



# TECHNOLOGY2030

*Released January 2024*

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## ABOUT THE AUTHORS

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Before Southern Growth, Ted was a practicing economic developer for 28 years, including eight years as executive vice president/COO for the Research Triangle Regional Partnership. His latest research has focused on reimagining workforce development, making manufacturing more competitive and analyzing 25 years of rural economic development policy. Ted received his bachelor's degree from the University of North Carolina at Chapel Hill and his master's from Johns Hopkins University. He is a graduate of the Economic Development Institute and is an Eisenhower Fellow for global economics.

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# Introduction



The nation's technology industry has experienced three years of transformation, rollercoaster growth and more recently rightsizing. Influences such as breakthroughs in artificial intelligence, reshoring prompted by geopolitics and supply chain rethinking and a new national industrial policy that is making massive investments in technology-based industries have transformed state competition for new jobs and investments.

The Missouri Chamber Foundation has contracted with Economic Leadership, a consulting firm with a long history of evaluating state technology performance, to build a report that will demonstrate the current state of the tech sector in Missouri. This report shows statistics for tech in 2022. The report offers a resource of data and trends for the economic development community, policy makers, the tech industry and the media. The tech sector has a strong and growing presence in the state and this report highlights its vitality and importance to the greater Missouri economy.

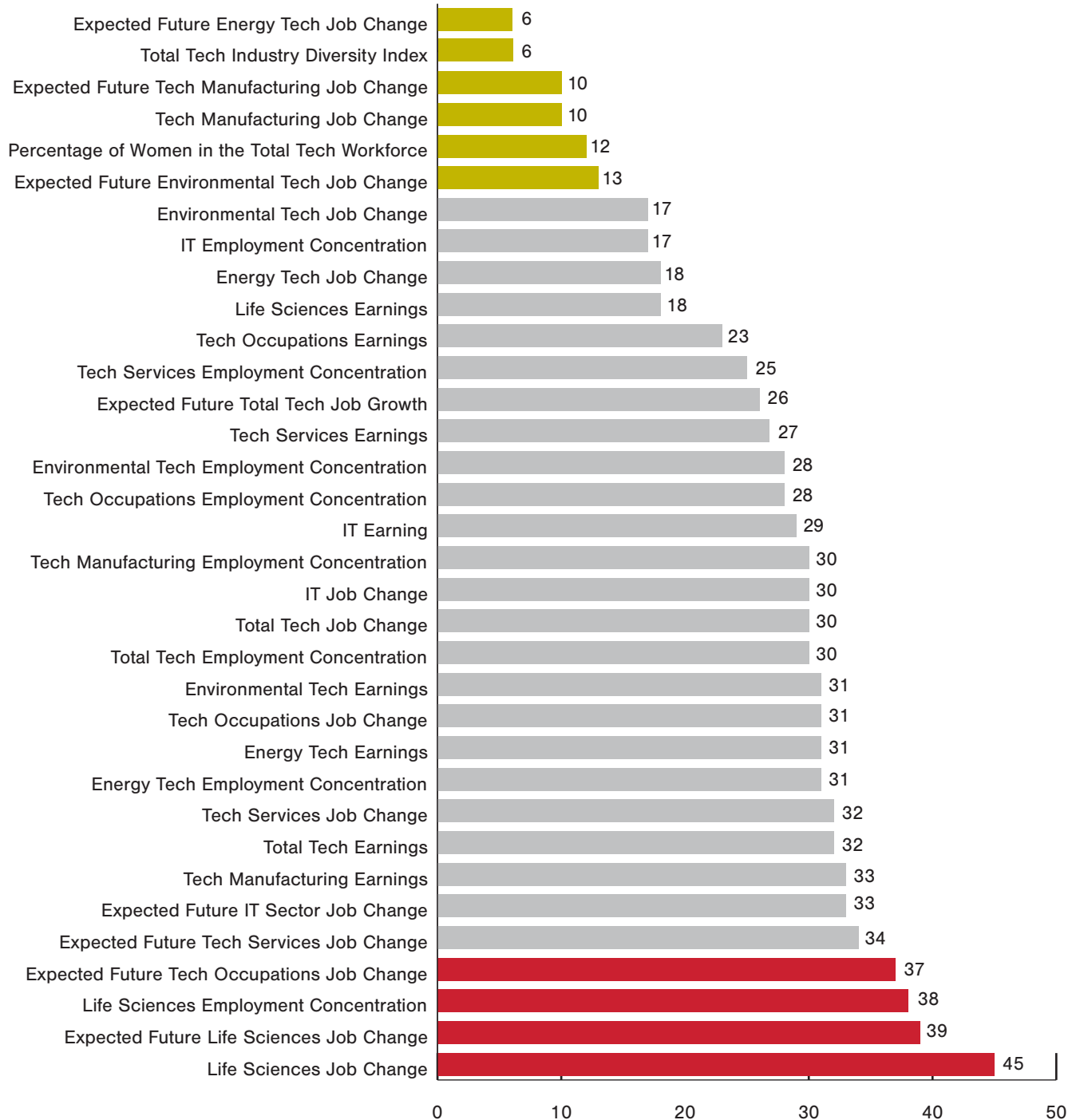
## HIGHLIGHTS:

- The tech industry accounts for almost 6 percent of Missouri's employment and 10 percent of the gross state product.
- Despite a turbulent time in the national economy, Missouri's tech industry has added 3,870 net jobs from 2021 to 2022, a growth rate of 2.5 percent.
- Over the last 10 years, Missouri has outpaced the national average in tech industry job growth and is projected to exceed the national average through the next decade.
- Missouri's tech industry had a job multiplier of 2.82 in 2022, higher than nearly all other industries.
- The IT and Environmental Technology subindustries have experienced double digit percentage growth in the last five years at 12 and 14 percent respectively.
- Over the last five years, Missouri was a top 10 state in Tech Manufacturing job growth and is expected to be a top 10 state through the next five years.
- Missouri ranks 12th in women working in the tech industry.
- Missouri ranks 6th among all states in the diversity index of the tech workforce.

In this report the total tech sector and each of the subsectors were compared to other states. The economic performance of the Missouri tech sector ranked strongest in measures of workforce diversity, growth in energy and environmental tech and tech manufacturing growth rates. For six of the 34 technology performance indicators, Missouri ranked in the top 15 states. Despite strong performance in Missouri, the state ranked in the middle of the pack on several indicators, often due to the even greater performance of states in the Southeast and Intermountain West that have experienced extreme growth during the pandemic and its aftermath. While these regions may be performing better in several metric areas, Missouri is consistently outpacing its neighboring midwest states in multiple tech sector indicators. The report also highlights several areas where the state is at a competitive disadvantage for future growth. Addressing these barriers through improvements in public policy and additional investments can improve Missouri's future performance.

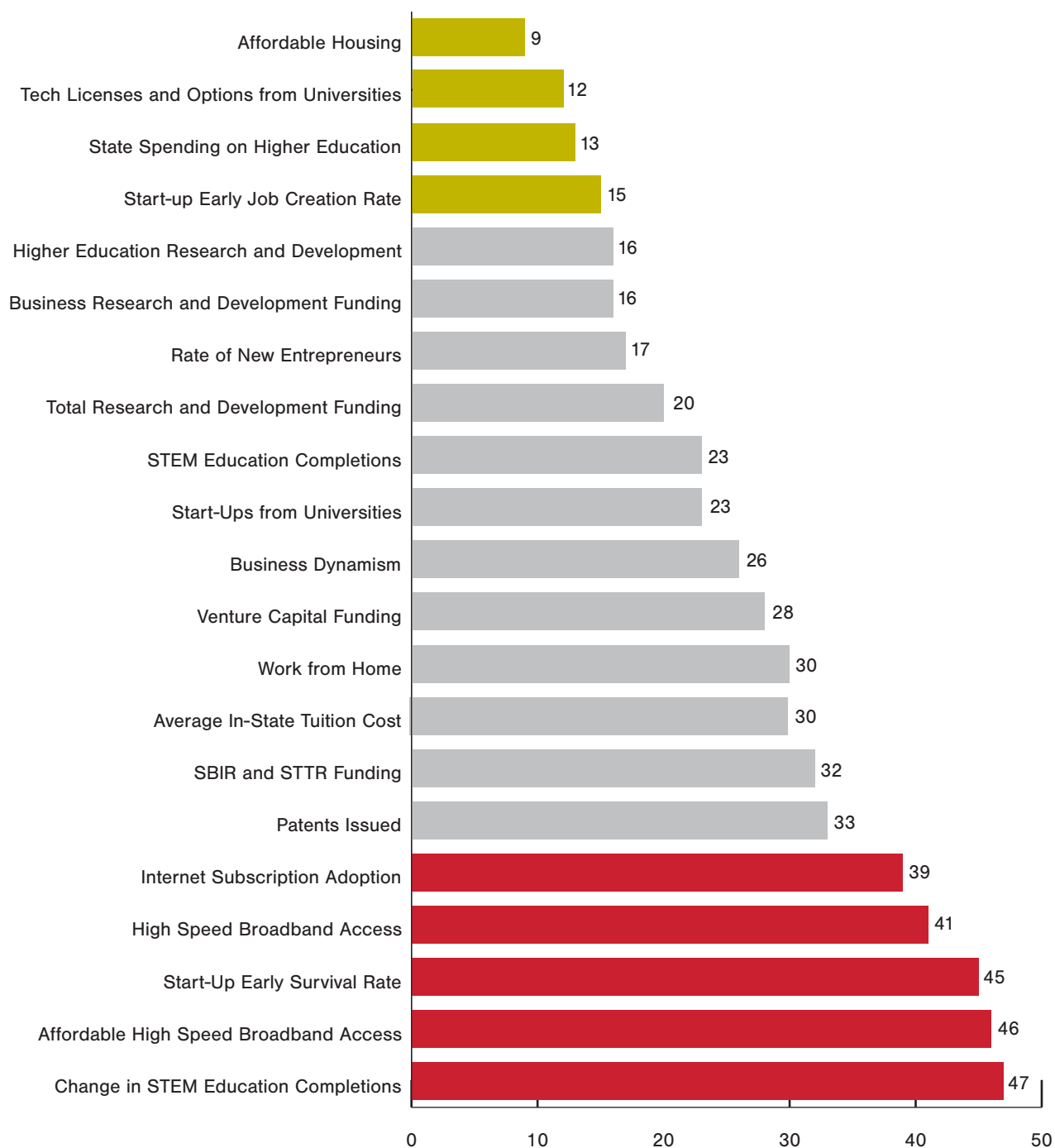


## Missouri State Rankings for Tech Performance Indicators





## Missouri State Rankings for Tech Infrastructure Indicators







# II. Methodology

In this report, we review the state of Missouri's technology industry and compare current Missouri performance to that of other states. A tech industry is a firm that operates in the tech space but might have employees that perform work that is not tech related (i.e. an accountant at Oracle). Later in the report tech occupations are measured. Tech occupations are workers whose roles are tech-related and can be employed at tech focused or not tech focused companies (i.e. the Chief Technology Officer for Edward Jones). The term "tech sector" is used to refer to both the tech industries and tech occupations.

Missouri is also ranked on factors that influence the technology sector such as research and development funding and talent availability. These metrics are defined as the "tech infrastructure". Reviewing these indicators can provide policy makers with an understanding of the industry's current reality, as well as takeaways that may provide insight for the best course of action to further support growth in the industry.

To define Missouri's technology industry, we have identified 86 separate 6-digit NAICS code industries to characterize the Total Technology Industry for the state and for comparison of other US states. A full list of each 6-digit industry is available in the appendix of this report; these codes match the recent 2022 NAICS code update. These categories are based on several definitions of the technology industry. The primary source for defining the technology industry was based on TechAmerica Foundation's Technology Industry Classification. To measure tech occupations that exist across all industries, 85 separate 5-digit SOC codes were grouped together to determine how many tech workers exist in the state across all industries.

The Total Technology Industry (hereby referred to as the 'tech industry') was further broken down into four subcategories:

- Energy Technology
- Environmental Technology
- Life Sciences
- IT, Telecom, Hardware and Software (Tech Core)




The NAICS codes in each subcategory are also provided in the appendix.

To calculate metrics and trends of the tech sector for employment, wages and establishments, Economic Leadership LLC used data developed by Lightcast (formerly EMSI Burning Glass) which is largely based on the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages. Lightcast data fills in gaps from the BLS non-disclosure policy by amalgamating several economic data sources to provide the best estimates for the years 2001-2032. This allows for a more granular analysis of the tech sector. Most of the data presented in this report are calculations based off Lightcast data for the year 2022. Final, reliable data for 2023 will be available in mid-2024. Most trend data presented is for the 5-year period from 2017-2022.

Data for the tech infrastructure state comparisons comes directly from publicly available resources such as the National Science Foundation, Bureau of Economic Analysis and the U.S. Census Bureau. This ensures consistent and comparable data across all the states.

