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STEM and the Local Economy: Do Regions Reap the Benefits of a STEM-Educated Workforce?

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STEM and the Local Economy

Do Regions Reap the Benefits of a STEM-Educated Workforce?

Fran Stewart

ARTICLE HIGHLIGHTS

- *Occupational competencies add insight to the educational attainment proxy.*
- *Increasing a region's share of bachelor's degrees may not increase regional economic well-being, broadly defined.*
- *A higher share of regional employment in jobs requiring above-average STEM does improve regional well-being, but many of these STEM jobs do not require a bachelor's degree.*
- *Roughly half of regional employment is in jobs requiring below average STEM* and *below-average soft skills, a category of occupational human capital associated with reduced regional well-being.*

The pursuit of science, technology, engineering, and math (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 when scientists make discoveries, engineers solve problems, and computer experts program solutions. The places that can attract or develop these professionals are deemed the winners in today's technology-driven economy. The certainty of this conventional wisdom has driven countless interventions targeted at growing the local STEM "pipeline." Yet, an important question remains: Does a greater supply of STEM-degreed workers bring about the expected economic gains for *regional* economies? Largely imitative efforts to expand the ranks of highly educated STEM workers neglect important differences in regional demand for such skills. This approach also neglects the importance of other skill sets to regional competitive advantage. Understanding the best way to invest in regional human capital requires a broader understanding of regional human capital differences.

Shifting the Focus to Occupational Competencies

This article highlights research in *The STEM Dilemma: Skills That Matter to Regions*, which was recently published by the Upjohn Institute (see p. 7). The book looks at the regional workforce through the lens of the knowledge, skills, and abilities (KSAs) associated with regional occupations. This fine-grained approach uses data in the Occupational Information Network (O*NET) database to identify differences in regional human capital concentrations. The O*NET database scores the importance and the required level of 120 individual KSA attributes for each occupation. Matching the occupational KSA attributes to wage and employment data available from the Occupational Employment Statistics (OES) enables examination of the actual human capital differences present in regional economies and answers some important questions:

1. To what extent do STEM occupations drive modern regional economies?
2. Do STEM occupations provide better wages for regional employees?
3. What other KSAs represent valuable regional human capital?
4. Is there a relationship between the KSAs in demand by regional occupations and the welfare of the region itself?

Guided by the sharp policy focus on STEM study, this research set out to explore the effect of STEM skill concentrations on regional well-being.

Educational attainment is associated with higher wages but does not necessarily have significant effects on other measures of regional well-being.

However, because employers often say they want workers who can communicate effectively, solve problems, think critically, and motivate others, the research also examined the contribution of "soft" skills to the regional economy. Of the 120 KSAs included in the O*NET database, this study sorted 35 into a bundle representing STEM competencies and 50 into a bundle representing soft skills. What is clear among the bundle of STEM KSAs is the importance of math and computer knowledge, as well as more "hidden" STEM competencies (Rothwell 2013), such as mechanical skills and operations monitoring. Within the bundle of soft KSAs, communication skills, specifically oral expression and comprehension, are important, as well as skills associated with listening and understanding.

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STEM Skills, Soft Skills, and Worker Wages

Each O*NET occupation was assessed as to whether its requirement of the bundle of STEM KSAs and the bundle of Soft KSAs was above or below the mean for all occupations. This allowed for the categorization of each occupation as High or Low STEM and High or Low Soft. Although STEM and soft skills are often discussed in policy, research, and the media in isolation, this research follows the premise that occupations require a combination of competencies. For example, high engineering knowledge presumably also often demands high deductive reasoning. Thus, all occupations were ultimately sorted into one of four categories: 1) High STEM/High Soft, 2) High STEM/Low Soft, 3) Low STEM/High Soft, and 4) Low STEM/Low Soft. The categories enable direct comparison of KSA distributions across U.S. regions and allow identification of differences in regional human capital needs.

The assumed payoff for individuals who invest in higher skills is higher wages. As human capital theory would suggest, occupations requiring both above-average STEM and above-average soft skills paid the highest wages, and occupations requiring below-average STEM and below-average soft skills paid the least (see Figure 1). But in the High/Low combinations of skills, occupations requiring High Soft skills but Low STEM skills returned higher median wages than those requiring above-average STEM skills paired with below-average soft skills. This suggests the importance of High Soft skills to individual returns on human capital. Interestingly, High Soft occupations were more highly correlated with occupations requiring at least a bachelor's degree than were High STEM occupations, bespeaking higher education's role in developing or signaling hard-to-assess soft skills. The data in Figure 1 argue for greater policy interest in the development of valuable soft skills, which often cut across a large variety of occupations.

