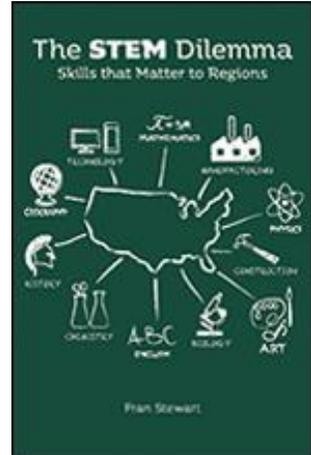


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More STEM Degrees: Economic Best Bets for Regions?

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More STEM Degrees

Economic Best Bets for Regions?

Within two months of taking office in December 2015, Kentucky Gov. Matt Bevin courted controversy with, in essence, an academic winners and losers list of public support for higher education: electrical engineers, yes; French literature majors, no. He articulated a simple policy reorientation toward incentivizing “things people want” (Beam 2016). Market forces have been reshaping college-going for decades, as individuals increasingly view further schooling in terms of professional development a necessity rather than a personal development luxury, but Bevin’s proposal made plain public education’s fundamental role as a tool of workforce and economic development.

Criticism of the proposal came swiftly from humanities professors, university presidents, and advocacy groups, as well as from more than a few political leaders in the state who no doubt had qualms about reinforcing Kentucky’s poor reputation regarding education, including school funding and literacy rates that repeatedly rank near the bottom among all states (Ellis 2011). Yet, Bevin’s vision of allocating public subsidy based on perceived workforce demand and best bets for investment return is not far outside the mainstream. Facing intense budget pressures following the Great Recession, 32 states had adopted some level of performance-based funding for two-year and four-year public postsecondary educational institutions, and another five states had such plans in the works in 2015 (National Conference of State Legislatures 2015). Many of these outcome-oriented measures include targets for degrees or certifications in science, technology, engineering, and mathematics (STEM) fields. In addition, a number of states use grant dollars to entice more high school graduates to pursue STEM majors in college.

ALL IN ON STEM

The rising preeminence of STEM is remaking primary and secondary educational systems as well, as evidenced by the renaming of local schools, realignment of curricula, and growth in after-school programs and ancillary activities. Examples include Science Club in Chicago, California Tinkering Afterschool Network, GirlsStart in Austin, Texas, and SHINE, which provides mostly low-income students in rural Pennsylvania exposure to STEM curricula.

Pursuit of STEM degrees has moved from one of personal interest or professional ambition to a matter of economic imperative and public priority. The policy assumption is clear: economies benefit from more scientists making discoveries, more engineers solving problems, and more computer experts programming solutions. In fact, President Obama issued an “all-hands-on-deck” alert for the critical mission of encouraging more students to pursue STEM degrees, setting a 10-year goal of 1 million more college graduates in such fields by 2020 (Office of the President 2012).

Despite the certainty evinced by the widespread federal, state, and local policies aimed at growing STEM education, there is only limited research demonstrating that a greater supply of STEM-degreed workers actually brings about the expected public gains. Certainly, there are reasons to assume such benefits will accrue: workers in various science and engineering occupations tend to earn wages that considerably exceed the average. Computer technology has transformed work environments and home life, creating demand for related skills. Areas home to products and activities emerging out of technological innovations have experienced the advantages of growth-stage industries.

Yet, the broad support for policies to increase the supply of STEM degrees obscures complexities and disregards contradictions. This is especially true when national goals and gains are adopted and applied locally. Does a larger share of STEM-degreed workers really improve the regional economy? Do regions have similar demand for such talent? Does promotion of STEM degrees—or degrees in general—neglect other avenues for workforce investment? What are the human capital best bets that can be made to address regional workforce challenges, align with opportunities, and advance regional economic well-being?

BEYOND DEGREES: BROADENING THE VIEW OF REGIONAL HUMAN CAPITAL

So many policies and programs aimed at increasing the supply of twenty-first century talent come with a terse one-size-fits-all tag—more college is good, and more STEM is even better. STEM degrees have come to dominate the discussion regarding critical workforce needs, crowding out other paths toward acquiring knowledge and skill, and overshadowing other investments in human capital.