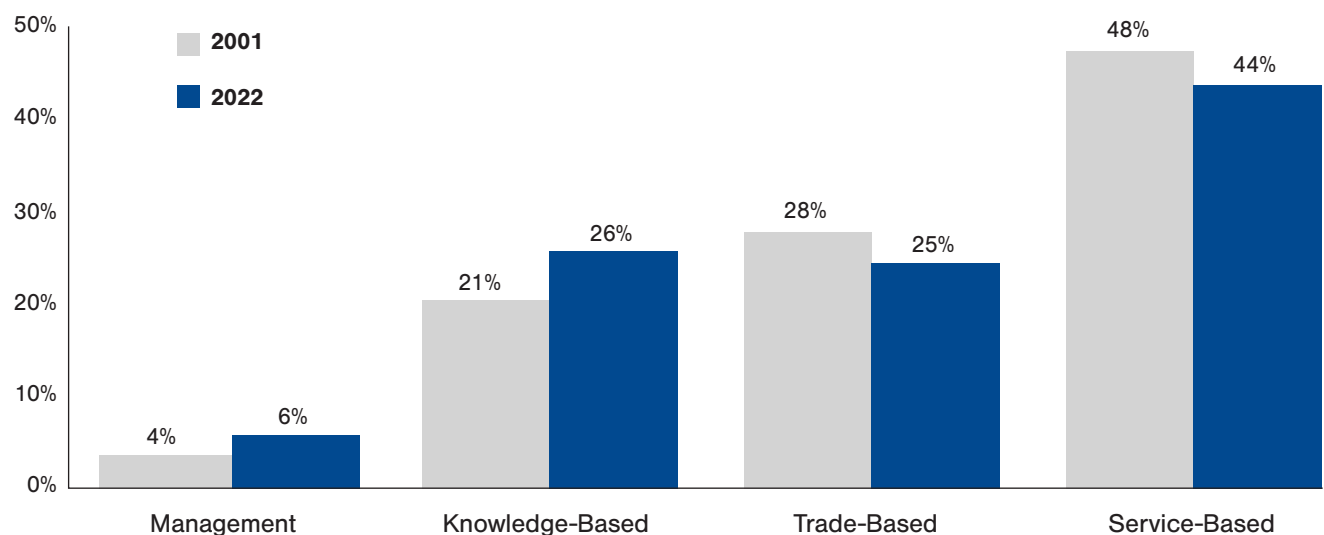
Throughout the report, Missouri's position in state rankings is color coded according to this key:

	Indicates state ranking of 1st – 15th
	Indicates state ranking of 16th – 35th
	Indicates state ranking of 35th – 50th

## III. State Economic Trends

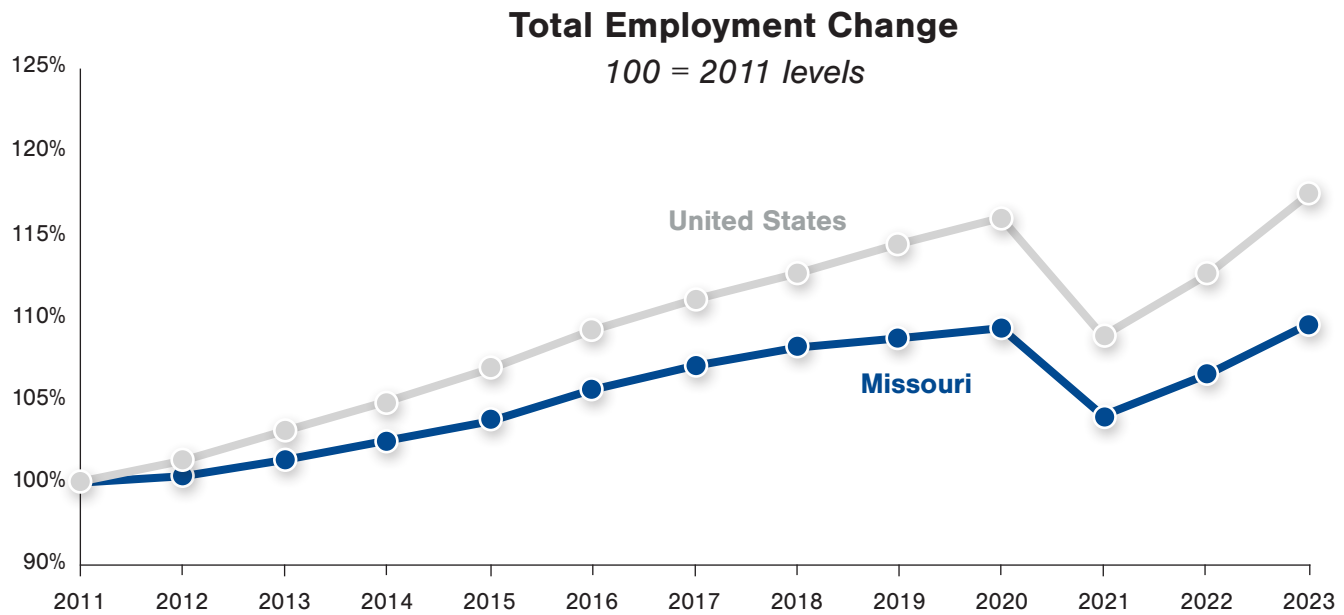
The technology industry has been one of the driving forces in Missouri's shifting economy. In the last two decades, the economy of the state has evolved dramatically. Occupations that were once traditional leaders in Missouri, like trade-based and service-based jobs, now account for a lower percentage of the state's economy. Meanwhile, growth has increased the role of management and knowledge-based jobs in the economy.

### Occupational Share of Missouri's Economy

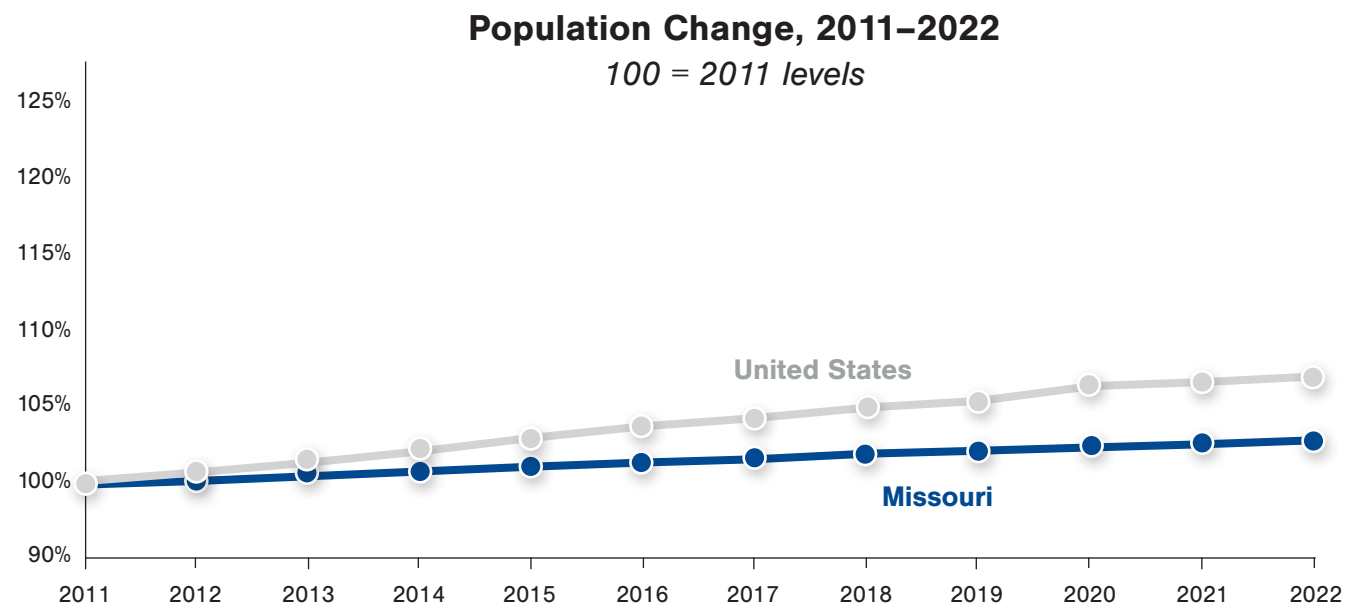


Source: EL calculations based on Lightcast 2023.<sup>4</sup>

Overall, the economy in Missouri has performed well in the last decade and continued to grow. This growth has been at a slower pace than the national average. This slower growth is consistent with the state’s population growth trend. In general, midwestern states have grown slower than southern or western states.



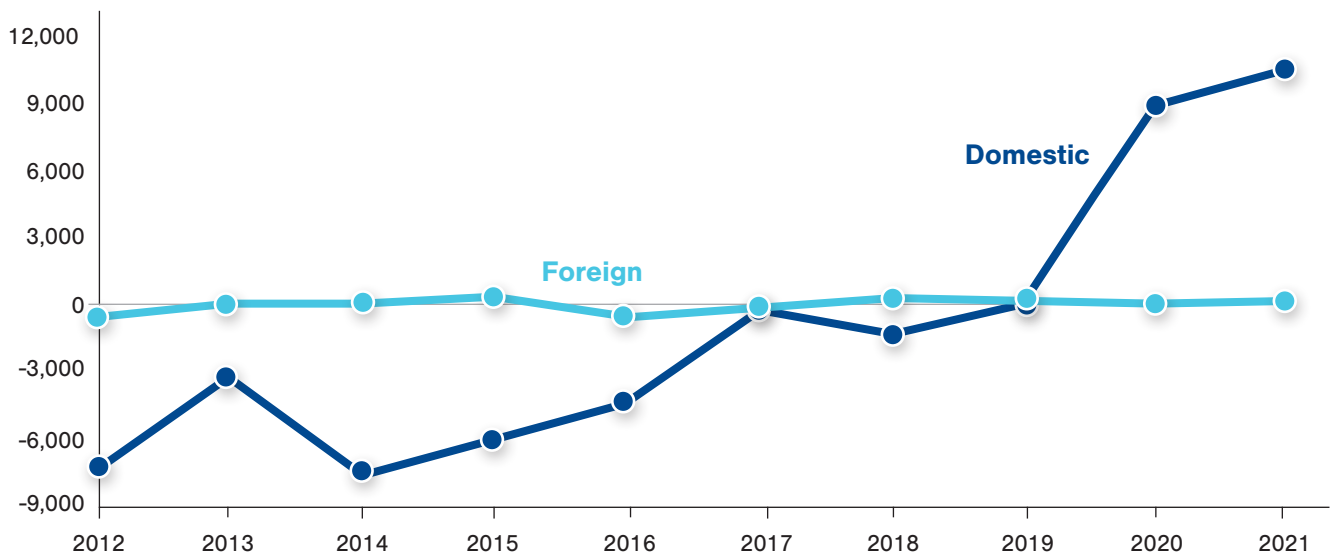
Source: EL calculations based on Lightcast 2023.4



Source: EL calculations based on Lightcast 2023.4

Some of the lack of population growth is the result of migration out of the state. Data from IRS tax records show that from 2012 to 2019 domestic migration of taxpayers was flat or a net negative for the state. In 2020 and 2021, the state saw net migration reverse to net positive. Other research supports the notion that Missouri was one of the states people chose to relocate to during the COVID-19 pandemic and the proliferation of remote work. Missouri's low cost of living and lower tax rates likely helped attract the new migrants.

### Missouri Net Taxpayer Migration, 2012–2021

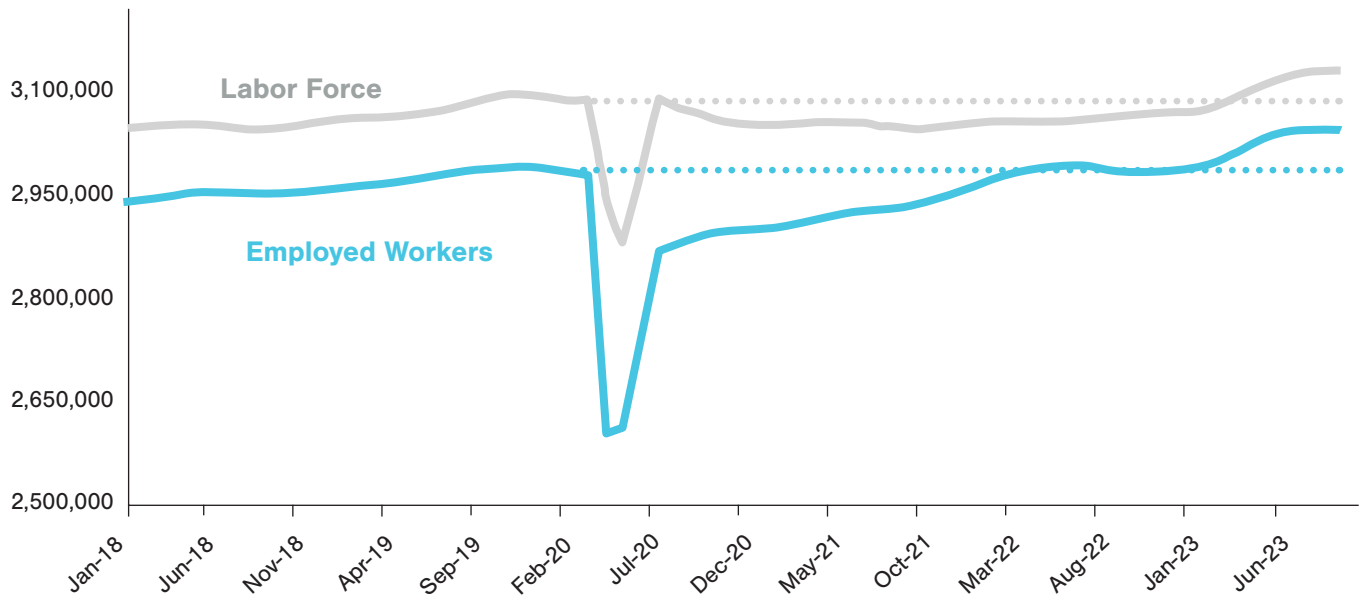


Source: EL calculations based on IRS (2023)

Note: Based on IRS data on individuals who file for federal taxes.

This trend has helped the Missouri economy to return to pre-pandemic levels of labor force and employment. In early 2023, the state returned to pre-COVID levels of employment and has continued to rise steadily in the ensuing months.

