WHERE WE STAND

Where We Stand ***tracks the health of the St. Louis region among the 50 most populous MSAs.[1] These metro areas, known as the peer regions, are our domestic competition and provide a consistent yardstick to gauge "Where We Stand."***

This update looks at trends in innovation and entrepreneurship in the St. Louis region and how we compare to our peer metropolitan regions.

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Innovation and Entrepreneurship

Over the last 40 years, the nature of the U.S. economy has changed substantially. The development of new technologies paired with deregulation and increased global competition disrupted many of the most well established firms of the 1970s and 1980s (Spence and Hlatshwayo 2011). Amid these changes, some metropolitan regions are thriving much more than others. In particular, San Jose (the home of Silicon Valley) has been one of the largest drivers of technological change and has subsequently attracted great amounts of wealth. According to CityLab, between 2009 and 2013, 63 percent of new jobs in San Jose were high-wage jobs. During the same time, 90 percent of new jobs in St. Louis were low-wage jobs (Florida 2013).

To stay competitive and adjust to the conditions of the new economy, many regions have adopted efforts to attract innovative jobs and become "the next Silicon Valley." In his book, *The New Geography of Jobs*, Enrico Moretti argues that innovative jobs can propel regional growth and "reshape the economic fates of entire communities" (Moretti 2012). To attract more innovative workers, several regions have developed innovation districts, including Cambridge, Philadelphia, and St. Louis (Katz and Wagner 2014).

The St. Louis region has received national attention for its efforts to develop a culture of innovation and entrepreneurship. According to a local magazine, *EQ*, the St. Louis region is home to numerous support organizations for new businesses and innovation, including 19 business incubators, 11 business accelerators, and 23 funding and business investment organizations (EQ 2017). A number of national sources have written about these efforts, including the Washington Monthly, FiveThirtyEight, the Brookings Institution, Forbes, Entrepreneur Magazine, and the Wall Street Journal. Last year, the blog FiveThirtyEight published an article declaring, "St. Louis is the New Startup Frontier."

This update takes a look at trends in innovation and entrepreneurship in the St. Louis region among the 50 most populous Metropolitan Statistical Areas (MSAs) in the country—also known as the peer regions. This report explores several measures of innovative activity, including productivity, invention, venture capital investment, and entrepreneurship, as well as measures that indicate the readiness of the workforce for the changing economy.

Generally, the St. Louis region ranks close to or below the national average on measures of innovation and entrepreneurship—particularly in economic productivity, patenting, and business survival rates. The region has a relatively high rate of business startups, although some of the increase in startups is attributable to a large growth of very small, low-paying firms in the health care industry. In recent years, the region has seen positive trends in venture capital investment and educational attainment. Relative to its Midwest peer regions, St. Louis generally ranks well.

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1 MSAs (Metropolitan Statistical Areas) are geographic entities delineated by the Office of Management and Budget (OMB). MSAs are areas with "at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties."

Productivity Growth

One of the most widely used measures of innovation is growth in productivity. Productivity growth occurs when a company or worker is able to produce more goods or services with the same quantity of inputs (i.e. labor or capital equipment). Generally, productivity can grow in two ways: through labor improvements, such as job training, or with improvements or upgrades to capital equipment. When productivity growth occurs, the company or individual should theoretically attract more wealth.

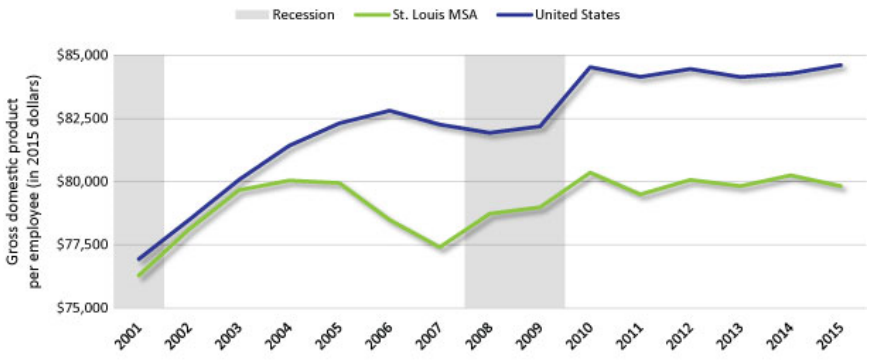
Overall Productivity

Productivity growth is measured by gross domestic product (GDP) per employee. As shown in Figure 1 (Page 2), productivity growth in the St. Louis region declined during the recession, recovered to pre-recession levels, and has remained about the same over the last five years.

At the beginning of the new millennium, the overall productivity of the St. Louis region closely tracked the national rate. In 2001, GDP was valued at about $76,000 per employee in both the St. Louis region and nationally. Leading up to the last recession, St. Louis' rate of productivity declined slightly. Since then, productivity in the St. Louis region has not caught up with the national rate. As of 2015, national productivity was $5,000 greater than the local rate, and St. Louis' overall level of productivity was low relative to many of the peer regions, ranking 38th.

Some of this difference is due to changes in the composition of the St. Louis economy. Over the last 15 years, service-providing industries have come to comprise a slightly larger share of the regional economy than what is seen nationally. In 2001, the production of service providing industries comprised 67.6 percent of the region's total economic production compared with 68.3 nationally. As of 2015, service provision makes up 72.2 percent of the region's economy, compared with 70.6 nationally.

Figure 1: Productivity - GDP per Employee
St. Louis MSA and the United States, 2001-2015



Source: U.S. Bureau of Economic Analysis, Regional Economic Accounts

Productivity
Real gross metropolitan production per employee in dollars, 2015

1	**San Jose**	**164,734**
2	Washington, D.C.	147,512
3	San Francisco	119,584
4	Houston	116,927
5	Seattle	115,838
6	New York	112,656
7	Boston	103,950
8	Philadelphia	101,053
9	Portland	100,637
10	Los Angeles	100,276
11	San Diego	98,048
12	Dallas	96,591
13	Chicago	95,712
14	Hartford	94,810
15	Denver	93,604
16	Indianapolis	93,117
17	Minneapolis	91,943
18	Charlotte	91,134
19	Virginia Beach	91,114
20	Baltimore	90,719
21	Pittsburgh	89,192
22	Richmond	88,613
23	Milwaukee	88,369
24	Detroit	88,248
25	Cleveland	87,721
26	New Orleans	86,426
27	Birmingham	86,341
28	Raleigh	86,320
29	Cincinnati	86,173
30	Atlanta	86,093
United States		**84,621**
31	Columbus	84,447
32	Kansas City	83,983
33	Austin	83,954
34	Nashville	83,572
35	Sacramento	83,084
36	Oklahoma City	81,405
37	Salt Lake City	81,068
38	**St. Louis**	**79,827**
39	Louisville	78,566
40	Phoenix	78,479
41	Providence	77,361
42	Miami	76,690
43	Las Vegas	75,983
44	Memphis	75,656
45	Buffalo	75,173
46	San Antonio	74,454
47	Orlando	73,161
48	Tampa	72,493
49	Jacksonville	71,973
50	**Riverside**	**64,536**

Source: U.S. Bureau of Economic Analysis, Regional Economic Accounts

Manufacturing Productivity

While overall productivity growth in the St. Louis economy has been slow, manufacturing productivity has increased steadily. Measured as the value of output per hour of labor, manufacturing productivity in the St. Louis region increased from $121.47 in 2002 to $180.85 in 2012 (48.8 percent).[2] Nationally, manufacturing productivity increased from $117.94 in 2002 to $150.31 in 2012 (27.5 percent). In 2012, St. Louis' rate of manufacturing productivity was higher than the national average and many of the peer regions, ranking 15th.

