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The Local Economic Impact of "Eds & Meds": How Policies to Expand Universities and Hospitals Affect Metropolitan Economies

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"Education and medical institutions can attract new monies to an area via students, patients, and visitors from outside the region, or by encouraging students and patients to stay in the region."

Economic development policymakers are increasingly looking to hospitals and universities as potential drivers of economic development in metropolitan areas, especially in central cities. These "eds and meds" institutions are large, immobile and often growing employers that hold the potential to offer relatively high-wage jobs to workers without college degrees. A number of metropolitan areas have large concentrations of colleges and universities, while health care institutions are more evenly spread out among metropolitan areas. This report examines the impact on metropolitan economic development of policies to expand health care and higher education institutions.

- **Expanding eds and meds brings in new income to a metropolitan area.** It does so by enabling those institutions to serve more students or patients who live elsewhere and who would not otherwise spend money in the metropolitan area. This effect is greater for an expansion of eds than for an expansion of meds, since more people cross metropolitan area boundaries to attend school than to receive medical treatment.

- **Expanding eds raises metropolitan residents' earnings by improving their skills.** The presence of eds in a metropolitan area makes area residents more likely to earn college degrees and remain in the area to work. In addition, students who come to the area from elsewhere are more likely to remain in the area to work after completing their degrees. In both these ways, expanding eds increases the percentage of a metropolitan area's residents who have college degrees and, therefore, increases earnings.

- **Expanding university research spurs metropolitan economic development.** University research can lead to the creation of new businesses in a metropolitan area and improve the performance of existing businesses. It can do so through technology transfer activities and through the broader involvement of universities with local businesses.

- **Expanding meds is likely to encourage other employers in a metropolitan area to pay higher wages.** Health care pays higher than average wages regardless of workers' skills and demographic characteristics. Expanding health care is likely to raise wages throughout a metropolitan area by putting upward pressure on wages throughout the metropolitan labor market.

As a result of these four impacts, policies to expand both eds and meds would raise the earnings of metropolitan residents. Such policies would raise metropolitan residents' earnings by roughly the same amount as would conventional policies that promote economic development through business tax incentives.

Introduction

This report analyzes the effects on a metropolitan area's economic development of investments by state and local governments in higher education and health care services—"eds and meds." It concludes that eds and meds can affect a metropolitan area's economic development, while also quantifying the size of such effects and how they occur—mechanisms that differ greatly from more traditional economic development policies such as providing manufacturing plants with tax breaks.

The analysis is based on a view that state and local economic development policy is an integral part of regional labor market policy. This view is more extensively justified in other publications.[2] A more traditional view, held by many practicing state and local economic developers, is that growth is assumed to simply be good in and of itself. Under this traditional view, whatever maximizes local growth for a given amount of resources devoted to economic development programs is the best economic development policy.

However, more local growth is only good insofar as it provides benefits to particular persons. Empirical studies suggest that by far the greatest benefit of more local growth is the resulting increase in earnings of the original local residents.[3] Other possible benefits of local growth, such as increased property values, increased profits of local businesses, fiscal benefits to various governmental units, and labor market gains to in-migrants, are much less important quantitatively, as measured by their present value in dollars. Growth's effects on the earnings of local residents occur because growth affects the demand for the labor of local residents. This increase in labor demand affects the likelihood of local residents finding work, the occupations they attain, and the wages they are paid in such occupations. More generally, economic development policies may also affect the composition of local labor demand across different types of industries or firms, or across different types of workers, not just the overall number of local workers demanded.

Therefore, the analysis of metropolitan economic development policy is viewed in this report as the analysis of how the earnings of the original residents of the metropolitan area are affected by any policy that alters the number or types of jobs open to these residents. Such policies may be traditional economic development policies that provide manufacturing branch plants with tax breaks. But, under this definition, "metropolitan economic development policies" may include other policies that create jobs through public spending or improved local labor quality, increase local productivity and local wages through greater local business knowledge, or increase wages through altering local standards for "typical wages." All of these other mechanisms by which policies may affect the amount and type of demand for local labor are included as metropolitan economic development policies. These mechanisms will be shown to be important ways in which eds and meds affect a metropolitan area's economic development.

This report focuses on the impact of eds and meds on the earnings of the original local residents who stay in the metropolitan area. Thus, it takes a metropolitan area perspective, rather than a national perspective that would include effects on earnings throughout the United States. The conclusion briefly considers how the analysis might vary from a national perspective. The report adopts the metropolitan perspective because benefits for metropolitan residents alone are easier to analyze theoretically, there is more empirical evidence available on such benefits, and the metropolitan area perspective is arguably the most relevant perspective for state and local government policymakers.

This report also chooses to focus on eds and meds defined as industries that provide services to local residents. Therefore, the definition of eds and meds used in this report does not include the biotechnology or pharmaceutical industries. This focus is in part adopted because an analysis of the economic development effects of service industries raises more surprising issues. It is not surprising at all that increasing a metropolitan area's ability to export biotechnology research products or pharmaceutical products to the nation or the world would increase the metropolitan area's economic development. What is surprising is that increasing a metropolitan area's services to local residents might increase the metropolitan area's economic development. Therefore, this report's type of analysis contributes to a broader and more flexible analysis of economic development policy.

This report's focus on eds and meds services is also motivated by recent trends in regional economic development and the thinking of local economic developers. With the declining importance of

manufacturing as a source of jobs, economic developers have increasingly been looking for other growth levers.

As a result, some services have been moved up from being considered as unimportant, secondary, "non-export base" activities, which are dependent on other activities to bring new monies into the area, to "export-base industry" status as potential generators of new monies into the area by serving national and international customers. Education and medical institutions can attract new monies to an area by attracting students, patients, and visitors from outside the region, or encouraging students and patients to stay in the region.

Eds and meds attract particular attention because of the size of higher education and health care institutions. For example, a 1999 Brookings Institution paper pointed out that in the largest 20 U.S. cities, eds and meds typically are among the largest private employers, with over one-third of those employed by the ten largest private employers working for higher education or health care institutions, and with an average of 6 percent of total city jobs accounted for by these large eds and meds.[4]

In addition, lower transportation and communication costs have caused many businesses to become more footloose. Many footloose businesses are increasingly selecting locations based on the availability and quality of the local labor supply, because one business location factor that remains difficult to move is the local labor force. Adam Smith's contention in *The Wealth of Nations* remains relevant: "A man is of all sorts of luggage the most difficult to be transported."[5]

Furthermore, some of the outstanding regional economic success stories of the last 30 years, such as Silicon Valley, Route 128 in Boston, and the Research Triangle in North Carolina, are high technology developments that are believed to be in part attributable to the quality of the local labor force and the quality of local universities.

Finally, a widespread perception is that a key future growth area will be biotechnology, as the health care sector expands and develops. It might reasonably be hypothesized that biotechnology might be attracted by a larger or better quality local higher ed and health care service sector.

For all these reasons, therefore, there is good reason for policymakers to be interested in exploring whether investments in higher education and health care institutions may boost a metropolitan area's economic development.

Whatever the historic impact of eds and meds on Silicon Valley, Route 128, and the Research Triangle, the relevant question is whether investments in eds and meds will pay off economically today and for most metropolitan areas. Some policymakers are clearly hoping that such investments will pay off. For example, various institutions and civic leaders in Grand Rapids, MI, provided tens of millions of dollars of subsidies to convince Michigan State University to agree in January 2007 to move its medical school to Grand Rapids.[6] This report aims to provide the conceptual framework and quantitative evidence needed for analyzing whether investments in eds and meds, such as the Grand Rapids example, pay off in boosting metropolitan area economic development.

Variation Across Metropolitan Areas in Eds and Meds

Before discussing the evidence on how eds and meds affect a metropolitan area's economy, understanding patterns in variations across metropolitan areas in specialization in eds and meds is necessary.

Our definition of eds includes colleges and universities, both four-year and community colleges.[7] Our definition of meds includes doctors' offices and other ambulatory medical facilities, hospitals, and nursing homes and other residential care facilities.[8] We strive to include both government-owned and privately-owned enterprises.[9]

Our meds definition does not include pharmaceutical companies or biotech companies or similar enterprises that are primarily concerned with inventing and selling new products and services to be used in health care. Similarly, our eds definition does not include activities in non-higher education industries that might produce the new knowledge that is "sold" in the higher education industry. Our focus is on service industries whose original primary goal is to enhance human capital, either through education or through health care. Of course, some of the possible positive economic effects of these service industries may come from positive effects on other industries; for example, the health care industry might have positive effects on the biotech industry.

Table 1. Top 30 Metropolitan Areas, Ranked by Location Quotient for Higher Education

Ranking	Metropolitan Area	Employment Location Quotient for "eds"
1	State College, PA	8.173
2	Champaign-Urbana-Rantoul, IL	7.734
3	Bryan-College Station, TX	7.160
4	Bloomington, IN	7.072
5	Iowa City, IA	6.664
6	Gainesville, FL	5.936
7	Lafayette-W. Lafayette, IN	5.391
8	Columbia, MO	5.385
9	Athens, GA	4.934
10	Yolo, CA	4.724
11	Charlottesville, VA	4.444
12	Auburn-Opekika, AL	4.439
13	Ann Arbor, MI	3.789
14	Muncie, IN	3.615
15	Flagstaff, AZ-UT	3.568
16	Madison, WI	3.559
17	Tuscaloosa, AL	3.472
18	Provo-Orem, UT	3.317
19	Lansing-E. Lansing, MI	3.280
20	Tallahassee, FL	3.043
21	Las Cruces, NM	2.973
22	Greenville, NC	2.941
23	Lincoln, NE	2.865
24	Lexington-Fayette, KY	2.837
25	Lubbock, TX	2.801
26	Fort Collins-Loveland, CO	2.788
27	Bloomington-Normal, IL	2.770
28	Springfield-Holyoke-Chicopee, MA	2.689
29	Hattiesburg, MS	2.530
30	Santa Barbara-Santa Maria-Lompoc, CA	2.496

Note: All 283 metropolitan areas identified in Census 2000 are ranked in Timothy J. Bartik and George Erickcek, "Higher Education, the Health Care Industry, and Metropolitan Regional Economic Development: What Can "Eds & Meds" Do for the Economic Fortunes of a Metro Area's Residents?" Upjohn Institute Staff Working Paper No. 08-140 (Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 2007), available at http://www.upjohninstitute.org/publications/wp/08-140.pdf.

Source: Authors' analysis of Census 2000 public use microdata.

We use data from the public use microdata sample of Census 2000. These data are derived from household surveys. Using these data, employment in higher education in 2000 was 2.3 percent of national employment, while employment in health care industries was 8.9 percent of national employment. Thus, meds is about four times as large as eds.