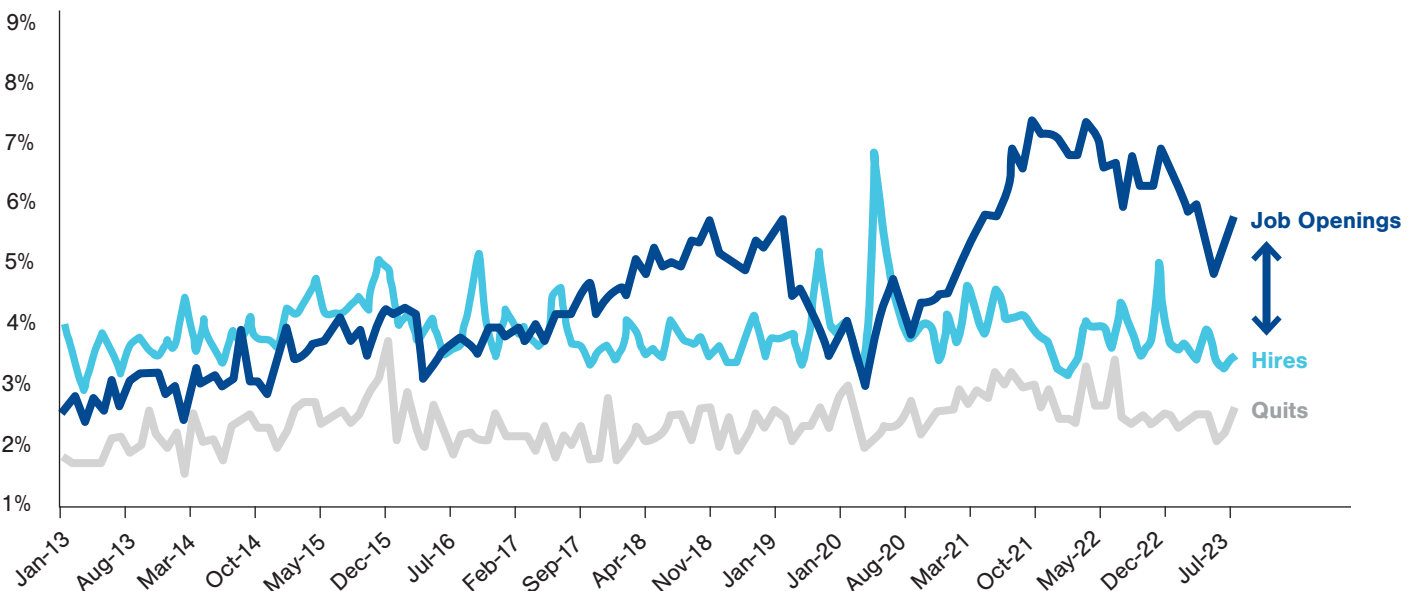
### Missouri Labor Force and Employed Workers



Source: BLS (2023)

Despite this recovery, the state is still experiencing the common challenge of increased growth and the struggle to fill open job positions. Demand and business conditions remain strong leading to a high rate of job openings. However, hiring has not been able to keep pace. This pattern matches national and global labor shortages. Buoyed by the number of openings, workers are also taking the opportunity to find better fitting positions, creating more churn in the economy.

### Missouri Labor Force Trends



Source: BLS (2023)

# IV. Missouri Tech Industry

The review of Missouri's technology industry found that in 2022 the industry employed 158,870 people and workers earned almost \$19 billion in income. The tech industry accounted directly for about 6 percent of the total jobs in the state, but about 10 percent of the state's total earnings and 9 percent of sales. In 2022, there were 16,710 technology establishments operating in Missouri.

## Missouri Technology Industry Summary Statistics, 2022

Indicator	Technology Industry	State Total	State Total Percentage
Employees	158,870	2,821,190	5.6%
Establishments	16,710	233,565	7.2%
Earnings (millions)	\$18,640	\$193,020	9.7%
Sales (millions)	\$56,470	\$631,640	8.9%

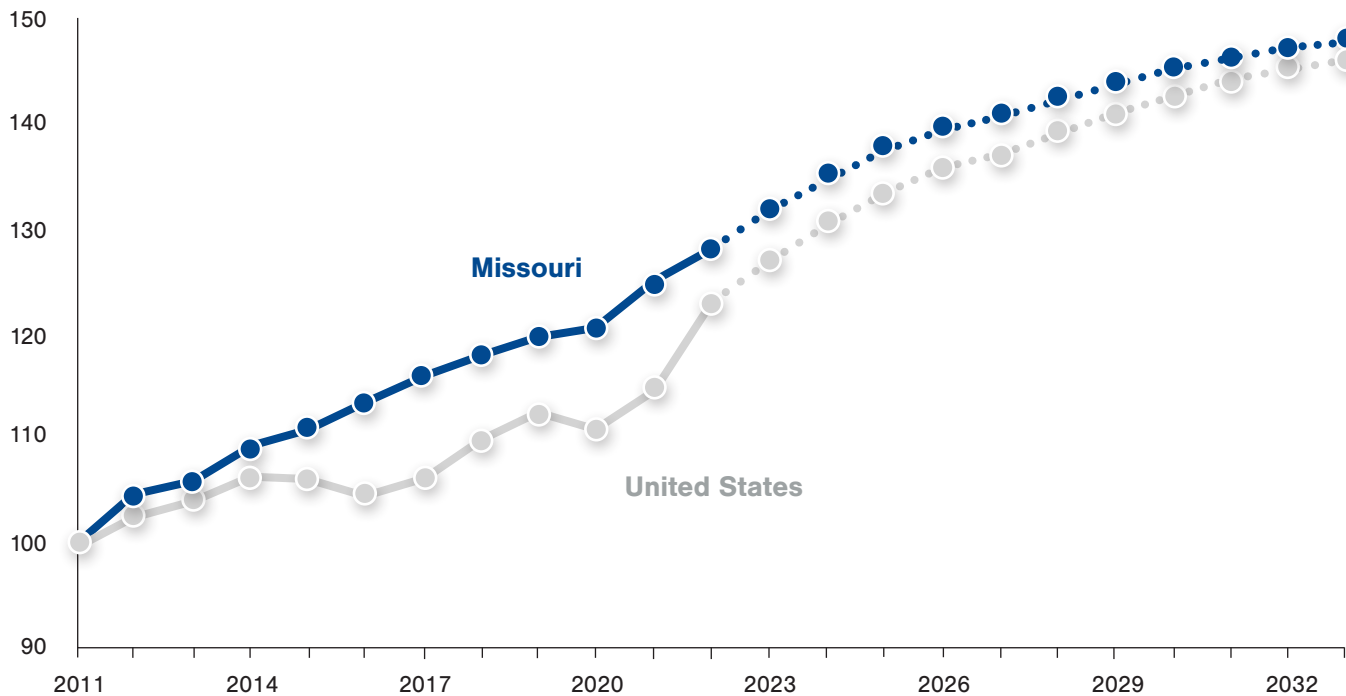
Source: EL estimates based on Lightcast 2023.4

## Tech Industry Job Growth

Job growth in Missouri's tech industry has been strong since the recovery from the Great Recession. The state has grown at higher rates than the nation for most of that time. Since the onset of the COVID-19 pandemic, other parts of the country have experienced large tech growth spikes that are more pronounced than in Missouri. Based on these recent changes, Lightcast models predict over the next 10 years that the state's growth will steadily exceed the national average.

### Tech Industry Employment Trends

100 = 2011 employment levels



Source: EL calculations based on Lightcast 2023.4

### Tech Industry Percent Job Change, 2019–2022



Source: EL calculations based on Lightcast 2023.4



## Economic Contributions of Tech Industry

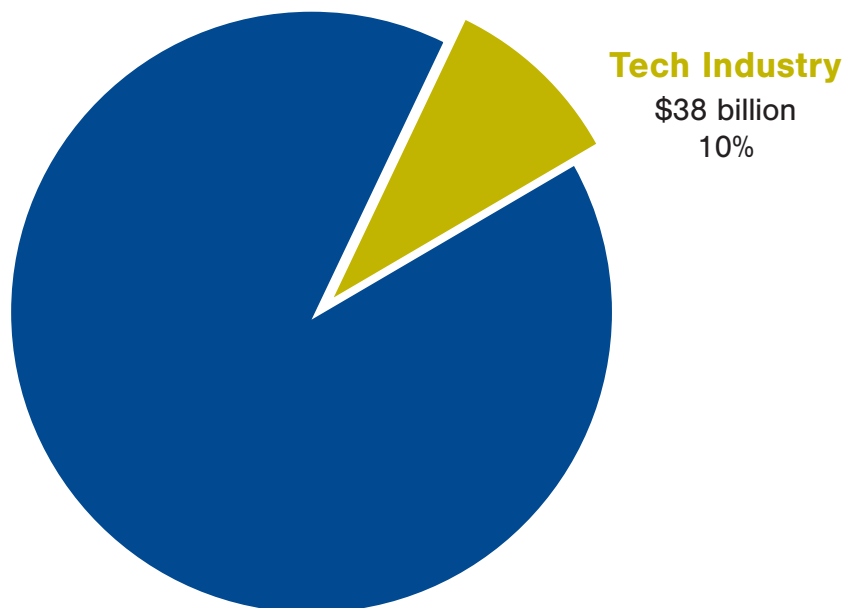
The industry also contributes heavily to Missouri's tax revenue, exports and gross state product (GSP). The tech industry generated over \$38 billion in GSP in 2022, accounting for about 10 percent of the state's total economic output.

## Missouri Technology Industry Economic Contributions, 2022

Indicator	Technology Industry	State Total	State Total Percentage
Taxes Paid (millions)	\$2,155	\$22,520	9.6%
Exports (millions)	\$24,160	\$405,430	6.0%
GSP (millions)	\$38,310	\$389,860	9.8%

Source: EL estimates based on Lightcast 2023.4

## Technology Industry Contribution to Missouri's Gross State Product, 2022

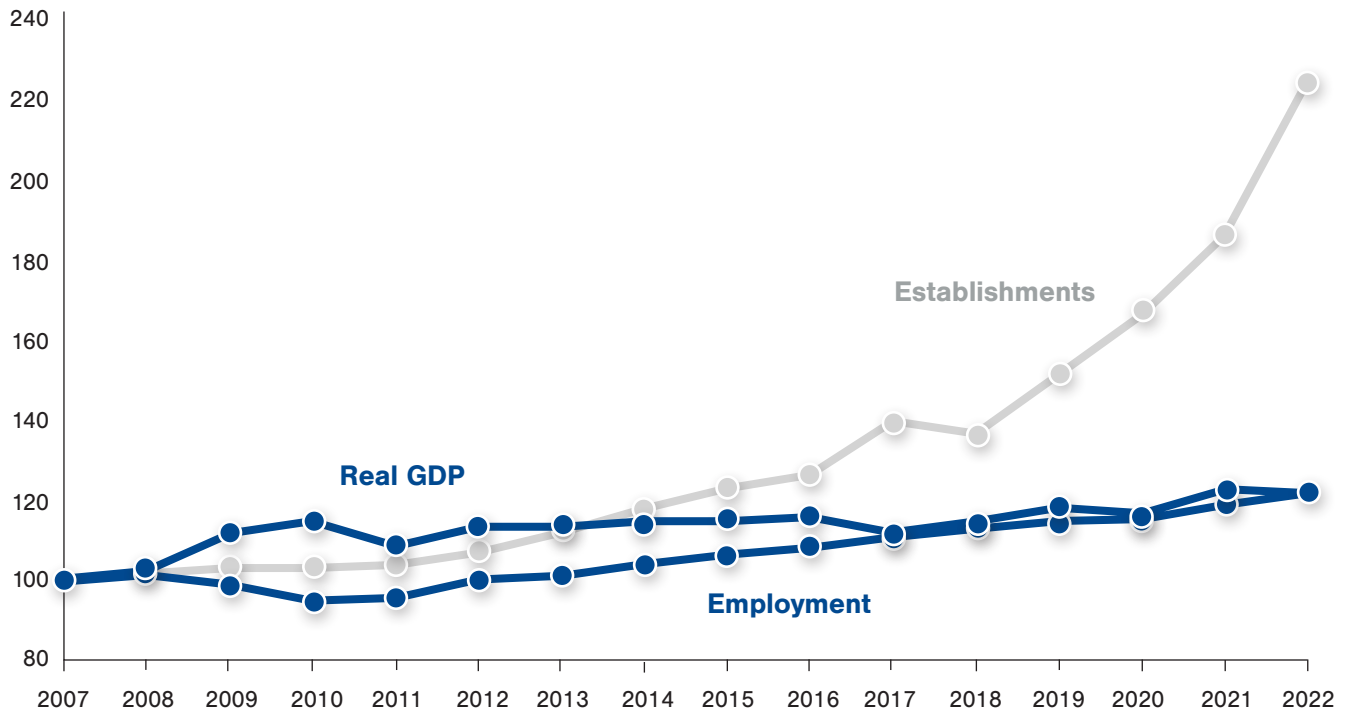


Source: EL estimates based on Lightcast 2023.4

In Missouri, the tech industry has been growing consistently, but in recent years the number of tech establishments has risen dramatically. An establishment is any company that has a location with a payroll. One company can have multiple establishments in a region. The growth in establishments has been primarily in computer systems, programming and software service companies.

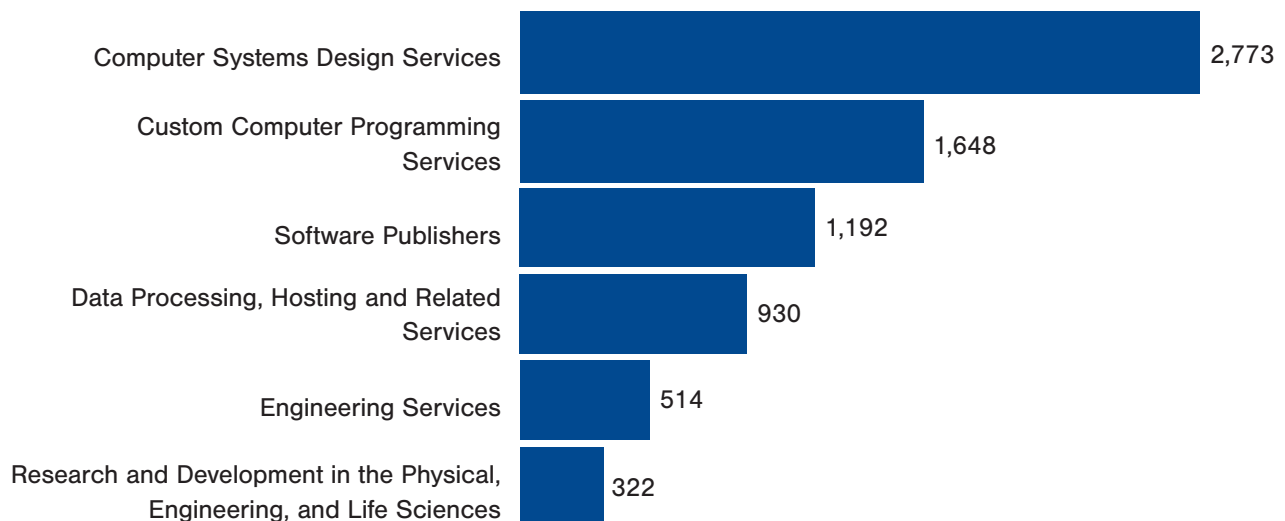
## Missouri Tech Industry Growth Metrics

