

# Illinois Innovation Index

Innovation news and metrics for metropolitan Chicago and the state of Illinois



**2014 Quarter 2**

## STEM attainment in Illinois and talent migration trends in Chicago

The Index is brought to you by the Chicagoland Chamber of Commerce, Illinois Science & Technology Coalition, and World Business Chicago in partnership with the Illinois Innovation Network.

# OVERVIEW

Degrees in science, technology, engineering, and math (STEM) fields are critical for supporting innovation, research, and growth in high-tech sectors that are driving the 21st-century economy. It is therefore crucial for Illinois to focus on increasing the number of STEM graduates and ensuring these individuals pursue careers within the state. Research indicates that employees with STEM degrees have a significant and long-lasting impact on cities: economist Enrico Moretti, a professor at UC Berkeley and author of *The New Geography of Jobs*, released last year, determined that every new high-tech position in a metro area results in an average of five additional local jobs—two in professional fields and three in nonprofessional fields. This virtuous cycle means that as innovation hubs attract talent, they trigger an increase in employment and investment, attracting even more talent.

Since the *Illinois Innovation Index* was created, it has monitored the state's progress in boosting the number of graduates in STEM fields. The [Q2 2013 Index](#) shared insights on STEM attainment at Illinois institutions and the migration patterns of talent within the Chicago region. This issue of the Index shares insight and analysis from newly released data in these areas.

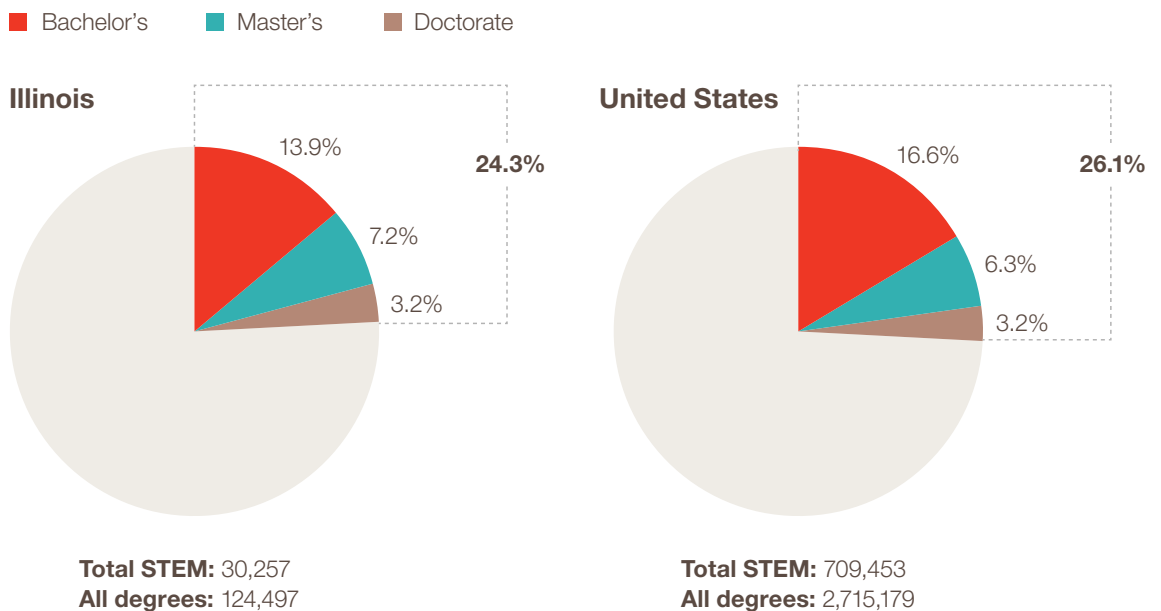
### **Key findings**

- ➔ As a percentage of all degrees conferred in Illinois, STEM graduates accounted for 24.3 percent in 2012, slightly below the national average of 26.1 percent. However, the number of STEM graduates in the state has risen significantly since 2009, when it was 20.7 percent.
- ➔ Illinois' STEM performance exhibits particular concentrations in computer sciences, engineering technologies, and health—fields that are instrumental in driving the innovation economy.
- ➔ The Chicago metropolitan statistical area (MSA) is a top destination for graduates with a bachelor's or master's degree in the Midwest, but Chicago is losing individuals to other large MSAs, particularly those located in the Southwest and on the West Coast.