Our definition of a metropolitan area's specialization in eds and meds is based on the metropolitan area's employment location quotient in each of these industries, a standard concept in regional economics. The employment location quotient for eds will simply be equal to the percentage that higher-education employment make up in the metropolitan area's total employment, divided by the percentage that higher-education employment make up in total national employment. A similar definition holds for the meds employment location quotient.

Table 2. Top 30 Metropolitan Areas, Ranked by Location Quotient for Medical Care

Ranking	Metropolitan Area	Employment Location Quotient for "Meds"
1	Rochester, MN	3.081
2	Alexandria, LA	1.905
3	Iowa City, IA	1.782
4	Columbia, MO	1.561
5	Waterbury, CT	1.507
6	Duluth-Superior, MN/WI	1.491
7	Punta Gorda, FL	1.485
8	Gainesville, FL	1.469
9	Sharon, PA	1.405
10	Asheville, NC	1.402
11	Redding, CA	1.399
12	Shreveport, LA	1.390
13	Johnstown, PA	1.387
14	New Haven-Meriden, CT	1.384
15	New Bedford, MA	1.382
16	Worcester, MA	1.377
17	Augusta-Aiken, GA-SC	1.364
18	Lexington-Fayette, KY	1.356
19	Tyler, TX	1.355
20	LaCrosse, WI	1.344
21	Galveston-Texas City, TX	1.344
22	Barnstable-Yarmouth, MA	1.344
23	Dutchess Co., NY	1.344
24	Pueblo, CO	1.342
25	Greenville, NC	1.337
26	Pittsburgh, PA	1.335
27	Utica-Rome, NY	1.334
28	Scranton-Wilkes-Barre, PA	1.326
29	Hartford-Bristol-Middleton- New Britain, CT	1.319
30	Vineland-Milville-Bridgetown, NJ	1.314

Note: All 283 metropolitan areas identified in Census 2000 are ranked in Timothy J. Bartik and George Erickcek, "Higher Education, the Health Care Industry, and Metropolitan Regional Economic Development: What Can "Eds & Meds" Do for the Economic Fortunes of a Metro Area's Residents?" Upjohn Institute Staff Working Paper No. 08-140 (Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 2007), available at http://www.upjohninstitute.org/publications/wp/08-140.pdf.

Source: Authors' analysis of Census 2000 public use microdata.

A location quotient of 1 means that the eds (or meds) industry employs the same percentage of local workers as it does of workers nationwide. A location quotient greater than 1 means that the industry employs a larger percentage of local workers than it does of workers nationwide; this indicates that the metropolitan area is more specialized in the eds (or meds) industry than is the nation as a whole. Similarly, a location quotient less than 1 means that the industry employs a smaller percentage of local workers than it does of workers nationwide; this indicates that the metropolitan area is less specialized in the eds (or meds) industry than is the nation as a whole.

Across the 283 metropolitan areas for which we were able to obtain reliable estimates of eds and meds employment, there is far greater variation in the eds location quotient than the meds location quotient. For example, 30 metropolitan areas have ed location quotients equal to or exceeding 2.49,

which means that they have a percentage of employment in eds of at least two-and-a-half times the national average. Thirty metropolitan areas have ed location quotients less than or equal to 0.44, meaning that their percentage of employment in higher ed is less than half the national average. In contrast, only one metropolitan area has a med location quotient exceeding 2.0, and the 30th ranked metropolitan area has a location quotient of 1.31. No metropolitan area has a med location quotient less than 0.58, and the 30th lowest ranked metropolitan area has a med location quotient of about 0.8, only one-fifth lower than the average percentage of employment in the meds sector.[10]

The greater variation across metropolitan areas in eds activity than in meds activity strongly suggests that a much larger share of eds activity than meds activity is export-oriented in the typical metropolitan area. Apparently meds activity is largely determined by total metropolitan area economic activity; eds activity varies much more independently of the size of the metropolitan economy. This is not surprising, as the term "college town" is better known and more widely heard than "hospital or medical town." There is little relationship between a metropolitan area's specialization in eds versus meds.[11]

Table 1 reports the employment location quotient for eds by metropolitan area for the 30 metropolitan areas with the highest eds location quotient. As one would expect, this eds location quotient is highest in what we generally think of as college towns, with large state universities in a relatively modest-sized community. Table 2 provides a similar list of the 30 metropolitan areas with the highest meds location quotient. Rochester, Minnesota, stands out as a city specializing in medical care.

Further analysis, more extensively reported in the Upjohn Institute working paper version of this report, shows that the larger metropolitan areas tend to have considerably less variation in location quotients for eds, and to a lesser extent for meds. Larger metropolitan areas tend to have strengths in a wider variety of industries, which means they are less likely to have unusually high concentrations of one industry. In addition, the analysis suggests that across the four census regions, the Midwest region appears to have more "college towns" than the other regions. Finally, analysis of the Census public use microdata for 1970, 1980, 1990, and 2000 suggest that the variation across metropolitan areas in the eds location quotient has declined in each decade. This may reflect an expansion of higher ed to more metropolitan areas as a higher percentage of the population decides to get a college education.

A Summary of Different Types of Impacts

The remainder of this report describes several possible types of impacts that eds and meds might have on a metropolitan area's economic development and provides evidence on the magnitudes of these impacts. It focuses on the following possible types of impacts of eds and meds on metropolitan economic development: stimulating local demand by increasing the local export-base; the job creation and earnings creation effects due to eds and meds increasing local human capital; R&D spillover effects on the local economy; and effects of eds and meds expansion on local standards of what constitutes a fair wage. The longer version of this report also considers several other possible impacts of eds and meds on metropolitan economic development; these are omitted here primarily for reasons of space.[12]

The longer version of this report also considers several other possible mechanisms by which eds and meds might affect metropolitan economic development.[13] These other possible mechanisms include: eds and meds' effects on increasing urban amenities and thereby attracting in-migration; the effects of higher education in increasing entrepreneurship; if higher education and health care investments are focused in cities as opposed to suburbs, any positive effects on the metropolitan area of reducing intra-metropolitan disparities; any contribution by higher education and health care institutions to providing better local leadership for economic development. These other possible impacts are omitted in part for reasons of space. In addition, we were able to come to more salient, and surprising, conclusions about the issues focused on in this report than for these other issues.

Eds and Meds' Effects as Export-Base Industries that Stimulate Demand for Local Goods and Services

If any industry, including eds and meds, brings in dollars to purchase local goods, and these dollars would otherwise be spent outside the local economy, then this increase in demand will increase local economic output and thereby increase local earnings.

An industry can bring in new dollars by selling its goods or services to persons or businesses from

outside the local economy ("export-base production"). In the case of higher education, a college or university can bring in students from outside its own metropolitan area. In the case of health care, a hospital can bring in patients from outside its own metropolitan area. An industry also can bring in new dollars by selling its goods or services to local persons or businesses that otherwise would have purchased these goods or services from sources outside the local economy ("import substitution").

For example, a college or university can bring in students from its own metropolitan area who would otherwise have gone to school in a different geographic area. A hospital can bring in patients from its own metropolitan area who would otherwise have sought medical treatment in a different region. In regional economics, either expanding export-base production or import substitution is frequently referred to as stimulating the local economy's export-base.

These new dollars for local industries in turn are in part respent by the local industries on local suppliers, and in part respent by the local industries' workers on local retailers, resulting in "multiplier effects" of the initial infusion of new dollars on the local economy. The resulting expansion in local labor demand will enable the original local residents to more readily get jobs, and more readily get better jobs. This greater job experience of the original local residents will, in turn, make local residents more productive and more employable in the long-run, therefore increasing their long-run earnings potential.[14]

Intuitively, such demand stimulus seems more plausible for eds than for meds. If a particular higher education institution closed, many of its students and research dollars would quite possibly go to higher education institutions outside its local economy. For health care institutions, demand for services tends to be more local. If a particular health care institution closed, other health care institutions in the region would arise or expand to meet local demand for health services.

Of course, the extent to which a particular higher education or health care institution brings in new dollars will vary quite a bit across different institutions. For example, community colleges, compared to a nationally known selective liberal arts college or research university, will tend to serve local residents and businesses. Although some of a community college's local students may have otherwise left the metropolitan area, other local residents would have stayed, and either not have gone to college, or gone to other local educational institutions that would arise or expand to meet local demand.

We must also be careful not to confuse the rapid expansion of an institution or an entire economic sector with whether that sector brings new dollars into the regional economy. For example, even if local hospitals are rapidly expanding and hiring many additional workers, this expansion could simply reflect expanding local demand for hospital services. (For example, hospitals may be expanding in a metropolitan area because of an aging population.)

The net demand effects of a state or local area investing in eds and meds must include the negative economic effects on the local economy of any taxes required. These increased taxes might be needed to directly subsidize the expansion of eds or meds, to provide public services to the eds or meds expansion, or to make up for foregone property taxes if the expansion of these tax exempt institutions removes property from the tax rolls. In general, such taxes will be considerably less than the expenditures associated with these industries, because these industries are substantially funded by fees charged to students or patients. In addition, even if state or local public spending on a good or service is 100 percent tax-financed, a balanced budget expansion in both taxes and spending will still have a net positive effect on the local economy. Only a portion of the increased taxes reduces consumer spending on local goods, whereas the first impact of spending is to increase demand for local goods.[15]

There is a huge literature on the demand effects of eds and meds, most of it in reports or working papers. In the case of higher education demand effects, an article by Leslie and Slaughter reviewed 60 reports on demand impacts, and a paper by Siegfried, Sanderson and McHenry reviewed 138 studies since 1992.[16] The literature on demand-induced economic impacts of hospitals and other health care facilities has not generated as many literature reviews, but there are easily several dozen studies, mostly of rural hospitals' economic impacts, such as those by the Kentucky Rural Health Works Program at the University of Kentucky.[17]

In addition, advocacy groups have completed several comprehensive national summaries of the demand effects of eds and meds for example, a study by the National Association of State Universities and Land-Grant Colleges (NASULGC) of the economic impacts of public universities, and a study by the Association of American Medical Colleges (AAMC) of the economic impacts of medical schools and

teaching hospitals.[18]

How to estimate demand impacts of eds and meds is conceptually clear, but the details are tricky. Among the issues that must be addressed are the four following concerns: 1) what proportion of the induced increase in eds and meds in fact will bring new dollars into the community-that is, will enhance the export-base, including substituting for imports; 2) what are plausible multipliers; 3) how to avoid double-counting; and 4) the economic costs of inducing increased local activity in eds and meds.

The export-base percentage. The policy-relevant issue in estimating the demand effects of some policy to induce eds or meds investment is the extent to which this investment will induce new dollars to enter the local economy, as opposed to substituting dollars that are already being spent locally.