100 = 2007 levels



Source: EL calculations based on Lightcast 2023.4

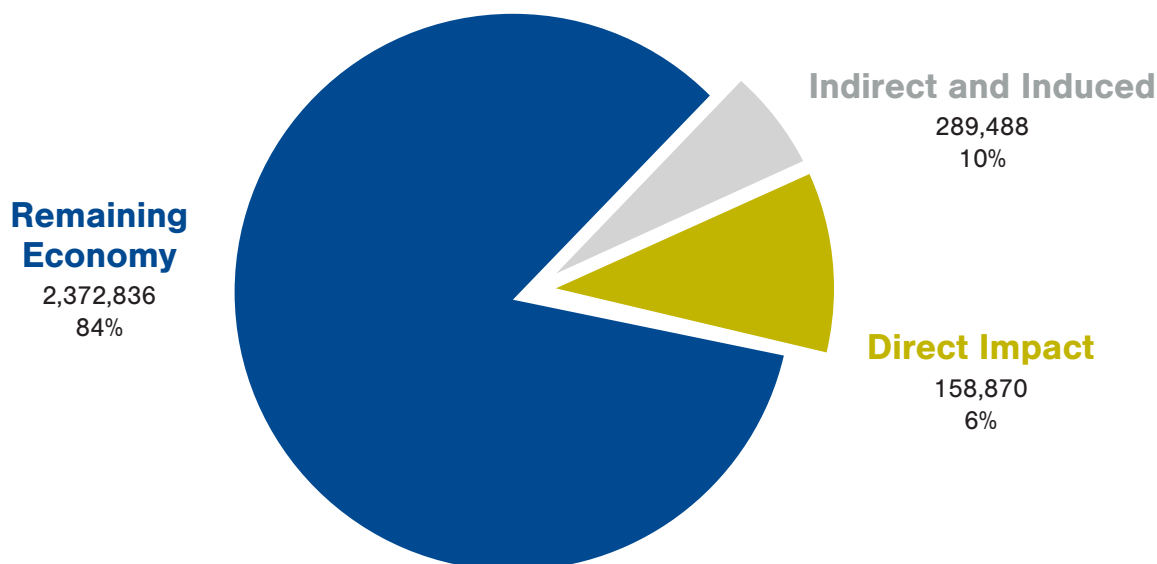
## Top Establishment Growth by Industry, 2007–2022



Source: EL calculations based on Lightcast 2023.4

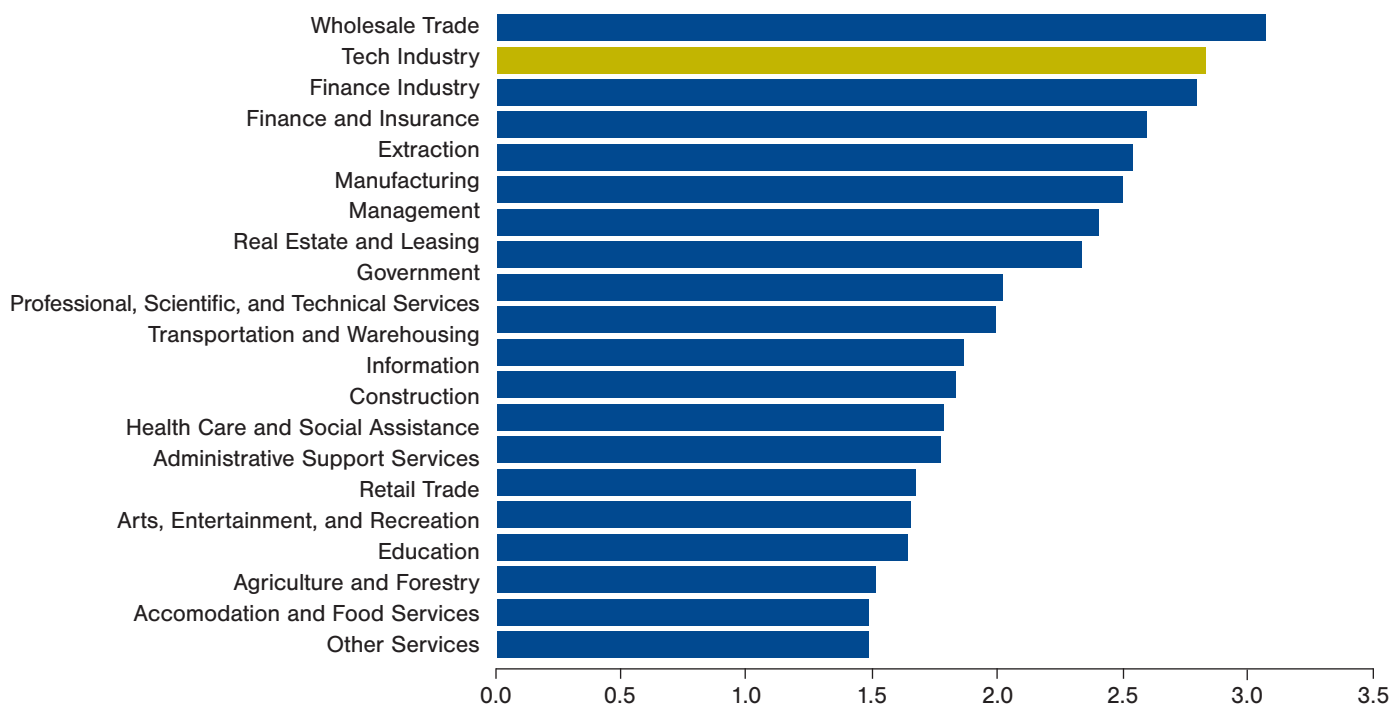
The presence of the tech industry also helps generate activity in other sectors of the economy. The tech sector in Missouri had a job multiplier of 2.82 in 2022. This means that for every job created in the tech sector, there were almost two additional jobs created or supported in the economy. This was the second highest job multiplier in Missouri's economy. Accounting for these multiplier effects increases the tech sector's overall impact on employment from 6 percent to 16 percent. In 2022, 448,358 workers in Missouri were directly or indirectly supported by the tech industry, roughly one out of every six workers.

### Tech Industry Contribution to State Economy, 2022



Source: EL estimates based on Lightcast 2023.4

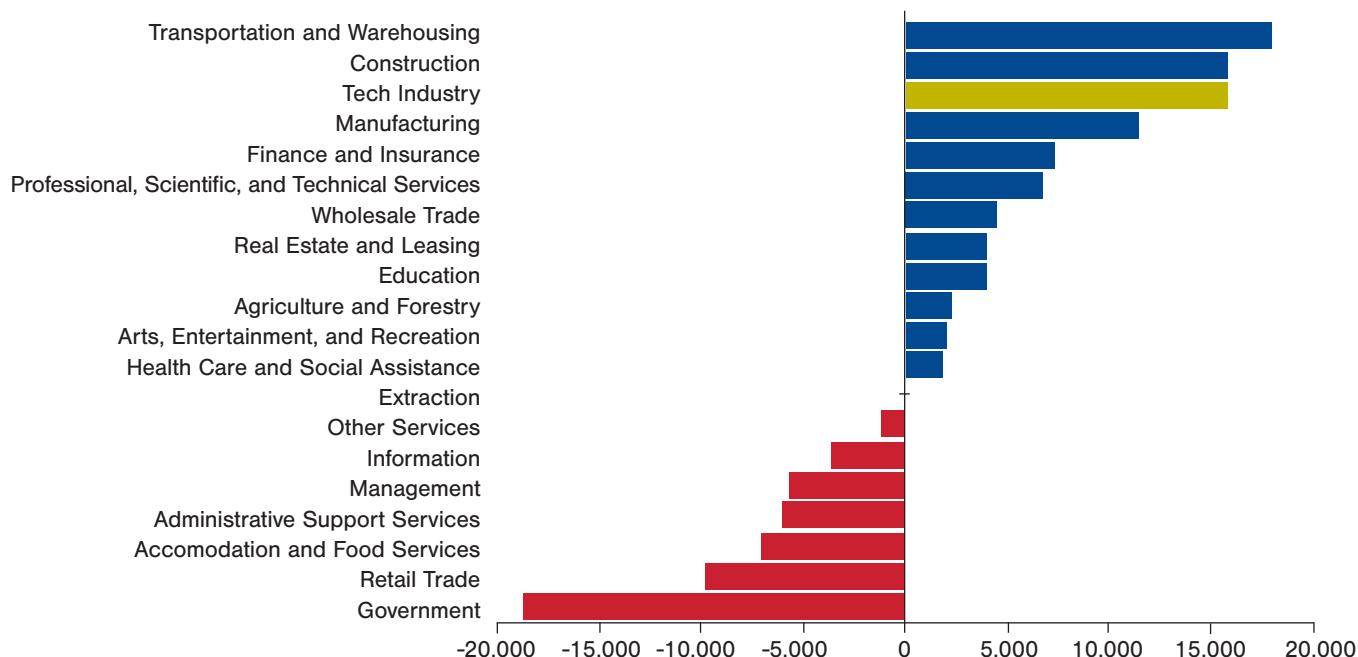
### Missouri Job Multiplier by Industry, 2022



Source: EL estimates based on Lightcast 2023.4

The tech industry is also becoming a major engine of the state economy. In the last five years, the tech industry added a net of 15,117 jobs. This was the third highest industry group, more than health care, manufacturing or finance. The top two industries for net jobs added were transportation and warehousing and construction. These industries pay wages at or below the state average in earnings per worker. The state's economy is benefiting by having a high-wage industry like tech as a top job grower.

### Net Jobs Change in Missouri by Industry, 2017–2022



Source: EL estimates based on Lightcast 2023.4

### Tech Subcategories

The tech industry was further evaluated by breaking it down into four sub-categories including:

- Energy Technology
- Life Sciences
- Environmental Technology
- IT, Telecom, Hardware and Software (IT)

The Information Technology (IT) group includes industries related to hardware manufacturing, software services, social media, telecommunications and other computer related services. Energy Technology includes industries related to fossil fuel and renewable power operations. Environmental Technology includes industries related to electrification, batteries, environmental consulting and waste remediation services. Life Sciences includes industries related to pharmaceutical manufacturing and research and development in biotechnology.

### Missouri's Technology Industry by Subcategories, 2022

Technology Categories	Employment, 2022	Employment Change, 2021–2022	Employment Change, 2017–2022	Establishments, 2022	Sales, 2022 (millions)	Concentration
Energy Tech	10,548	-0.3%	-1.3%	418	\$10,100	0.58
Enviro Tech	14,444	5.7%	13.9%	1,123	\$3,500	0.97
Life Sciences	39,262	6.5%	8.5%	3,543	\$12,000	0.69
IT	94,616	0.8%	12.4%	11,623	\$30,900	0.91
<b>TOTAL TECH</b>	<b>158,870</b>	<b>2.5%</b>	<b>10.5%</b>	<b>16,706</b>	<b>\$56,500</b>	<b>0.82</b>

Source: EL estimates based on Lightcast 2023.4 | Note: Some values may not add to the exact total due to rounding.

Employment concentration ratios offer an understanding of the concentration of an industry in an economy. Concentration values greater than 1.00 indicate that industry is more concentrated than the national average and a significant part of a region's economic base. Industries with high concentration often generate an economy's exports and wealth. Overall, the tech industry is 18 percent less concentrated than the national average. High concentrations in some technology hubs such as San Jose, Austin and Boston raise the national average. The IT group of industries accounts for 60 percent of the total tech industry employment in the state. Job growth has been strong in each subcategory except Energy Tech. The Energy Tech subcategory has been shedding jobs nationally as well. Even in the last year, the entire tech industry added a net of 3,870 jobs, a 2.5 percent growth rate. In the last year the greatest job growth has been in the Life Sciences subcategory.

## Tech Output Groups

The tech industry can also be evaluated by whether the jobs and establishments are involved in tech services or tech manufactured goods. These are called Output Groups.

In Missouri, as in all states, most of the tech industry was involved in providing tech services. However, tech manufacturing is experiencing high levels of job growth in the state and signals a unique opportunity for Missouri. The level of growth in tech manufacturing has been outpacing the national average consistently since 2011. This output group contains semiconductor manufacturing which is experiencing a boon in the U.S. due to efforts to reshore tech manufacturing.

Missouri has made significant headway on enhancing the ecosystem for semiconductor and active pharmaceutical ingredient high-tech manufacturing by investing state funds to support reshoring efforts and strengthening national security. The establishment of the NextFlex Missouri Node, led by the Jordan Valley Innovation Center at Missouri State University, was recently announced. This node is part of NextFlex, which is a Manufacturing USA institute, and is aimed at driving innovation and accelerating the growth of flexible hybrid electronic manufacturing within the United States through public-private partnerships. The launch of a new NextFlex node in Missouri illustrates the strength and potential of Missouri's high-tech manufacturing ecosystem.