## Illinois STEM attainment is on the rise

In 2012, Illinois universities produced approximately 30,200 graduates with STEM degrees at all levels (bachelor's, master's, and doctorate)—24.3 percent of all degrees conferred by those institutions that year. The state's performance put it slightly behind the U.S. average of 26.1 percent of all degrees. Master's degrees in STEM fields in Illinois accounted for 7.2 percent of the total, outpacing the U.S. average share of 6.3 percent, and doctorate degrees matched the national level of 3.2 percent. However, Illinois underperformed on STEM bachelor's degrees, which at 13.9 percent was nearly 3 percentage points short of the U.S. average.

### STEM degrees as a percentage of all degrees, Illinois and the United States, 2012



Source: Integrated Postsecondary Education Data (IPEDS)/National Center for Education Statistics (NCES) Completions Survey, 2012

Still, Illinois showed impressive growth over an 11-year period. From the 2001–02 school year to the 2011–12 school year, the number of annual STEM graduates rose nearly 42 percent. Master's STEM degrees in Illinois nearly doubled during this period, from 4,745 to 8,881 per year, and the number of bachelor's degrees conferred annually also rose nearly 4,000, to 17,159 per year. Data indicate that the pace of growth has picked up significantly in recent years: from 2002 to 2012, the compound annual growth rate (CAGR) of STEM graduates was 3.6 percent. However, from 2009 to 2012 (the post-recession years), the CAGR was 6.4 percent, matching the U.S. growth rate.

## Growth of STEM degrees, Illinois and United States, 2002–2012

	Number of degrees	
	Illinois	United States
2001–2002	21,071	450,008
2002–2003	21,927	469,793
2003–2004	22,210	489,464
2004–2005	21,583	501,275
2005–2006	22,368	517,892
2006–2007	23,076	534,793
2007–2008	24,610	557,583
2008–2009	24,926	583,288
2009–2010	26,169	614,396
2010–2011	28,425	656,912
2011–2012	30,029	703,141

CAGR, 2002–2012  
**3.6%**

CAGR, 2002–2012  
**4.6%**

CAGR, 2007–2012  
**5.4%**

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CAGR, 2009–2012  
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Source: Integrated Postsecondary Education Data (IPEDS)/National Center for Education Statistics (NCES) Completions Survey, 2012

## Comparing Illinois with peer states reveals progress and challenges

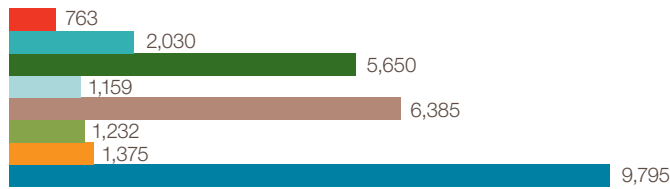
When compared with the nation's large states with vibrant economies—California, New York, and Texas—as well as tech-intensive Massachusetts, Illinois has held its own in producing STEM graduates. (See methodology below for explanation of state sample). Illinois ranked third among these states, with STEM bachelor's degrees accounting for a total of 23.7 percent of all bachelor's degrees conferred in 2012. (The national average for STEM degrees was 24.6 percent.)

Differences in demand among these states can be attributed to their varying economies. Texas led the pack, with 25.5 percent, possibly due to the state's energy-driven economy. Meanwhile, New York had the lowest percentage of STEM graduates among our sample—likely attributable to the wide spread of talent demand in New York City, including demand for graduates with an arts degree.

## STEM bachelor's degrees by field, Illinois and selected states, 2012



### Texas

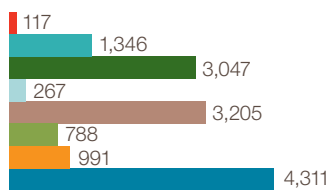


Total STEM degrees: **28,389** Total bachelor degrees: **111,324**

Percent of  
STEM degrees

**25.5%**

### Massachusetts



Total STEM degrees: **14,072** Total bachelor's degrees: **55,823**

**25.2%**

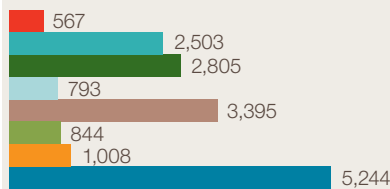
### California



Total STEM degrees: **40,832** Total bachelor's degrees: **172,410**

**23.7%**

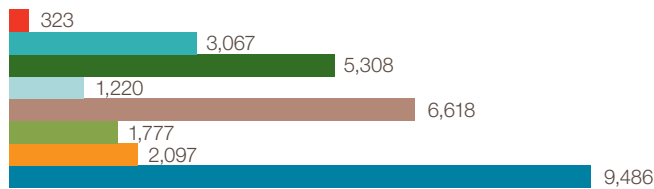
### Illinois



Total STEM degrees: **17,159** Total bachelor's degrees: **72,455**

**23.7%**

### New York



Total STEM degrees: **29,896** Total bachelor's degrees: **129,426**

**23.1%**

Source: Integrated Postsecondary Education Data (IPEDS)/National Center for Education Statistics (NCES) Completions Survey, 2012

Furthermore, Illinois exhibited strong performance in a number of fields that are instrumental in driving the innovation economy.

