

# Extending the Reach of Research Universities

## A Proposal for Productivity Growth in Lagging Communities

E. Jason Baron, Shawn Kantor, and Alexander Whalley



## MISSION STATEMENT

The Hamilton Project seeks to advance America's promise of opportunity, prosperity, and growth.

We believe that today's increasingly competitive global economy demands public policy ideas commensurate with the challenges of the 21st Century. The Project's economic strategy reflects a judgment that long-term prosperity is best achieved by fostering economic growth and broad participation in that growth, by enhancing individual economic security, and by embracing a role for effective government in making needed public investments.

Our strategy calls for combining public investment, a secure social safety net, and fiscal discipline. In that framework, the Project puts forward innovative proposals from leading economic thinkers — based on credible evidence and experience, not ideology or doctrine — to introduce new and effective policy options into the national debate.

The Project is named after Alexander Hamilton, the nation's first Treasury Secretary, who laid the foundation for the modern American economy. Hamilton stood for sound fiscal policy, believed that broad-based opportunity for advancement would drive American economic growth, and recognized that "prudent aids and encouragements on the part of government" are necessary to enhance and guide market forces. The guiding principles of the Project remain consistent with these views.



This policy proposal is a proposal from the author(s). As emphasized in The Hamilton Project's original strategy paper, the Project was designed in part to provide a forum for leading thinkers across the nation to put forward innovative and potentially important economic policy ideas that share the Project's broad goals of promoting economic growth, broad-based participation in growth, and economic security. The author(s) are invited to express their own ideas in policy papers, whether or not the Project's staff or advisory council agrees with the specific proposals. This policy paper is offered in that spirit.



# Extending the Reach of Research Universities

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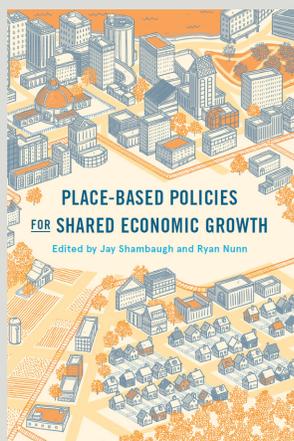
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## Place-Based Policies for Shared Economic Growth

For a century, the progress our nation made toward realizing broadly shared economic growth gave our economy much of its unparalleled strength. However, for the last several decades, that progress has seemed to stall. On critical measures such as household income, poverty, employment rates, and life expectancy, there exist yawning, persistent gaps between the best- and worst-performing communities. These conditions demand a reconsideration of place-based policies. The evidence-based proposals contained in this volume can help restore the conditions of inclusive growth that make it possible for individuals from any part of the country to benefit from economic opportunity.

BROOKINGS

# Abstract

In contrast to the observed convergence in incomes between high- and low-income areas throughout much of the 20<sup>th</sup> century, recent decades have seen an increased clustering of economic activity that has led to diverging fortunes of different places. This phenomenon has revived interest in place-based policies that seek to revitalize lagging communities. Perhaps due to the widely held perception that high-tech clusters around the United States owe much of their success to neighboring universities, establishing research universities in lagging communities is increasingly being considered as a potential place-based policy. Our policy proposal seeks to shed light on the potential role of research universities as anchor institutions for local economic development. After carefully analyzing data and reviewing the literature, we propose that instead of establishing a new research university, lagging communities should focus on transferring productivity-enhancing knowledge to their local employers from existing research universities near their regions. To help achieve this goal, we propose a regionally targeted expansion of the 1988 Manufacturing Extension Partnership program that would encompass a broader range of sectors.

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# Introduction

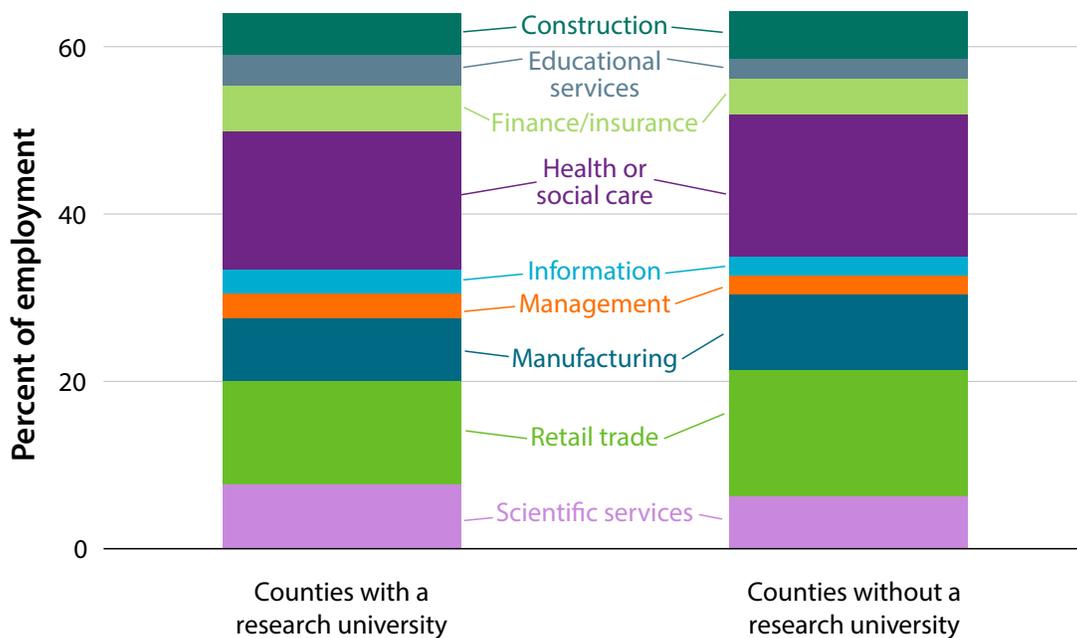
Throughout the past three decades the U.S. labor market has undergone remarkable structural changes. The replacement of manufacturing as the economy's engine of growth with the knowledge-based economy has shifted the geographic distribution of income. Today, many cities with once-thriving manufacturing clusters suffer from significant income and population declines, while other cities, particularly those with innovation hubs, enjoy economic prosperity.

In contrast to the convergence in incomes between high- and low-income areas throughout much of the 20<sup>th</sup> century, recent decades have seen an increased clustering of economic activity that has led to diverging fortunes of different places. This increasing geographic clustering of economic activity has spurred interest in place-based policies that seek to revitalize lagging communities (Austin, Glaeser, and Summers, forthcoming). Perhaps due to the widely

held perception that high-tech clusters such as California's Silicon Valley, Massachusetts's Route 128 corridor, and North Carolina's Research Triangle owe much of their success to neighboring universities, expanding higher education activity in struggling communities is increasingly being considered as a potential place-based policy that could spur economic growth in these areas.

In spite of this perception, however, the data suggest that the establishment of a research university may not be sufficient to transform a local economy. For instance, figure 1 presents the industry composition of employment for counties with and without a research university. Industry employment shares in the two types of counties are remarkably similar, suggesting little relationship between the presence of a research university and a county's composition of employment.

**FIGURE 1.** Share of County Employment, by Selected Industries and Presence of Research University



Source: County Business Patterns (CBP; U.S. Census Bureau [Census] 2017).