For example, if we add a new local college or university, a key question is to what extent this adds new students to the community. We do not want to count, as additional local demand, any expenditures associated with students in the new college who would have otherwise attended another local college, or who would have not attended college but would have been living and spending money in the local community.

As another example, if we add a new local hospital, a relevant issue is the extent to which this adds new patients and health care spending to the community. We would not want to count, as additional local demand, any patients or health care dollars that otherwise would have gone to some already existing facility in the community. In the case of meds, this may be more difficult to see because of the natural growth of the industry. With growing income and aging, the demand for medical services will continue to grow. In such a growth environment, the displacement impact may be difficult to see as the expansion at one hospital will not affect the current demand for services at the other existing hospitals but instead will curtail their growth plans.

Many studies ignore this issue by implicitly assuming that 100 percent of the activity at any eds and meds facility in the local community is truly from new dollars brought to the community that would not have occurred in the community if this institution or this group of institutions had disappeared. This assumption can only be rationalized as an answer to a quite different and much less policy-relevant question: what would happen if we closed down a particular ed or med institution, or even all such institutions in a local community, and made it illegal to open up or expand any ed or med facilities to replace the closed institution or institutions? This is a less policy-relevant question because this is not a feasible experiment that we can imagine carrying out in anything resembling our society. (In addition, the effect on local demand would not be the main social impact of such insane and infeasible policies as forbidding hospitals or colleges to operate in a particular metropolitan area.) In the real world, even if we somehow imagined that all the colleges and hospitals in a metropolitan area were closed, there would be some alternative institutions that would arise to, in part, replace the closed institutions.[19]

In determining the effect of addition to local capacity in eds and meds, we must not only look at new students or new patients attracted to the metropolitan area, but also at whether any local residents who would have otherwise gone to a college or health care facility outside the metropolitan area are induced to stay in the metropolitan area. In the jargon of regional economics, we need to not only look at the effect of an induced capacity expansion in eds and meds on the metropolitan area's "exports" of services to nonmetropolitan area residents, but also the extent to which the induced capacity expansion substitutes for "imports" by reducing the consumption by metropolitan area residents of services outside the metropolitan area.

Intuition suggests that expansion in eds is much more likely to increase the metropolitan area's exports or substitute for imports than expansion in meds. College students are far more geographically mobile than health care consumers. This intuition is backed up by the earlier results that show there is far more variation in location quotients for eds than there is for meds. Meds activity is very tightly tied to local demand, whereas eds activity is far more independent.

We would also expect eds and meds to have greater export-base effects in smaller metropolitan areas. In a smaller metropolitan area, for example, the disappearance of a particular ed or med institution is less likely to result in its replacement by the expansion of another institution.

In addition, the extent to which a particular ed or med institution expands exports, or substitutes for imports, will be greater if that institution is offering an ed or med service that is more specialized. If the ed or med service is more specialized, there are less likely to be good local substitutes for that

service if this particular institution goes away. The entry of a more specialized ed or med service into the area is not likely to cause any displacement of existing activities since this specialized service was not offered locally before.

The multiplier. A second tricky issue is the likely multiplier effect of any expansion in metropolitan area exports or substitution for imports induced by expansion in eds and meds capacity. By multiplier effects, we mean the ratio of the total increase in local economic activity to the direct increase in economic activity due to expanded exports/reduced imports in eds and meds. This ratio will be greater than 1 because of induced effects on local suppliers to eds and meds, and also because of effects on local industries that sell goods or services to the employees of eds and meds.

We would expect these multiplier effects for eds and meds to be relatively modest compared to the metropolitan-area multipliers that we see for many manufacturing industries. Eds, and to a lesser extent meds, do not depend as much as many manufacturers on specialized local suppliers who must be located close by in order to communicate about new technologies and to meet just-in-time inventory requirements. For example, there is no equivalent in the eds and meds industry to the networks of various tiers of nearby suppliers that characterize the auto industry. In addition, as we will review below, eds (and to a lesser extent meds) is not a particularly high-paying industry, which reduces the local demand effects that are due to local spending by employees.

Considering both weaker local supplier links and the modest wages of eds and meds, it would be surprising if multiplier effects for eds and meds exceeded 2. Most studies do seem to get multipliers of less than 2. For example, Siegfried, Sanderson, and McHenry found that median multipliers in college impact studies for expenditure were 1.7, and for employment were 1.8; Leslie and Slaughter found mean multipliers of 1.6 for two-year colleges and 1.8 for four-year colleges.[20] However, some studies seem to get multipliers considerably higher than 2, which is questionable.

Multipliers for eds and meds will generally be higher in larger metropolitan areas. A larger metropolitan area will have more specialized local suppliers and will have a wider variety of goods and services to capture the spending of the employees of eds and meds.

Double-counting. One subtle problem that occurs in some studies, as pointed out by Siegfried, Sanderson, and McHenry, is double-counting certain expenditures.[21] For example, it would be incorrect to count both a college's total spending and student spending on tuition, or to count both a college's total spending and its employees' spending.

Opportunity cost of inducing eds or meds expansion. A difficult issue is the economic impact of the costs of inducing an eds or meds expansion. In general, expansion of publicly-owned colleges and universities would be heavily influenced by state government policy, as state government supplies such a significant share of the revenue of public colleges and universities. The state and local government share of public college and university revenues is about 40 percent, of which about 36 percent is state and 4 percent local.[22] However, local political lobbying for an expansion of a publicly-owned higher education facility may require local "spending" of considerable political capital and giving up other projects or local benefits. At the extreme, one might imagine that the local area essentially has to incur political costs equivalent to paying for the entire state and local share of the increased revenue needed for expanding the eds facility.

For public hospitals, state and local subsidies amount to about 15 percent of revenue (this excludes Medicare and Medicaid, which amount to another 19 percent and 37 percent of revenue, respectively).[23] Of the $103 billion in annual state and local government spending on hospitals, 59 percent comes from local governments.[24]

For private colleges or universities, private hospitals or other medical care facilities, the location and expansion decisions are made by the private entity that controls that institution. It is unclear what the typical costs are of inducing such an entity to expand its local capacity.

If inducing the expansion of eds or meds has local costs, which will require higher local taxes, the costs of such taxes should be considered in the analysis. Other things being equal, higher local taxes will lower local demand and local economic activity. In general, this local economic effect will be less than the same-sized local spending, as only a portion of any increase in local taxes will come at the expense of less spending on local goods. This is because local residents would have spent a considerable amount on out-of metropolitan-area purchases from internet sales, tourism, and travel-related sales, or would have saved some of these funds.

Any tax costs of financing an expansion of eds or meds are likely to only be a small fraction of the increased expenditures associated with the eds or meds expansion. As mentioned, total state and local spending on public higher education is only about 40 percent of such an institution's revenues, and state and local spending on health care is only 13 percent of total health care spending.[25]

Some illustrative calculations. We provide some reference calculations for plausible impacts of eds and meds using the Upjohn Institute's version of the Regional Economic Models, Inc. (REMI) model for the Grand Rapids-Wyoming and Kalamazoo-Portage, Michigan, metropolitan areas.[26] For each metropolitan area, we consider the economic effects of inducing an expansion of a higher education institution, or a hospital, that is associated with a $100 million increase in expenditures of the institution. Such calculations allow us to consider the issues outlined above in a consistent way for both eds and meds.

When public policy induces a higher education institution or hospital to expand, part of that expansion comes because the educational institution or hospital takes in new students or patients who would otherwise have attended school at another educational institution in the same metropolitan area or obtained medical care at another hospital in the same metropolitan area. That part of the expansion does not bring in new dollars to the metropolitan area but simply shifts them from one institution to another within the metropolitan area. (For example, if the state of Michigan expands enrollment at Western Michigan University, a student who transfers from Kalamazoo College to Western Michigan University, or an entering freshman who decides to attend the latter institution rather than the former, does not bring in new dollars to the Kalamazoo area.[27])

The remaining part of the expansion, called the "export base percentage," comes because the educational institution or hospital takes in new students or patients who would not otherwise have attended school or obtained medical care in that metropolitan area. Those new students or patients, who may come from within the metropolitan area or from elsewhere, do bring in new dollars to that metropolitan area. (For example, if the state expands enrollment at Western Michigan University and a student consequently transfers from Ohio State to Western Michigan, or an entering freshman decides to attend Western Michigan rather than Ohio State, that student brings in new dollars to the Kalamazoo area.)

As shown in Table 3, the REMI model has default estimates for the export base percentages for the higher education and health care. For example, the 75 percent export base percentage for higher education in Grand Rapids means that, for every dollar of new spending by a Grand Rapids-area college or university that is induced by a public policy change, 75 cents are new spending that would not otherwise have occurred in the Grand Raids metropolitan area, while the remaining 25 cents would have been spent in the metropolitan area even if the public policy change had not occurred.

As shown in the table, the export base percentage is much greater for higher education than for health care. (This is probably because colleges and universities are more likely to draw students from other regions than hospitals are to bring in patients from other regions.) In addition, the export-base percentage is higher for Kalamazoo than for Grand Rapids, which reflects the larger size of Grand Rapids and the greater substitution response that comes from an expansion in ed and med capacity in Grand Rapids. (A student attending college or a hospital patient receiving medical care in Kalamazoo is more likely to come from outside the Kalamazoo area than a college student or hospital patient in Grand Rapids, simply because Kalamazoo is smaller to begin with. When a college or hospital in Kalamazoo is induced to expand, the new students or patients in that institution are more likely to come from outside the metropolitan area than are new students or patients under similar circumstances in Grand Rapids.)

The multiplier estimates from the REMI model, as expected, are modest in size. Multipliers are lower for higher ed than for health care. The lower multipliers for eds than for meds may be due to fewer local suppliers in higher ed than in health care, and to lower wages in higher ed than in health care. As expected, multipliers are also lower in the smaller metropolitan area of Kalamazoo than in Grand Rapids.