Among the 10 Midwest peers (highlighted in light blue on the WWS table), St. Louis' rate of manufacturing productivity is second only to Indianapolis. Kansas City is third among the Midwest peers, with a rate that closely tracks that of St. Louis. As seen in Figure 2 (Page 3), manufacturing productivity in St. Louis has consistently been slightly higher than the national average since the 1980s.

Manufacturing Productivity

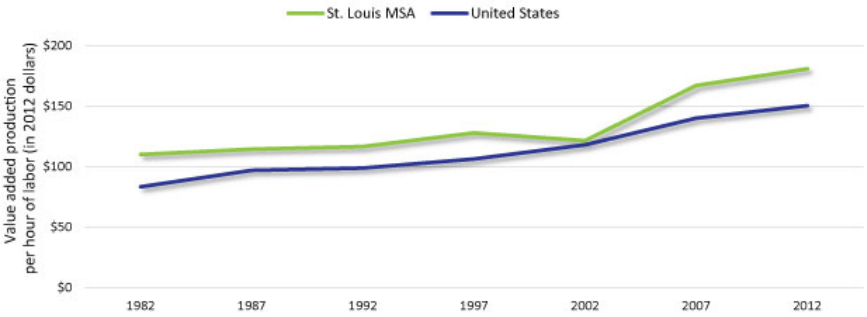
Value added production per hour of labor in dollars, 2012

1	**Raleigh**	**450.4**
2	Richmond	448.1
3	New Orleans	311.3
4	San Francisco	286.5
5	San Jose	272.3
6	Houston	268.6
7	Indianapolis	247.1
8	Seattle	225.6
9	Austin	200.0
10	Memphis	196.2
11	Baltimore	192.2
12	Boston	187.5
13	Salt Lake City	184.1
14	Dallas	181.0
15	**St. Louis**	**180.8**
16	Kansas City	177.7
17	San Diego	177.3
18	Phoenix	174.3
19	Jacksonville	171.1
20	Washington, D.C.	166.4
21	Minneapolis	165.5
22	Denver	160.5
23	Cincinnati	156.1
24	Philadelphia	152.0
25	Buffalo	150.6
United States		**150.3**
26	New York	150.3
27	Pittsburgh	150.3
28	Tampa	150.2
29	Columbus	149.2
30	Orlando	145.5
31	Riverside	143.5
32	Milwaukee	142.5
33	Chicago	142.2
34	Hartford	140.5
35	Los Angeles	138.3
36	Portland	135.9
37	Birmingham	135.3
38	Atlanta	134.7
39	Sacramento	131.0
40	Virginia Beach	130.4
41	Providence	126.8
42	Louisville	126.8
43	San Antonio	125.3
44	Nashville	124.6
45	Charlotte	122.7
46	Las Vegas	119.4
47	Oklahoma City	118.4
48	Miami	116.6
49	Cleveland	114.5
50	**Detroit**	**108.9**

Source: U.S. Census Bureau, Economic Census

Figure 2: Manufacturing Productivity

St. Louis MSA and the United States, 1982 to 2012



Source: U.S. Census Bureau, Economic Census

2 Dollar amounts in this paragraph are inflation adjusted to 2012 dollars using the Bureau of Labor Statistics consumer price index (CPI).

Invention

Another indication of an innovative economy is the invention of new products. Some researchers have found evidence that patents are linked with economic growth. According to a 2013 report from the Brookings Institute, when regions experience a significant increase[3] in the number of patents granted, there is an associated "2.7 percent increase in economic growth—measured as output per worker" (Rothwell et al 2013). The report also found that "areas with the fastest growth in patenting tend to have lower unemployment."

In 2015, the regions with the most patents[4] granted were also among the nation's largest regions, including Boston (5,950), Los Angeles (6,476), New York (8,627), San Francisco (9,732), and San Jose (14,618). Nearly half of all patents granted in 2015 (47.0 percent) were granted to inventors in just 10 of the peer regions. In 2015, 780 patents were granted for inventions in the St. Louis MSA, a rate of around 5.5 utility patents per 10,000 employees. Compared with the peer regions, this rate of invention is lower than many of the peers, ranking 32nd and is below the national average of 9.4 per 10,000 employees.

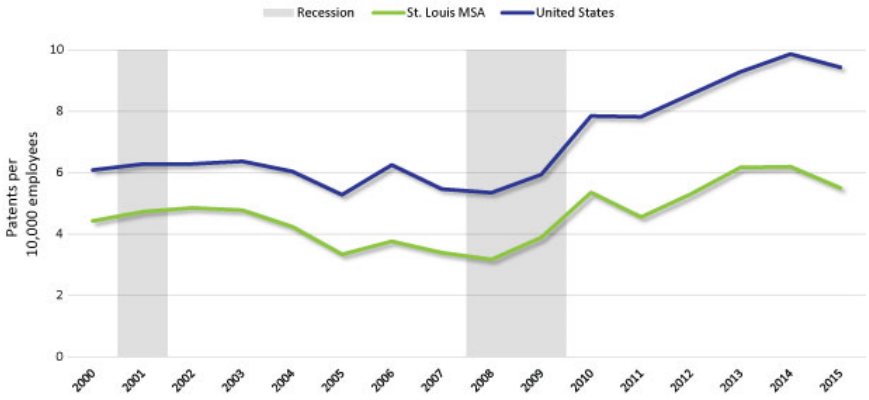
The rate of patents in the region has grown over the past 15 years but not as much as the rest of the nation. Figure 3 (Page 4) shows that the patent rate has been higher in the United States than in St. Louis over the entire time period. Between 2005 and 2015, over 7,000 patents were granted in the St. Louis region, many of which were granted for inventions related to the life sciences, including inventions related to multicellular organisms, drugs, organic compounds, and molecular biology. The companies with the most patents granted during this time include Boeing (590), Monsanto (378), Washington University (155), Mallinckrodt (131), and Emerson Electric (110). Nearly 500 patents were also granted to individuals for inventions during this time.