Note: Data are for 2015. Figure shows the relationship between higher education activity and a county's employment industry mix. Specifically, it presents the share of employment in various industries separately for counties with a research university (defined as a doctoral university with "highest research activity," "higher research activity," or "moderate research activity" designation in the 2015 Carnegie Classification) and counties without one. Industry employment shares do not sum to 100 percent because only selected industries are shown.



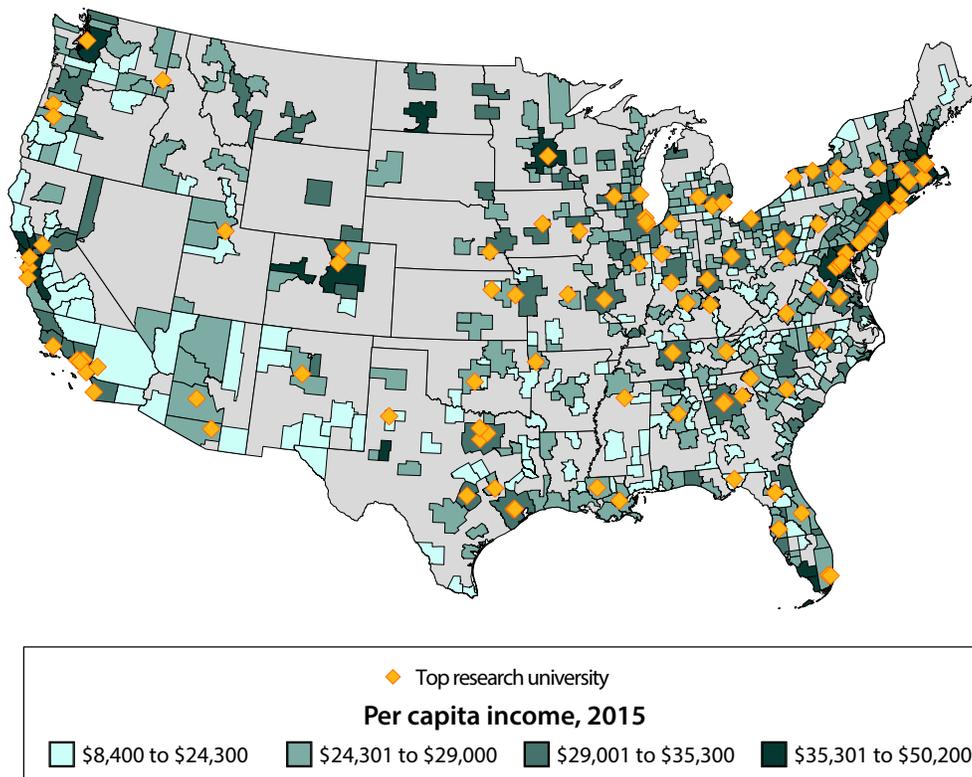
Is it perhaps a matter of having a top research university? Figure 2 shows the per capita incomes of metropolitan areas with and without a top research university. The map demonstrates that having a top research university in the area is not sufficient for economic prosperity. Even though many metropolitan areas with top research universities enjoy high levels of per capita income, many other metropolitan areas such as Bloomington, IN (home to Indiana University), Lansing-East Lansing, MI (home to Michigan State University), and Eugene, OR (home to University of Oregon) do not.

While suggestive, one must be cautious when interpreting these simple correlations. Colleges and universities are not randomly assigned across the country, which makes it difficult to estimate their causal impact. For instance, colleges and universities may be strategically located and resourced in places where demand for them is high. Alternatively, policymakers might have increased higher education expenditures in economically depressed areas with the aim of revitalizing these communities.

Consequently, a closer examination of the causal relationship between university activity and local economic development is warranted; this examination constitutes the goal of ongoing and future research. By carefully analyzing data and summarizing the empirical literature, this policy proposal

FIGURE 2.

### Top Research Universities and Per Capita Income, by Metropolitan Area



Source: IPUMS NHGIS (Manson et al. 2017).

Note: The map shows the per capita income of metropolitan areas with and without a top research university (defined as a doctoral university with the “highest research activity” designation in the 2015 Carnegie Classification).



seeks to shed light on the potential role of higher education as a place-based policy for local economic development.

We document three main findings. First, universities’ ability to affect their local economies solely through the supply of college graduates is limited. Second, the main channel by which universities can affect their local economies is through highly localized knowledge spillovers. Third, the literature provides little evidence that establishing a new university in the 21<sup>st</sup> century is sufficient to revitalize a lagging community and transform its economy. To help revive struggling regions, using existing nearby universities could be a far more cost-effective policy tool.

Based on our findings, we propose that instead of establishing new research universities, lagging communities should focus on transferring productivity-enhancing knowledge to their local employers from existing research universities near their regions. To help achieve this goal, we propose a regionally targeted expansion of the 1988 Manufacturing Extension Partnership (MEP) program that would encompass a broader range of sectors. We propose that MEP centers change their focus from demand-driven one-time solutions (i.e., consulting services) to long-lasting community partnerships whereby universities work with regional MEP centers to communicate and transfer cutting-edge knowledge to local firms.

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# The Challenge

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## HUMAN CAPITAL AND ECONOMIC GROWTH

In order to examine whether expanding higher education in lagging communities can help spur economic development in these areas, one must first understand the reasons for the observed spatial divergence in the economic success of many areas. While these reasons remain a subject of debate, it is generally accepted that the increased sorting of high-skilled workers into select areas has been a key contributor to spatial income inequality (Austin, Glaeser, and Summers, forthcoming; Berry and Glaeser 2005; Glaeser 2012; Glaeser and Saiz 2004; Moretti 2012).

As illustrated in figure 3, counties with a larger share of college-educated workers in 1980 have continued to become more educated over time, while counties with a low initial share of college-educated workers have found it difficult to catch up and attract new high-skilled workers to their areas.<sup>1</sup> Economists often attribute part of the increased spatial sorting of high-skilled workers to the role of so-called agglomeration forces in the innovation sector. High-tech companies, for instance, tend to locate in places with other high-tech companies and a high-skilled population. Labor markets with an abundance of job options, the presence of an entrepreneurial ecosystem with specialized service providers such as venture capitalists and start-up lawyers, and highly localized knowledge spillovers all incentivize new high-skilled workers and start-ups in the innovation industry to locate in places with a preexisting innovation hub (Moretti 2012). Knowledge spillovers are particularly important: firms in close proximity to innovators and knowledge creators can benefit from their neighbors through a variety of both formal (e.g., access to presentations at universities) and informal (e.g., incidental conversations between employees of different firms) channels.

As Glaeser points out, successful cities have been able to “create a virtuous cycle in which employers are attracted by the large pool of potential employees and workers are drawn by the abundance of potential employers” (Glaeser 2012, 25). This means that places with an initial stock of innovative activity and highly educated workers will continue to attract other workers with similar levels of education, while places with low initial levels of human capital might find it difficult to attract new start-ups and high-skilled workers.