The export-base percentages and multipliers end up yielding an estimate that the gross local economic impact of a $100 million increase in the expenditures of a college or university is about $100 million. Thus, the gross local impact of an entire higher education institution is about equal to the total expenditure of the higher education institution. This finding is consistent with Blackwell, Cobb, and

Table 3. Estimated Local Economic Development Impacts of $100 million Eds and Meds Expansion in Two Typical Metropolitan Areas

		Grand Rapids		Kalamazoo	
Category of Effect	**Source of calculation**	**Higher Ed**	**Health care**	**Higher Ed**	**Health care**
$100 million expenditure expansion of eds or meds	Assumed for example	$100 million	$100 million	$100 million	$100 million
Export base percent	From REMI model	75%	16%	87%	31%
Multiplier	From REMI model	1.33	1.69	1.16	1.47
Gross economic impact	= $100 million expenditure expansion of eds and meds X export base percent X multiplier	$100 million	$27 million	$101 million	$45 million
Gross effects on local resident earnings (in millions of dollars)	= gross impact X 70 percent labor share X 0.4 local earnings effect	$28 million	$8 million	$28 million	$13 million
Rescaled effects: Gross effects as percentage of local earnings for initially induced change of 50 percent of the industry's employment share in the average metropolitan area).	= 50 percent X national earnings share of industry X ratio of gross impact to initial $100 million expenditure X 0.4 local earnings share	0.44%	0.54%	0.45%	0.89%

Note: These figures are largely derived from simulating the effects of inducing a $100 million expansion in expenditure on higher ed or health care institutions in Grand Rapids, Michigan, or Kalamazoo, Michigan.. The multiplier effects represent the ratio of the impact on total local economic activity to the increase in export-base expenditure. The rescaled effects are percentage effects on local earnings due to an attempt to induce a one-half location quotient expansion in eds or meds in each metropolitan area. These rescaled numbers are derived from these simulations by rescaling the size of the expansion, and rescaling the impact to a percentage of local earnings. In making these estimates, we assumed that the national earnings shares of eds and meds are 2.20 percent and 9.87 percent respectively (calculated from Census 2000 public use microdata).

Source: Authors' calculations based on the Upjohn Institute's simulations using the REMI model.

Weinberg's statement that in "most of the university impact studies [that] we reviewed . . . a university's annual impact approximately equals its annual budget."[28] This finding occurs because the export-base percentage for the typical university is slightly less than 1, and the multiplier is slightly higher than 1, so the resulting impact is close to the university's budget.

In contrast, the economic impact of meds is only one-quarter to one-half of the institution's budget. This largely occurs because of a much lower export-base/import substitution role for the typical health care facility, which is only partly offset by a larger multiplier.

As mentioned before, most of the ultimate benefits of local economic development are due to increased earnings of the original local residents. These increased local earnings will be some lesser percentage of the total increase in earnings of the metropolitan area because of expanded capacity in eds and meds. We assume about 70 percent of increased local economic activity goes to labor. Based on previous regional studies, we assume that increased earnings of the original local residents, because of a demand shock to local earnings, are about 40 percent of the total increase in metropolitan area earnings.[29] The result is an increase in local earnings of about one-quarter of the institution's expenditure for eds, and about one-tenth of the institution's expenditure for meds.

We might want to standardize such impacts not in terms of a given dollar increase in induced institutional capacity, but rather in terms of the size of that sector. This would allow us, for example, to consider such issues as the relative impact of inducing an x percent expansion in eds versus an x percent expansion in meds. We therefore consider the effect on local residents' earnings of a policy that attempts to induce a 50 percent increase in the ed or med percentage of employment in the average metropolitan area. Based on the national averages presented previously, this would be an attempt

to increase eds employment by 1.16 percent of total local employment (equal to 50 percent of average eds employment share of total employment of 2.32 percent), and an attempt to increase meds employment by 4.45 percent of total local employment (equal to 50 percent of average meds employment share of total employment of 8.90 percent). It should be emphasized that we allow for substitution effects that occur because this induced 50 percent expansion in the eds or meds employment share will not all be export-base, but will instead displace existing activity in other eds or meds facilities.[30] In particular, with meds, an attempt to increase meds' employment share by 50 percent (or 4.45 percent of total employment) ends up displacing so much existing meds activity that the net increase in meds activity is only one-sixth to one-third of the initial increased activity, or only an 8 to 16 percent increase in meds. For eds, because of displacement, the net increase in eds activity is three quarters to seven-eighths of the initial increase in eds, or a 38 percent to 44 percent net expansion in eds.

As shown in Table 3, because meds is a much larger industry than eds, we end up getting similar-sized increases in local earnings from a 50 percent expansion in employment in each of these industrial sectors. For both industries, an attempt to change eds or meds capacity by 50 percent would affect local earnings by about one-half of 1 percent (with a little higher figure for meds in Kalamazoo of about 1 percent). Even though the meds sector is far less an export base sector than the eds sector, its much larger size means that its demand-side impact on local residents' earnings is equal to, or even somewhat greater than, the impact of the eds sector. Although this earnings impact may seem modest, we should recall that a 50 percent increase in the eds employment share is only 1 percent of total local employment and a 50 percent increase in the meds employment share is only 4 percent of total employment.

To get a further sense of the size of these percentage employment expansions, consider effects in "small" versus "large" metropolitan areas. Out of our 283 metropolitan areas, the cutoff for the smallest fifth in terms of employment is employment of around 80,000; that is, one-fifth of metropolitan areas have employment smaller than 80,000, whereas four-fifths of metropolitan areas have employment larger than 80,000. The cutoff for the largest fifth of all metropolitan areas is an employment level of around 450,000; one-fifth of the 283 metropolitan areas have total employment of more than 450,000, whereas four-fifths are smaller. An eds expansion in employment of 1 percent of total local employment is equal to an employment increase of a little less than 1,000 jobs in a "small" metropolitan area that is just at the cutoff for the smallest one-fifth of all metropolitan areas. For a metropolitan area that is "large" (one that is just at the cutoff for the largest one-fifth of all metropolitan areas), an eds expansion of 1 percent of total employment would be equal to an employment expansion of a little less than 5,000 jobs. A meds expansion of 4 percent of total employment is equal to a little less than 4,000 jobs in a small metropolitan area, and a little less than 20,000 jobs in a large metropolitan area.

Although an increase of one-half of 1 percent in earnings sounds modest, this amounts to millions of dollars in increased annual earnings, even in small metropolitan areas. In a small metropolitan area with employment of around 80,000, the likely increase in annual earnings would be around $20 million per year.[31] For a large metropolitan area with employment of around 450,000, the likely increase in annual earnings would be over $100 million per year.

We also did some speculative calculations in which we adjust for some hypothetical local tax costs of inducing these eds and meds expansions. These assumed costs are based on the extreme assumption that the costs of inducing an expansion will be equal to the state and local share of revenues for the industry, which is 40 percent for public higher education and 13 percent for the overall health care sector. We then run these costs into the REMI model to see the economic impact of these increased local taxes, and the extent to which these tax costs might offset the gross impact of the increased capacity in eds and meds. We find that these tax costs, at most, might offset one-third to one-half of the previously calculated impacts, which assumed zero local tax costs. (The detailed figures are not presented in Table 3, but are available in the Upjohn Institute working paper version of this report.[32]) The economic impact is not fully offset due to the local costs for two reasons: 1) it does not cost $1 to induce a $1 increase in local capacity; 2) in general, a $1 increase in local taxes, even with multiplier effects of those taxes, reduces local demand by less than a dollar.

Eds and Meds' Effects on Metropolitan Economic Development by Increasing Local Human Capital

Increases in the local supply of more productive workers will tend to encourage business development that will use these skills to expand local output and local earnings. Increased local supply of a particular labor skill may increase productivity more if that skill has spillover effects—that is, if an increased supply of workers with that type of labor skill increases the productivity of other types of labor. In addition, long-run productivity effects of an increased local supply of some types of labor skill increases if those skill types allow workers not only to be more productive, but also to more rapidly adapt to new technology that increases productivity.

Development of greater skills and knowledge in their graduates is still a primary goal of colleges and universities. Local colleges and university graduates' greater skills and knowledge will stimulate the local economy to the extent that these graduates result an increase in the average prevailing skills and knowledge in the local economy. Greater availability of local higher education institutions may encourage greater educational attainment by local residents by making higher education more accessible.[33] In addition, graduates of a college and university, both those who originally were residents of the metropolitan area and those who moved to the metropolitan area to attend the college, may be more likely to locate in that metropolitan area than they would have been had they attended college elsewhere.

Of course, different types of colleges and universities produce different types of skills. Many liberal arts colleges and universities focus more on increasing their graduates' general skills. Community colleges may focus more on producing occupation-specific or even job-specific skills. For example, many states, most notably North Carolina, provide funding for community colleges to provide free customized job training for new workers or incumbent workers in new or expanding manufacturing companies. Both general skills and occupation-specific skills can increase the productivity of the local workforce, though perhaps different companies will have a different valuation on general vs. occupation-specific skills.

The logical chain of causation between eds capacity expansion and increase in local college grads is as follows. Some induced increase in eds capacity will result in a somewhat lesser increase in the size of the eds sector, after allowing for some substitution for otherwise existing eds capacity. The net increase in eds capacity will increase local production of college grads. Only some proportion of this increase in local production of college grads will result in a net increase in the proportion of college grads in the local labor force, for two reasons. First, some of the locally produced college grads will move out, even if nothing has changed in local labor market conditions. Second, with more local college grads, wages and employment rates for college grads will be depressed. While this will attract some employers seeking college grad workers, it also will encourage out-migration of college grads and discourage in-migration of college grads.

The ultimate increase in the "local college grads percentage"—the percentage that college grads make up of the local labor force—has effects on the earnings of the original local residents in two ways. First, some of the increase in local college grads may reflect local residents who were induced by the ed capacity expansion to get a college degree and ended up both getting higher earnings and staying in the local area. This reflects a private return to more educational attainment of local residents. Second, there is significant evidence that there are spillover effects on the local labor market of educational attainment. The productivity of an individual worker will not only depend on that individual's educational attainment, but also on the average educational attainment in the local labor market. This average educational attainment may allow employers to more readily use more advanced technology or introduce new technologies. The productivity increases stemming from spillover effects of a greater local college grad percentage will increase local earnings by attracting business growth, and this growth in labor demand will raise local earnings both by increasing local employment-to-population ratios and by increasing local occupational attainment.

From a local economic development perspective, we do not want to count the gains from this area's expansion of eds capacity that will accrue outside the area's original residents who remain in the area. For example, we do not want to count the gain in earnings of original local residents whose educational attainment is increased by the expanded capacity, but who end up obtaining higher earnings in some other local economy. Furthermore, we do not count the extra local earnings of outsiders who come in for a college degree and stay, as these outsiders would have otherwise probably been just as well-off

in some other area. However, we do count the education spillover effects of these outsiders on the original local residents. By inducing persons to come to the area and get a college degree and stay, the productivity of the local economy is enhanced, which will help attract business growth and thereby provide spillover benefits to the original residents.[34]

All of these effects take some time to occur. It takes a while for an increase in local educational capacity to have its full effects upon the college grad percentage in the local labor force. It also takes a while for an increase in the local college grad percentage to have its full effects in attracting additional business activity and increasing local earnings.