We are in a period when technology has broadened the reach of firms and individuals to engage in world markets. Ideas and information are exchanged virtually instantaneously, answers to even the most random questions are readily available, and change happens at a rapid pace. Yet the path to developing the knowledge and skills needed to operate within this environment has narrowed to the pursuit of one of a handful of educational degrees that take years to achieve.

This book details research directly inhabiting the muddled space where education policies and economic goals intermingle. The research expands beyond the current preoccupation with STEM degrees to explore the knowledge and skills occupations require. It sheds light on fundamental questions underlying Gov. Bevin’s proposal and the actions of so many other political leaders: What is the appropriate role for public investment in knowledge and skills? What human capital development yields the greatest public return? Do these roles and forms vary by place?

Four assumptions lie at the heart of this research and challenge the orthodoxy of current STEM-oriented workforce development approaches to higher education and job training:

- 1) Differences in human capital deployment are key to understanding regional competitive advantage and economic well-being.
- 2) Jobs are a mix of specific knowledge and skills, including STEM-related skills but also generic skills, such as problem solving and communication. Generic skills are transferable and foundational and are commonly described as “soft.”

- 3) Regions have distinct demands for different combinations of human capital and are the geographic units that best represent the function of labor markets.
- 4) Unique regional human capital is best represented not by the postsecondary degree attainment of its population but by the knowledge and skills required by its mix of jobs.

Research findings do support efforts to shift public resources toward the specific development of valuable technical skills. However, findings also indicate misconceptions and misperceptions about human capital concentrations and contributions, suggesting that the connection between human capital and economic well-being is not nearly as straightforward as STEM advocates suggest or as most STEM policies presume.

A COMPLEX RELATIONSHIP: HUMAN CAPITAL AND REGIONAL ECONOMIC WELL-BEING

Regional economic well-being is a multifaceted concept and requires a broader measurement than the commonly accepted focus on wages. Markers of healthy regions are higher wages, vigorous growth in gross regional product, higher productivity, higher per capita incomes, and lower poverty rates. Public policymakers often assume that human capital investments have across-the-board beneficial effects, but this study reveals a more complicated reality. Generic human capital investments impact some measures favorably, whereas other measures remain unchanged or even worsen.

Regions with greater human capital development do, by and large, enjoy higher wages. Yet, the effects of human capital development on regional output, productivity, per capita income, and poverty are much less straightforward. There is support in this work for the importance of higher STEM skills to regional economic well-being, but not for the rather narrow view of policies that strongly favor or promote increasing the number of scientists and engineers.

This study makes use of existing federal data collection of occupational knowledge, skill, and ability requirements and regional occu-

pational employment levels to delineate differences in human capital needs and concentrations. Through a more fine-grained approach to operationalizing the concept of human capital than is found in discussions of STEM occupations, a new and more complete picture of how human capital impacts regional economic well-being emerges. Some of these new insights open new avenues for policy. This research exposes the thorny challenges associated with developing an economically viable workforce. Key conclusions from the research include:

- Degrees matter more to individuals than to the regional economy. Thus, policies that narrowly focus on college degrees may not be what benefits regions the most. Occupational knowledge and skill requirements are better measures of regional human capital than the commonly used proxy of degree attainment.
- STEM is more than scientists and engineers. Occupations requiring higher-than-average STEM skills are important to regional economic performance, but such occupations may not require a college degree.
- Not all high-paying jobs require STEM degrees or skills. Occupations with higher STEM requirements do tend to pay higher wages, but *so do* occupations demanding higher “soft” skills (i.e., critical thinking, teamwork, and communication). Occupations that pay the *highest wages* are those requiring both higher STEM and higher soft skills.
- STEM investment isn’t necessarily a jobs program. Occupations with *higher* STEM requirements tend to employ disproportionately *fewer* workers.
- Low-skill, low-wage jobs predominate in most regions. Despite the policy focus on growing the supply of workers to fill “high-skill” jobs, *more than half* of all U.S. employment is relatively *low skill*. Large concentrations of low-skill employment drag down regional economic well-being.
- Regional differences in demand matter. The region with the largest share of employment accounted for by engineers, scientists, software developers, and similar STEM occupations had five times more STEM employment than the region with the smallest share of such occupations. Some regions have nearly 60 per-

cent of their employment in occupations requiring a bachelor's degree, whereas other regions have 60 percent or more of their employment in low-skill occupations.