Patents
Utility patents granted per 10,000 employees, 2015

1	**San Jose**	**132.5**
2	San Francisco	40.4
3	San Diego	34.8
4	Austin	27.3
5	Raleigh	24.8
6	Seattle	23.7
7	Boston	21.8
8	Portland	18.5
9	Minneapolis	17.3
10	Detroit	16.7
11	Hartford	12.8
12	Los Angeles	10.4
13	Houston	10.3
14	Cincinnati	9.6
United States		**9.4**
15	New York	9.1
16	Phoenix	8.9
17	Dallas	8.7
18	Cleveland	8.7
19	Salt Lake City	8.5
20	Chicago	8.2
21	Denver	8.2
22	Atlanta	8.1
23	Philadelphia	8.1
24	Milwaukee	7.9
25	Pittsburgh	7.5
26	Kansas City	7.5
27	Indianapolis	7.3
28	Washington, D.C.	7.2
29	Providence	6.8
30	Sacramento	6.6
31	Baltimore	5.9
32	**St. Louis**	**5.5**
33	Miami	5.1
34	Memphis	5.0
35	Tampa	4.8
36	Buffalo	4.5
37	Louisville	4.5
38	Charlotte	4.4
39	Las Vegas	4.4
40	Columbus	4.2
41	Richmond	3.9
42	San Antonio	3.9
43	Orlando	3.8
44	Riverside	3.3
45	Jacksonville	3.0
46	Nashville	2.4
47	Oklahoma City	2.4
48	New Orleans	2.2
49	Birmingham	2.1
50	**Virginia Beach**	**1.2**

Source: U.S. Patent and Trademark Office; U.S. Bureau of Economic Analysis

Figure 3: Utility Patents per 10,000 employees
St. Louis MSA and the United States



Source: U.S. Patent and Trademark Office, Patent Statistics and Research Reports; U.S. Bureau of Economic Analysis, Regional Economic Accounts

3 Defined as an increase of one standard deviation.
4 In this report, patents measure utility patents. According to the U.S. Patent and Trademark Office, utility patents "may be granted to anyone who invents or discovers any new and useful process, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof." This report does not discuss other patent types, such as design patents, which are issued for the ornamental design of an item, or plant patents, which are issued for invented or discovered plants (U.S. Patent and Trademark Office 2015).

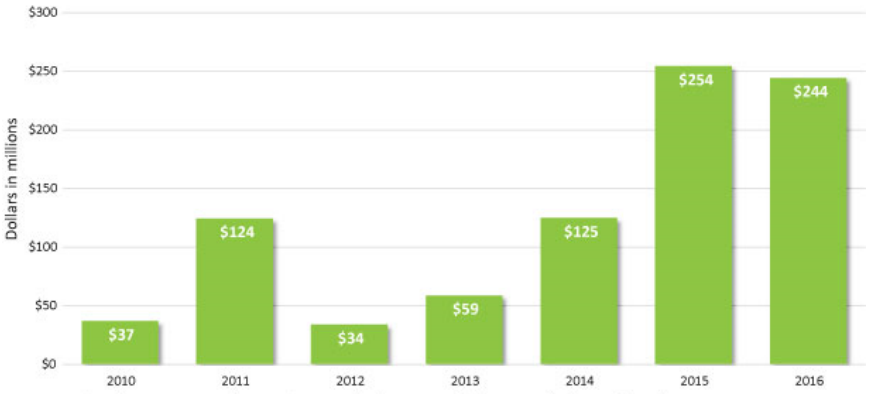
Venture Capital

Venture capital investments are an important funding source for innovative activity. Kortum and Lerner (2000) find that "venture capital is associated with a substantial increase in patenting." Others have also found evidence that venture capital investments have spillover effects for other businesses—not just the firm receiving the investment. Samila and Sorenson (2011) find that when a venture capital firm invests in a business it stimulates "the entry of two to twelve establishments—in other words, more new firms than actually funded."

According to data from the National Venture Capital Association, in 2016 over 40 percent of U.S. venture capital was invested in the San Jose and San Francisco regions—a combined total of $30.1 billion dollars. The dollar value of venture capital investments in the St. Louis region is much smaller, although the region has started to see an increase in recent years.

While there are fluctuations from year to year, annual venture capital investments in 2015 and 2016 were roughly twice the amount of investments in the previous five years. In 2016, the St. Louis region attracted over $240 million in venture capital investment. This is down slightly from 2015 when the region attracted over $250 million, but still higher than in 2014 when it attracted $125 million. In 2016, total venture capital investments in St. Louis equated to $179 per employee in the region. This rate of investment ranks 23rd among the peer regions and the 3rd highest among the Midwest peers.

Figure 4: Total Venture Capital Investment
St. Louis MSA, 2010 to 2016



Source: National Venture Capital Association, Yearbook Report with data provided by Pitchbook

Venture Capital
Venture capital investment per employee in dollars, 2016

1	**San Francisco**	**9,985**
2	San Jose	6,270
3	Boston	2,231
4	San Diego	1,089
5	Austin	977
6	Los Angeles	912
7	Salt Lake City	902
8	New York	794
9	Seattle	770
10	Miami	501
United States		**491**
11	Raleigh	364
12	Denver	350
13	Washington, D.C.	337
14	Nashville	335
15	Philadelphia	313
16	Atlanta	283
17	Chicago	268
18	Portland	260
19	Minneapolis	251
20	Pittsburgh	197
21	Dallas	193
22	Baltimore	183
23	**St. Louis**	**179**
24	Phoenix	136
25	Hartford	130
26	Las Vegas	129
27	Cincinnati	127
28	Indianapolis	126
29	Sacramento	117
30	Charlotte	113
31	Richmond	105
32	Louisville	103
33	Buffalo	96
34	Cleveland	92
35	Tampa	85
36	Birmingham	83
37	Houston	82
38	San Antonio	77
39	Providence	70
40	Detroit	65
41	Kansas City	59
42	Columbus	58
43	Orlando	57
44	Milwaukee	52
45	Memphis	35
46	New Orleans	34
47	Jacksonville	32
48	Oklahoma City	11
49	Riverside	7
50	**Virginia Beach**	**1**

Source: National Venture Capital Association Yearbook Report with data provided by Pitchbook; U.S. Bureau of Labor Statistics, Current Employment Statistics

Entrepreneurship

Entrepreneurship is another important measure of innovation. Economic theory suggests there is a link between entrepreneurship, innovation, and economic growth. Joseph Schumpeter, an economist and contributor to economic theory in the 20th century, wrote about entrepreneurs as "innovators" and "agents of transformative change" (Glaeser et al 2010). Entrepreneurs facilitate the commercialization of new ideas, ideas that may have otherwise remained unrealized in more established firms (Porter 1990; Audretsch 2007).

Robert Solow, a student of Schumpeter and a Nobel laureate, wrote that while an entrepreneur may not have invented a new product, "the entrepreneur is the one who first sees its economic viability, bucks the odds, fights or worms his way into the market, and eventually wins or loses" (Solow 2007).

Schumpeter argued that by bringing new ideas to a market, entrepreneurs provide "the fundamental impulse that keeps the capital engine in motion" (Foster et al 2001). With the commercialization of new ideas, older, more "institutionalized" ideas and products may become obsolete and are replaced (Porter 1990; Carrie and Thurik 2003). Through this process, which Schumpeter calls "creative destruction," highly productive firms replace less productive firms, which in turn, results in higher overall productivity for an entire economy (Carrie and Thurik 2003; Foster et al 2001).

Researchers rely on several measures to gauge entrepreneurship, including rates of self-employment, small businesses, and business startups (Glaeser et al 2010). This section explores these measures as well as the survival rate of startups.

Economic theory suggests there is a link between entrepreneurship, innovation, and economic growth.