We will try in a rough way to assign numbers to the long-run local earnings effects of an ed capacity expansion, and then scale back these effects for shorter-run analyses. We scale these effects for an initially induced increase in eds capacity of 50 percent for an average metropolitan area, or an increase of 0.5 in the location quotient for eds. To get long-run numbers, we make various assumptions based on the empirical literature.

A technical appendix details the resulting calculations. These calculations suggest that an increase of 50 percent in the eds percentage of total employment in the average metropolitan area will in the long-run increase the number of college graduates in the area by 1.63 percent of the population (e.g., from 29 percent to 30.63 percent). Of that 1.63 percent, a conservative estimate is that one-quarter is due to local residents being more likely to attend and complete college. In the long-run, the increase in earnings of the local residents who complete more education as a result of the extra local eds capacity is estimated to be equal to 0.27 percent of overall local earnings of all local residents. The spillover effects on the productivity of the local economy due to the higher college graduation percentage are estimated to increase total local earnings by 0.28 percent. Therefore the overall effect of a 50 percent increase in the eds share of a metropolitan area's employment is to increase overall local earnings by 0.55 percent. However, this is a long-run effect that only occurs after about 40 years, time enough for one generation to attend and complete their education in the local eds sector. If these long-run effects take place evenly over time, only one-fourth of this 0.55 percent effect would have occurred after 10 years, or an increase in local earnings after 10 years of 0.14 percent.

Would these same effects occur regardless of whether the increase in local eds capacity was in a university, a four-year college, or a community college? We simply don't know. Existing estimates of the spillover effects of the college grad percentage on local wages focus on completion of a four-year degree, and we don't know whether associates' degrees from community colleges have the same spillover effects. On the other hand, it could be argued that local community college capacity has more effects on the educational attainment of local residents than does local university or four-year college capacity, as the students considering community college attendance may be less mobile. But empirical evidence on the differential effects of different types of local eds capacity is lacking.

It could be argued that human capital effects might also be produced by improvement in local health care quality, which might be brought about by expansions in the local health care industry. In theory, better local health care quality should reduce absenteeism, worker turnover, and improve workers' mental health and therefore productivity at work. However, there is insufficient evidence of what the magnitude might be of some of the links in this causal change. Will improvements in local meds capacity actually improve health care quality and hence the health of local workers? If so, what is the magnitude of these effects? What is the magnitude of the link between local health care quality and local productivity? We don't know the answers to these questions.

R & D Spillovers

Increased research knowledge of local businesses may raise local output by raising local productivity directly. This increased local productivity may lead to further rises in local output by allowing local businesses to gain a greater share of the national market. Increased research knowledge of local businesses or potential local entrepreneurs also may allow production of new products. These increases in local productivity and wages, in turn, may increase wages and employment opportunities for local residents.

Local businesses' research knowledge may be increased by various spillover effects of the R&D knowledge and activities of professors at colleges and universities, and of doctors at hospitals, in several ways. The most direct and obvious economic spillover of the research of eds and meds is some

professor or doctor deciding to use his or her research knowledge to start up their own business in the local area. In addition, the R&D of researchers at universities and hospitals may be licensed to local businesses. University and hospital researchers may convey a wide variety of research knowledge to local businesses, either through formal consulting contracts, or more informally through meetings and casual conversations.

It has been argued that, among all the activities of universities, R&D has "the greatest potential to affect economic development."[35] The policy community's interest in this role of higher education institutions is probably largely inspired by the successes of Silicon Valley, Route 128 around Boston, and the Research Triangle, all of which are usually believed to be in part attributable to the research strengths of nearby universities.

What is the research evidence on the magnitude of these economic development effects of universities through research spillovers? To summarize at the outset, case studies of particular universities suggest that the local economic development impact of higher education research activities is not a mechanical function of the size of the research or the size of the university, but rather depends upon many idiosyncratic features of the university and the local economy. Local economic development impacts of eds' research activities do not occur solely or in many cases primarily because of technology transfer to local new business start-ups, but rather occurs due to a wide variety of ways in which the research knowledge and expertise at the university can help local businesses address productivity problems and other business problems. Empirical estimation of effects of university research activities on local economic development tend to be fragile—that is, results vary widely depending upon what measures of university research activities and local economic development are used, and what metropolitan areas and time period are considered. The fragility of results may reflect the difficulty of measuring what activities of universities matter most to different types of local economic development and how these effects vary according to the local economy, as well as our inability in most cases to find natural experiments in which government policy or some other exogenous change has caused large changes in university research activities.

Some major recent projects that coordinate multiple case studies of university research–local economic development interaction are the Local Innovation Systems Project, based at the MIT Industrial Performance Center and a recent report for the Economic Development Administration done by the Center for Economic Development at Carnegie Mellon University.[36] As these case studies point out, the typical U.S. university cannot be expected to have the same economic influence on the local economy as MIT or Stanford. For example, the University of Akron sought to focus on helping the local economy transition from tire production to innovation in polymer production. But, according to the case study evidence, Akron-area polymer firms "didn't see much of value emerging from the university's laboratories, and some had already developed sophisticated strategies for interacting with universities nationally."[37]

In fact, the evidence suggests that the overall university influence of local economic development through technology transfer is quite limited. As pointed out by Lester, "new business formation around university science and technology is a very small fraction—probably no more than 2–3 percent—of the total rate of new business starts in the U.S." Furthermore, patenting by universities in the U.S. "is only a minor contributor to the overall stock of patented knowledge. About 3,700 patents were granted to U.S. universities in 2001, out of a total of about 150,000 U.S. patents issuing in that year."[38] A 2003 review paper by Feldman and Desrochers makes the judgment that "[S]ince the 1980s, despite the establishment of university technology transfer offices, incentives from federal and state governments, and new industrial outreach efforts, most research universities have not been particularly successful at technology transfer and have not yet generated significant local economic development."[39]

However, for the typical university, university research activities can have a much broader impact on local economic development than is captured by just looking at technology transfer through new business startups. This broader impact is through a wide variety of formal and informal interactions in which professors, researchers and students at the university interact with nearby businesses, either through formal contracts or more informal interaction to help local businesses solve a wide variety of problems. Paytas, Gradeck, and Andrews conclude from their various case studies that "the structure of the [university's] technology transfer office does not determine a university's performance in generating economic impact."[40] According to them, one factor that really distinguishes a university that is effective in local economic development is the "breadth of involvement" of the university:

"Universities need to address business and legal issues, workforce education, infrastructure, and industry relationships, as well as technology and R&D capacity, in order to yield regional benefits. The most engaged universities demonstrate these kinds of diverse, integrated commitments across administrative and academic units, including the schools of business, engineering, law, medicine, and public policy."[41] They also argue that impacts depend on the alignment of the university's research activities with the characteristics of local industries.

Given the diversity of interactions between university research activities and local economic development, it is perhaps not surprising that quantitative research on these interactions has yielded diverse results. For example, Anselin, Varga, and Acs find that more university research in a metropolitan area is positively associated with private research in the metropolitan area and with the number of business innovations in the metropolitan area.[42] Varga goes on to find that the impact of university research on business innovations is greater in metropolitan areas that are larger and have more existing high technology activity.[43] Hill and Lendel (2007) find that higher-rated science and technology doctoral research programs at a metropolitan area's universities are associated with significantly higher metropolitan employment and per capita income growth. They report that this result is fragile when a control for metropolitan area size is included.[44] Bania, Eberts, and Fogarty find that university research in a metropolitan area only positively affected business start-ups in the metropolitan area in one industry—electrical and electronic equipment—out of the six industries they studied. Bania, Eberts, and Fogarty also point out that even if university research leads to innovation, "any resulting new products or processes will frequently be developed in other locations."[452]

An important recent empirical paper on the connection between university research and local economic development is a working paper by Andersson, Quigley, and Wilhelmsson.[46] The main strength of this paper is that it focuses on the results of an explicit policy decision by the Swedish government to establish new universities with a strong research component in a number of regions from the late 1970s on. Their data is pooled cross-section data on output per worker and number of researchers in different Swedish communities and years. Controlling for fixed community effects and year effects, they find that having more university researchers is associated with higher output per worker. That is, a community's relative productivity, compared to its past relative productivity, is positively influenced by its relative share of university researchers, compared to its past share. These effects are particularly strong for the newer universities set up by the Swedish government. Because of these stronger effects for the newer universities, their simulations find that the decentralization of university research in Sweden raised the average productivity of the Swedish economy, compared to what would have happened if the research had been kept in the old universities. This finding is in obvious contrast with the empirical estimates of Varga.[47] Andersson, Quigley, and Wilhelmsson's results support decentralization of higher education research activities as the best way to promote overall national economic development, whereas Varga's results support more spatial concentration of higher education research activities as the best way to promote overall national economic development.

Based on these case studies and quantitative research studies, it seems likely that spillover effects of university research activities on local economic development are important. However, it seems impossible, and also misleading, to come up with a summary estimate of how much a given expansion in a local university will affect local employment growth and hence local earnings. The research findings are too diverse to come up with a believable summary, and the literature suggests that the impact will depend upon many features of the local university and local economy. Finally, there does not appear to be much evidence on the potential role of teaching hospitals or other health care institutions in creating research spillovers.

Effects of Eds and Meds on Local Standards of Fair Wages and Fair Labor Market Practices

Evidence suggests that wages persistently vary across industries and firms for workers with the same characteristics.[48] Some have positive wage differentials, i.e., pay more than the average industry in the metropolitan area, while others have negative wage differentials, i.e., pay less than the average industry. These wage differentials may reflect a wide variety of industry characteristics, including unionization, wage norms, the costs of worker turnover, and the ease of monitoring worker productivity.

Some economic theories imply that prevailing wages in a local labor market may depend on notions

of what wage policy of employers (or other labor market practice by employers) is considered "fair." There is some evidence to support this idea. For example, studies of local living wage laws, which typically regulate the wages paid to government contractors or firms receiving economic development subsidies, suggest far larger effects on local wages and poverty than would be expected by their direct effects on firms whose wages are covered by these laws.[49]

The labor market practices of local higher education and health care institutions, as large local employers, may influence beliefs in local labor markets about what wages and other employer practices are considered to be fair. If these large employers choose "high road" labor market practices, with higher wages, more internal promotion, and lower employee turnover, these practices may reinforce other local employers to adopt such practices.

Obviously a redistribution of a metropolitan area's workers toward industries with positive wage differentials, and away from industries with negative wage differentials, will directly increase wages for the workers who move to higher paying industries. In addition, however, there is evidence that a metropolitan area that moves towards higher paying industries will find its overall earnings per capita increasing by more than one would predict based on national industry wage differentials.[50]

Suppose a metropolitan area's industry mix changes so that, based on national industry wage patterns, we would expect wages to be higher by 1 percent. Empirical estimates suggest that the resulting increase in average real earnings per working-age adult would be 2.2 percent. These overall wage effects of the mix of different-paying industries in the metropolitan area appear to reflect, in part, an influence of average metropolitan wage practices on the wages paid in each industry. In addition, higher metropolitan area wages will tend to increase labor force participation, and will also increase local demand and job creation.