- Regional economic development requires more than just STEM workers, or even investments in human capital. Regional human capital is important, but it can only partly explain why some regions perform better than others.

STEM: A TRICKY PUBLIC INVESTMENT

Implicit in many STEM initiatives is the belief that a larger pool of workers educated in STEM will lead to the technological innovations, new products, and new processes that drive employment growth and economic well-being. Economists have long refuted the notion that increased supply of a product creates increased demand for that product (this is a refutation of what is termed Say's Law). No doubt, workers with understanding and mastery of modern technologies will be more likely to build on and expand new technologies. Yet, is mastery of specific technical skills what generates new products and markets or is it an entrepreneurial talent for observing the environment, envisioning opportunities, sizing up risk, and persisting in the face of obstacles and failures? Focusing too sharply on the technical aspects of innovation minimizes the importance of other knowledge, skills, and abilities, such as problem solving, critical thinking, teamwork, communication, and personal resilience.

Place-based initiatives that aim to grow the supply of STEM workers as a tool of economic development also run the risk that the newly developed human capital investments will not remain rooted in place. This newly minted supply can easily migrate to where demand is stronger and earnings are higher, or where tacit knowledge related to the occupation is being created. Well-educated, young workers tend to be highly mobile in any case, meaning they are likely to take their in-demand skills with them if there is not some rewarding job, emotional attachment, or area amenity holding them in place. A 2016 examination of American Community Survey and Census data by the *New York*

Times Upshot (Bui 2016) reveals the winners and losers in attracting educated talent. In general, college graduates have been leaving the Midwest and Northeast in favor of the West Coast and South. From 2000 to 2015, states such as Ohio and Michigan lost 4 percent or more of their college-educated workers age 40 and younger. Many of these migrating graduates owe at least part of their college educations to the states they ultimately fled. In essence, these states have become human capital exporters.

THE “ME TOO” TRAP

Many of the STEM initiatives adopted by state and local governments have little regard for the differences of place. This approach drives efforts to mimic the skill mix of Silicon Valley and other thriving technology hubs. Although this may be a winning strategy for areas that have the right conditions for STEM employment, not all places are competitive imitations of Silicon Valley, with rich veins of venture capital, large benches of experienced managers of high-growth firms, and—most importantly—a deep pool of talent and institutional support aligned to the high-technology product structure. Areas lacking in such locational advantages are likely to see their efforts at using the public policy equivalent of spontaneous generation either wither or fail to take root.

Areas are bound by their own industrial heritages and, to a certain extent, are built and buffeted by forces beyond their control. A legacy of dominant industries may leave some areas pockmarked with deep pools of obsolete talent when such industries decline or retreat, whereas other areas get lucky. What would the modern tech hubs of San Jose and Seattle be if William Shockley hadn't chosen to launch his nascent silicon semiconductor business near his ailing mother or Bill Gates hadn't relocated Microsoft closer to his boyhood home? Initiatives that assume investments in a larger pool of STEM talent will catalyze sustained growth through radical innovation and disruption ignore the tendency of innovation to be incremental in nature, building on *existing* platforms and strengths.

The business strategy literature acknowledges vagaries of external forces beyond the ability of managers and firms to predict. Yet, it makes clear that competitive advantages emerge out of how managers and firms *uniquely* respond to these external forces. This is the critical element in creating value and sustaining competitive advantage—not the sameness of development, not retracing trajectories of other firms, but deploying unique resources toward opportunities that leverage existing strengths, minimize risk, and align with market demand. A lesson to be transferred from business strategy to economic development strategy is that economic development policy must be attuned to the specific strengths and resources of a specific location. Strengths are often embedded in past industrial investments; thus, an understanding of how traditional industries are evolving is key. In addition, as local industries naturally evolve into new versions of themselves, workforce development must keep pace.