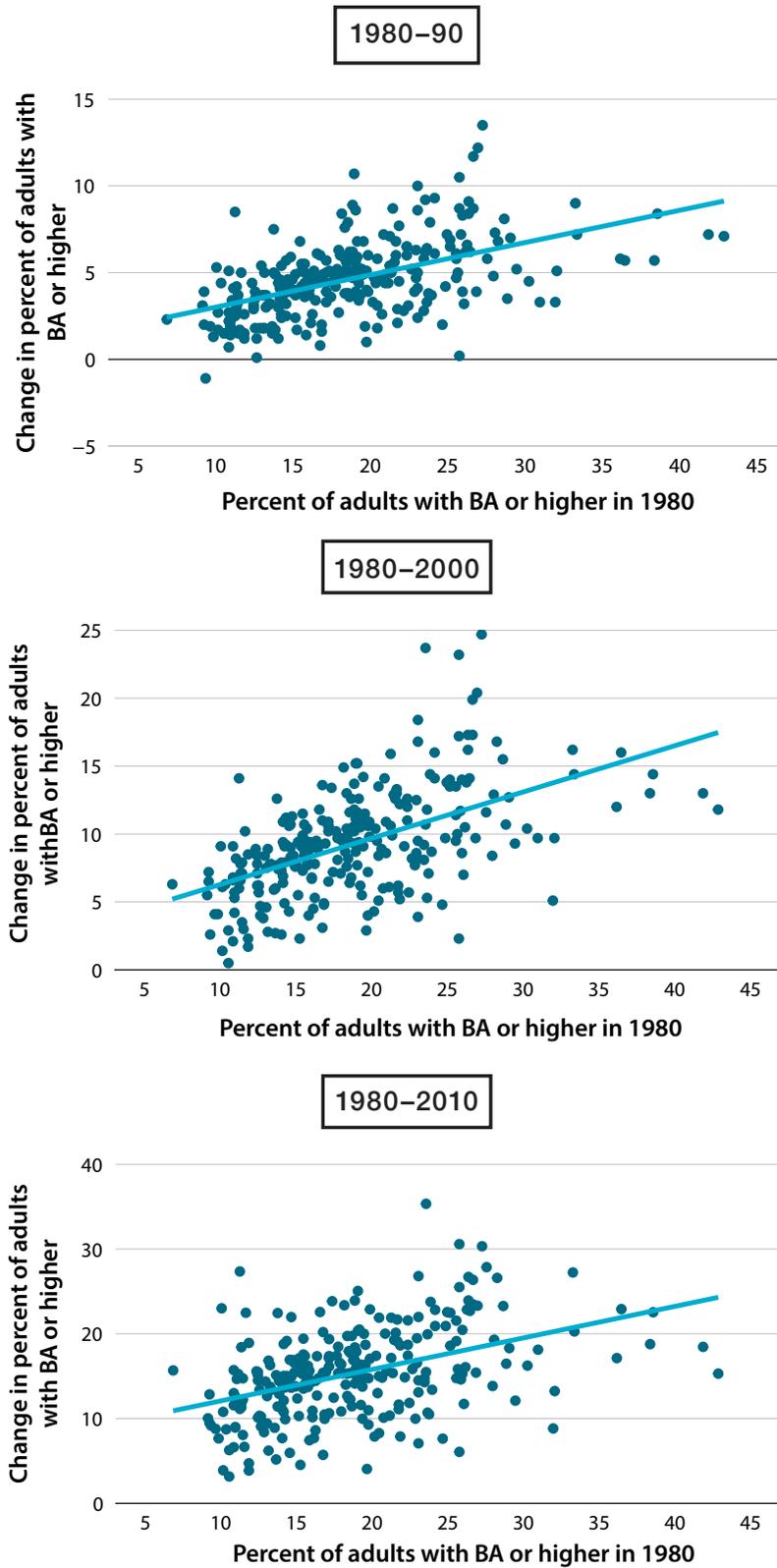
The increased spatial concentration of high-skilled workers is key for understanding the lack of convergence in economic success across places. Tech companies are increasingly looking to locate in areas with a highly educated population. For instance, according to the *Wall Street Journal*, Amazon recently visited more than half of the cities on its list of 20 finalists to host its new headquarters. People familiar with the visits have highlighted Amazon’s focus on each city’s talent and level of education when making its decision. The *Journal* reports that Amazon’s economic development team is particularly concerned with how much talent the company can attract to the area, and examines data such as the city’s average ACT and SAT scores. Therefore, instead of trying to lure Amazon with fancy hotels and private planes, cities “are attempting to be creative by bringing in university officials, younger people and professionals who can speak to talent and growth in the area” (Stevens, Mahtani, and Raice 2018).

It is now widely understood that, in a knowledge-based economy, the amount of human capital (or level of education) within a region is the best predictor of its economic prosperity (Gennaioli et al. 2013, 2014; Henderson 2007). Figure 4 shows a clear positive relationship between a county’s average share of adults with a bachelor’s degree or higher (from 2012 to 2016) and its noneducation labor income in 2015. Furthermore, areas with high human capital levels have in previous decades experienced increases in population and wages, while areas with less human capital have suffered significant declines (Glaeser and Saiz 2004).

The observed relationship between economic prosperity and human capital is in fact causal. Numerous studies have documented a causal private return to education (Angrist and Krueger 1991; Ashenfelter and Krueger 1994; Oreopoulos and Petronijevic 2013).<sup>2</sup> By extension, when the stock of highly educated workers in a region increases, one might expect aggregate income in the region to increase as well. Furthermore, the social return to education has been found to be even larger than the sum of its private returns. Moretti (2004) estimates college education spillovers and concludes that an increase in the supply of college graduates in an area also raises the wages of high school dropouts, high school graduates, and other college graduates through human capital externalities. Moreover, Glaeser (2005) shows that

FIGURE 3.

### Levels and Growth of College Attainment, by County

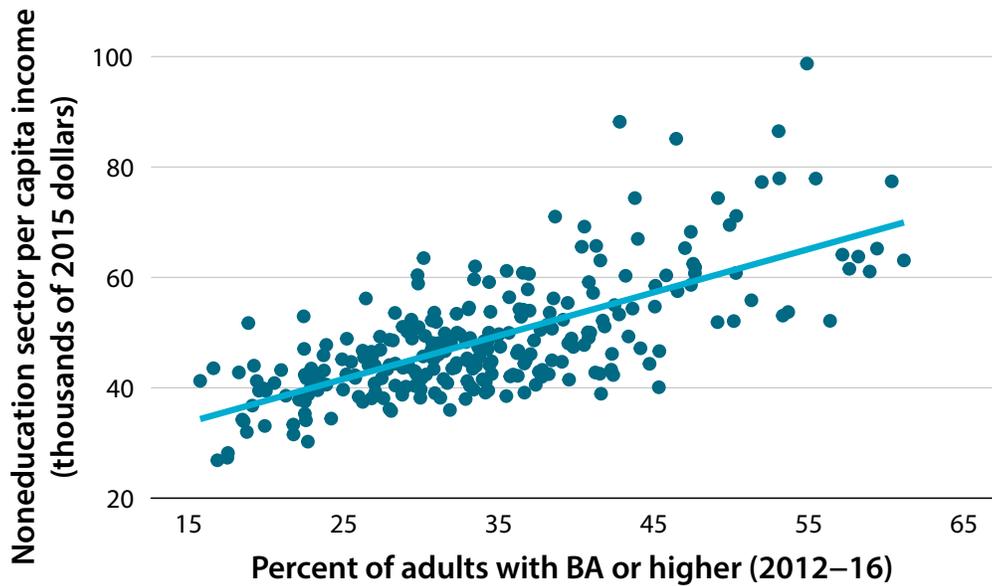


Source: American Community Survey (ACS; Census 1980–2016).