Self-Employment

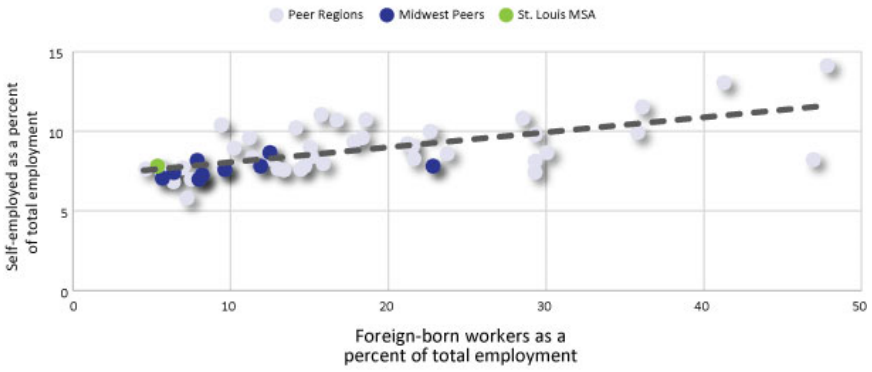
In St. Louis, 7.8 percent of the employed population is self-employed. This ranks 31st among the peer regions and is below the peer region average of 9.3 percent. Nearly one quarter of the self-employed (22.7 percent) work in the professional services industry.[5] Another 17.3 percent work in construction, and 12.2 percent work in the retail trade industry. Close to 40 percent (38.7 percent) of people who are self-employed hold a bachelor's degree or higher, and around 30 percent (29.5 percent) have a high school diploma or less.

Foreign-born workers are disproportionately represented among the self-employed. The foreign-born population makes up 5.4 percent of total employment in St. Louis, and comprises 7.0 percent of those who are self-employed. Roughly, 10 percent (10.3 percent) of the working foreign-born population in St. Louis is self-employed. By comparison, 7.7 percent of the working native-born population is self-employed. Generally, peer regions with a higher share of foreign-born workers tend to have higher rates of self-employment (see Figure 5, page 7). In four of the five regions with the highest rates of self-employment, the foreign-born population makes up 25 percent or more of total employment.

There are several organizations in St. Louis that offer support to foreign-born entrepreneurs, including the Mosaic Project and the International Institute Community Development Corporation (IICDC). IICDC, for instance, is a community development financial institution that offers small business loans and business training to local immigrants and refugees. According to their website, between 2006 and 2013, IICDC services supported over 500 businesses in the St. Louis region (IICDC 2017).

Figure 5: Percent Immigrant v. Percent Self-Employed

St. Louis and the Peer Regions, 2015



Source: IPUMS, U.S. Census Bureau, American Community Survey, 1-Year Estimates

Self-Employment

Percent of employed population that is self-employed, 2015

1	**Miami**	**14.1**
2	Los Angeles	13.1
3	San Francisco	11.6
4	Portland	11.1
5	San Diego	10.9
6	Austin	10.8
7	Tampa	10.7
8	New Orleans	10.4
9	Denver	10.2
10	Sacramento	10.0
11	New York	10.0
12	Riverside	9.8
13	Atlanta	9.6
14	Oklahoma City	9.6
15	Phoenix	9.4
Peer Average		**9.3**
16	Seattle	9.2
17	Orlando	9.1
18	Raleigh	9.0
19	Nashville	9.0
20	Houston	8.7
21	Minneapolis	8.7
22	Dallas	8.6
23	Salt Lake City	8.4
24	Jacksonville	8.4
25	Boston	8.3
26	Charlotte	8.3
27	San Jose	8.2
28	Kansas City	8.2
29	Washington, D.C.	8.1
30	Hartford	8.0
31	**St. Louis**	**7.8**
32	Chicago	7.8
33	San Antonio	7.8
34	Detroit	7.8
35	Richmond	7.7
36	Louisville	7.7
37	Philadelphia	7.7
38	Pittsburgh	7.7
39	Providence	7.6
40	Columbus	7.6
41	Birmingham	7.6
42	Baltimore	7.6
43	Las Vegas	7.4
44	Cleveland	7.4
45	Milwaukee	7.3
46	Cincinnati	7.1
47	Memphis	7.0
48	Indianapolis	7.0
49	Buffalo	6.9
50	**Virginia Beach**	**5.8**

Source: U.S. Census Bureau, American Community Survey 1-Year Estimates

5 This industry includes management and public relations services, legal services, child day care services, and health and educational services, among several others.

Small Businesses

According to data from the U.S. Census Bureau, over 95 percent of all firms in the United States are small businesses. In this report, small businesses are defined as firms with one to 49 employees. These businesses employ roughly one-fourth of all U.S. workers.

While St. Louis is home to several large nationally known businesses, most businesses in the region are relatively small. Of all the existing businesses in the St. Louis region, nearly 90 percent have fewer than 50 employees. This rate is not uncommon throughout the country. Among the peer regions, small businesses range from comprising 83.0 percent (Memphis) to 95.1 percent (New York) of all businesses. Among the peer regions, St. Louis' percentage is roughly in the middle, ranking 20th, but the region has the 3rd highest ranking among the Midwest peers, only behind Chicago and Detroit.

As shown in Table 1 (Page 8), nearly 20 percent of small businesses in the St. Louis region are in the health care and social assistance industry. Another 13 percent are in professional, scientific, and technical services industries, and 11 percent are in construction. Twenty-five percent of the region's small businesses are female owned, 13.2 percent are minority owned, and 8.3 percent are veteran owned. Nationally, 20.1 percent of small businesses are female owned, 18.4 percent are minority owned, and 7.3 are owned by veterans.

Small Business Firms
Firms with 1-49 employees as a percent of all firms, 2014

United States		**95.6**
1	New York	95.1
2	Miami	94.9
3	Los Angeles	93.6
4	Chicago	92.0
5	Tampa	91.7
6	Philadelphia	91.3
7	Seattle	91.3
8	San Francisco	91.1
9	Detroit	91.0
10	Boston	91.0
11	San Diego	90.9
12	Atlanta	90.7
13	Providence	90.7
14	Washington, D.C.	90.4
15	Portland	90.4
16	Riverside	90.4
17	Orlando	90.3
18	Houston	90.0
19	Dallas	89.8
20	**St. Louis**	**89.8**
21	Denver	89.7
22	Minneapolis	89.6
23	Baltimore	89.5
24	Pittsburgh	89.2
25	San Jose	89.1
26	Sacramento	89.1
27	Phoenix	89.1
28	Oklahoma City	88.6
29	Cleveland	88.6
30	Buffalo	88.5
31	Virginia Beach	88.4
32	Jacksonville	88.0
33	Kansas City	88.0
34	Austin	87.8
35	Salt Lake City	87.4
36	New Orleans	87.4
37	Richmond	87.4
38	Las Vegas	87.2
39	Hartford	87.1
40	San Antonio	86.7
41	Charlotte	86.7
42	Cincinnati	86.6
43	Raleigh	86.5
44	Milwaukee	86.5
45	Nashville	86.0
46	Indianapolis	85.9
47	Louisville	85.9
48	Columbus	85.9
49	Birmingham	85.6
50	**Memphis**	**83.0**