Figure 1 Occupational Median Wage by STEM/Soft Category

	Low STEM	High STEM
High Soft	$57,360 (N = 155)	$72,220 (N = 182)
Low Soft	$29,500 (N = 259)	$41,300 (N = 168)

SOURCE: O*NET and OES (2014); author's calculations.

Wide Differences in Regional Human Capital Concentrations

Table 1 shows how human capital concentrations differ across metropolitan statistical areas (MSAs). On average, scientists, engineers, software developers, and other High STEM/High Soft workers make up 13.1 percent of regional employment. However, the region with the largest concentration of High STEM/High Soft employment has five times the share of the MSA with the least. Computer programmers, electromechanical technicians, computer numerically controlled machine programmers, and other High STEM/Low Soft workers account for about 10 percent of regional employment on average but 25 percent of employment in the region with the largest concentration of such workers. The Low STEM/High Soft category include such occupations as chief executives, managers, lawyers, teachers, and mental health counselors. The average regional employment in Low STEM/High Soft occupations is 16 percent, but the MSA with the largest concentration has more than three times that of the region with the smallest share. The category consisting of occupations with Low STEM/Low Soft requirements, such as home health aides, customer service representatives, and retail salespeople, accounts for nearly half of all employment across the regions. Some regions have as many as 6 of 10 jobs in occupations requiring below-average STEM and below-average soft skills. Given the overriding policy focus on college-going, Table 1 also shows the average share of the MSAs' population age 25 and over with a bachelor's degree or higher. The difference between regions with the smallest share of highly educated residents and those with the largest is pronounced.

The wide variation in occupational human capital requirements evident in Table 1 calls into question the wisdom of largely imitative policies aimed at growing the STEM pipeline. Not all places have the same STEM demand or capacity to absorb STEM supply. This difference also raises doubt as to whether the individual benefits from human capital development (higher wages) "roll up" to improve regional economic well-being overall, as so many policies that promote college-going and STEM study assume.

A Complex Relationship: Human Capital and Regional Economic Well-Being

To examine the relationship between regional human capital concentrations and regional economic well-being, a region's distribution of employment across the four categories was regressed against data from the American Community Survey and Moody's Analytics. Guided by Andreason (2015), this study adopts a broader view of regional economic well-being beyond the common focus on wages. In addition to wages, gross regional product (GRP), GRP per capita, per capita income, and poverty

rate were used as dependent variables in the study. Each MSA's labor force participation rate, share of employment in manufacturing, population change from 2010–2013, and ratio of median house value relative to the U.S. median house value were entered as control variables. A common measure of human capital—the share of the adult population with a bachelor's degree or higher—was also regressed on the data for comparison, revealing that the models with the occupational competency measures had greater explanatory power. Moreover, the education variable was only positively associated with two well-being indicators: median wage and per capita income.

All the occupational human capital categories affected regional median wage in the way human capital theory suggests. A higher concentration of employment in occupations requiring any kind of above-average KSAs was associated with higher regional wages. The practical implication of this finding is that a region may see improved economic well-being from promoting STEM skill development, but the region may also benefit from focusing on soft skill development. Another important finding is that having a high proportion of Low STEM/Low Soft employment was a substantial drag on the regional economy. Such regions tend to have lower (or negative) growth in GRP, lower productivity, and lower per capita incomes. This indicates a need for greater policy focus on addressing issues surrounding jobs that are important to the economy but that come with low pay and limited benefits for workers and present significant challenges to regional well-being.

Only one skill category—High STEM/Low Soft—was shown to have a statistically significant impact on all five indicators of regional economic well-being, controlling for the other variables. Table 2 details the magnitude of the effects of variations in human capital concentrations on regional economic well being. In broad terms, human capital development accrues benefit to regions, but the effect is not as straightforward or as broad-based as typically assumed. Some human capital categories are statistically associated with some aspects of regional well-being while others are not.

Table 1 Human Capital Concentrations across 395 MSAs

Occupational human capital category	Mean share across regions	Share in region with least highly educated residents	Share in region with most highly educated residents
High STEM/High Soft	13.1	5.0	25.4
High STEM/Low Soft	9.5	4.1	25.1
Low STEM/High Soft	15.9	8.1	26.2
Low STEM/Low Soft	48.4	34.9	62.3
Population aged 25+ with BA+	26.9	11.9	58.3

SOURCE: Author's calculations.