REGIONAL INVESTMENT IN HUMAN CAPITAL DEVELOPMENT: A DELICATE BALANCE

How human capital concentrations relate to regional economic well-being is highly dependent on product cycles and industry performance. The findings presented here offer strong support for an integrated view that “what regions do,” to quote Feser (2003), is due in large part to what regions make now and made in the past. The ways in which a region’s economic history can shape its future suggest a need for better alignment of human-capital-based policies with industry needs and expected performance. This would enable the prioritization of immediate talent demands as well as the identification of skill sets on which to build for the future. After all, most regional economic development is evolutionary, not revolutionary, and most technology-based development is found when new technology is pulled into existing products, rather than in new products that were pushed out from new technologies.

Aligning human capital investments too closely to existing industry needs does present the risk of an over-supply of workers in what may become legacy occupations. Over-supply, or redundant supply, of people in legacy occupations is a problem that many older industrial

regions have faced when the skills of their workforce were tied too tightly to dominant industries that fell into decline. Although there is a risk associated with inaction, action based on faulty assumptions is risky as well. Regions that focus primarily on increasing the supply of workers with college degrees without regard to the local demand for human capital may find themselves with well-educated workers who are underemployed. These regions may see their investments depart for other areas where job prospects match the workers' newly developed skills. Either way, the regions' investments fail to achieve the desired results.

In some real sense, regional investments in workforce development involve three sets of comparisons: 1) weighing the value of skills with broad application against those with more narrow importance and worth, 2) determining support for skill sets with immediate relevance versus those that may bring future gains, and 3) recognizing that skills with broad benefit to the region may not be as rewarding to individuals. Evaluating trade-offs across these three dimensions represents a delicate balance for individuals, employers, and government-supported providers of education and training. The task of crafting regional human capital strategies is made more difficult by the fact that regions, despite being fundamental economic units, are rarely polities. Instead, regions encompass a number of political jurisdictions, all acting on their own set of needs with little effort spent on collaboration for the good of the region overall. In addition, funding for investments in regional human capital often comes through state and federal agencies, reflecting their goals and priorities, which may or may not match regional ones.

WHAT TO DO? RESHAPING POLICIES FOR REGIONAL ADVANTAGE

This research reveals insights for the Kentucky governor and other policymakers who want to pursue human capital development as a path to better economic well-being. Although Gov. Bevin's proposed plan to incentivize "useful" majors and other plans like it are made at the state level, they impact regional workforces. Findings from this research indicate several ways in which state and local policymakers and practi-

tioners could refine and recalibrate their efforts directed at developing knowledge and skills critical to current and future advantage.

- Let data drive decisions (or at least inform them). Choices about investments in human capital development are often shaped by perceptions and observations that may or may not reflect ground-level realities for individual regions. Analyses of primary industries, specific occupations, and associated skill sets would provide the type of region-specific contours of human capital deployment that enable better targeted interventions.
- Cultivate collaboration. Regions may best represent the functioning of distinct labor markets, but policies that support them tend to be an amalgam of local actions and state and national initiatives. Given that few regions have political jurisdictions that mirror their geographic boundaries, the challenge falls to economic developers, regional education and workforce training providers, local mayors, city managers, and council members to build relationships, identify strategies, and encourage cooperation toward mutual place-based benefit. In addition, a collective regional voice serves to amplify the message that state and national skill-development strategies should recognize and be attuned to regional differences in demand.
- Avoid imitation. Resist the urge to think of human capital needs as uniform and to develop imitative policies. It's important to study best practices for insights into what works—at least, what seems to be working in certain regions. There will be shared goals and broad strategies, but the workforce needs of regions are highly individualized. Opportunities for competitive advantage arise from difference, not from sameness. Being in a position to seize on opportunities that arise from differences highlights the importance of a thorough and periodically updated understanding of immediate and near-term needs that are shared within industries or cut across multiple industries.
- Learn from the regional experts—employers—but don't let anecdotes drive decisions. Business leaders and industry advocates should be welcome partners, shaping understanding of immediate and projected human capital needs, but business reluctance

to train and invest in developing its workers does not necessitate government intervention.