**Computer science.** At the subject level, Illinois has demonstrated rapid growth in the conferral of computer science degrees. After a significant drop in computer science graduates in the middle of the past decade, the number of computer science graduates increased at a CAGR of 15.4 percent from 2009 to 2012. Furthermore, among the sample states, Illinois was ranked first by intensity in the production of computer science graduates in 2012; approximately 14.4 percent of Illinois' STEM graduates are in computer science compared with second-place New York at 10.2 percent. Despite this increase, the number of computer science graduates in 2012 was still below Illinois' 2002 total by about 250 students.

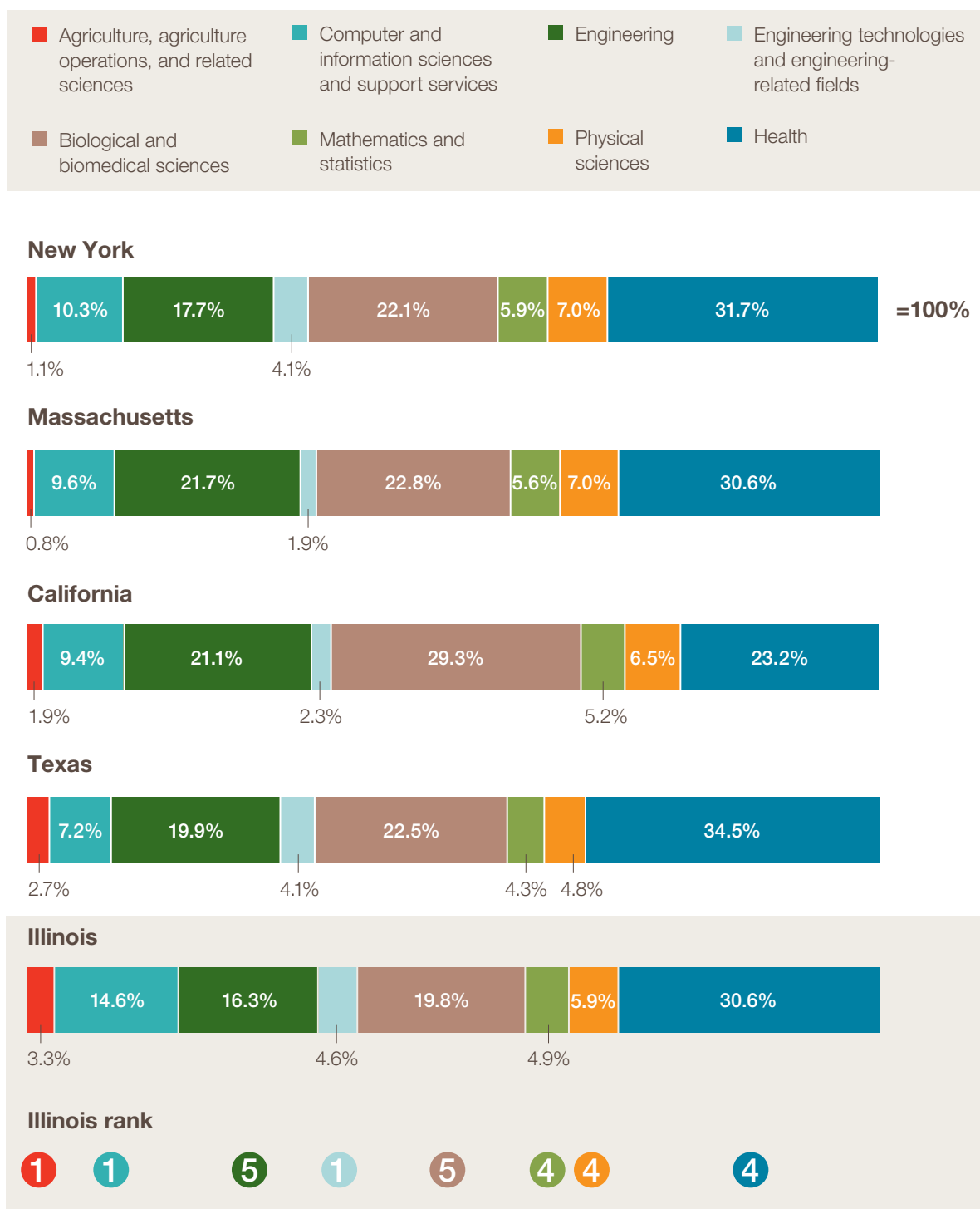
**Engineering technologies.** Illinois also excels in the production of graduates in engineering technologies and related fields, ranking first among our sample. Degrees in this category cover a wide range of applications, including industrial production, nanotechnology, mining and petroleum, and civil engineering.