Conclusion

This research clarifies how human capital development functions in the larger economy and how differences in human capital deployment impact regional well-being. These insights should help policymakers shape more targeted and effective place-based policies. Regional human capital development should increase the supply of valuable talent, provide employers with access to appropriately skilled workers, and connect workers to opportunities that best align with their talents. Key insights from the research include the following:

- Educational attainment is associated with higher wages but does not necessarily have

Table 2 Summary of the Impact of a One Standard Deviation Increase in the Share of Employment in a Specific Occupational Group on Five Measures of Regional Economic Performance

Occupational group			Five dependent or outcome variables				
Category	Mean share of regional employment (%)[a]	SD (% point)	Median wage ($)	Gross regional product (% pt.)	GRP per capita ($)	Per capita income ($)	Poverty rate (%)
High STEM/ High Soft	13.1	3.1	6,131	–1.5	3,138		
High STEM/ Low Soft	9.5	2.6	5,250	3.3	9,779	1,507	–0.8
Low STEM/ High Soft	15.9	3.1	5,443		4,914	1,056	
Low STEM/ Low Soft	48.4	4.3	–3,548	–1.9	–4,281	–690	

NOTE: A blank cell indicates that the impact was not statistically significant from having no impact.
[a] The percentages do not add up to 100% because not all occupations have been mapped by O*NET; the OES survey does not include self-employed workers; certain government occupations are not included in this analysis; and the OES suppresses data at the detailed occupational level if inclusion of the data may reveal specific establishments in an MSA.
SOURCE: Author's calculations.

significant or desirable effects on other measures of regional well-being.

- Above-average STEM KSAs are associated with increased regional well-being, but "high" may not be as high as is typically assumed. Not all value comes from college-degreed STEM occupations. These results show the importance of many technician and mechanical jobs that often are overlooked or ignored in articles, research, and policy on the economic importance of STEM jobs.
- Efforts to help dislocated workers may be more effective if they explore the skills associated with previous occupations and try to match workers to occupations with similar skill needs. Helping workers make the case for cross-cutting skills to regional employers could be a more effective economic development strategy than investment in big leaps of unrelated retraining.

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Fran Stewart is the author of The STEM Dilemma: Skills That Matter to Regions *(Upjohn Press, 2018). She has written extensively on economic development, manufacturing, economic driver industries, and education.*

Race to the Bottom?

Local Tax Break Competition and Business Location

Evan Mast

State and local governments in the United States spend $45–$80 billion each year on programs that encourage economic development in a particular geographic area (Bartik 2017; Kline and Moretti 2014). These programs, often called place-based policies, typically offer tax breaks in an effort to attract businesses or encourage the growth of existing businesses. These range from huge subsidies like the $3 billion that Foxconn recently received from the state of Wisconsin to small programs that target local small businesses. A crucial feature of place-based policies is that they are very decentralized—state and local governments account for 80 percent of total spending.

This article highlights findings from a recent paper that focuses on two potential effects of decentralization in business tax breaks (Mast 2017). First, competition between subnational governments could increase total tax exemptions. Second, local control of tax breaks could cause firms to choose locations where they produce more value for the community. The latter may occur because jurisdictions with more to gain from landing a firm offer larger exemptions, sending a signal that could improve the match quality between towns and firms.

These two effects are important for evaluating policies that restrict which governments can offer tax breaks, such as proposals to ban state exemptions or the recent moratorium on some local exemptions in the Phoenix area. Such proposals have attracted attention recently, as Amazon and Foxconn have conducted well-publicized searches for locations for new expansions.

The Importance of Local Taxes For Businesses

This article focuses on local, rather than state, government tax breaks. State and local taxes are a large component of the total business tax burden—a 2014 estimate pegged total state and local businesses taxes at $688 billion versus total federal corporate income tax revenues of $320 billion (Phillips et al. 2015).[1]

While state incentive packages for national searches are more heavily publicized, local tax breaks are important in many cases. First, most firms do not search nationally when considering an expansion or relocation. Second, even for firms conducting national searches, there is often a second, local stage to their search. For example, Foxconn considered several sites in Racine and Kenosha Counties after announcing their intention to build in Wisconsin. Local tax breaks also amount to large sums—approximately $700 million in New York State in 2013.

The Effect of Competition on Local Tax Breaks

To begin, I study spatial competition between local governments in New York State. Do governments offer

ARTICLE HIGHLIGHTS

- *Competition from nearby local governments increases business tax breaks.*
- *Simulations suggest that businesses typically locate in the same towns that they would have chosen if local tax breaks were not allowed.*