Note: Figures show the increased spatial concentration of highly educated workers in recent decades. Counties with a larger share of college-educated workers in 1980 have continued to become more educated over time, while counties with a low initial share of college-educated workers have disproportionately not been able to attract new highly educated workers. The sample includes only counties with populations greater than 250,000. Line represents linear fit. BA refers to bachelor's degree.

FIGURE 4.

## Noneducation Sector Income, by Share with Bachelor's Degree



Source: ACS and CBP (Census 2012–16; 2017).

Note: Noneducation sector income data are for 2015. Figure shows the relationship between human capital and noneducation labor income. Specifically, it presents a scatter plot and a linear fit of the relationship between a county's share of adults with a bachelor's degree or higher and its associated noneducation labor income. The figure provides suggestive evidence of a positive relationship between a county's human capital stock and its economic success. Line represents linear fit. BA refers to bachelor's degree.



larger amounts of human capital have allowed cities such as Boston to achieve long-run economic growth by reinventing themselves in periods of economic crisis and decline. An increase in human capital within a region has also been found to induce subsequent employment growth. Shapiro (2006) estimates that a 10 percent increase in the share of residents who are college-educated leads to an increase in employment growth of roughly 1.7 percent. Finally, increases in education have been shown to lead to other social benefits such as reduced crime. Thus, locations with a more-educated population may enjoy higher wages, lower crime rates and unemployment, and better amenities, which together further attract other highly educated workers (Lochner and Moretti 2004; Shapiro 2006). All of these points indicate that, in an innovation-driven economy, the stock of human capital in a region is key to its success, and that any successful place-based policy must lead to an increase in the stock of local human capital, whether directly or indirectly.

### HIGHER EDUCATION AND HUMAN CAPITAL

The positive relationship between human capital and economic success, as well as the perception that high-tech clusters such as California's Silicon Valley, Massachusetts's Route 128 corridor, and North Carolina's Research Triangle owe much of their success to neighboring universities, has spurred interest in higher education among local

governments. Can the expansion of higher education in struggling communities increase the stock of human capital in their regions and therefore generate economic prosperity? In this section, we examine the relevant empirical literature and conclude that universities have only a very limited ability to directly impact their regions' supplies of human capital. However, by increasing demand for skilled labor through localized knowledge spillovers, colleges and universities can contribute to the economic success of their local economies.

### SUMMARY OF FINDINGS

As the U.S. economy continues to shift away from the production of goods to the production of knowledge and ideas, the amount of human capital in a region will continue to be key to its success. Therefore, a crucial consideration for place-based policies that seek to revitalize lagging communities is whether they lead to an increase in the area's stock of human capital. Our research summary provides evidence that, through knowledge spillovers arising from increases in university research spending, a higher education institution can bolster its region's economy by increasing the demand for local human capital. However, universities are not panaceas and are most beneficial as complements to a preexisting industrial ecosystem.

Three main findings are most important to describe. First, the ability of universities to affect their local economies solely through the supply of college graduates is limited. College-educated workers are highly mobile and are more likely to migrate than their less-educated peers.

Second, the main channel by which universities can affect their local economies is through highly localized knowledge spillovers that make existing nearby firms more productive and attract new firms to the area. These knowledge spillovers, however, are not broad-based. Spillovers from universities to the local economy are strongest for industries that rely on innovation and technical training more heavily, and that share a labor market with universities. Therefore, areas with preexisting clusters and a large concentration in high-tech employment are more likely to enjoy knowledge spillovers than are areas with higher employment concentrations in low-skilled industries.

Third, the literature provides little evidence that establishing a new university in the 21<sup>st</sup> century is sufficient to revitalize a lagging community and transform its economy. Using existing nearby universities might be far more cost-effective in many cases to revive struggling regions.

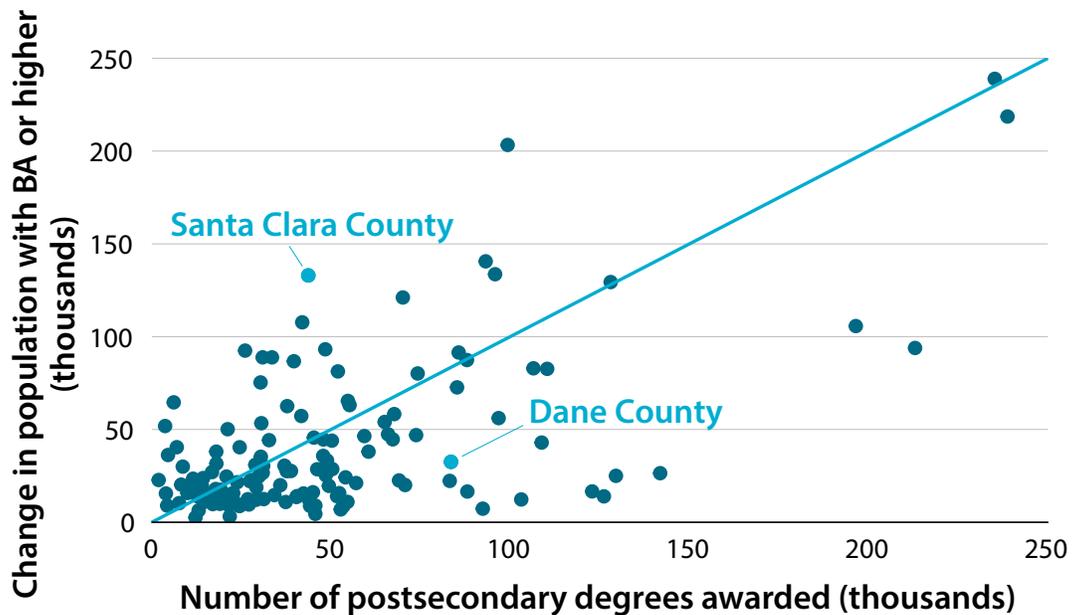
### Supply of Human Capital

In theory, universities can influence the stock of human capital in a region by increasing both the supply of and the demand for college graduates (Abel and Deitz 2012). At first glance, it may seem obvious that colleges and universities directly increase the supply of college graduates in their regions. After all, one of the key roles of a university is that of an educational institution. However, a closer look at the literature reveals that the impact of universities on the supply of college graduates in a region could be small for certain areas. For instance, if a region's local labor market is not robust enough to create job opportunities for newly minted graduates, alumni might not be incentivized to remain in the area.

College-educated workers are highly mobile and more likely than their less-educated peers to migrate in search of better jobs (Bound et al. 2004; Faggian and McCann 2009; Moretti and Wilson 2014; Wozniak 2010). Therefore, areas with strong local labor markets may both retain their graduates and attract graduates from other locations, while regions with less-robust labor markets may struggle to retain their graduates.

FIGURE 5.

## Local Labor Market Flows of College-Educated Adults by Number of Postsecondary Degrees Awarded, 1990–2000



Source: Integrated Postsecondary Education Data System (National Center for Education Statistics 1980–2000); ACS (Census 1980–2016).

Note: Figure shows the relationship between a county's production of higher education degrees and its flow of high-skilled individuals. A high-skilled individual is defined as someone who holds a bachelor's degree or higher. The county's number of higher education degrees awarded between 1990 and 2000 was interpolated by multiplying the total number of bachelor's, master's, and doctoral degrees awarded in 1999–2000 by 10. Line represents 45 degree angle. BA refers to bachelor's degree.