To our knowledge, no prior analysis of industry wage differentials, controlling for worker characteristics, has included all workers, both public and private, in these two industries. We also wanted to explore how these industry wage differentials differed by education level. Therefore, we decided to do our own wage analysis that would include estimation of how wages differ from other industries for both eds and meds, controlling for worker characteristics.

We analyzed wages using regression analysis on a sample from the Census 2000 public use microdata. Table 4 reports the results and provides detailed information about the regression model. Overall, eds pays about 14.5 percent less than the average industry for a given set of worker characteristics. Meds pays about 4.8 percent more than the average industry. The separate regressions for different education groups make it clear that these results are not simply being driven by high wages for doctors and low wages for professors, relative to their education. On the other hand, for some of the lowest education groups, the wage differentials are quite different.

We can apply these results to estimate the effects on local earnings of a policy that tries to induce each industry's share of total metropolitan area employment to expand by 50 percent in an average metropolitan area. As previously discussed, because of displacement effects, the proportion of metropolitan area employment in the industries will, on net, expand by less than 50 percent.

For eds we assume, as was done previously, that a policy that raises the eds employment share by 50 percent will lead to a net expansion of 37.5 percent (50 percent adjusted downwards by a 25 percent displacement of existing eds activity). For meds, displacement is higher. We assume, as was done previously, that a policy that raises the meds employment share by 50 percent will lead to a net expansion of 8 percent to meds activity, after allowing for five-sixths of the initial capacity increase to be offset by displacement of existing meds activity.

For eds, the mean percentage of national employment in this industry is 2.32 percent as of 2000. Therefore, an attempted expansion in a metropolitan area of this industry by 50 percent will result in a net increase in the percentage of local employment in this industry of 0.87 percent (equal to 37.5 percent of 2.32 percent). We assume that we are switching employment to eds from industries of average pay. Therefore, a switch of employment of 0.87 percent from an average-paying industry, to an eds industry that pays 14.5 percent below average, will directly lower average wages in the metropolitan area by -0.13 percent (= 0.87 percent x -14.5 percent). But, as mentioned above, estimates suggest that a 1 percent change in the average predicted wage in a metropolitan area based on the metropolitan area's industry mix will change overall metropolitan area earnings per capita by 2.2 percent, due to both changes in other industries' wage practices and changes in employment rates. Therefore, we

Table 4. Percent by Which Eds and Meds Wages Differ from Average Industry Wages

	Eds	Meds
All workers	_14.5%	4.80%
High school dropout	*	_2.4
High school graduate	_3.8	_5.9
Some college	_.14.1	_1.4
Associate degree	_16.6	15.5
College degree	_20.0	5
Post-graduate degree	_12.9	13.2

** Indicates eds wage is not significantly different from the average industry wage at the 5 percent level of significance.*
Note: Positive percent differences indicate that eds or meds pays more than the average industry. Negative percent differences indicate that eds or meds pays less than the average industry. Wages are calculated as annual earnings for the person divided by the product of annual weeks worked and usual weekly hours. Observations are excluded if earnings, weeks worked, or usual weekly hours were imputed rather than actually observed. Observations were excluded if calculated wages were outliers, which means that wages were less than $2 or more than $200. The sample is all workers 16 years old to 64 years old in metropolitan areas. The data in the table come from regressions in which the dependent variable is the natural logarithm of an individual's wage and the explanatory variables are the individual's gender; marital status; marital status interacted with gender; race (mutually exclusive race categories of Hispanic, white non-Hispanic, black non-Hispanic, and other non-Hispanic); age, age squared, age cubed and age raised to the fourth power; metropolitan area (283 metropolitan area dummies); and industry (dummy variables for 254 industries). The industry dummies were all included; the weighted sum of the industry variables, where the weights are the estimated proportion of each regression sample in each industry, was constrained to equal zero. This means that the industry wage coefficient measures the wage paid in that industry versus the all industry average wage for that education group. Each row corresponds to a different regression. The education groups are defined so that they are mutually exclusive. For example, "some college" means some years of college attendance without any degree.

Source: Authors' analysis of Census 2000 public use microdata.

predict that this investment in attempting to expand local eds capacity by one location quotient will, through its effect on local efficiency wages, lower average local earnings per capita by -0.29 percent (= -0.13 percent x 2.2).

For meds, the mean percentage of national employment in this industry is 8.90 percent as of 2000. Therefore, an attempted expansion in a metropolitan area of this industry by 50 percent will result in a net increase in the percentage of local employment in this industry of 0.71 percent (= 0.16 x 50 percent x 8.90 percent). A switch of employment of 0.71 percent from an average-paying industry, to a meds industry that pays 4.8 percent above average, will directly increase average wages in the metropolitan area by 0.03 percent (= 0.71 percent x 4.8 percent). With a multiplier on local earnings of 2.2, due to both effects on local wage practices and employment rates, the estimated effect on metropolitan area earnings per capita is an increase of 0.07 percent (= 0.03 percent x 2.2).

The above analysis simply considers the labor market effects of expanding eds or meds, conditional on current labor market practices in these industries. There also is the policy option of altering employer practices in these industries in terms of pay, worker training, and promotion practices. Sectoral employment programs are one option for the public sector to seek to intervene to alter training and upgrading opportunities in a given industry.

Many such programs involve public sector training organizations working with different firms and organizations in a particular industry to set up training programs that are suited to the industry's needs, while also improving worker advancement options. Sectoral employment programs frequently target health care because it is a major industry that employs many low-income persons, is expanding, and frequently has concerns about worker shortages. An evaluation of one group of initiatives in sectoral programs is provided by Pindus and others.[51] While such programs are promising, as of now there is still considerable uncertainty about sectoral programs' effects on worker outcomes.

Conclusion

To sum up: Eds and meds have a variety of positive effects on a metropolitan area's economic development. However, there is considerable uncertainty about the magnitude of many of these effects. The magnitude of effects likely depends a great deal on the nature of the metropolitan area economy, and the specific characteristics of the induced expansion of eds or meds.

Taking all the previous estimates together, a policy that attempted to expand a metropolitan area's eds employment by 50 percent, or about 1.2 percent of total employment in the average metropolitan area, is estimated to increase average earnings of the original residents of the metropolitan area after 10 years by 0.3 percent.[52] To this should be added the positive effects on local earnings of the R&D spillovers due to eds expansion. A policy that attempted to expand a metropolitan area's meds employment by 50 percent, or about 4.5 percent of total employment in the average metropolitan area, is estimated to increase local earnings by 0.6 percent.[53]

Therefore, for policies that attempt to expand eds or meds by 50 percent, the effects of the meds expansion on the earnings of local residents are about twice as great. This is largely due to the greater size of the meds sector. If we considered instead eds or meds expansions equal to the same percentage of overall local employment-say an eds or meds expansion of 1 percent of local employment- the effects of eds expansion on local residents' earnings is about twice the size of the effects of meds expansion. A policy attempting to expand eds by 1 percent of total local employment in all industries is estimated to increase average earnings of the original residents of the metropolitan area by 0.2 percent, whereas a policy attempting to expand meds by 1 percent of total local employment in all industries is estimated to increase average earnings of the original residents by 0.1 percent.[54]

These estimated effects of eds or meds expansion on local earnings are an important part of considering the benefits and costs of any public policy that attempts to induce such an expansion. For eds, such policies could include state or local investments in new higher educational institutions, proposals to expand higher educational institutions or encourage expansion by subsidizing tuition, and proposals to either consolidate or decentralize the provision of higher educational services across a state. For meds, such policies could include state and local efforts to subsidize or constrain the expansion of health care institutions, either directly or indirectly through the details of health care programs such as Medicaid.

These effects are large enough to be important for public policy. The effects of a 50 percent expansion of eds and meds employment are similar to those of a 50 percent increase in business tax incentives. As noted above, we estimate that such an expansion of eds would increase earnings by 0.3 percent in a metropolitan area. For meds, the effect is 0.6 percent. Even such small percentage increases amount to tens of millions in annual earnings in even small metropolitan areas. Bartik recently considered the effects on local earnings of an expansion of state and local tax incentives to attract new branch plants or encourage business expansions. The incentive expansion considered was about 50 percent of the typical level of local business incentives. Such an incentive expansion was estimated to increase local earnings after ten years by about 0.5 percent.[55] Therefore, a 50 percent expansion in eds or meds activity has about the same scale of local earnings effects as a 50 percent expansion in business tax incentives.

We emphasize again that all these estimates are for effects of eds and meds expansion on a metropolitan area's economy. The economic development effects of eds and meds expansion at the national level might be quite different. From a national perspective, we would have to consider whether an expansion of eds or meds capacity in one metropolitan area might displace some other eds or meds capacity in other metropolitan areas. This displacement at the national scale would diminish the effects of eds and meds expansion. On the other hand, from the national perspective we would consider the effects of eds and meds expansion on increasing earnings of individuals who migrate outside the metropolitan area. This would enhance the effects of investments in eds and meds.

There are three important research questions that are important for eds and meds policy at the metropolitan level but about which little is known.

First, we know less than we would like about the effects of particular types of eds or meds expansion in particular types of metropolitan areas. What, for example, are the relative effects of community

college versus university expansion, and how do these effects differ in metropolitan areas of different sizes with different industrial specializations?

Second, we know much less about the local economic development effects of meds than of eds. For example, we know relatively little about how a higher quality local meds sector might enhance the health and productivity of local workers and thereby affect the local economy.

Third, our knowledge of the research spillover effects of eds is incomplete. We don't know as much as we would like about the quantitative magnitude of different types of research spillover effects of different activities of higher educational institutions.

Which activities of higher educational institutions pay off the most in their research spillover effects on the local economy, and what are the magnitudes of those payoffs? The general belief is that the research activities of higher education institutions are likely to have large long-run effects on a metropolitan area's economic development. Although this is useful for lobbying to expand overall university budgets, this belief lacks sufficient specific quantitative backing to provide definitive advice to policymakers that might guide more selective investments in universities. In addition, we need to know more about whether it makes more sense for a state government to focus research investments on the state's flagship university or universities, or whether state governments should instead spread such research investments more broadly among many educational institutions.