**Agriculture, agriculture operations, and related technologies.** Illinois also ranked first among the sample states in terms of STEM graduates with degrees in agriculture, agriculture operations, and related technologies. Though the total number of graduates in this field is relatively small—567 in 2012—our universities' focus on developing agricultural technologies—such as those emerging from the University of Illinois at Urbana-Champaign help support Illinois' substantial agriculture economy, including global leaders such as Archer Daniels Midland.

**Health.** Among all STEM fields, health-related degrees have grown the fastest in Illinois, increasing at a CAGR of 6.3 percent between the 2001–02 school year and the 2011–12 school year. The increase was primarily due to a boom in nursing graduates. As with the other four sample states, health-related degrees account for approximately 30 percent of all STEM bachelor's degrees. (Healthcare positions are among the top ten positions for online job postings. See the [May 2014 Index](#) for more detail.)



## Concentration of STEM bachelor's degrees by field, Illinois and selected states, 2012



Source: Integrated Postsecondary Education Data (IPEDS)/National Center for Education Statistics (NCES) Completions Survey, 2012



However, Illinois ranked second to last among this sample of five states in the intensity of degrees conferred in mathematics and the physical sciences. Furthermore, Illinois is last among this sample in its share of STEM graduates with engineering degrees and those with biological sciences degrees. More research is needed to understand the reason for these trends, but since the latter two STEM fields typically account for more than a third of STEM graduates among our sample states, Illinois could boost its overall share of STEM graduates by working to increase the number of college students earning degrees in engineering or biological sciences.

Illinois Pathways, established with funding from Race to the Top, has been promoting STEM fields over the past several years. In a reflection of the program's potential, Illinois was recently awarded \$12 million from the U.S. Department of Labor to expand the Pathways program.

## Talent migration patterns for Chicago

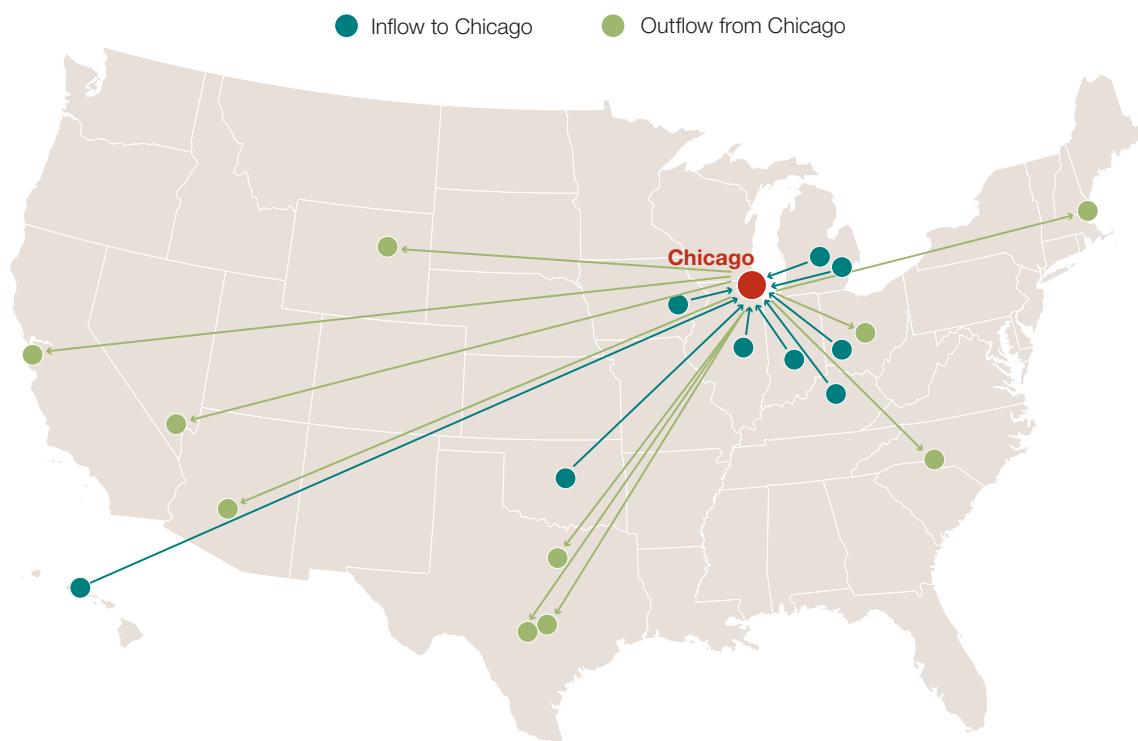
<sup>1</sup> Due to confidentiality concerns, the Census Bureau suppressed roughly one third of all records for the educational attainment cohorts used in this analysis, representing roughly one quarter of all migrants.