Figure 5 shows the importance of migration in the market for high-skilled individuals. In some counties, such as Santa Clara County (home of Stanford University), significantly more high-skilled individuals (those who hold a bachelor's degree or higher) enter the local labor market than the number of high-skilled individuals that the county's universities produce. On the other hand, areas such as Dane County (home of the University of Wisconsin–Madison) produce far more high-skilled workers than they receive. For instance, from 1990 to 2000 the University of Wisconsin–Madison granted roughly 83,000 higher education degrees. However, over this same period, Dane County experienced a net gain of only 32,000 high-skilled individuals. In fact, during this same period only 37 percent of counties in our sample—comprising urban counties with at least one research university—experienced higher influx of high-skilled workers than the number of higher-education degrees they awarded.

Indeed, research by Abel and Deitz (2012) shows that there is no statistically significant relationship between an area's production and its stock of human capital, which further confirms the important role of migration in the market for high-skilled workers. Thus, universities acting solely as educational institutions could fail to induce a significant increase in the stock of human capital in their regions. College graduates migrate to the best opportunities.<sup>3</sup>

### *Demand for Human Capital*

While it may not be possible to substantially increase local human capital directly through postsecondary instruction, colleges and universities can increase the stock of human capital in their regions through alternative channels. Particularly, increases in research activities at universities can raise the stock of local human capital by increasing the demand for human capital.

If innovative ideas and technology resulting from university research spending spill over to the private sector, then the productivity of nearby firms may increase, thereby improving the local economy (Kantor and Whalley 2014). Furthermore, if these knowledge spillovers are mostly present for firms relatively close to the university, new innovative firms that wish to gain access to these ideas could be drawn to the area (Hausman 2017), increasing the demand for local human capital.

The argument that university research can increase the demand for human capital, however, relies on the assumption that knowledge spillovers are highly localized, and it is not immediately clear that this is the case. After all, the basic research in which university faculty and staff are engaged is often disseminated broadly. While research is produced locally, it is available for anyone in the world to adopt when it is published online in scholarly journals. Furthermore,

declines in communication and transportation costs in recent decades have lowered the cost of information transfer, which should reduce the incentive for a firm to locate near a university solely for the purpose of gaining access to its research (Glaeser and Ponzetto 2010).

Yet the observed geographic concentration of economic activity seems to indicate that proximity to knowledge does matter. In fact, as described previously, economists often highlight the role that knowledge spillovers play in contributing to the increasing returns of geographic density (Henderson 2007). Proximity to knowledge seems to be particularly important in the innovation industry. As Moretti explains, “In the world of innovation, productivity and creativity can outweigh labor and real estate costs.” Thus, agglomeration forces, including knowledge spillovers, “ultimately determine the location of innovative workers and companies and therefore shape the future of entire communities” (Moretti 2012, 124).

That geographic proximity to knowledge is crucial in the innovation industry could be an indication of the importance of face-to-face contact and the human factor in the transmission of tacit, informal knowledge (Glaeser 2012; Rocco 1998).<sup>4</sup> Adams (2002) finds that knowledge spillovers from universities are much more localized than industrial spillovers. According to Adams, “Firms go to nearby universities for advice, research, and students. In contrast, industrial interactions take place over a greater distance and occur selectively” (254). Highlighting the aforementioned paradox that universities generate public knowledge that seems to benefit local firms disproportionately, Adams explains that it is precisely the nature of open science that incentivizes firms to locate near universities. Firms need to “go to local universities to obtain information that is reasonably current and not proprietary. This increases the localization of academic spillovers” (Adams 2002, 274). Similarly, Yusuf (2008) explains that universities often act as hubs that connect the creators and users of path-breaking knowledge that can set the stage for future economic prosperity.

There is a large empirical literature confirming the existence of highly localized spillovers of university research on outcomes such as patenting (Aghion et al. 2009; Andersson, Quigley, and Wilhelmsson 2009; Jaffe 1989; Jaffe, Trajtenberg, and Henderson 1993), technological innovation (Acs, Audretsch, and Feldman 1992; Anselin, Varga, and Acs 1997; Audretsch and Feldman 1996; Jaffe 1989), business start-ups (Abramovsky, Harrison, and Simpson 2007; Audretsch, Lehmann, and Warning 2005; Bania, Eberts, and Fogarty 1993; Woodward, Figueiredo, and Guimaraes 2006), and employment growth (Hausman 2017). This literature has shown the importance of academic research to the development of specific local industries, such as

pharmaceuticals or electrical and electronic equipment. Furthermore, it has shown that the productivity gains stemming from knowledge spillovers of academic research are indeed highly localized and that they translate into higher local human capital levels (Abel and Deitz 2012).

Less studied, however, has been the extent to which these localized university knowledge spillovers actually translate into broad-based regional economic development. Kantor and Whalley (2014) address this question directly by examining the impact of increases in university expenditures on local noneducation labor income. As mentioned before, the main empirical challenge in estimating the impact that universities have on their local economies is that university activity is not randomly assigned: universities might be more likely to locate and expand in places that are (for unrelated reasons) on a stronger or weaker economic growth trajectory.

To deal with this econometric challenge, Kantor and Whalley (2014) exploit a natural experiment. Specifically, the authors consider significant and sudden changes, or shocks, to universities' endowment levels that are caused by fluctuations in stock market values. Universities typically spend a constant fraction of the market value of their endowments every year. Therefore, sudden shocks to the stock market determine how much a university will be able to spend from its endowment in any given year. Given that shocks to stock market returns occur at the national or international level and that prior levels of university endowments are not affected by future economic activity in the university's county, we can use these shocks to examine random variation in university expenditures on research and other activities.

Taking this approach, Kantor and Whalley (2014) find that increases in university research activity result in productivity spillovers to other industries. The estimates indicate that a \$1.00 increase in university spending generates an \$0.89 increase in noneducation labor income in the county in which the university is located. The results further show that this effect persists for at least five years, which suggests that the impact of research expenditures goes beyond a short-run boost to local labor demand.

While the average spillover effect is rather modest, the authors further investigate whether the magnitude of the effect varies with the intensity of university research or the strength of economic links between universities and local industries. Knowledge spillovers are found to be significantly larger for universities that have a greater focus on research, for industries that share a labor market with universities, and for industries that use knowledge more intensively.

These findings are in line with previous research showing that knowledge spillovers tend to be concentrated in particular industries such as pharmaceuticals or electronics, and are

not broad-based (Jaffe 1989). In the models estimating the spillover effect over five years, the estimates indicate that firms in industries that are technologically closer to university research, in the sense that they share a labor market with higher education and are more likely to cite university patents, enjoy a spillover that is double that of the typical firm.<sup>5</sup>

Using an alternative econometric strategy, Hausman (2017) arrives at a similar conclusion. Specifically, the author investigates whether an increase in university innovation leads to local economic growth. Hausman finds that the passage of the Bayh-Dole Act in 1980, which incentivized universities to commercialize new innovations, resulted in wage and employment growth for communities near the universities, and specifically for those industries that were more closely related to the technological strengths of the nearby university.

Hausman (2017) finds that large numbers of small unit firms entered the university area, possibly as a result of spin-offs from new university ideas. However, she finds that most of the employment gains came from new establishments of existing firms in university-related industries.

Hausman's findings suggest that highly localized university knowledge spillovers may not only make existing firms in the area more productive, but may also attract new firms wanting to gain access to these spillovers. Altogether, research has shown that universities can affect the stock of local human capital and spur economic development in their communities as long as they focus on academic research in areas that are relevant to local industry.