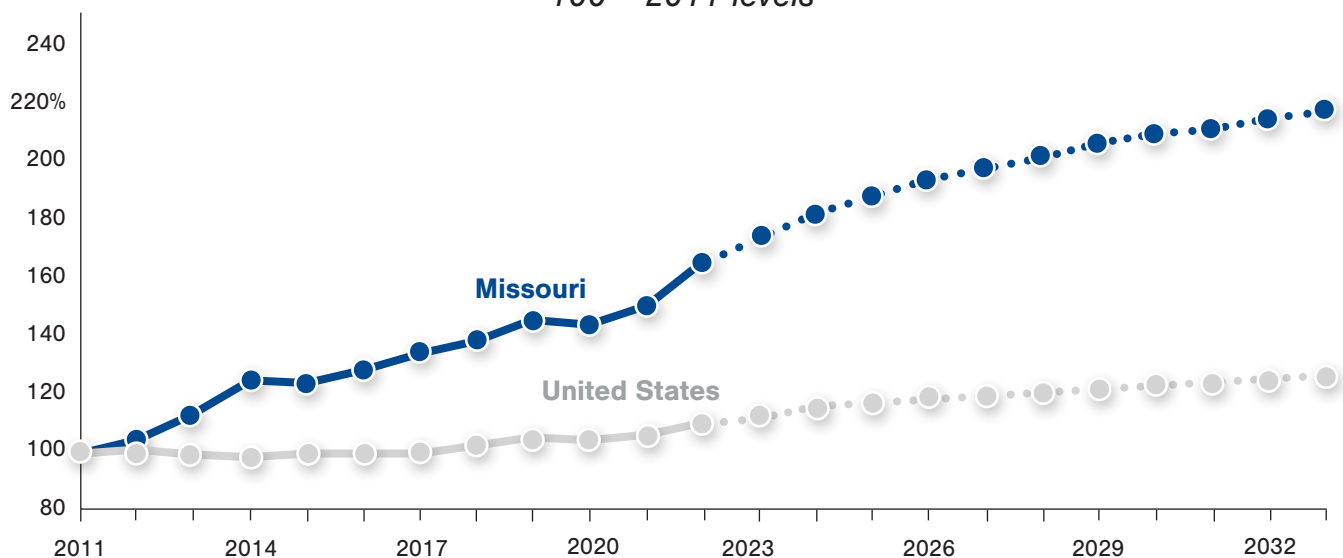
## Missouri's Tech Industry by Output Groups, 2022

Technology Output Categories	Employment, 2022	Employment Change, 2021–2022	Employment Change, 2017–2022	Establishments, 2022	Sales, 2022 (millions)	Location Quotient
Tech Services	133,059	1.2%	8.3%	15,993	\$47,800	0.83
Tech Manufacturing	25,810	9.5%	23.7%	713	\$8,700	0.76
<b>TOTAL TECH</b>	<b>158,870</b>	<b>2.5%</b>	<b>10.5%</b>	<b>16,706</b>	<b>\$56,500</b>	<b>0.82</b>

Source: EL estimates based on Lightcast 2023.4

## Tech Manufacturing Employment Trends

100 = 2011 levels



Source: EL calculations based on Lightcast 2023.4

## Tech Industry Wages

The tech industry is prized for its high wages paid to workers. In Missouri in 2022, the average earnings per worker in the tech industry were \$123,800 a year. The average earnings for workers across all industries in the state are about \$72,300. A tech industry worker almost earns 1.7x the average worker in the state. This metric of earnings includes all the wages and supplements received by a worker. Supplements include employee benefits and on average accounted for about \$21,600 of a tech industry worker's earnings in Missouri. Even when accounting for the cost-of-living-index (COLI), Missouri's tech earnings are lower than the national average. This is both a positive and negative competitive factor. Lower wages present an opportunity for businesses moving from high-cost locations, but can make it difficult to recruit talent to relocate to the state.

## Average Annual Earnings per Worker by Sub-Industry, 2022

Technology Categories	Missouri	Missouri (Purchasing Power)	National Average
Energy Tech	\$153,200	\$166,500	\$172,700
Environmental Tech	\$81,000	\$88,000	\$92,900
Life Sciences	\$123,900	\$134,700	\$147,800
IT	\$127,000	\$138,000	\$178,200
AllCategories	Missouri	Missouri (Purchasing Power)	National Average
Tech Services	\$126,900	\$137,900	\$162,400
Tech Manufacturing	\$107,700	\$117,000	\$161,500
<b>TOTAL TECH INDUSTRY</b>	<b>\$123,800</b>	<b>\$134,500</b>	<b>\$162,200</b>

Source: EL estimates based on Lightcast 2023.4 and BEA (2023)

## Super Sub-Industries

The industries were also divided down into even further detailed groupings, super sub-industries. This breakdown shows that software services are a significant driver of the tech industry growth in the state. Jobs in this group employ over 51,320 workers. Concentration is strong in the Internet, Social Media and Telecoms super sub-industries. Growth is strongest in Electronics Hardware Manufacturing and Life Science Manufacturing. Although small in job numbers, Renewable Energy has experienced the highest percentage growth.

## Missouri's Tech Industry by Super Sub-Industries, 2022

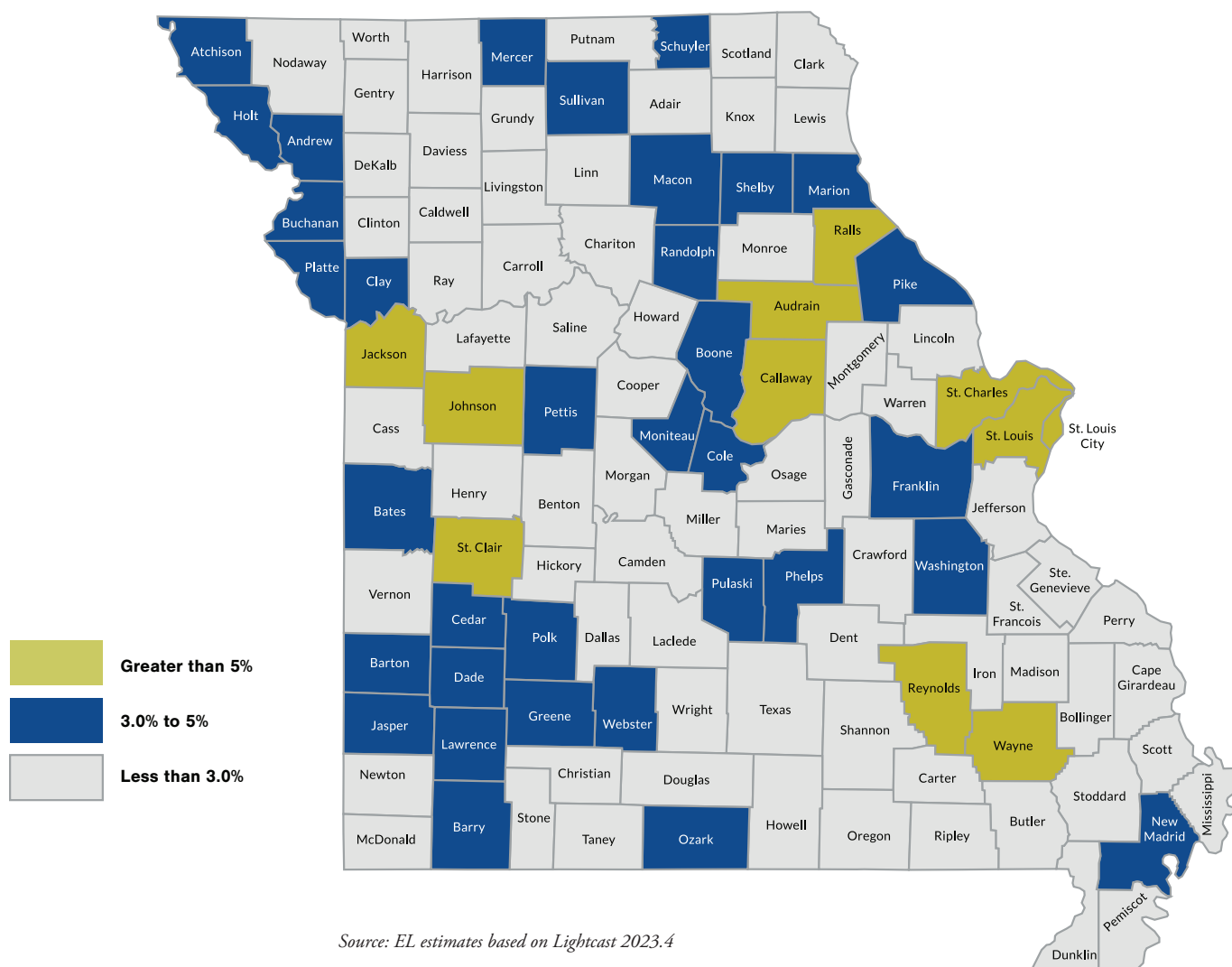
Super Sub-Industries	2022 Employment	Employment Change (2017-2022)	Concentration
Software	51,324	18%	0.88
Internet, Social Media and Telecom	32,576	0%	1.14
Engineering, Environmental and Clean Tech	23,172	7%	0.89
Research and Development and Testing	12,279	4%	0.54
Electronics Hardware	10,716	33%	0.64
Life Sciences Manufacturing	10,606	20%	0.75
Other Energy and Power Generation	10,333	-3%	0.58
Remediation and Waste Management	7,649	15%	0.84
Renewable Energy	214	529%	0.46
<b>TOTAL TECH</b>	<b>158,870</b>	<b>11%</b>	<b>0.82</b>

Source: EL estimates based on Lightcast 2023.4



## Tech Industry Location

Across the state, the tech industry is primarily concentrated in the major metro areas of Kansas City and St. Louis with some dispersion in less urban areas. Eleven counties have tech industry employment concentrations higher than 5 percent of the workforce.



Source: EL estimates based on Lightcast 2023.4



# State Comparisons of ● Tech Industry Metrics

Using the same methods for calculating the tech industry in Missouri, metrics were calculated for the remaining states and the District of Columbia to measure how Missouri tech trends compare. The District of Columbia is included in the charts, but not included in the state rankings. This section of the report evaluates many of the metrics shown in Section 3 compared against the values for the United States as a whole and the other states. This section looks first at metrics for the total tech industry but also shows state comparisons of the subcategories and output groupings. Tech occupation data is compared in a later section of the report.

The following charts list all the metrics we have measured for Missouri’s tech sector and its corresponding ranking among the other states. Missouri ranks in the best 15 of all states for 2 of the 6 indicators evaluated for the total tech sector. The state did not rank in the bottom 15 for any of the indicators.



## Total Tech Industry

Metric	Value	Rank
Total Tech Industry Employment Concentration (2022)	0.82	30
Total Tech Industry Job Change (2017-2022)	10.5%	30
Expected Total Tech Industry Job Change (2023-2028)	7.9%	30
Avg Earnings for Total Tech Industry Employees with Purchasing Power (2022)	\$134,520	32
Percentage of Women in the Total Tech Industry Workforce (2022)	35.1%	12
Total Tech Industry Diversity Index (2022)	94.8	6

Source: EL estimates based on Lightcast 2023.4

Comparing Missouri with other states in the country helps place the state's performance in context. In 2022, Missouri was the 30th most concentrated tech industry economy. Despite positive net gains in the past five years and again predicted for the next five years, Missouri ranked 30th for past and future job growth rates. This indicates that while Missouri's tech industry is growing, it is not growing quite as strong as other states. The appendix of this report details the state rankings and shows that states in the Southeast like Florida and North Carolina and states in the Intermountain West like Idaho and Utah are growing at much higher rates than Missouri. The state did rank in the top 15 states for the percentage of women in the tech industry and the diversity of the tech workforce.

## IT Industry Subcategory

Next, the IT Subcategory specifically was compared to other states. This group of industries represents the high-tech core including hardware manufacturing, internet, data storage, telecommunications and software companies. In 2022, the IT Subcategory accounted for 3.4 percent of Missouri's employment with a location quotient of 0.91. This is the 17th most concentrated IT economy in the nation. Growth in the IT Subcategory has been higher than the total tech industry in the state. Missouri does not rank in the top growth states despite a growing IT industry because many states are growing at even stronger rates. Top growth states like Nevada and Maine had growth rates over 40 percent from 2017 to 2022. Missouri ranked in the top 15 for IT job growth in previous iterations of this report, but growth has not kept up at the same pace and the state's ranking has fallen out of the top 15.

## IT Industry

Metric	Value	Rank
IT Employment Concentration (2022)	0.91	17
IT Job Change (2017-2022)	12.4%	30
Expected IT Job Change (2023-2028)	9.1%	33
Average Earnings for IT Employees with Purchasing Power (2022)	\$137,980	29

## Life Sciences Industry Subcategory

The Life Sciences was the fastest-growing tech subcategory in the state from 2021 to 2022. In 2022, Life Sciences accounted for 1.4 percent of Missouri's employment with a location quotient of 0.69. This was the 38th most concentrated Life Sciences economy in the nation. The subcategory has expanded jobs at a rate of 8.5 percent over the last five years. However, that growth ranked 45th in the nation because other states have experienced on average about 19 percent growth in Life Sciences during this time. The average earnings in Missouri for this sector are in the top 20 states when purchasing power is considered.

The Life Sciences industry is having strong performance in several counties even if the overall state values are not as elevated. In Jackson County, which added about 920 new jobs in the last five years, the employment concentration is 1.17. Life Sciences in this area is likely to get a boost as Kansas City was selected by the EDA as a Tech Hub for vaccine biologics manufacturing. This designation allows the hubs to apply for millions of dollars in funding from the CHIPS Act. In addition, the API Innovation Center was founded in St. Louis to leverage the state's strengths in bioscience, health Care and advanced manufacturing, as well as strengthen technology innovation in the active pharmaceutical ingredient (API) supply chain. APIs are a critical component of the pharmaceutical supply chain with a national security risk as the United States has become overly reliant on other countries for the manufacturing of these important products. The API Innovation Center has garnered national attention and will also likely bolster the life sciences employment concentration.

## Life Sciences Industry

Metric	Value	Rank
Life Sciences Employment Concentration (2022)	0.69	38
Life Sciences Job Change (2017-2022)	8.5%	45
Expected Life Sciences Job Change (2023-2028)	5.0%	39
Average Earnings for Life Sciences Employees with Purchasing Power (2022)	\$134,690	18

## Energy Tech Industry Subcategory

The Energy Tech subcategory is a small part of the Missouri economy at 0.4 percent. However, as the energy fuel mix in the country shifts to cleaner technologies, states like Missouri are places where wind, solar and carbon capture can expand. This combined with national expansion in clean energy is why the state is predicted to add jobs in this industry group at the 6th highest rate in the next five years.

## Energy Tech Industry

Metric	Value	Rank
Energy Tech Employment Concentration (2022)	0.58	31
Energy Tech Job Change (2017-2022)	-1.3%	18
Expected Energy Tech Job Change (2023-2028)	5.9%	6
Average Annual Wage for Energy Tech Employees with Purchasing Power (2022)	\$166,528	31

## Environmental Tech Industry Subcategory

Environmental Tech is another emerging subcategory for Missouri. This subcategory accounts for 0.5 percent of Missouri's economy. Past and predicted job growth are among the top 20 states in the country. Growth in this subcategory is driven by battery manufacturing and environmental consulting services. Jobs in Environmental Tech are likely to expand in the future as the industry will be supported and incentivized through federal legislation like the Inflation Reduction Act and CHIPS Act. In St. Louis, mineral company ICL has broken ground on a large-scale lithium iron phosphate plant to help supply the EV market. The project is supported by a \$197 million grant from the U.S. Department of Energy. Additionally, as part of the CHIPS Act, the University of Missouri was designated as a tech hub to advance critical mineral processing for lithium and lead-acid batteries.