Source: U.S. Census Bureau, Business Dynamics Statistics

Table 1: Small Business Firms by Industry
St. Louis MSA, 2015

Sector	Percent of Small Business Firms
Health care and social assistance	19.4
Professional, scientific, and technical services	13.0
Construction	11.0
Retail trade	9.6
Accommodation and food services	7.0
Administrative and support and waste management and remediation services	6.9
Wholesale trade	5.6
Finance and insurance	5.5
Real estate and rental and leasing	4.2
Manufacturing	4.0
Other Industries	13.8

Source: U.S. Census Bureau, Annual Survey of Entrepreneurs, 2015

Small Business Startups

Business startups are another way to measure entrepreneurship. According to Business Dynamics Statistics (BDS) from the U.S. Census Bureau, 4,876 new businesses were created in the St. Louis region in 2014. This was the highest rate of new business creation in the region since 2005, when 4,892 new businesses were created. Of this total, almost all (99.4 percent) were small—employing between one and 49 people. When accounting for population size, St. Louis had 171.2 small business startups per 100,000 residents in 2014. This startup rate is above the peer region average (145.2 per 100,000 residents) and the national average (126.1 per 100,000 residents) and is the 7th highest among the peer regions.

Based on the BDS data, St. Louis' 2014 startup rate has climbed to pre-recession levels (see Figure 6, Page 9). This makes the St. Louis region an outlier compared to the peer regions. Since the end of the recession in 2009, few regions have seen their startup rates reach pre-recession levels. Austin and St. Louis are the only regions to see their startup rates return to their pre-recession levels. Among the Midwest peers, only St. Louis and Kansas City had positive growth in new business startups since the end of the recession.

However, some caution should be used in interpreting these numbers. It appears that a recent increase in the number of small, low-paying businesses in the health care sector are skewing the data for the St. Louis region and the state of Missouri. According to the 2015 Annual Survey of Entrepreneurs, 36.3 percent of startups in St. Louis were in the health care and social assistance industry. Twenty-nine percent of startups in the state of Missouri were in this sector, compared to just 8.8 percent nationally.

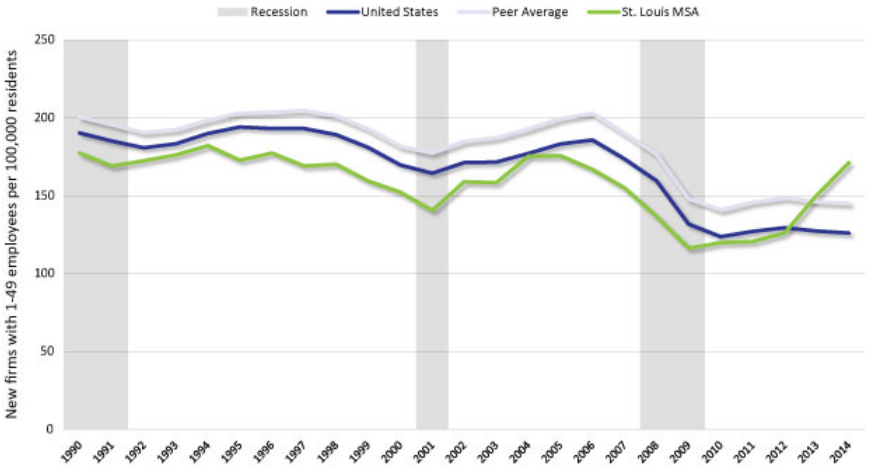
Most of these new businesses appear to be providers of home and community based services, although it is unclear why Missouri has had such a dramatic increase in these firms. St. Louis startups in the health care and social assistance sector tended to be very small, with an average firm size of 1.2 employees and an annual salary of $12,000. Nationally, the average startup in this sector had 6.2 employees with an annual salary of $33,000. The unique nature of the health care and social assistance industry in the state of Missouri appears to be skewing the total number of new businesses. As a result, the following section examines startups outside of the health care and social assistance industry.

Small Business Startups
New firms with 1-49 employees per 100,000 residents, 2014

1	**Miami**	**232.9**
2	New York	185.6
3	Orlando	184.4
4	Denver	180.5
5	Austin	176.3
6	Los Angeles	173.4
7	**St. Louis**	**171.2**
8	San Francisco	169.7
9	San Diego	167.4
10	Portland	165.0
11	Seattle	163.8
12	Salt Lake City	163.4
13	Las Vegas	163.3
14	San Jose	158.7
15	Tampa	156.6
16	Raleigh	151.8
17	Jacksonville	151.7
18	Oklahoma City	147.6
19	Charlotte	145.2
20	Atlanta	145.0
21	Kansas City	143.4
22	Dallas	137.4
23	Minneapolis	131.5
24	Washington, D.C.	131.3
25	Chicago	130.6
26	Houston	129.9
27	Boston	129.5
28	Nashville	128.6
United States		**126.1**
29	Phoenix	121.0
30	New Orleans	119.7
31	Philadelphia	117.8
32	Sacramento	117.2
33	Richmond	116.6
34	Baltimore	116.1
35	Detroit	113.9
36	Indianapolis	113.3
37	Providence	111.1
38	San Antonio	108.8
39	Buffalo	108.5
40	Louisville	104.2
41	Milwaukee	103.3
42	Birmingham	100.1
43	Pittsburgh	99.5
44	Virginia Beach	99.4
45	Riverside	98.8
46	Cleveland	93.8
47	Columbus	91.9
48	Hartford	90.5
49	Cincinnati	87.9
50	**Memphis**	**79.0**

Source: U.S. Census Bureau, Business Dynamics Statistics; Population Estimates

Figure 6: Small Business Startups Per 100,000 People
St. Louis MSA, the Peer Regions, and the United States, 1990 to 2014



Source: U.S. Census Bureau, Business Dynamics Statistics

Manufacturing and Tech Related Startups

In St. Louis, many efforts to attract and cultivate new business startups focus on industries related to science, technology, and manufacturing including T-Rex, Cortex, and BRDG (Bio Research & Development Growth) Park. According to data from the 2015 Annual Survey of Entrepreneurs, 581 startups in St. Louis were in industries related to manufacturing or professional, scientific, and technical services, making up 10.4 percent of all startups in the region. This equates to 20.5 startups per 100,000 residents which ranks 37th among the peer regions. In St. Louis, the average manufacturing and tech startup has around 5.2 employees and pays an annual salary of over $77,000. Nationally, these startups make up 17.3 percent of all startups, have an average of 4.3 employees, and pay an average annual salary of around $47,000.

Recently, the tech industry has received criticism for its lack of diversity and inclusion in the workplace. A 2016 report from the U.S. Equal Employment Opportunity Commission looked into this issue and found that minorities and women are underrepresented in tech related industries, especially in leadership positions (U.S. Equal Employment Opportunity Commission 2016). In the St. Louis region, manufacturing and tech related startups are largely owned by non-Hispanic whites and by males. Around 87 percent of startups in these industries are owned by non-Hispanic whites, and 78.3 percent are owned by males. Only 12.4 percent of these startups are minority-owned, and 13.8 percent are female-owned. Nationally, startups in manufacturing and tech are also mostly owned by non-Hispanic whites and males, although minorities and females have slightly better representation than in St. Louis. In the United States, non-Hispanics whites own 75.5 percent of startups in manufacturing or tech related industries, and males own 63.0 percent. Nearly 20 percent are minority-owned (19.9 percent), and 23.4 percent are female-owned.