## ALTERNATIVE CHANNELS

In addition to its effect on local economic development through the human capital channel, a university can contribute to its local economy directly through increased employment and consumption. As with any large employer, universities create a substantial number of jobs and bring consumer spending into the local economy.

Higher education institutions can bring new dollars into their local economies through two channels: export-based production (bringing in students and research funding from outside its local area) and import substitution (bringing in students from its own metropolitan area who would have gone to school outside the area). Income brought into the local labor market by universities will in turn be re-spent by the local industries on local suppliers or retailers, resulting in a fiscal multiplier effect of the initial infusion of money (Bartik and Erickcek 2008; Blackwell, Cobb, and Weinberg 2002; Siegfried, Sanderson, and McHenry 2007).

## ESTABLISHING A UNIVERSITY VS. EXPANDING RESEARCH ACTIVITY

Most of the research to date has focused on the effect of expanding higher education activity, through either research expenditures or increases in degree production. This research is less informative regarding the effects of opening a new university. Furthermore, the literature has primarily focused on metropolitan areas and urban counties, and not on rural areas. The effects of higher education expansions can be quite different in these latter areas, particularly since university knowledge spillovers are larger when research is focused in areas relevant to industry fundamentals (Kantor and Whalley 2014).

The example of the University of California, Merced (UC Merced) is informative. UC Merced is the first American research university built in the 21<sup>st</sup> century (2005 marked the year of its official grand opening), and it provides an excellent opportunity to test whether establishing a new university in a relatively small and less-educated local economy can bring economic prosperity to the region.

A recent study by Lee (forthcoming) finds that the university has generated only a modest impact on the local economy by increasing local employment. Job creation was large for the service sector, but was not significant for either the manufacturing or high-skilled sectors, leading the author to conclude that the establishment of a new university in the 21<sup>st</sup> century is likely insufficient to yield robust agglomeration economies. The opening of UC Merced did induce a local labor demand shock, which resulted in the fiscal multiplier effects described earlier. However, at least in the short run the university has not generated the knowledge spillovers required to induce a meaningful increase in its region's stock of human capital.<sup>6</sup>

Lee (2018) explains that his findings are consistent with the findings of Kantor and Whalley (2014): although Kantor and Whalley find evidence of localized spillovers from university activity, the effects are larger in those industries that use knowledge more intensively. Given that the initial industrial

composition in Merced was not concentrated in high-tech industries, workers in neighboring firms might not have benefited as much from the opening of a research university.

Varga (2000) arrives at a similar conclusion, finding that proximity is not sufficient for technology transfer to occur. Johns Hopkins University and Cornell University are noted as two examples of important research universities that have nonetheless not led to substantial clusters of high-tech economic activity. Varga finds that concentration in high-tech employment is the most important factor promoting localized knowledge spillovers, and that a critical mass of agglomeration is needed if one is to expect substantial university knowledge spillovers. Similarly, Aghion et al. (2009) show that exogenous increases in research university activity have a greater impact on economic growth for states that are closer to the technological frontier because potential beneficiaries of such education migrate to frontier states. As the authors put it, "Massachusetts, California, or New Jersey may benefit more from an investment in Mississippi's research universities than Mississippi does" (39). All of these findings suggest that the effect of establishing a research university in areas without a preexisting innovation cluster and without the "right" industrial composition may be small.

The results obtained by Lee (2018) and Bonander et al. (2016) differ from those of Liu (2015), who documents long-lasting spillovers on manufacturing productivity following the establishment of land-grant colleges in the late 19<sup>th</sup> century.<sup>7</sup> There are three plausible explanations for these differing conclusions. First, in contrast to the market for higher education in the late 19<sup>th</sup> century, today this market is extremely saturated. There are hundreds of universities in the United States competing for new students every year and accreditation is difficult to obtain. Second, in contrast to the late 19<sup>th</sup> century, geographic mobility is much higher today (Ferrie 1997). Third, as previously mentioned, agglomeration forces play a far more important role in the modern innovation industry than they do in manufacturing. Attracting high-skilled workers and high-tech start-ups to Merced, for example, might be a difficult task in today's economy due to the advantages that areas with preexisting clusters already provide.

Overall, the current literature suggests that establishing a new university in the 21<sup>st</sup> century is not sufficient to generate a self-sustaining cluster. Nevertheless, once a cluster has started, a university can play a key role in fostering it by becoming part of a larger ecosystem and spilling knowledge to nearby firms.<sup>8</sup>

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# The Proposal

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Based on these three main findings, we propose that instead of establishing new research universities, lagging communities should focus on transferring productivity-enhancing knowledge to their local employers from existing research universities located near their regions. Such knowledge could increase the productivity of firms in these communities and eventually lead to an increase in the demand for local human capital, a key determinant of economic prosperity.

To help lagging communities transfer knowledge from universities to their local firms, we propose a regionally focused expansion of the MEP program (described in box 1). Targeting left-behind regions where joblessness has been

particularly pronounced—and employment responses to increases in labor demand may be more elastic (Austin, Glaeser, and Summers, forthcoming)—could raise the effectiveness of our proposed MEP expansion. In order to receive the targeted employment area designation, a location must experience an employment-to-population ratio in the bottom 20 percent of U.S. counties, averaged over the previous five years.

The U.S. Department of Commerce would solicit applications from postsecondary institutions and from state or local governments applying either on behalf of their postsecondary institutions or for the purpose of establishing MEP branch offices in targeted areas. These applications would be

## BOX 1.

### The Manufacturing Extension Partnership

Initiatives focusing on outreach and knowledge diffusion from universities to the local private sector have been in place since the early 20<sup>th</sup> century and provide a model of what could be done for the digital economy of the 21<sup>st</sup> century. Seaman Knapp, the founder of the agricultural extension movement in the United States, captured the importance of outreach and demonstration itself on successful knowledge diffusion: “What a man hears, he may doubt; what he sees, he may possibly doubt; but what he does himself, he cannot doubt” (Knapp quoted in Sanders 2010).

An example of a current outreach initiative is manufacturing extension, which seeks to improve the productivity of small- and medium-size manufacturing firms. While there have been many such extension initiatives, the MEP, created in 1988, has proven particularly successful at providing information on modern production techniques to local manufacturing firms. The MEP program focuses on the diffusion and adoption of new knowledge and technology among small- and medium-size manufacturing firms.

The MEP is a national network administered by the National Institute of Standards and Technology of the U.S. Department of Commerce. The network includes MEP centers in all 50 states and Puerto Rico, with these centers often having multiple affiliate offices within a state. Each center is a public–private partnership structured either as a separate nonprofit corporation or as part of existing organizations such as state agencies, economic development groups, or universities. Centers are funded by a combination of contributions from federal, state, and local governments, as well as industry contributions and fees generated from the services provided to client firms.

Each MEP center works directly with local manufacturing firms to provide face-to-face, individually-tailored technical and business assistance. Services range from expert advice on process improvements and applications of information technology, to employee training and marketing. Additionally, centers inform local firms of recent innovations and breakthroughs generated in public entities such as universities or other government laboratories, and help client firms adopt these new technologies.