<sup>2</sup> In other words, accounting for the survey's margins of error, 32 MSAs had outflows from Chicago that were statistically different from their inflows to Chicago. See full methodology below.

In April 2014, the U.S. Census Bureau released county-to-county migration data from its 2007–2011 American Community Survey (ACS). This issue of the Index draws on the data for two cohorts—college graduates with at least a bachelor's degree and those with a graduate or professional degree—which, although not comprehensive due to the survey's methodology,<sup>1</sup> are directional and offer valuable insight into migration trends.

For the cohort with bachelor's degrees and up, the Chicago-Naperville-Elgin metropolitan statistical area (MSA) indicated statistically significant net flows of residents from or to 32 other MSAs.<sup>2</sup> Overall, Chicago attracted net gains from 9 and suffered net losses to 23. Across all 32 MSAs, Chicago saw a net loss of an estimated 5,700 people with bachelor's degrees or higher. Chicago's significant net gains came primarily from Midwestern college towns, while its net losses were largely to major MSAs outside the Midwest, including Boston, Dallas, San Francisco, Denver, Phoenix, Austin, San Antonio, and Portland (OR).

**Top 10 MSAs by annual inflows to/outflows from Chicago,**  
individuals with bachelor's degree or above, 2007–2011



**Inflow to Chicago**

Champaign-Urbana, IL; Detroit, MI; Iowa City, IA; Honolulu, HI; Cincinnati, OH; East Lansing, MI; Oklahoma City, OK; Bloomington, IN; Lexington, KY

**Outflow from Chicago**

Phoenix, AZ; Denver, CO; Austin, TX; San Antonio, TX; Las Vegas, NV; Boston, MA; Dallas, TX; Columbus, OH; Charlotte, NC; San Francisco, CA

Source: U.S. Census Bureau, 2007–2011 American Community Survey

The Chicago MSA's graduate/professional degree cohort showed statistically significant net flows of residents from or to 21 other MSAs—attracting net gains from 9, and suffering net losses to 12. Chicago's significant net gains were again mostly from Midwestern college towns, while its significant net losses were largely to major MSAs such as Los Angeles, Phoenix, Washington, D.C., Dallas, Denver, Seattle, and Austin.

A growing economy and focus on entrepreneurship could have an impact on these numbers going forward. Since 2011 (the last year covered by these data), the city and state have implemented a number of initiatives that could have a direct impact on talent attraction and retention. Chicago has built a reputation as a tech hub through multiple policies, programs, initiatives, and institutions—including the creation and recent expansion of 1871 and the announcement of the Digital Manufacturing and Design Institute (DMDI), slated to open on Goose Island in early 2015. In addition, a renewed focus on innovation and programs to support the growth of new and established businesses have had an impact: venture capital investments in the MSA in the first quarter of 2014 were up nearly 277 percent compared with the previous year, and funding for digital start-ups increased by nearly 158 percent.<sup>3</sup>

## Looking forward

Chicago and the State of Illinois face a two-pronged challenge in supporting the innovation economy: first, continue to promote STEM fields, and second, find ways to keep graduates as a whole (and STEM graduates in particular) in the state. While individuals might choose to consider other locations for a variety of reasons—job opportunities in specific fields, a desire for a different setting, better year-round climates—Illinois and Chicago have a valuable advantage: these students are already familiar with the region’s unique strengths. To gain new ground in innovation-intensive sectors, the state must continue to create new and exciting opportunities for graduates.