The Kauffman Foundation studied the region's "startup ecosystem" to gain a better understanding of the region's efforts in this area. They found a connected system of entrepreneurs, support organizations, mentors, and universities. Based on interviews, it is believed this supportive structure was developed over the past five years (Motoyama and Watkins 2014). One of the organizations identified in the Kauffman Foundation's research as central to the startup ecosystem is the Information Technology Entrepreneur Network (ITEN). ITEN pairs young entrepreneurs with experienced mentors, it connects entrepreneurs with venture capital investors, and it facilitates a monthly networking event called "2nd Thursday" (ITEN 2017).

Manufacturing and Tech Startups

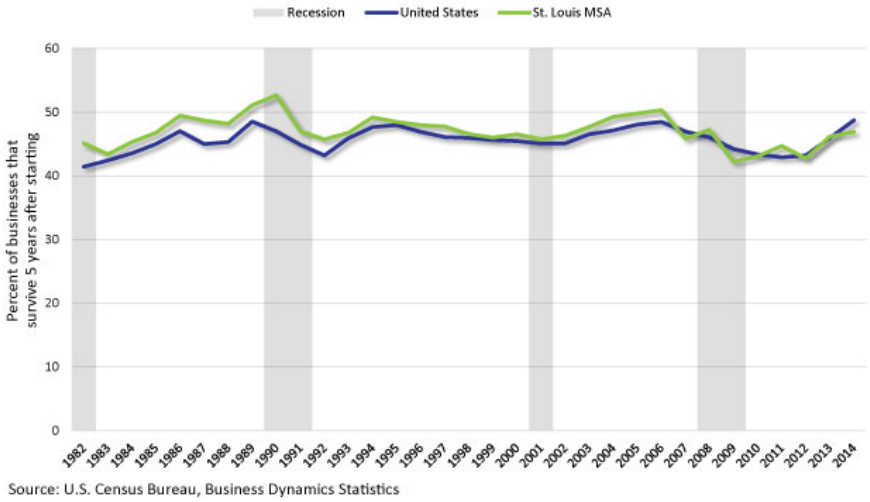
Firms in manufacturing, professional, scientific, and technical services industries with less than 2 years in business per 100,000 residents, 2015

1	**Miami**	**71.8**
2	Austin	60.1
3	San Jose	57.6
4	San Diego	50.8
5	Denver	50.0
6	Seattle	45.4
7	Washington, D.C.	43.5
8	Las Vegas	41.8
9	Portland	41.6
10	Charlotte	41.0
11	Los Angeles	40.3
12	Tampa	39.7
13	New York	39.1
14	San Francisco	38.6
15	Atlanta	37.1
16	Kansas City	35.9
17	Dallas	35.6
Peer Average		**33.6**
18	Raleigh	33.4
19	Orlando	33.4
20	Minneapolis	31.3
21	Richmond	30.9
22	Jacksonville	29.7
23	Chicago	29.6
24	Houston	28.8
25	Phoenix	28.5
26	Sacramento	27.7
27	Salt Lake City	27.3
28	Oklahoma City	26.1
29	Louisville	25.4
30	Philadelphia	24.8
31	Boston	23.9
32	Indianapolis	22.9
33	Buffalo	22.5
34	Cleveland	22.4
35	Milwaukee	21.8
36	Baltimore	21.5
37	**St. Louis**	**20.5**
38	Hartford	20.4
39	Columbus	20.0
40	Cincinnati	18.5
41	Detroit	18.1
42	Riverside	17.5
43	Nashville	17.5
44	Providence	17.5
45	New Orleans	14.9
46	Pittsburgh	14.7
47	San Antonio	14.4
48	Virginia Beach	13.1
49	Birmingham	11.7
50	**Memphis**	**9.5**

Source: U.S. Census Bureau, Annual Survey of Entrepreneurs

Figure 7: Business Survival Rate

St. Louis MSA, and the United States, 1982 to 2014



Source: U.S. Census Bureau, Business Dynamics Statistics

Business Survival Rate

The number of new startups is a positive indication for the St. Louis economy. However, while there are regional benefits to entrepreneurship, starting a small business can be risky. In the United States, less than half of all businesses survive through their first five years. Over 350,000 new businesses were created across the country in 2009. Of those, 48.7 percent were still operating five years later in 2014. In St. Louis, the 5-year survival rate for businesses is lower. In 2009, there were 3,288 new businesses in the St. Louis region. Of this total, 1,542, or 46.9 percent, were still operating in 2014. As shown on the Business Survival Rate table, St. Louis' 5-year survival rate for businesses ranks 41st among the 50 peer regions, and it ranks 9th among the region's 10 Midwest peers.

St. Louis also ranks in the bottom half of the peer regions according to the business survival rate of more recent business startups. Of the 4,266 new businesses started in St. Louis in 2013, 3,207, or 75.2 percent, were still operating in 2014. Compared with the peer regions, St. Louis' 1-year survival rate for businesses ranks 45th, and it ranks 9th among the 10 Midwest peers.

In spite of the region's relatively low business survival rate, there are a number of organizations working to help entrepreneurs navigate risks and build successful startups, including T-Rex, a startup incubator. According to its recent impact report, since its founding in 2011, T-Rex has graduated 82 startups, of which 68 remain in the St. Louis region. According to their report, these 68 startups support over 1,200 jobs in the region (T-Rex 2017).

Business Survival Rate
Percent of businesses that survive 1 year after starting, 2014

1	**Richmond**	**80.3**
2	Birmingham	79.8
3	Pittsburgh	79.7
4	Houston	79.3
5	Kansas City	79.2
6	Minneapolis	79.1
7	San Francisco	78.8
8	Austin	78.7
9	Boston	78.6
10	Oklahoma City	78.6
11	Washington, D.C.	78.5
12	San Jose	78.5
13	Louisville	78.3
14	Virginia Beach	78.3
15	Dallas	78.2
16	Portland	78.1
17	Raleigh	78.0
18	Milwaukee	78.0
19	New York	77.8
20	Buffalo	77.8
21	New Orleans	77.8
22	Nashville	77.7
23	Columbus	77.6
24	Philadelphia	77.6
25	Sacramento	77.5
26	Memphis	77.4
27	Cincinnati	77.4
28	San Diego	77.4
29	San Antonio	77.4
30	Providence	77.3
31	Cleveland	77.3
United States		**77.3**
32	Riverside	77.2
33	Hartford	77.1
34	Detroit	77.0
35	Seattle	77.0
36	Los Angeles	77.0
37	Baltimore	77.0
38	Chicago	76.6
39	Salt Lake City	76.6
40	Denver	76.1
41	Tampa	75.9
42	Phoenix	75.7
43	Charlotte	75.4
44	Miami	75.3
45	**St. Louis**	**75.2**
46	Atlanta	75.0
47	Indianapolis	75.0
48	Las Vegas	74.9
49	Orlando	74.4
50	**Jacksonville**	**73.7**

