop products and technologies, and the companies in the consortium gain access to cutting-edge laboratories and supercomputers on campus. This business activity requires workers with college degrees, which raises the demand for human capital.

[7] This is another example of an instrumental variables approach, albeit a more complicated one because of multiple potentially endogenous explanatory variables of interest. As such, this analysis exploits variation in the characteristics of colleges and universities to simultaneously predict differences in both the degree production and academic R&D activity occurring across metropolitan areas. Because these instruments capture differences in the colleges and universities themselves, the key indentifying assumption of this approach is that any effect they may have on local human capital levels operates only through the activities of these institutions. Thus, using the exogenous variation that exists in the characteristics of U.S. colleges and universities creates a natural experiment that can identify the effects of each higher education activity on local human capital levels.

[8] See, for example, Jaffe (1989), Anselin, Varga, and Acs (1997), and Varga (2000).

Chart 4

Degree Production Intensity and Local Human Capital



Sources: Integrated Postsecondary Education Data System; 2006 American Community Survey.

Table 2

Research Expenditures, 2006

United States			Second District		
Rank	Metro Area	Expenditures (Millions of Dollars)	Rank	Metro Area	Expenditures (Millions of Dollars)
1	New York	2688.7	1	New York	2,688.7
2	Baltimore	2076.6	21	Ithaca	652.3
3	Los Angeles	2013.2	34	Rochester	396.2
4	Boston	1759.3	38	Albany	371.0
5	San Francisco	1522.1	47	Buffalo	307.0
6	Raleigh-Durham	1448.6	89	Syracuse	98.1
7	Chicago	1291.7	109	Binghamton	30.0
8	Houston	1261.8	141	Newburgh	7.7
9	Philadelphia	1027.4	143	Bridgeport	7.0
10	Atlanta	910.7	161	Utica	2.8
			172	Monmouth	1.7
	Average metro area	158.9	188	Poughkeepsie	1.0
			199	Jamestown	0.3
				Glens Falls	0.0

Source: National Science Foundation.

Another example can be found in Ithaca, home to Cornell University. In Tompkins County, which comprises the whole of the Ithaca metropolitan area, more than eighty companies—in industries ranging from information technology and medical equipment to agriculture—have direct ties to Cornell.[9] Many of these businesses were started by the faculty and students and have remained in the local economy in order to stay connected to the university. Other companies were attracted to the region because they wanted access to specific knowledge or to new products and processes developed at the university.

At the Rochester Institute of Technology's Center for Integrated Manufacturing Studies, local manufacturing companies can gain access to the latest industry research, technology-testing facilities, and various engineering resources. This access helps these manufacturers increase their economic activity and boosts their demand for high-skilled workers.

In addition, universities often use local businesses to develop and commercialize products that result from their research activities. The University at Buffalo, for example, recently engaged a local business to collaborate on the development of a new electronic records system for patients with kidney disease. Meanwhile, the university-based New York State Center of Excellence in Bioinformatics and Life Sciences works with local business partners to commercialize university inventions in fields such as medical devices and pharmaceuticals. In fact, most major research universities have established their own technology-transfer offices in an effort to harness more effectively the synergies between university research and commercial product development.

For these reasons, it is possible for academic research activity to make a contribution to the stock of local human capital. To examine this relationship, we construct a measure of academic R&D expenditures for U.S. metropolitan areas using data compiled by the National Science Foundation (NSF) in its Survey of Research and Development Expenditures at Universities and Colleges. This survey reports all funds spent on activities created specifically to produce research in a wide range of disciplines, including physical sciences, life sciences, engineering, math and computer sciences, social sciences, business and management, law, education, social work, and the arts. As before, we map academic research spending by individual institutions to their respective metropolitan areas, aggregating science and non-science R&D expenditures.[10]

According to this measure, academic R&D expenditures tend to be more geographically concentrated than degree production, reflecting the more specialized nature of research activities. Table 2 reports the top ten metropolitan areas based on academic R&D expenditures. With outlays of nearly $2.7 billion, the New York metropolitan area ranks first, followed by Baltimore, Los Angeles, and Boston. These rankings differ somewhat from those for degree production (Table 1). In total, the top ten metropolitan areas accounted for almost one-third of all academic R&D expenditures, compared with one-fourth for degree production. The average metropolitan area had $157 million in academic R&D expenditures in 2006, while more than 150 metropolitan areas out of 284 had less than $10 million in expenditures.

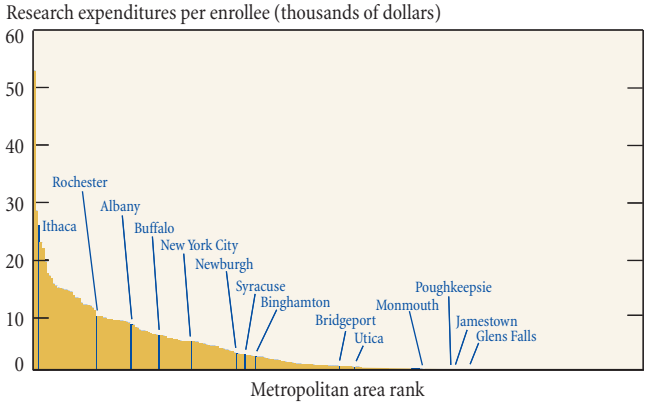
Table 2 also shows the academic R&D expenditures for metropolitan areas in the Second District. Together, these metropolitan areas account for 9 percent of all academic R&D spending in the United States. While New York City is again the largest contributor, several areas located in upstate New York—Ithaca, in particular—have a significant amount of academic R&D activity taking place; other areas, such as Poughkeepsie, have relatively little.