## Environmental Tech Industry

Metric	Value	Rank
Environmental Tech Employment Concentration (2022)	0.97	28
Environmental Tech Job Change (2017-2022)	13.9%	17
Expected Environmental Tech Job Change (2023-2028)	9.9%	13
Avg Annual Wage for Environmental Tech Employees with Purchasing Power (2022)	\$87,994	31

## Tech Services Output Group

Next, tech groupings based on output group were evaluated. Tech services represents the high-tech core services like social media, data storage, telecommunications and software companies. In 2022, the tech services industry accounted for 4.7 percent of Missouri's employment with a location quotient of 0.83. This is the 25th most concentrated tech services economy in the nation. Missouri ranks in the middle of the pack for many of the metrics in tech services. Job growth for tech services has been consistent in the state but has not ranked as well as other states in recent years.

### Tech Services

Metric	Value	Rank
Tech Services Employment Concentration (2022)	0.83	25
Tech Services Job Change (2017-2022)	8.3%	32
Expected Tech Services Job Change (2023-2028)	6.4%	34
Avg Annual Earnings for Tech Services Employees Adjusted for Purchasing Power (2022)	\$137,910	27

## Tech Manufacturing Output Group

Next, tech groupings based on output type were evaluated. Tech manufacturing is strong in Missouri and accounts for 0.9 percent of Missouri's economy. In the past five years, tech manufacturers in the state added jobs at a rate of almost 24 percent. This was the 10th fastest rate in the nation during this time. The future growth is also predicted to be among the top 10. These industries will likely continue to expand as federal policy like the CHIPS Act is providing investment in U.S. manufacturing and research and development of tech manufactured products like semiconductors.

### Tech Manufacturing

Metric	Value	Rank
Tech Manufacturing Employment Concentration (2022)	0.76	30
Tech Manufacturing Job Change (2017-2022)	23.7%	10
Expected Tech Manufacturing Job Change (2023-2028)	15.4%	10
Avg Annual Earnings for Tech Manufacturing Adjusted for Purchasing Power (2022)	\$117,040	33

# Tech Occupations



Technology workers today are present in almost every industry. As technology has permeated most businesses and is increasingly important to company competitiveness, industries like banking, media and health care employ more tech workers. To account for the number of tech occupations that exist across all

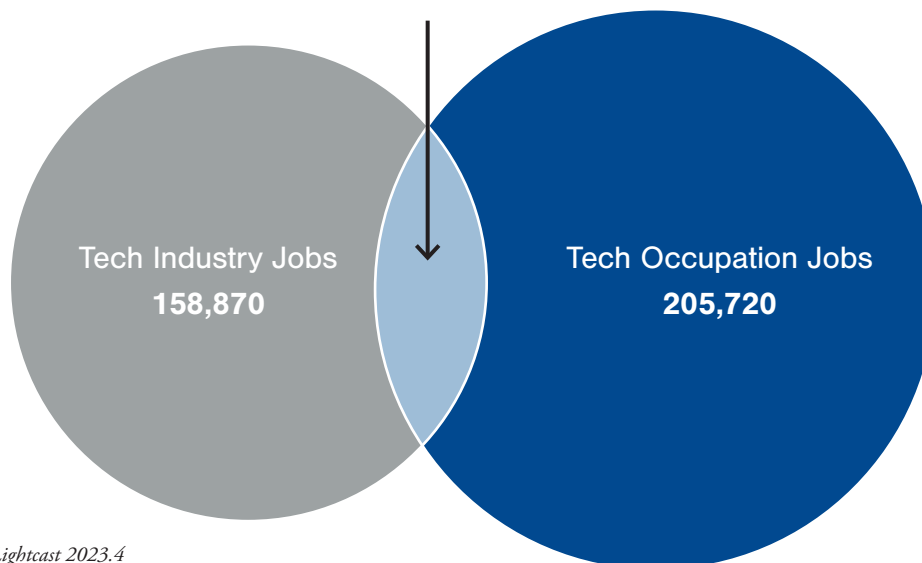
industries, we reviewed 85 separate 5-digit Standard Occupational Codes (SOC) codes focusing mostly on STEM driven work. A complete list is included in the appendix.

Using this methodology, the data showed that there are 205,720 workers in tech occupations in Missouri. This number is higher

than the 158,870 workers employed by the tech industry. This means there is a significant portion of tech occupations outside traditional technology companies in the state. About 34 percent of tech occupation jobs are located within the tech industry; the rest are employed in other industries such as manufacturing and finance.

## Staffing Patterns of Tech Industries and Tech Occupations, 2022

**34% of tech occupation jobs are employed in tech industries.**



Source: EL estimates based on Lightcast 2023.4



Software developers are the top occupation of the tech workers group, accounting for almost 11 percent of the workforce. Every year, on average, 25,845 tech jobs need to be filled in the state to accommodate for growth and retiring workers. The median annual wage for tech workers is over \$81,000 and jobs are growing in the state at a rate of 15 percent.

## Top Tech Occupations in Missouri, 2022

Description	2022 Occupations	Employment Change, 2017–2022	Median Hourly Wage	Annual Openings	Turnover Rate
Software Developers	22,570	+34%	\$49	2,340	30%
Computer User Support Specialists	12,970	-6%	\$26	1,300	44%
Management Analysts	12,020	+42%	\$40	1,770	44%
Market Research Analysts	11,180	+20%	\$30	1,330	52%
Computer and Information Systems Managers	7,920	+31%	\$64	890	32%
Computer Systems Analysts	7,830	-25%	\$48	760	32%
Network and Computer Systems Administrators	7,440	-6%	\$38	600	36%
Computer Occupations, All Other	7,270	+18%	\$48	820	36%
Industrial Engineers	6,330	+16%	\$43	640	24%
Financial and Investment Analysts	5,775	+40%	\$38	680	24%
Computer Network Support Specialists	4,630	-4%	\$29	450	40%
Data Scientists	3,920	+180%	\$38	680	42%
Computer Network Architects	3,410	+5%	\$57	320	34%
Information Security Analysts	3,320	+61%	\$41	430	35%
Logisticians	2,925	+23%	\$37	350	32%
<b>All Tech Occupations</b>	<b>205,720</b>	<b>+15%</b>	<b>\$81,600</b>	<b>25,845</b>	<b>38%</b>

Source: EL estimates based on Lightcast 2023.4

Analyst jobs were among the top occupations and those experiencing the most growth. The increase of Big Data has created demand for workers who can help process and dissect that information. This shows that from a talent perspective, cultivating a tech workforce is not just about coding websites and apps, but having smart individuals who are well versed in statistics and mathematics is also valuable. Higher education is responding to the current and projected significant increase in demand for workers with skills in data science. The University of Central Missouri recently announced that it is launching a new bachelor's degree program that will combine artificial intelligence (AI), machine learning and data science at the Missouri Innovation Campus (MIC) in Lee's Summit.

The Missouri Chamber Foundation is also working to increase the tech workforce. The Missouri Chamber Foundation is helping tech employers train more than 5,300 apprentices in high demand occupations through a \$6 million grant from the Department of Labor.

Given Missouri's strong tech manufacturing growth, engineering and manufacturing technician positions are also expanding at high percentage rates.

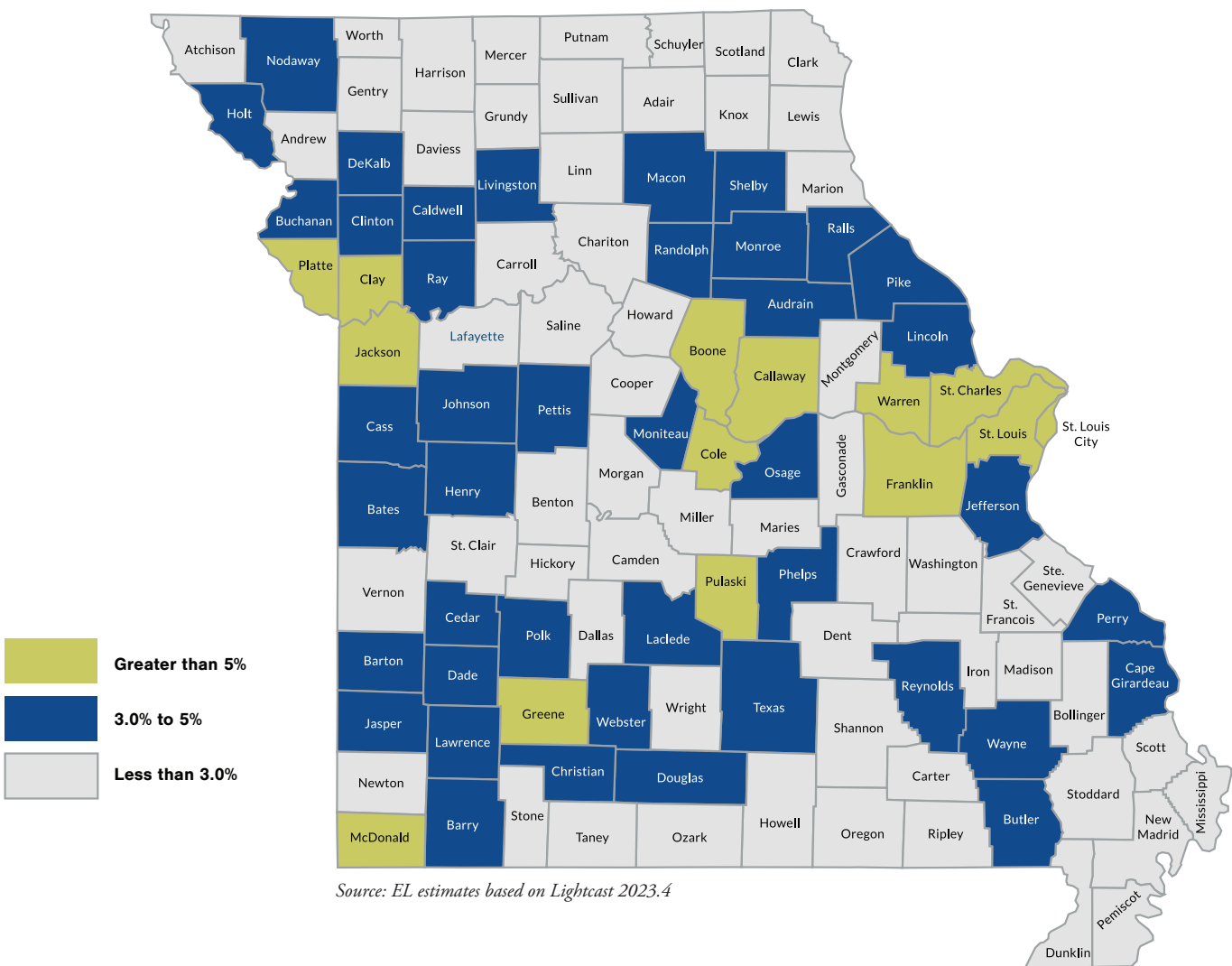
## Top 5 Tech Occupations in Growth

Top Five in Net Job Growth		Top Five in Growth Percentage	
Software Developers	+5,670	Nuclear Technicians	425%
Management Analysts	+3,565	Data Scientists	180%
Data Scientists	+2,515	Aerospace Engineering Technologists	161%
Computer and Information Systems Managers	+1,895	Computer Hardware Engineers	133%
Market Research Analysts	+1,870	Calibration Technologists	118%

Source: EL estimates based on Lightcast 2023.4

Like tech industry jobs, tech occupations tend to strongly concentrate in the more urban counties but there's a higher number of counties that have tech occupation concentrations higher than 5 percent and between 3 and 5 percent.

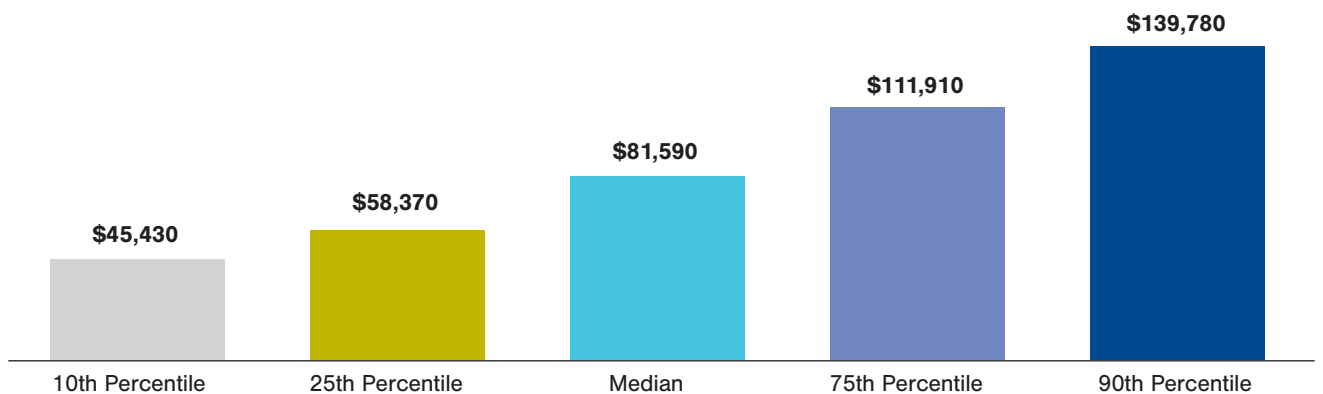
## Tech Occupations Percentage of Total Jobs



Source: EL estimates based on Lightcast 2023.4

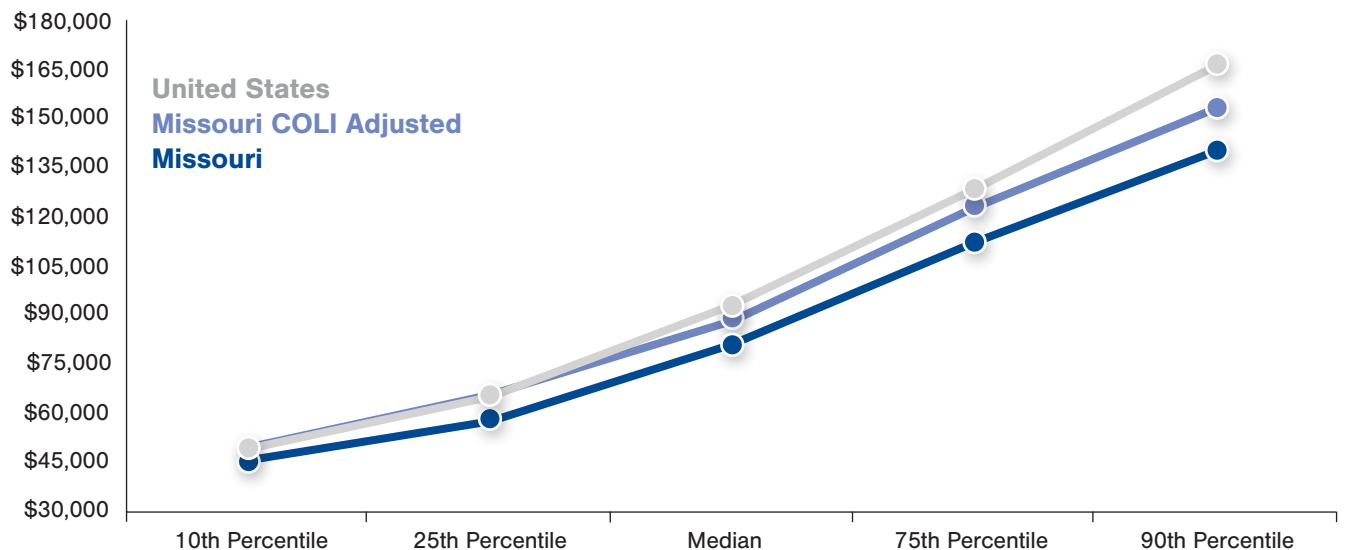
While the median earnings for a tech occupation are around \$81,600, the true earnings can range based on industry and experience. The lowest percentile earns about \$45,430 and the highest can earn about \$139,780 a year. Missouri wages are competitive with the national average when cost of living is considered – except for the highest-skilled positions where this talent can likely earn higher wages elsewhere in the country.