Source: U.S. Census Bureau, Business Dynamics Statistics

Business Survival Rate
Percent of businesses that survive 5 years after starting, 2014

1	**Boston**	**54.0**
2	Pittsburgh	53.8
3	Washington, D.C.	52.4
4	Hartford	52.4
5	Austin	52.3
6	Baltimore	52.2
7	Richmond	52.0
8	Cleveland	51.6
9	Portland	51.2
10	Columbus	50.8
11	Louisville	50.4
12	Philadelphia	50.4
13	Minneapolis	50.4
14	Virginia Beach	50.2
15	Chicago	50.2
16	Oklahoma City	50.2
17	San Francisco	50.0
18	New Orleans	49.9
19	Memphis	49.6
20	Buffalo	49.6
21	Houston	49.6
22	Cincinnati	49.4
23	New York	49.4
24	Providence	49.1
25	Sacramento	48.8
26	Seattle	48.7
United States		**48.7**
27	Raleigh	48.6
28	Detroit	48.5
29	Birmingham	48.4
30	Denver	48.3
31	Dallas	48.1
32	Charlotte	48.1
33	San Diego	47.8
34	Indianapolis	47.8
35	San Jose	47.5
36	Kansas City	47.4
37	Los Angeles	47.4
38	Riverside	47.2
39	San Antonio	47.1
40	Tampa	47.1
41	**St. Louis**	**46.9**
42	Nashville	46.9
43	Milwaukee	46.8
44	Atlanta	45.5
45	Jacksonville	45.5
46	Orlando	45.4
47	Miami	45.1
48	Salt Lake City	45.0
49	Phoenix	43.5
50	**Las Vegas**	**41.3**

Source: U.S. Census Bureau, Business Dynamics Statistics

Skilled Workforce

Demands for workforce skills have changed over the last several decades. Studies on this topic find that employment is shrinking in occupations where workers primarily perform routine tasks and expanding where workers are required to perform non-routine tasks (Dvorkin and Shell 2017). Other studies have found that middle-skilled, middle-wage jobs are disappearing and being replaced with either low-skilled, low-wage jobs or high-skill, high-wage jobs.[6] Over the last several decades, wages and salaries for highly skilled workers have risen, while real earnings for low-skilled workers have declined (Acemoglu and Autor 2011). These trends highlight the importance of having a highly skilled workforce in a changing U.S. economy. This section explores several measures of a highly skilled workforce, including educational attainment, educational requirements for jobs, and the share of jobs in science, technology, engineering, or mathematics related industries.

Educational Attainment

One way to measure the skill level of the workforce is educational attainment. According to the St. Louis Regional Chamber's Top Ten Initiative, a one percentage point increase in college attainment in St. Louis would "inject an additional $2.4 billion into the regional economy each year" (St. Louis Regional Chamber 2013).

The St. Louis workforce is relatively well educated. Of the region's adults aged 25 and older, 32.5 percent hold a bachelor's degree or higher, and 12.8 percent have earned an advanced degree. As shown on Figure 8 (Page 12), since the 1990s, the percentage of adults with an advanced degree has nearly doubled. In 1990, around 6.9 percent of adults had an advanced degree. Compared with the peer regions and the United States as a whole, St. Louis' rate of educational attainment ranks in the middle. Among the peer regions, St. Louis ranks 29th in terms of adults with a bachelor's degree, and 22nd in terms of adults with advanced degrees.

The tables on Page 13 show the percent of jobs that typically require a bachelor's degree or higher and the percent of jobs that require a post-graduate (or advanced) degree. In both tables, St. Louis ranks close to the national average.

According to data from the Bureau of Labor Statistics (BLS), 25.8 percent of jobs in the region require a bachelor's degree or higher. This percentage is lower than 31 of the peer regions. Among Midwest peers, St. Louis has the 2nd lowest proportion of these jobs. For jobs that require a post-graduate degree, St. Louis has a larger proportion than many of the peers, ranking 20th with a rate of 4.1 percent. This is the 3rd highest proportion among the Midwest peers.

Figure 8: Percent of Adults with an Advanced Degree

St. Louis MSA, the Peer Regions, and the United States, 1990 to 2015

Source: U.S. Census Bureau, Decennial Census; American Community Survey, 1-Year Estimate

6 Middle skill jobs include occupations in sales, office and administrative support, production, and labor. As described by Acemoglu and Autor, these positions are generally filled by people with only a high school degree. Low skill jobs include occupations in protective services, food preparation, and cleaning services. High skill jobs include occupations in professional, managerial, and technical services.

Bachelor's Degree or Higher

Percent of adults aged 25 and older, 2015

1	**Washington, D.C.**	**49.3**
2	San Jose	48.7
3	San Francisco	47.2
4	Boston	46.0
5	Raleigh	44.4
6	Austin	42.6
7	Denver	41.8
8	Seattle	41.2
9	Minneapolis	40.3
10	Baltimore	38.6
11	New York	38.4
12	Hartford	38.3
13	Portland	37.9
14	San Diego	37.2
15	Atlanta	37.0
16	Philadelphia	36.0
17	Chicago	36.0
18	Kansas City	35.8
19	Richmond	35.2
20	Columbus	35.1
21	Milwaukee	33.9
22	Nashville	33.6
23	Charlotte	33.5
24	Dallas	33.4
25	Pittsburgh	33.0
26	Indianapolis	32.9
27	Los Angeles	32.7
28	Salt Lake City	32.7
29	**St. Louis**	**32.5**
30	Sacramento	32.2
31	Cincinnati	32.1
32	Houston	31.5
33	Miami	30.9
United States		**30.6**
34	Providence	30.6
35	Buffalo	30.3
36	Virginia Beach	30.2
37	Jacksonville	30.0
38	Orlando	29.9
39	Detroit	29.5
40	Cleveland	29.4
41	Phoenix	29.4
42	Oklahoma City	29.3
43	Tampa	28.9
44	Louisville	28.7
45	Birmingham	28.6
46	New Orleans	28.6
47	Memphis	26.9
48	San Antonio	26.6
49	Las Vegas	23.1
50	**Riverside**	**20.1**

Source: U.S. Census Bureau, American Community Survey 1-Year Estimates

Advanced Degrees

Adults with post-graduate degrees as a percent of adults aged 25 and older, 2015

1	**Washington, D.C.**	**24.0**
2	San Jose	22.7
3	Boston	20.8
4	San Francisco	19.1
5	Baltimore	16.9
6	Hartford	16.4
7	Raleigh	15.9
8	New York	15.8
9	Denver	15.3
10	Seattle	15.0
11	Austin	14.8
12	San Diego	14.5
13	Philadelphia	14.3
14	Portland	14.0
15	Chicago	13.9
16	Minneapolis	13.9
17	Atlanta	13.7
18	Buffalo	13.2
19	Richmond	13.1
20	Pittsburgh	12.9
21	Kansas City	12.9
22	**St. Louis**	**12.8**
23	Columbus	12.4
24	Providence	12.1
25	Nashville	12.1
26	Detroit	11.7
United States		**11.6**
27	Cincinnati	11.5
28	Cleveland	11.5
29	Milwaukee	11.5
30	Houston	11.4
31	Los Angeles	11.4
32	Salt Lake City	11.4
33	Virginia Beach	11.4
34	Louisville	11.3
35	Dallas	11.3
36	Indianapolis	11.2
37	Miami	11.2
38	Charlotte	11.1
39	Sacramento	11.1
40	Oklahoma City	10.6
41	Phoenix	10.5
42	New Orleans	10.4
43	Birmingham	10.4
44	Tampa	10.3
45	Memphis	10.3
46	Jacksonville	10.0
47	Orlando	9.5
48	San Antonio	9.3
49	Las Vegas	7.6
50	**Riverside**	**7.2**