[9] See Cornell University (2009).

[10] The NSF does not report information for institutions having less than $150,000 in total annual R&D expenditures.

Chart 5

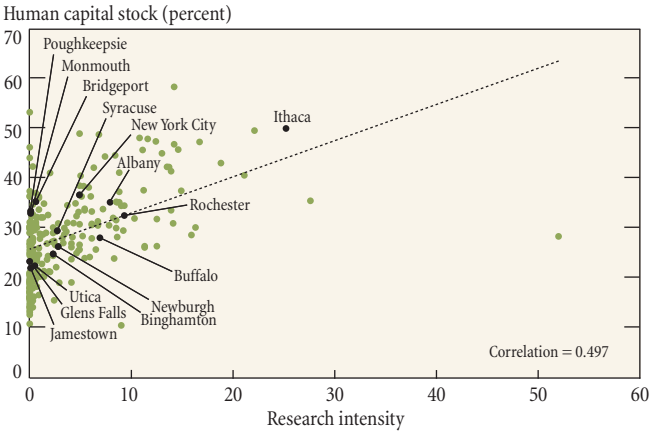
Research Intensity



Sources: National Science Foundation; Integrated Postsecondary Education Data System; 2006 American Community Survey.

Chart 6

Research Intensity and Local Human Capital



Sources: National Science Foundation; Integrated Postsecondary Education Data System; 2006 American Community Survey.

To assess the relationship between research activities and local human capital levels, we construct a measure of the research orientation of each metropolitan area's colleges and universities. This *research intensity* variable is calculated as the academic R&D expenditures per enrolled student in a metropolitan area.[11] That is, if two metropolitan areas have the same number of students but one has twice as much research spending, the latter is considered more research oriented.

Because research-oriented colleges and universities are more intensively engaged in research than other institutions, they are more likely to facilitate spillovers into the local economy. Of the metropolitan areas in the Second District, Ithaca stands out as the clear leader in research intensity (Chart 5), and indeed it ranks very high among all metropolitan areas in the country on this score. New York City occupies a position below Rochester, Albany, and Buffalo—all three of which rank in the top quartile.

To what extent is research intensity associated with a metropolitan area's stock of human capital? It appears that places that are more research intensive also tend to have a larger stock of human capital (Chart 6). As with degree production, this positive correlation does not necessarily imply causation. Other factors that differ across metropolitan areas may be at work. For example, academic R&D's spillover benefits to local business activity depend on support from an area's economic environment and infrastructure, both of which can differ across metropolitan areas.

Perhaps more important, there are reasons to believe that causality may run in both directions. First, colleges and universities require human capital to conduct academic research. Second, it is likely that knowledge spillovers flow in both directions if local business activities influence the R&D activities of nearby universities. This could happen if, for example, a local business develops a product that generates a need for new research carried out in partnership with a nearby university.

Recent research by Abel and Deitz (2011) provides new evidence on the direction and magnitude of this relationship. Controlling for a wide variety of factors that may also influence human capital levels, including degree production, and using statistical techniques to identify causal links, they find that a doubling of a metropolitan area's research intensity is associated with a 4 to 9 percent increase in levels of local human capital. Again, while this effect may appear relatively small, it suggests that academic research activity can permanently shift a metropolitan area's stock of human capital.

In fact, all else equal, increasing the demand for skilled labor through academic R&D activities appears to have a larger causal effect on local human capital levels than does an expansion in the supply of local graduates. So it is important not to lose sight of the complete set of higher education activities performed by colleges and universities when thinking about how these institutions can shape local human capital levels.

Conclusion

The amount of human capital in a region is a key determinant of its economic vitality and long-run economic success. As the U.S. economy continues to shift away from manufacturing and the distribution of goods toward the production of knowledge and ideas, the importance of human capital to a region will only grow.

Colleges and universities can facilitate an increase in both the supply of and demand for human capital by producing degrees and engaging in research activities. As a result, higher education institutions can play a vital role in local economic development.

Nevertheless, in their efforts to enhance local human capital, policymakers should consider a number of issues. First, while colleges and universities do increase the supply of human capital in metropolitan areas, there is only a small positive relationship

[11] Enrollment data are drawn from IPEDS.

between the human capital produced by these institutions and the local stock of human capital. Thus, policymakers have limited ability to raise the level of human capital in a region if they focus solely on increasing the number of local graduates. The demand side of the labor market is an important factor—local graduates need job opportunities in order to stay.

Policy can play a key role in shaping this side of the market. In particular, enhancing the research dimension of local colleges and universities can promote spillovers into the local economy, helping local businesses expand and creating jobs requiring high human capital. This process can increase the demand for skilled labor, whether those workers are graduates who are produced locally or imported from elsewhere. Thus, policymakers seeking to increase a region's human capital through its local colleges and universities may want to consider both the supply and demand sides of local labor markets so that they can attract, as well as retain, human capital.

The higher education industry in the Second District is sizable, and the colleges and universities located in many of the region's metropolitan areas conduct a significant amount of academic research. Thus, the region appears well positioned to leverage the strengths of its existing colleges and universities. Although a number of economic forces are at work in determining the distribution of human capital—many of which are outside the control of policymakers—finding ways to more effectively harness the potential of academic institutions can provide a promising pathway to local economic development.

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