### Wage Distribution of Tech Occupations in Missouri, 2022



Source: EL estimates based on Lightcast 2023.4

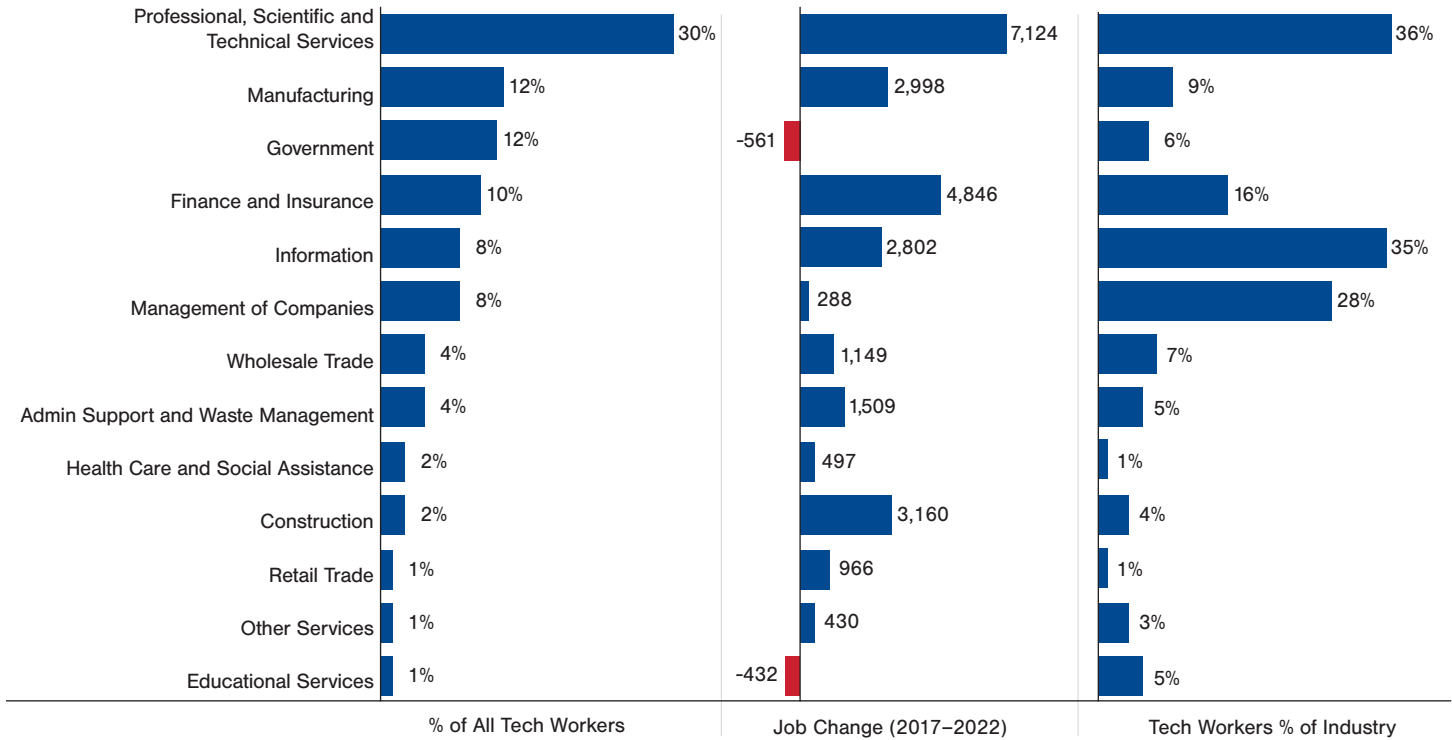
### Tech Occupation Wage Distribution by Location, 2022



Source: EL calculations based on Lightcast 2023.4

As mentioned, these tech occupations exist across many different industries. The chart below demonstrates which industries (two-digit level) employ tech workers in Missouri. Beyond the expected Professional Services and Information industries, tech workers are also present and growing strongly in manufacturing, finance, government and management. About 16 percent of all jobs in the finance and insurance industries are tech occupations and added more than 4,846 tech workers from 2017 to 2022. Tech workers now account for 9 percent of the manufacturing industry as production become more automated and integrated.

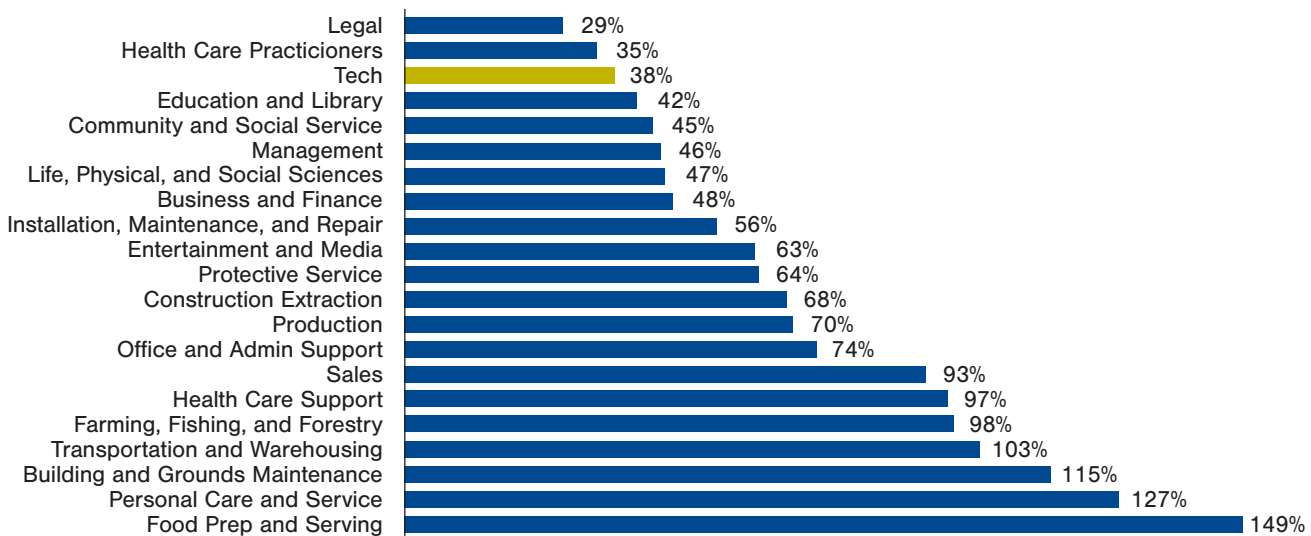
### Top Industries Employing Tech Workers, 2022



Source: EL estimates based on Lightcast 2023.4

Turnover across occupations can be measured by taking the number of separations (when a Social Security number is removed from a payroll) by the total number of employees in the field. This turnover rate provides a measure of churn in workers in the field. For tech jobs in Missouri, the rate was about 38 percent in 2022. This was one of the lowest rates in the state's economy.

### Missouri Turnover Rate by Occupation Group, 2022



Source: EL estimates based on Lightcast 2023.4

## Gender Demographic Breakout

To understand the demographic distribution within tech occupations, the percentage of workers in a group was compared to the percentage of that group in the Missouri population. This produces an index value where 100 indicates equal representation of the group in tech occupations compared to the state's population. If the index value is less than 100, the gender is underrepresented in tech occupations and vice versa if the index value is over 100. Looking first at gender demographics, women account for one-third of tech occupations while accounting for one-half of the population. While we know Missouri has higher rates of women working in the tech industry compared to most other states, women are still well underrepresented in tech occupations.

### Gender Distribution of Tech Occupations in Missouri, 2022

Demographic	Tech Occupations	MO Population	Index
Women	34%	51%	67.1
Men	66%	49%	133.7

Source: EL estimates based on Lightcast 2023.4

## Race Demographic Breakout

In Missouri, 80 percent of tech workers are white and they are just slightly overrepresented in tech occupations when compared to the state's population. Workers who are Asian are well-represented in the tech workforce. Other groups of color do not fare as well. Black people accounted for 8 percent of tech occupations but make up 11 percent of the state's total population. The index rates for the Latino or Native communities in the tech workforce also indicate their underrepresentation in tech occupations. As the tech market continues to grow in the state, it is important that many parts of the population benefit. Despite these numbers, Missouri still outpaces most other states in tech worker diversity.

### Race/Ethnicity Distribution of Tech Occupations in Missouri, 2022

Demographic	Tech Occupations	MO Population	Index
White	80%	78%	101.9
Black or African American	8%	11%	70.6
Asian	7%	2%	305.8
Hispanic or Latino	3%	5%	53.8
Two or More Races	2%	2%	95.5
American Indian or Alaska Native	0.2%	0.4%	45.5
Native Hawaiian or Other Pacific Islander	0.1%	0.2%	62.8

Source: EL estimates based on Lightcast 2023.4

## Age Demographic Breakout

The age of the tech workforce was also compared against the age breakdown of the overall workforce. Tech occupations tend not to rely on the very young but have a higher level of young and middle-aged workers. Compared to the overall state workforce, tech occupations employ less older workers. This group still represents 21 percent of the tech jobs in Missouri and is at risk of retirement in coming years. Companies and workforce stakeholders will need to be able to replace their skillsets in the future.

## Age Distribution of Tech Occupations in Missouri, 2022

Demographic	Tech Occupations	MO Workforce	Index
Age 24 and Younger	6%	14%	38.5
Age 25 to 34	26%	21%	122.0
Age 35 to 44	27%	21%	125.9
Age 45 to 54	21%	20%	109.2
Age 55 and Older	21%	23%	87.6

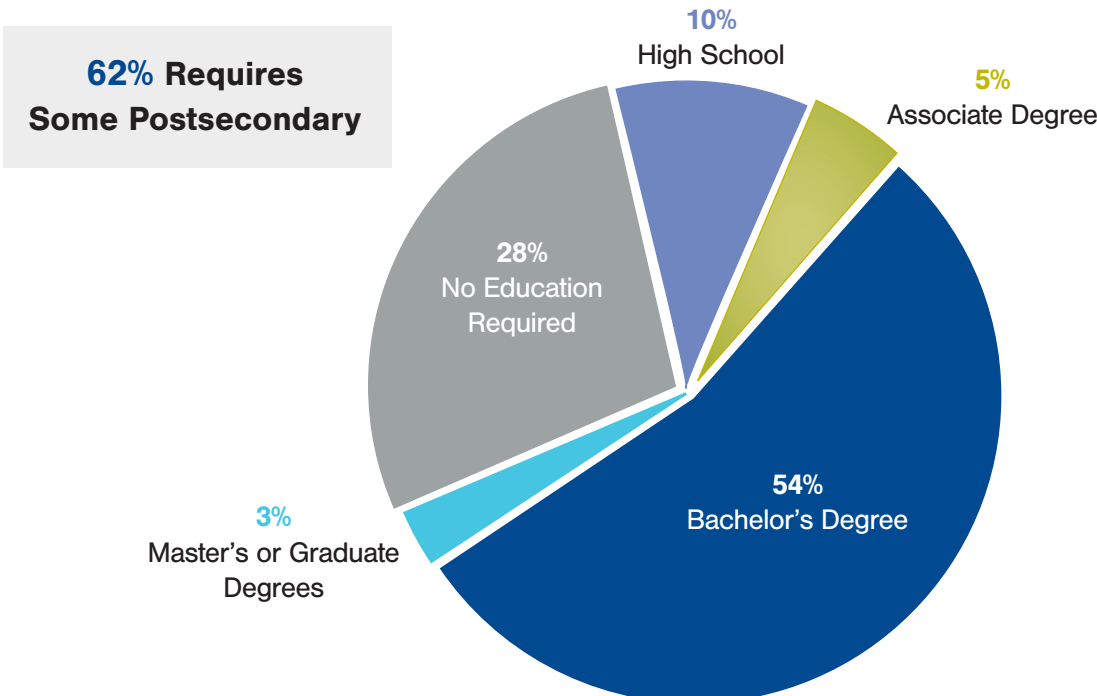
Source: EL estimates based on Lightcast 2023.4

## Education Attainment

One of the ways to increase the equity of tech jobs is to focus on skills-based hiring. While many companies have started to remove education requirements to expand applicant pools, a review of job postings in the last three years reveals that about 62 percent of postings for tech jobs required some form of postsecondary education.