Source: U.S. Census Bureau, American Community Survey 1-Year Estimates

Bachelor's Degree Requirement

Percent of occupations that typically require a bachelor's degree or higher, 2016

1	**San Jose**	**41.5**
2	Washington, D.C.	40.0
3	Boston	35.1
4	San Francisco	34.2
5	Seattle	31.9
6	Hartford	31.2
7	Denver	30.7
8	Minneapolis	30.4
9	Baltimore	30.0
10	Sacramento	29.9
11	Raleigh	29.5
12	Austin	29.4
13	Portland	29.3
14	New York	29.2
15	San Diego	28.9
16	Philadelphia	28.3
17	Atlanta	28.2
18	Columbus	28.1
19	Chicago	27.9
20	Richmond	27.3
21	Detroit	27.3
22	Salt Lake City	27.3
23	Los Angeles	27.1
24	Kansas City	27.1
25	Cleveland	26.7
26	Cincinnati	26.2
27	Oklahoma City	26.2
28	Charlotte	26.0
29	Milwaukee	25.9
30	Providence	25.9
31	Pittsburgh	25.8
32	**St. Louis**	**25.8**
United States		**25.6**
33	Indianapolis	25.6
34	Phoenix	25.5
35	Houston	25.0
36	Dallas	24.6
37	Buffalo	24.3
38	Nashville	23.9
39	Birmingham	23.7
40	Tampa	23.6
41	Virginia Beach	23.6
42	San Antonio	23.1
43	Jacksonville	22.9
44	Miami	22.1
45	New Orleans	21.7
46	Louisville	21.2
47	Orlando	21.1
48	Memphis	20.5
49	Riverside	19.8
50	**Las Vegas**	**17.2**

Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

Post-Graduate Requirement

Percent of occupations that typically require a post-graduate degree, 2016

1	**Washington, D.C.**	**6.5**
2	Boston	6.4
3	Baltimore	5.5
4	New York	5.4
5	Philadelphia	5.3
6	Buffalo	5.2
7	Providence	5.1
8	Pittsburgh	4.9
9	Oklahoma City	4.8
10	Cleveland	4.7
11	San Francisco	4.7
12	Richmond	4.7
13	San Diego	4.6
14	Denver	4.5
15	Birmingham	4.3
16	Sacramento	4.2
United States		**4.2**
17	Portland	4.2
18	Columbus	4.2
19	San Jose	4.2
20	**St. Louis**	**4.1**
21	Minneapolis	4.1
22	Chicago	4.1
23	Milwaukee	4.1
24	Indianapolis	4.1
25	Raleigh	4.0
26	Seattle	4.0
27	Los Angeles	4.0
28	Cincinnati	3.9
29	Salt Lake City	3.9
30	Miami	3.9
31	Kansas City	3.9
32	Tampa	3.8
33	New Orleans	3.8
34	Detroit	3.8
35	Austin	3.7
36	Nashville	3.7
37	San Antonio	3.7
38	Atlanta	3.6
39	Phoenix	3.6
40	Memphis	3.6
41	Hartford	3.5
42	Louisville	3.5
43	Jacksonville	3.4
44	Dallas	3.3
45	Houston	3.3
46	Riverside	3.2
47	Charlotte	3.1
48	Orlando	3.1
49	Virginia Beach	2.4
50	**Las Vegas**	**2.4**

Source: U.S. Bureau of Labor Statistics, Occupational Employment Statistics

STEM Employment

Another way to gauge the skills of the St. Louis workforce is employment in science, technology, engineering, and math (STEM) related occupations. According to Occupational Employment Statistics from the Bureau of Labor Statistics, around 6.4 percent of St. Louis' workforce is employed in industries directly related to STEM. This percentage is close to the national rate of STEM employment (6.3 percent) and ranks close to the middle of the peer regions (29th).

While only 6.4 percent of jobs in St. Louis are in STEM related industries directly, in 2011, the Brookings Institution found that 22 percent of all jobs in the region required knowledge of STEM related subjects (Rothwell 2013). At the time, this ranked 14th among the peer regions, and was the second highest rate among the Midwest peers, behind Detroit (22.9 percent).

Conclusion

As the U.S. economy changes, regions are facing pressure to become more innovative and economically productive. In the St. Louis region, organizations, institutions, and leaders have responded by cultivating a network of support systems for new enterprises. This collective effort has attracted excitement and attention, both locally and nationally. The results of this effort, however, are still yet to be fully realized. On many measures of innovation and entrepreneurship, St. Louis still ranks near or below the national average. Nevertheless, the region has seen notable improvements in some areas, with recent increases in venture capital investment and in educational attainment. Only time will tell whether these increases are a temporary jump or the start of a longer-term trend.

STEM Employment

Percent of jobs in industries related to science, technology, engineering, or math, 2016

1	**San Jose**	**21.9**
2	Seattle	11.6
3	Washington, D.C.	11.6
4	Raleigh	11.5
5	San Francisco	11.3
6	Austin	11.2
7	Boston	10.7
8	Detroit	9.3
9	Denver	9.2
10	Portland	8.9
11	San Diego	8.8
12	Baltimore	8.6
13	Minneapolis	8.4
14	Salt Lake City	7.7
15	Hartford	7.7
16	Columbus	7.7
17	Sacramento	7.7
18	Houston	7.6
19	Atlanta	7.6
20	Kansas City	7.4
21	Dallas	7.3
22	Virginia Beach	7.1
23	Philadelphia	7.1
24	Phoenix	7.0
25	Pittsburgh	7.0
26	Cincinnati	6.8
27	Charlotte	6.6
28	Indianapolis	6.5
29	**St. Louis**	**6.4**
30	Cleveland	6.4
31	Milwaukee	6.3
32	Richmond	6.3
United States		**6.3**
33	Oklahoma City	6.2
34	Chicago	6.2
35	Los Angeles	6.0
36	Tampa	5.8
37	New York	5.7
38	Nashville	5.4
39	Providence	5.2
40	San Antonio	5.0
41	Buffalo	5.0
42	Orlando	5.0
43	Jacksonville	4.8
44	Birmingham	4.7
45	Louisville	4.2
46	Miami	4.1
47	New Orleans	4.1
48	Memphis	3.5
49	Riverside	3.0
50	**Las Vegas**	**2.8**

Source: U.S. Department of Labor, Bureau of Labor Statistics, Occupational Employment Statistics

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