Technical Appendix

This technical appendix provides more details about how we calculate the magnitude of the metropolitan economic development effects of eds that occur due to eds' effects on local human capital. This appendix focuses on the effects on local earnings in the long-run. (In the main text of the report we then scale these back to shorter-run effects). We scale these effects for an initially induced increase in eds capacity of 50 percent in the average metropolitan area, or one-half location quotients. Our long-run numbers are derived from various assumptions based on the empirical literature.

Substitution effects

Per our discussion above, we conservatively assume that the net effects on ed capacity are 75 percent of the initially induced effects. (This uses the export-base percentage for higher education in Grand Rapids from the REMI model.) To put it another way, if some college increased its capacity in an amount equal to one-half of the entire current local educational sector, we assume that 25 percent of this increase would be offset by reductions in capacity in other local educational institutions. Therefore, the net change in ed capacity from a one-half location quotient (LQ) induced change is a change of 0.375 LQ.

Long-run effects on stock of college grads, allowing for their direct and induced migration

Bound and others estimate that 15 years after some increase in a state's production flow of college grads, the increase in the stock of college grads is about 30 percent of the stock increase.[56] This presumably reflects some normal out-migration of college grads, plus the effects on migration patterns, due to changes in state labor market conditions caused by a shock to college grad labor supply. As metropolitan labor markets are, in general, smaller than state labor markets, we assume that the net effects on the local stock of college grads of an increase in the flow are about 15 percent of the flow. Therefore, the college grad stock will go up by about 15 percent of .375LQ = 5.625 percent of whatever stock of college grads would occur nationally due to a location quotient of 1.0. About 29 percent of the current labor force (age 25–29) has a college degree.[57] By definition, the typical area in the U.S. has a location quotient of 1.0. This amount of higher education activity must be sufficient at the national level to result in 29 percent of the labor force having a college degree. Therefore, this implies that an initial induced increase in the local ed location quotient of one-half will lead to an increase in the local percentage of college grads of 5.625 percent times 29 percent= 1.63 percent of the local labor force.[58]

Impact of college grads percentage on long-run local labor demand due to productivity effects

A number of studies suggest that an increase in the percentage of college grads in the local labor force will increase local employment growth.[59] The empirical estimates from Shapiro are typical in their magnitude. Shapiro's estimates imply that an increase in the local percentage college graduates of 1.63 percent (from above) will increase a metropolitan area's employment after ten years by 0.72 percent.[60]

But the 10-year increase in employment will be an underestimate of the long-run increase in employment. We know that the employment level in regions only gradually adjusts to its long-run equilibrium level in response to changes in regional economic conditions. The well-known article by Helms estimates that regional employment adjusts annually by 8.9 percent of the difference between current regional employment and the region's long-run equilibrium employment level.[61] This implies that the long-run increase in employment will be 1.64 times the 10-year increase in employment.[62] Therefore, the implied long-run increase in employment, due to a 1.63 percent increase in the local percentage of college graduates, will be 1.18 percent (= 0.72 percent x 1.64).[63]

Shapiro's estimates suggest that about 60 percent of the effects on employment growth of the local college grad percentage is due to the college grad percentage's effects on the local labor force's productivity. (The remaining 40 percent of the growth effects of the college grad percentage is estimated to be due to effects of the local college grad percentage on the metropolitan area's amenities; we consider these amenity effects further in the working paper version of this report.) This implies that the productivity effects of an increase of 1.63 percentage points in the local college grad percentage will only explain 60 percent of the total long-run increase in employment of 1.18 percent. Therefore, an increase of 1.63 percentage points in the local college grad percentage will increase labor demand, due to higher labor force productivity, by 0.71 percent (= 60 percent of 1.18 percent).

Effects of shocks on local labor demand on local earnings

The regional economics literature suggests that a 0.71 percent shock to local labor demand will increase local earnings by two-fifths or 40 percent of the shock to labor demand, or 0.28 percent (= 0.4 x 0.71 percent).[64] About half of this increase in local earnings is due to increases in the local employment-to-population ratio, and the other half is due to local residents moving up to higher-paying occupations.[65]

Private earnings returns to local residents from increased local educational attainment

Card estimates a quite large effect of the availability of local 4-year colleges on educational attainment.[66] The presence of such a college in the local community when a youth is 14 is estimated to raise the average number of years of education by at least 0.32 years. An increase of 0.32 years is roughly equivalent to an increase in the percentage of youths graduating from college of 8 percentage points (8 percentage points = 0.32 / 4).[67]

Suppose we assume that the effects of college availability are roughly linear, that is, a change in the college LQ by one unit always has the same effect on college graduation rates in local youth (from 0.0 to 1.0, or from 1.0 to 2.0), and a change in the college location quotient by 0.50 location quotients will have half of that effect on college attainment, etc.; Card's estimates can be interpreted as switching from a location quotient for local colleges of zero to a location quotient of 1.0. The implied effect of this is to increase the college graduation rate for local youth by 8 percentage points.

As described above, we assume that if we induce an initial increase in the ed LQ by 0.5, the resulting net increase in the local ed LQ will be 0.375, due to displacement of existing ed activity. Under these assumptions, this investment in ed capacity will increase the college graduation rate for local youth by 3 percentage points.

However, not all these youth will stick around the metropolitan area. Estimates suggest that in the long-run, a little over 50 percent of college graduates stay in the same state as their state of birth (Bartik, 2006). Suppose we assume that this percentage is half as much for the typical metropolitan area, or about 25 percent of local area residents who get a college education in the area stay in the area. Then the implication is that the local residents who get a college education because of expanded local college options, and then stay in the local area, will comprise about 0.75 percent of the local

labor force. This would be about half of the 1.63 percent increase in the local percentage college grads that we previously calculated.

To be conservative in our calculations, we assume that only one quarter of the 1.63 percent increases in the local college grad percentage is due to local residents who were induced to get a college degree, or 0.41 percent of the total local labor force. Earnings differentials due to a college degree are now over 60 percent; we use a figure of 66.5 percent, taken from the College Board. The percentage increase in overall local earnings due to the increase in college graduation of the original residents who stay in the local area will be 0.41 percent times 66.5 percent or 0.27 percent.

Therefore, the total estimated increase in local earnings due to an inducement of a 50 percent or 0.5 LQ increase in ed capacity is 0.28 percent (social spillover effects of education on earnings) + 0.27 percent (effects on local residents induced to increase their college graduation rate) = 0.55 percent. Half is due to extra educational attainment for the area's youth, and the other half is due to the social spillover effects of having more college grads.

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Endnotes

1. Timothy J. Bartik is a senior economist and George Erickcek is a senior regional analyst with the W.E. Upjohn Institute for Employment Research, Kalamazoo, MI. This report should not be construed as representing the official views of the Upjohn Institute.
2. Timothy J. Bartik, *Who Benefits from State and Local Economic Development Policies?* (Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 1991); Timothy J. Bartik, "Economic Development," in J. Richard Aronson and Eli Schwartz, eds., *Management Policies in Local Government Finance,* 5th edition (Washington, DC, International City/County Management Association, 2004).
3. Bartik, Who Benefits?; Timothy J. Bartik, "Solving the Problems of Economic Development Incentives," *Growth and Change* 36 (2005): 139–166.
4. Ira Harkavy and Harmon Zuckerman, Eds and Meds: Cities' Hidden Assets (Washington: Brookings Institution, 1999).
5. Adam Smith, *The Wealth of Nations* (London: Methuen, 1922 [1776]), book I, chapter 8.
6. Matthew Miller, "Moving Forward: MSU Trustees OK Purchase of Site for Grand Rapids Med School," *Lansing State Journal,* January 19, 2007.
7. These are classified under NAICS codes 6112 and 6113 and SIC codes 8221 and 8222.
8. These are classified under NAICS codes 621, 622, and 623 and SIC code 80.
9. This is not always possible with many establishment-based databases on industry. Most of our data, however, are Census-based data collected from households, in which the industry definitions from the employment questions typically include both government-owned and privately-owned enterprises.
10. A descriptive table is in Bartik and Erickcek, "Higher Education." The standard deviation of the eds location quotient across these 283 metro areas is 1.24; the standard deviation of the meds location quotient is 0.24.
11. The calculated correlation across the 283 metropolitan areas in the eds and meds location quotients is -0.04.
12. See Timothy J. Bartik and George Erickcek, "Higher Education, the Health Care Industry, and Metropolitan Regional Economic Development: What Can "Eds & Meds" Do for the Economic Fortunes of a Metro Area's Residents?" Upjohn Institute Staff Working Paper No. 08-140 (Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 2007), available at http://www.upjohninstitute.org/publications/wp/08-140.pdf.
13. Ibid.
14. Bartik, *Who Benefits?*
15. This is the version at the state and local level of the balanced budget multiplier from any standard macroeconomics course, and has been explored by Orszag and Stiglitiz. See Peter Orszag and Joseph Stiglitz, *Budget Cuts vs. Tax Increases at the State Level: Is One More Counter-Productive Than the Other During a Recession?* (Washington: Center on Budget and Policy Priorities, 2001).
16. Larry L. Leslie and Sheila A. Slaughter, "Higher Education and Regional Development," in William E. Becker and Darrell R. Lewis, eds., *The Economics of American Higher Education* (New York: Kluwer Academic Publishers, 1992).; John J. Siegfried, Allen R. Sanderson, and Peter McHenry, "The Economic Impact of Colleges and Universities." Vanderbilt University Department of Economics Working Paper no. 06-W12 (2006)..
17. For an example of a study of the economic impacts of rural hospitals, see R.E. McDermott, G.C. Cornia, and R.J. Parsons, "The Economic Impact of Hospitals in Rural Communities." *Journal of Rural Health* 7 (1991): 117–133. Local economic studies by the Kentucky Rural Works Program can be found at www.ca.uky.edu/krhw/impact.html [March 2007].
18. National Association of State Universities and Land-Grant Colleges, *Shaping the Future: The Economic Impact of Public Universities* (2001).; Association of American Medical Colleges, *The Economic Impact of AAMC-Member Medical Schools and Teaching Hospitals* (2007).
19. This discussion oversimplifies things a bit. Actually, the usual approach has to assume that after closing existing eds or meds institutions, not only would there not be any substitution of increased spending on newly arising eds or meds institutions, but that there would not be any increased spending on other local goods or services. Throughout this paper, we focus on the substitution of spending for eds (or meds) institutions for one another, because we think that it is the most important demand-side effect to consider, but there also are other types of expenditure substitution.
20. Leslie and Slaughter," Higher Education"; Siegfried, Sanderson, and McHenry, "Economic Impact."
21. Siegfried, Sanderson, and McHenry, "Economic Impact."
22. See Institute of Education Sciences,. *Digest of Education Statistics* 2005 (2006), table 329.
23. National Association of Public Hospitals and Health Systems, *How Are Safety Net Hospitals Financed? Who Pays for 'Free Care'?* (2004).
24. .U.S. Census Bureau, "State and Local Government Finances by Level of Government and By State," available at http://www.census.gov/govs/estimate/0500ussl_1.html [accessed July 11, 2007]).