Chicago and other cities across the country are struggling to meet the high demand for STEM talent, meaning that competition for these graduates will likely remain fierce. A report from the Brookings Institution found that jobs requiring a STEM bachelor’s degree in Chicago typically took 44 days to fill compared with 41 days for positions in other fields. The shortage of talent was even more pronounced in tech centers on the West Coast: San Jose and San Francisco took an average of 59 and 56 days, respectively, to fill professional STEM jobs.

<sup>3</sup> Chicago by the Numbers,”  
World Business Chicago,  
June 3, 2014.

In the coming years, the Index will share updated data to monitor progress in STEM attainment and talent attraction and retention. ■



## Methodology for STEM attainment data

The five states were selected for comparison because their population size and economic diversity makes them comparable with Illinois, which is similarly characterized by a diverse economy and is one of the most populous states in the country. The five states' economies are characterized by the existence of vibrant digital ecosystems as well as large biotech, semiconductor, and electronics industries. All these technology-driven industries generate demand for graduates with STEM training. Massachusetts, although smaller than the other states in the sample, has a tech-based economy and is often considered an innovative state based on outsized employment in tech-focused industries and high concentrations of private sector R&D.

## Methodology for STEM graduate production

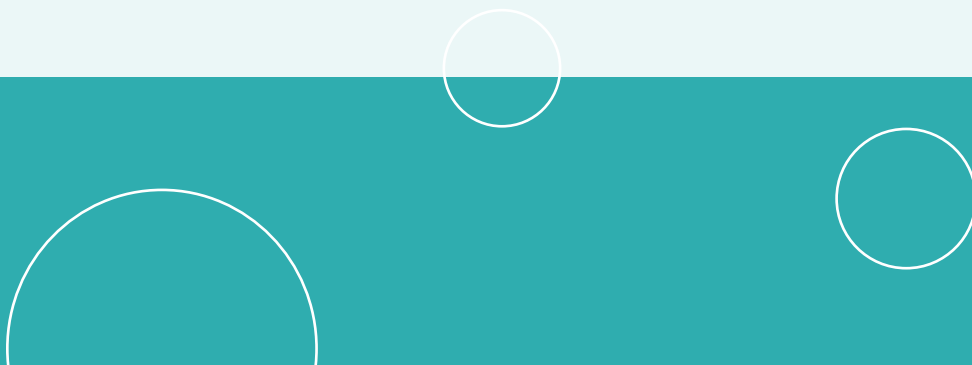
The data used by the Index to discuss STEM graduate production and comparative rates of growth drew on data from the National Center for Education Statistics' (NCES) Completion Survey for 2001 through to 2012. Completions Survey data for the period was accessed using the [NSF WebCASPAR data portal](#).

1. Calculations are based on the NCES population of post-secondary institutions.
2. STEM degree designations are based on four-digit Classification of Instructional Programs (CIP) codes.
3. Health degrees that were exclusively focused on administrative health skills were excluded from the count of health-related degrees as these do not include significant instruction in mathematics and science.
4. "Mechanic and repair technologies/technicians; and construction trades" have been excluded from the count of engineering-related degrees.
5. Comparator states (California, New York, and Texas) were selected for comparative purposes due to the size of their populations, the diversity of their economy, and the important role of science and technology driven industries in those states.
6. Massachusetts was chosen because of its leadership position in a series of economic metrics related to innovation and the role of science and technology in the state's economy. As such, it enables us to compare Illinois with a state where rates of STEM graduation are expected to be high.

## Methodology for migration data

In the discussion of talent migration, this issue of the Index features analysis of migration data from the US Census Bureau, which drew from responses to the 2011 five-year American Community Survey; these numbers were divided into five educational attainment cohorts (for population aged 25 and older). The following steps were taken to calculate the Chicago MSA's migration totals:

1. The ACS county-to-county data were joined to a table of MSA definitions released by the U.S. Office of Management and Budget in February 2013. Using the origin and destination county fields, the ACS numbers were grouped by MSA.
2. Aggregate inflows, outflows, net flows, and margins of error were calculated for each MSA that shared a migration relationship with Chicago. The method outlined on page 52 (A-14) of the ACS General Users Handbook was used to calculate the aggregate margins of error.
3. To determine statistical significance, the aggregate flows and margins of error were applied using the method outlined on page 56 (A-18) of the ACS General Users Handbook. If the inflow from an MSA was significantly different from the outflow to that MSA, the net gain/loss was included in the results described above. All margins of error and significance tests were calculated at 90 percent confidence, the Census Bureau's standard level.



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