While some services are provided by in-house staff, centers often act as hubs for manufacturers, connecting them with private consultants, trade associations, faculty and scientists at local universities and other research laboratories, government agencies, and many other entities that seek to help clients become more productive in an increasingly competitive international marketplace. Client services are often provided for subsidized fees.

competitively evaluated on the basis of the following criteria: the potential to support economic activity in depressed areas, the degree of coordination planned between universities and MEP regional centers, and (relatedly) the extent to which the applicants plan to feature universities and university basic research at the center of their activities.

On the research side of the partnership, the Department of Commerce grants would support work conducted at research universities that has the potential to enhance economic activity in targeted areas. The universities themselves would not need to be located in targeted areas.

On the business side of the partnership, the Department of Commerce grants would be available to fund a combination of discounted MEP services for businesses operating in those areas and establishment of new MEP branch offices in these communities. These offices would help local businesses to benefit from the work being done on (potentially distant) university campuses.

We advocate a change of focus for the modified MEP, shifting toward a role as knowledge diffusers of breakthrough university research. While applied and demand-driven services can benefit local firms in the short run, the transfer of university tacit knowledge related to more basic research is likely to yield longer-term and more-significant increases in firm productivity. This redirected focus requires that research universities, whose mission includes the creation and dissemination of knowledge, reposition themselves at the center of MEP partnerships.

Even though we can find examples of MEP centers where universities already play a major role in knowledge transfer, more often centers simply ask faculty at nearby universities

for demand-driven one-time solutions. (Box 2 describes notable examples of existing public–private partnerships centered around universities.) Long-lasting center–university partnerships where universities work with centers to share frontier knowledge with local firms are likely to yield significantly higher returns. In order to encourage these relationships, we propose that the expansion includes grants to fund doctoral or postdoctoral students who would work through MEP regional centers to translate the basic research undertaken at the university and find practical applications for such research in firms in struggling communities.

Unlike the current MEP, our proposal would encompass a broad array of academic fields and industrial sectors. Any academic work that is useful for private economic activity would be within the scope of the proposal. For example, a business school with faculty conducting research on management practices would be able to share its work with firms, as would engineering and physics faculty researching new materials science.

However, university knowledge spillovers tend to be concentrated in industries that rely more heavily on innovation and technical training. A common feature of firms in these industries is their reliance on the collection and processing of new data. Therefore, we propose that data science methods—a new general purpose technology that is emerging due to dramatic cost reductions in the collection, storage, and processing of data—be a natural focus of our proposal. In particular, firms in lagging areas can apply data science knowledge to smart manufacturing. Universities have substantial data expertise across a wide range of disciplines and are well poised to lead the charge in transferring this knowledge to local firms through regional MEP centers.

#### BOX 2.

### University-Centered Public–Private Partnerships

A notable example is the collaboration between the Georgia Institute of Technology and the Georgia Manufacturing Extension Partnership. Examples of other successful university-centered partnerships outside the scope of MEP regional centers include the University of Southern California’s role in the Advanced Manufacturing Partnership for Southern California (AMP SoCal).

AMP SoCal deserves particular attention, and we view its structure as a model for our proposal. AMP SoCal is a collaboration of government, academia, and industry that aims to strengthen the industrial ecosystem for aerospace and defense (A&D) manufacturers in Southern California. Importantly for our proposal, the University of Southern California leads the AMP SoCal effort through its Center for Economic Development.

In contrast to a relationship that is focused solely on demand-driven one-time solutions, AMP SoCal seeks to engender a long-lasting collaborative partnership with the goal of transforming Southern California’s industrial ecosystem. For instance, in addition to red carpet services that deliver business assistance ranging from training resources to consulting services, AMP SoCal assembles innovation forums and workshops for the A&D industry in Southern California. These workshops seek to increase interactions between universities involved in AMP SoCal and innovators at small- and medium-size manufacturing firms. At the workshops, university leaders inform A&D firms of federal R&D funding opportunities as well as the newest available productivity-enhancing technologies.

Universities require large fixed costs and establishing a leading research university in a crowded higher education market can take many decades. Additionally, as mentioned above, the main benefit to a local economy from a research university arises from knowledge spillovers of frontier research conducted at the university. Our proposal is based on the idea that a focus on university knowledge diffusion, as opposed to the creation of a new higher education institution, would be a far more cost-effective way of transferring knowledge to firms in lagging communities.

The transfer of tacit knowledge from universities to local industries is an important channel through which policymakers can pursue local economic development. While policymakers and scholars have focused on more-formal channels of technology transfer such as patenting, licensing, and the commercialization of university inventions, the role of knowledge-related collaboration between academic researchers and nonacademic entities has been largely ignored (Perkmann et al. 2013).

This collaboration can be particularly valuable given that universities have a comparative advantage in basic research, with firms' comparative advantage in applied research. Moreover, effective collaboration in formal technology transfer can be difficult given that the primary motivation for academic scientists to work with industry is often to further their own research agendas rather than to commercialize their knowledge (D'Este and Perkmann 2011). For instance, engagement with industry allows faculty members to gain access to new research ideas, data, and funding (Boardman and Ponomariov 2009).

From the firm perspective, informal technology transfer is often far more valuable to their R&D success than other forms of codified knowledge. Analyzing data from the Carnegie Mellon Survey on industrial R&D, Cohen, Nelson, and Walsh (2002) find that the key channels through which useful information moves from universities to industrial R&D facilities include published papers and reports, public conferences, meetings, consulting services, and informal information exchange. The absence of patents and other intellectual property from this list could be partially due to the fact that informal technology transfer is largely insulated from these collaboration barriers, whereas formal technology transfer channels may lead to conflicts over intellectual property between universities and private firms.

In the aftermath of the Bayh-Dole Act, many universities established a technology transfer office that supports the commercialization of university inventions and facilitates the licensing of intellectual property to private firms (Siegel, Waldman, and Link 2003). Although the presence of formal technology transfer structures is positively related to commercialization, these mechanisms have been less adept

at fostering informal technology transfer (Perkmann et al. 2013). Therefore, whereas previous policies have sought to assign direct entrepreneurial responsibilities to universities, we view the transfer of tacit knowledge to local firms as a more promising local economic development tool and one that is more consistent with the comparative advantage of universities.

Knowledge diffusion from universities to firms in lagging communities that do not have a research university is not easy. This proposal has emphasized the highly localized nature of university knowledge spillovers that often depend on face-to-face interaction and the human factor for the transmission of tacit knowledge. Fortunately, these challenges have long been recognized by policymakers.

## EVIDENCE ON MANUFACTURING EXTENSION SERVICES

Recent research shows expanding manufacturing extension in this way could be a promising place-based policy. Bartik (2018) examines the success of various public policies aimed at revitalizing manufacturing-intensive communities that have been left behind by technological advancement and globalization. The author concludes that while wage subsidies, business tax cuts, and other business tax incentives are relatively expensive per job created, high-quality customized services such as manufacturing extension initiatives—aimed at increasing the productivity of existing firms—have proven more successful.

Bartik (2018) provides compelling evidence from the literature that manufacturing extension services have been successful at increasing the productivity of client firms. For instance, Jarmin (1999) estimates the impact of manufacturing extension on firm productivity. Matching data from eight manufacturing extension centers in two states to plant-level data from the U.S. Census Bureau's Longitudinal Research Database, the author finds that manufacturing extension clients enjoyed between 3.4 percent and 16 percent higher growth in labor productivity between 1987 and 1992 than similar non-client firms.