25. See National Center for Health Statistics, Health, United States, 2006 (2007), table 120.
26. Regional Economic Models Incorporated (REMI) constructed the model for the Grand Rapids and Kalamazoo metro areas at the request of the Upjohn Institute. REMI models combine the standard regional input-output model with a general equilibrium model having a forecast component. REMI is well regarded by regional economists and has been used in hundreds of studies.
27. Both Kalamazoo College and Western Michigan University are located in the Kalamazoo-Portage metropolitan area.
28. Melanie Blackwell, Steven Cobb, and David Weinberg, "The Economic Impact of Educational Institutions: Issues and Methodology." *Economic Development Quarterly* 16 (2002): 88–95.
29. Bartik, *Who Benefits?'*; Timothy J. Bartik, *Jobs for the Poor: Can Labor Demand Policies Help?* (New York and Kalamazoo, MI: Russell Sage Foundation and W.E. Upjohn Institute for Employment Research, 2001).
30. It may also displace spending on other local goods and services.
31. This is based on multiplying the lowest fifth of metropolitan areas' cutoff employment level (78,250) by the average earnings to employment ratio ($47,286) reported by the Regional Economic Information Service of the U.S. Bureau of Economic Analysis for 2006, and then multiplying the result by one-half of one percent. A similar calculation is done for a "large" metropolitan area that is at the cutoff for the largest fifth of all metropolitan areas (an employment level of 448,514).
32. Bartik and Erickcek, "Higher Education."
33. David Card, "Using Geographic Variation in College Proximity to Estimate the Return to Schooling," in Louis Christofides, E. Kenneth Grant, and Robert Swindinsky, eds., *Aspects of Labour Economics: Essays in Honour of John Vanderkamp* (Toronto: University of Toronto Press. 1995).
34. Of course, from a national perspective, we would want to consider benefits and costs, regardless of the location of who receives them. The national perspective will be briefly considered later in this report.
35. Jerry Paytas, Robert Gradeck, and Lena Andrews, *Universities and the Development of Industry Clusters* (Pittsburgh: Carnegie Mellon University Center for Economic Development, 2004), p. 4.
36. The Local Innovation Systems Project case studies can be found in Richard K. Lester, "Universities, Innovation, and the Competitiveness of Local Economies: A Summary Report from the Local Innovation Systems Project–Phase I." Working Paper no. 05-010 (Cambridge: MIT Industrial Performance Center, 2005). The report by the Center for Economic Development can be found in Paytas, Gradeck, and Andrews, *Universities*.
37. Lester, "Universities," based on Sean Safford, "Searching for Silicon Valley in the Rust Belt: The Evolution of Knowledge Networks in Akron and Rochester." Working Paper no. 04-002 (Cambridge: MIT Industrial Performance Center, 2004).
38. Lester, "*Universities*,"
39. M.P. Feldman and P. Desrochers, "Research Universities and Local Economic Development: Lessons from the History of Johns Hopkins University," *Industry and Innovation* 10 (2003): 5–24, p. 5.
40. Paytas, Gradeck, and Andrews, *Universities*, p. 7.
41. Paytas, Gradeck, and Andrews, *Universities*, p. 9.
42. L. Anselin, A. Varga, and Z. Acs, "Local Geographic Spillovers between University Research and High Technology Innovations." *Journal of Urban Economics* 42 (1997): 422–448.
43. Attila Varga, "Local Academic Knowledge Transfers and the Concentration of Economic Activity." *Journal of Regional Science* 40 (2000): 289–309.
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47. Varga,"Local Academic Knowledge Transfers."
48. See, e.g., Alan B. Krueger and Lawrence H. Summers, "Efficiency Wages and the Inter-Industry Wage Structure." Econometrica 56 (1998): 259–293; William T. Dickens and Lawrence F. Katz, "Inter-Industry Wage Differences and Industry Characteristics." In Kevin Lang and Jonathan Leonard, eds., Unemployment and the Structure of Labor Markets (New York: Basil Blackwell, 1987)l; Erica L. Groshen, "Five Reasons Why Wages Vary Among Employers," *Industrial Relations* 30 (1991): 350–381.
49. Timothy J. Bartik, "Thinking About Local Living Wage Requirements," Urban Affairs Review 40 (2004): 269–299; David Neumark and Scott Adams, "Detecting Effects of Living Wage Laws," *Industrial Relations* 42 (2003): 531–564.
50. Timothy J. Bartik, *Economic Development and Black Economic Success.* Technical Report No. 93-001 (Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 1993).

51. Nancy M. Pindus and others,. Evaluation of the Sectoral Employment Demonstration Program (Washington: Urban Institute, 2004).
51. This is equal to 0.44 percent due to the demand stimulus from enhancing the export base, plus 0.14 percent due to effects on human capital development of the eds expansion, minus 0.29 percent due to the eds industry's relatively low wages.
52. This is equal to 0.54 percent due to the demand stimulus from enhancing the export-base, plus 0.07 percent due to the meds industry's relatively high wages.
53. These figures are derived by rescaling the estimated effects of 50 percent expansions in eds or meds.
54. These calculations are based on table 6 in Timothy J. Bartik, The Economic Development Benefits of Universal Preschool Education Compared to Traditional Economic Development Programs (Kalamazoo, Michigan: W.E. Upjohn Institute for Employment Research, 2007), available at http://www.upjohn.org/preschool/Short_report.pdf. The incentive expansion considered would cost about $15 billion annually at the national level, which is about 50% of estimated state and local economic development incentives.
55. These calculations are based on Table 6 in Timothy J. Bartik, *The Economic Development Benefits of Universal Preschool Education Compared to Traditional Economic Development Programs,* a 2007 report available at the Upjohn Institute website. The incentive expansion considered would cost about $15 billion annually at the national level, which is about 50% of estimated state and local economic development incentives.
56. John Bound and others, "Trade in University Training: Cross-State Variation in the Production and Stock of College-Educated Labor," *Journal of Econometrics* 121 (2004): 143–173.
57. Institute of Education Sciences, *Digest of Education Statistics,* table 8.
58. Jeffrey A. Groen, "The Effect of College Location on Migration of College-Educated Labor," *Journal of Econometrics* 121 (2004): 125-142 has sometimes been cited as showing a weak relationship between college location and the eventual choice of place to live and work of college-educated workers. Groen concludes that at the state level, attending a college in State X increases the proportion of students who eventually choose to work in that state by only 10 percent. However, Groen obtains these estimates by focusing on students who apply to more than one state for college, and these students may be more footloose than the students who only apply to one state for college. In addition, Groen's estimates do not allow for any effect of college expansion in increasing the proportion of the local population that attends college; all of Groen's estimates are conditional on students deciding to attend college. Furthermore, Groen's estimates do not allow for any aggregate effects of more students graduating on the attractiveness of an area to college graduates. Finally, Groen's estimates are contradicted by the aggregate estimates of Bound and others, which seem more directly pertinent to the issue at hand.
59. Jesse M. Shapiro, "Smart Cities: Quality of Life, Productivity, and the Growth Effects of Human Capital," *Review of Economics and Statistics* 88 (2006): 324–335.; Edward L., Glaeser and Albert Saiz, "The Rise of the Skilled City," in William G. Gale and Janet Rothenberg Pack, eds., Brookings-Wharton Papers on Urban Affairs: 2004 (Washington: Brookings Institution, 2004), p. 305; Paul D. Gottlieb and Michael Fogarty, "Educational Attainment and Metropolitan Growth," Economic Development Quarterly 17 (2003): 325–336.
60. Shapiro's empirical estimate in table 3 of Shapiro, "Smart Cities," is that the coefficient on the ln (college grad share) in an equation explaining ten-year growth is 0.0786. But Shapiro's estimates are for the 1940-1990 period, with lower average educational attainment. Using 1980 as a typical year, the average percentage of college graduates in that year was 17 percent, according to the 2005 Digest of Education Statistics. Thus, ln (17 + 1.63) - ln (17) = 0.09156. Multiplied by 0.0786, this gives a 10-year increase in ln (employment) of 0.0072.
61. L. Jay Helms, "The Effect of State and Local Taxes on Economic Growth: A Time Series Cross Section Approach," *Review of Economics and Statistics* 67 (1985): 574–582.
62 Helms' adjustment estimates imply that the long-run effect on regional business activity is equal to the effect after t years, divided by (1 - (0.9104 taken to the Tth power)). For T = 10, this equation means that long-run employment will increase by 1.64 x the 10-year effects.
63. This is derived by using a national average college grad percentage of 17 percent for the Shapiro results in Table 3, and then taking 10-year growth and multiplying based on Helms by 1.64.
64. Bartik, *Who Benefits?*
65. This is a conservative estimate of the effects on the earnings of the local college grad percentage compared to more direct estimates of the effects of the local college grad percentage on wages. However, we believe this conservative estimate is more reliable. For example, Moretti estimates that a one percentage point increase in the local college grad percentage will increase local wages (in addition to the effects on those educated) by 0.6 to 1.2 percentage points. He argues that this increase is an increase in the real wage. See Enrico Moretti, "Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data," *Journal of Econometrics* 121 (2004): 175–212. These estimates imply that a 3.26 percentage point increase in local college grads will increase local wages and thereby local earnings by 2 to 4 percent. This estimate is 4 to

8 times the earnings effects we use in the text. However, we regard our smaller estimate as more reliable than Moretti's, for several reasons. First, most of his estimates do not control for any local prices. The one estimate that does control for local prices only controls for a local rent index. But we would expect overall local prices, other than local rents, to go up due to the share of local land and labor costs in the production and distribution of many local goods and services. Therefore, it is unclear whether Moretti's estimates really represent real wage and real earnings effects. Second, the local college grad percentage can affect local wages in a number of ways, not just due to effects on productivity. Local wages can also be affected by the amenity effects of the local college grad percentage, and by effects of higher education institutions on local wage norms. Moretti's estimates do not allow us to separate these effects out, unlike Shapiro's estimates.

66. Card, "Using Geographic Variation."

67. For example, if the presence of the local college only has one effect, that of causing 8 percent of local youth to increase their education by four years and graduate from college, 0.08 x 4 will equal a 0.32 increase in average years of education. Of course in the real world, a presence of a local college may cause some local youth to increase their education from zero years of college to one year, which will not affect the college graduation rate. But it may also cause some local youth to increase their years of college from three years to four years, which will increase the college graduation rate. If we assume these effects are roughly offsetting, then a 0.32 increase in average years of education is equivalent to an 8 percentage point increase in college graduation.

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