- Focus on fungible skills. The role for public support, especially at the regional level, is in developing fungible capacity, meaning skills and knowledge bases shared by entire industries or those that cut across multiple industries. These skills serve as the connective tissue and building blocks of a dynamic, adaptive workforce. Developing very job-specific skills should be left to employers.
- Explore many paths to important skills. Critical-thinking skills are considered key by-products of STEM education. But other higher education pursuits—business strategy courses, communication classes, and, yes, liberal-arts studies—develop critical-thinking skills in students. The challenge is having institutions demonstrate that they inculcate valuable and largely fungible cognitive skills that develop in concert with specific knowledge domains. It is also important to recognize that the same technological forces reshaping other industries will disrupt and remake learning models, as well. Online education has grown both as a disruptive enabler of distance learning and as an expander of traditional classroom activities. However, video games, virtual reality programming, and one-on-one mentoring, in person or assisted by technology, all have the potential to augment training and skill development outside formal educational and workplace settings.
- Balance immediate needs versus important future demands. The appropriate role for national and state governments may be to encourage high aspirations for human capital development and to shape a view of the future workforce. As the fundamental economic unit, however, regions must keep an eye on immediate needs while also strategically envisioning and assessing opportunities.
- Connect the next generation of workers to the work of the region. Develop programs or support opportunities for internships, mentoring, and apprenticeships. Opportunities for hands-on learning and career exposure should particularly be directed at the high

school level. Make sure that high school students receive career guidance, and support interactions between high school guidance counselors, teachers, and local employers, especially manufacturers. Recognize that skill development and career preparation begin early. The math and science classes that students take in high school flow out of actions and decisions made in intermediate grades. Early exposure to work opportunities is critical to shaping learning choices and career aspirations.

- Pay attention to the bottom of the skills spectrum. Although so much of the focus of human capital interventions is on growing the share of workers with a high level of knowledge and skill, occupations requiring very little of their workers make up a far greater share of employment. As this research makes plain, larger concentrations of low-skill employment represent a significant drag on regional economic well-being, offsetting or even exceeding the gains from higher skills. Low-skill jobs provide critical access to the labor market, but the associated low wages and relatively limited opportunities for advancement present challenges for workers and regions alike.
- Brace for change and disruption. Regions know all too well how advancements in technology and changes in industrial processes have reshaped workforces. Industries that once employed thousands now produce more with only a handful of workers overseeing automated systems. Industries that once dominated local economies have shrunk, and even greater disruptions loom: self-driving vehicles, workerless stores, and self-directed learning, among others, will transform regional skill demand while also transforming the very nature of work.

MAKING THE CASE: EXPLORING AN OCCUPATION-BASED VIEW OF REGIONAL HUMAN CAPITAL

The remainder of this book presents a method for exploring regional human capital based on the knowledge and skill requirements evident in each region's portfolio of occupations. Chapter 2 provides a brief

overview of key insights drawn from theory and highlights the ways in which these insights are being distorted in practice. Chapter 3 details the use of existing federal data to categorize occupations by the intensity of their STEM skill requirements, as well as their demand for “soft” skills. Chapter 4 examines the relationships between these categories, which reflect occupational skill requirements and wages. Chapter 5 applies the occupational skill requirements to regional employment levels to explore the effects of variation in human capital concentrations on regional economic well-being. Chapter 6 tests the explanatory power of regional human capital concentrations based on these occupational skill requirements within different educational attainment and population contexts. Chapter 7 offers an alternate method of categorizing occupational requirements to explore the effects of “middle skills” (the middle third of the distribution of skill levels) on regional economic well-being. Chapter 8 lists skill requirements shared across the occupational categories. Chapter 9 suggests ways in which considering variation in regional human capital deployment, manifest in occupational skill requirements, can be used to shape policy and practice.