According to Bartik (2018), these estimates suggest that manufacturing extension services would be at least five times more cost-effective than other policies such as business tax incentives in inducing firms to create, expand, and retain jobs in a location. While there is no silver bullet for local economic development, the success of previous manufacturing extension initiatives, as well as the documented importance of university tacit knowledge to firm productivity, make our proposal an appealing and cost-effective way of helping revitalize lagging communities.

## EVALUATING THE PROPOSAL

We believe that accountability and continuous program monitoring are keys to the success of our proposal. Therefore, we propose that a rigorous program evaluation be built into the MEP expansion. Successful program evaluation must address two main challenges.

First, it is necessary to accurately and empirically measure outcomes of interest at the firm level. We propose using firm-level wages and total employment as the outcomes of interest. Matching worker–firm data such as from the Longitudinal Employer–Household Dynamics (LEHD) program to data collected by regional MEP centers on client firms can be used to track the impacts of the program. Restricted-use LEHD data includes job-level quarterly earnings history data, person-level demographic data, establishment-level firm characteristics, and establishment-level Quarterly Workforce Indicators such as employment, job creation, earnings, and other measures of employment flows. Tracking these variables

would be valuable for understanding the full range of impacts of the proposal.

Second, it is necessary to compare the productivity of participant firms to the productivity of comparable nonparticipants. Random assignment of targeted manufacturing extension services would yield the most reliable results. We propose that the expansion of extension services be first rolled out on a small scale and in a conditionally randomly assigned manner. Conditional on being in one of the lagging communities that this proposal seeks to help revitalize, firms treated by the program expansion should be randomly selected at first. While this means that some firms in need of help would not initially receive extension services, random assignment would ensure that our program evaluation captures the causal effect of the expansion by comparing treated firms to carefully selected control firms. Furthermore, this initial evaluation would give policymakers information about whether the program is achieving its intended goals before dramatically expanding it.

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# Questions and Concerns

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## ***1. Will increased productivity of firms in lagging communities have benefits for residents?***

Expanding the role of university extension is intended to raise the productivity of firms in lagging communities. In turn, this increased productivity will benefit local residents (Hornbeck and Moretti 2018). Hornbeck and Moretti conclude that increases in an area's productivity gains in manufacturing lead to substantial local increases in employment and average earnings. Furthermore, the authors document a decrease in local inequality: increases in productivity raise the earnings of local less-skilled workers more than the earnings of relatively higher-skilled local workers. The differential effect on earnings is partially due to the lower geographic mobility of less-skilled workers. Based on these findings, we expect that our extension proposal might disproportionately benefit less-skilled workers in lagging communities who are less geographically mobile.

## ***2. What effects would your proposal have at the national level?***

The discussion in this chapter has focused on the effects of an expansion in higher education on a regional labor market. Efficiency of these policies from the point of view of the aggregate economy is far more complicated and is outside the scope of this chapter. However, one must consider whether an expansion in manufacturing extension services to less-productive areas could be detrimental to the nation as a whole. For instance, since high-skilled people achieve their greatest productivity when working near similarly productive and skilled people, even if a place-based extension policy were successful at bringing a cluster of firms to a lagging community, aggregate productivity could be lower as a result. Even in that scenario, the policy could be desirable

if policymakers have a sufficiently strong preference for supporting economic activity in distressed places.

## ***3. The policy proposal focuses on research universities, but is there a role for other segments of the higher education system?***

Left-behind communities often experience skills gaps in industries such as manufacturing. Expanding access to vocational training and apprenticeship programs to workers from disadvantaged backgrounds through community colleges could thus prove beneficial for local economic development, considering that individuals in this group have lower rates of geographic mobility.

For instance, sector-based vocational training programs have been found to be successful at raising the employment rates and wages of participants (McConnell, Perez-Johnson, and Berk 2014). These programs focus on a particular industry (e.g., manufacturing) and bring together training providers (e.g., community colleges) and employers with the goal of developing training programs tailored to specific job opportunities. The program uses data collected from employers in order to identify the skills that employers need.

Evaluations of sector-based training programs have yielded positive results. In an in-depth study of the impact of three sector-based training programs, Maguire et al. (2010) estimate that participants earned roughly 18 percent more over the two years after they participated in the program than similar workers who did not enroll in the program. Similarly, participants were significantly more likely to find employment and obtain higher-wage jobs than similar nonparticipants. While these results are encouraging, understanding whether training programs through community colleges and other technical schools could result in broad-based regional economic development represents an important question for future research.

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# Endnotes

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1. Nunn, Parsons, and Shambaugh (2018) also document this relationship earlier in this volume. This relationship has also been shown to hold at the metropolitan area level (Berry and Glaeser 2005).
2. These studies typically find that each additional year of education leads to roughly an 8 percent increase in earnings.
3. It is important to note that while there may not be a statistically significant relationship between an area's production and stock of human capital due to the role of migration in the market for high-skilled individuals, it has been shown that opening new two- and four-year colleges in a county does lead to an increase in college attendance among that county's residents (Currie and Moretti 2003).
4. According to Glaeser, "A wealth of research confirms the importance of face-to-face contact. One experiment performed by two researchers at the University of Michigan challenged groups of six students to play a game in which everyone could earn money by cooperating. One set of groups met for ten minutes face-to-face to discuss strategy before playing. Another set of groups had thirty minutes for electronic interaction. The groups that met in person cooperated well and earned more money. The groups that had only connected electronically fell apart, as members put their personal gains ahead of the group's needs. This finding resonates well with many other experiments, which have shown that face-to-face contact leads to more trust, generosity, and cooperation than any other sort of interaction" (Glaeser 2012, 34–35).
5. Studies of agglomeration spillovers in manufacturing have similarly found that the magnitude of the spillover is related to input and output linkages as well as the pooling of labor markets (Ellison, Glaeser, and Kerr 2010; Greenstone, Hornbeck, and Moretti 2010).
6. Similarly, Bonander et al. (2016) find small or no effects on the regional economy of granting research university status to three former university colleges in Sweden in 1999. Specifically, just as with the establishment of the University of California, Merced, the authors find robust evidence that the transition to research university status increased both the number of awarded doctoral degrees and the number of professors in the region. However, they find no evidence that the intervention had an effect on outcomes such as local patent applications, firm start-ups, regional GDP per capita, or employee compensation during the 13-year follow-up period.
7. Similarly, Moretti (2004) shows that areas that received land-grant colleges in the late 19<sup>th</sup> century continue to have more-educated workforces to this day.
8. See Bercovitz and Feldman (2006) for related discussion.

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## Highlights

Given the growth of the knowledge-based economy as well as the role universities play in high-productivity clusters, many policymakers have discussed the role of new universities in helping stimulate growth. In this policy proposal, E. Jason Baron, Shawn Kantor, and Alexander Whalley instead argue for the expansion of the Manufacturing Extension Partnership program to help more communities benefit from knowledge spillovers generated by existing universities.

## The Proposals

**Expand the Manufacturing Expansion Partnership program** to help facilitate knowledge transfer between research universities and firms in struggling areas.

**Target struggling areas** in the bottom 20 percent of county employment rates.

**Build capacity at both universities and in targeted communities** to facilitate transfer of knowledge resulting from core research activities.

## Benefits

The proposal would benefit firms in economically struggling regions that can take advantage of spillovers generated by universities in the area.



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