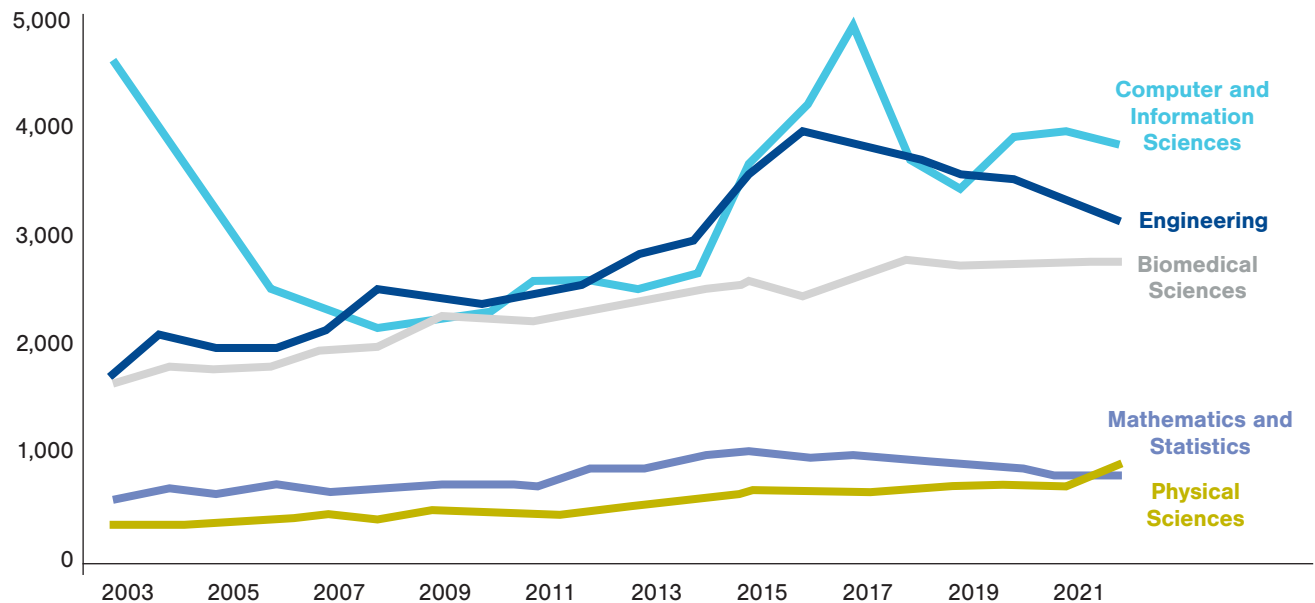
### Minimum Education Required for Missouri Tech Job Postings

Sept. 2020–Sept. 2023



When looking at the data for educational completions, which includes degrees, certificates and awards from postsecondary institutions, there has been a decrease in STEM related fields. Computer and Information Science programs have produced about the same number of graduates for the last five years. Engineering completions have been falling in the state since 2017. Fortunately, other STEM programs are increasing their graduates like biomedical sciences and math and statistics. In 2022, postsecondary institutions in Missouri produced over 10,100 completions in STEM.

### Annual Education Completions in Missouri for Selected Programs



Source: EL calculations based on Lightcast 2023.4

Online job profiles for Missouri graduates indicate that about 38 percent stay in the area for work. This indicates that Missouri will need to continue to produce talent through the postsecondary system and find new ways to train talent for tech jobs. Research from CompTIA that surveys individuals between the ages of 18 to 34 has highlighted that many workers self-select themselves away from a career in tech. About 6 in 10 prospective workers believe there is a major barrier to them pursuing a career in tech. The top confidence gap barriers include:

- Concern over perceived lack of math/science skills
- Concern over not having 4-year degree
- Belief that it is too late to start a career in tech
- Belief that training is cost prohibitive
- Belief that jobs are limited to “Big Tech”/Silicon Valley firms
- Belief that there are not significant tech jobs in their region

The truth about the demand and accessibility of a tech career might not be reaching the potential workers. Companies and workforce stakeholders will need to do more to develop a skills-based hiring approach and finding new ways to connect workers to these jobs. Companies will likely need to perform more in-house training than they have in the past as the tech skills needed are changing rapidly.



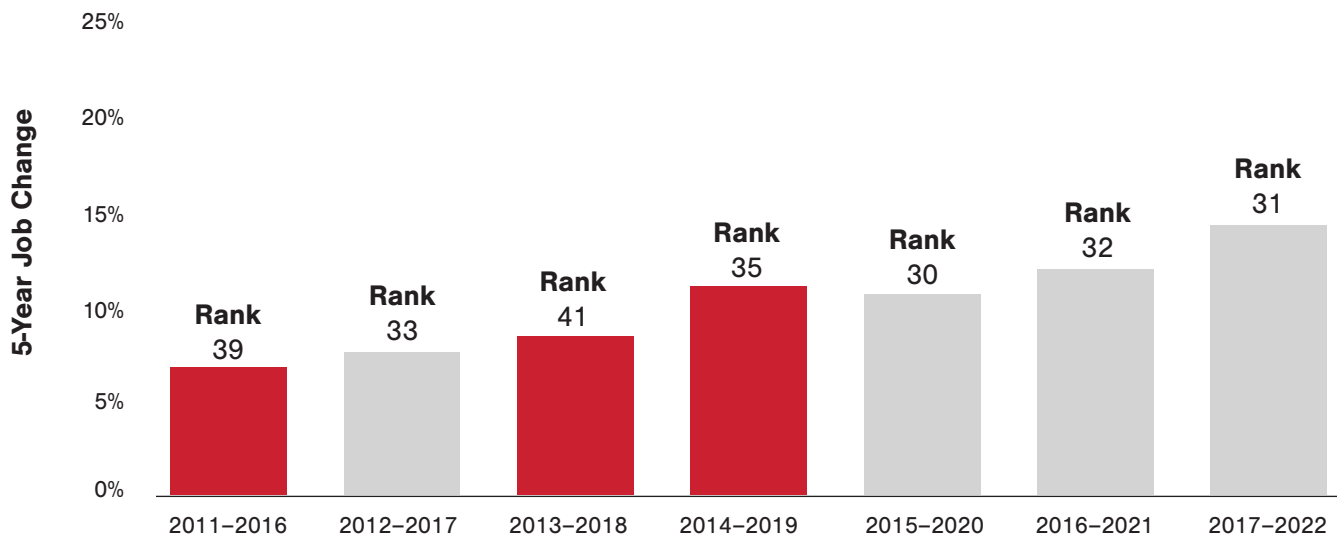
When the performance of tech occupations in Missouri are compared against the rest of the nation, again, the state ranks in the middle of the pack. Tech jobs are growing at robust rates but are not as high as other states. The lower cost of living in Missouri increases tech workers' purchasing power. Median earnings for tech occupations ranked in the top 25 states in the nation.

### Tech Occupation State Comparisons

Metric	Value	Rank
Tech Occupations Employment Concentration (2022)	0.83	28
Tech Occupations Growth (2017-2022)	14.5%	31
Expected Tech Occupations Growth (2023-2028)	7.6%	37
Median Annual Earnings Adjusted for Purchasing Power (2022)	\$88,660	23

Source: EL estimates based on Lightcast 2023.4

### Missouri Tech Occupations 5-Year Job Change by Percentage and State Ranking



Source: EL estimates based on Lightcast 2023.4

# VI. Emerging Tech

There are many portions of the tech sector that stakeholders would like to measure but are difficult to capture in the traditional labor market data. A company is assigned to the NAICS code of their primary activity. If a company is providing software solutions to the agricultural market, they are likely categorized as a software publisher but there is no way of knowing they are a player in the emerging market of AgTech. One way to measure and track these emerging markets are through online job postings. Job postings data can be filtered based on the postings that mention certain phrases. In this section, job postings data is used to reveal some trends in some emerging tech markets that are of interest to the Missouri economy.

## AgTech

Missouri has a strong agricultural industry and has had several AgTech start-ups in recent years. Job postings data from September 2020 to September 2023 revealed that there were 1,123 unique postings that mentioned keywords associated with AgTech. In the last three years 106 different employers in Missouri posted jobs with AgTech keywords. The median posted salary for these jobs was \$23.45 per hour. AgTech focused positions are averaging 25 job postings per month in the state for job titles ranging from laboratory technicians, biologists, research associates and data scientists.

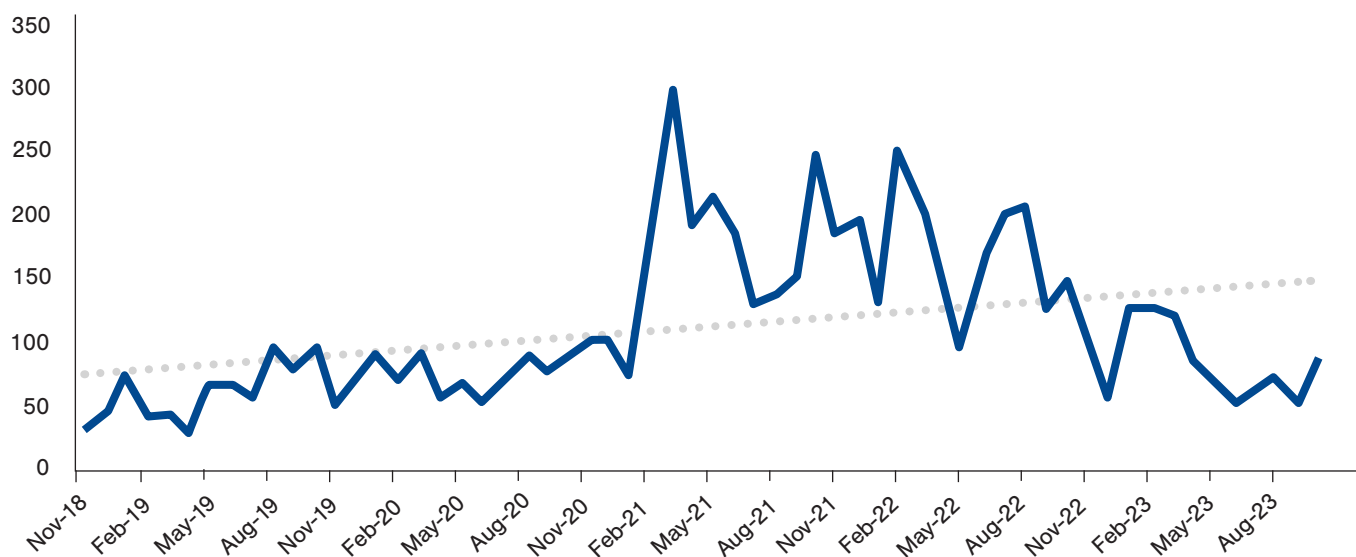
### Top Missouri Companies Posting for AgTech:

- Randstad
- Bunge
- Bayer
- Benson Hill
- Land O'Lakes
- Farmer's Business Network

## FinTech

Missouri is home to major financial companies. Technology has helped disrupt the traditional banking structure and created a demand for tech workers in the industry. In the last three years, there were 5,137 unique postings in Missouri that mentioned FinTech keywords. There were 347 employers competing for talent with FinTech skills. The median posted salary for these FinTech positions was \$46.71 per hour. Averaging 110 job postings per month for job titles ranging from expansion managers, software engineers and digital product managers. FinTech boomed during 2021 when there was a lot of private investment when interest rates were low, but demand in finance is down as the Federal Reserve has increased interest rates to curb inflation.

### Missouri FinTech Unique Job Postings



Source: EL estimates based on Lightcast 2023.4

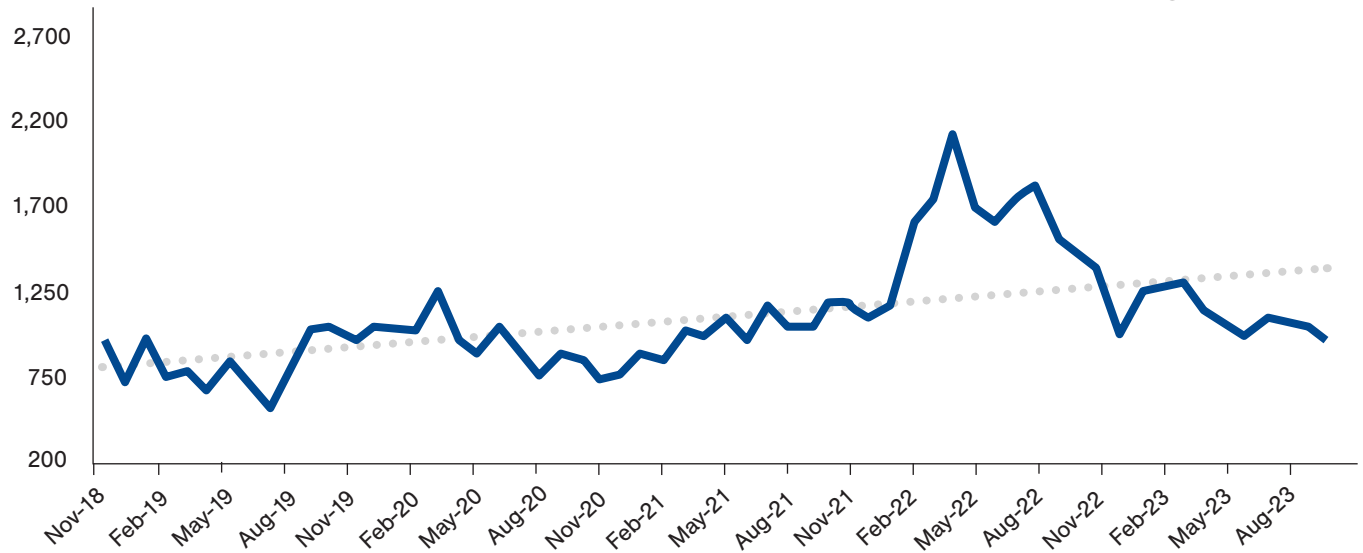
### Top Missouri Companies Posting for FinTech:

- Fiserv
- C2Fo
- JP Morgan Chase
- Broadridge Financial Solutions
- H&R Block
- Jack Henry & Associates

## Cybersecurity and Data Privacy

Data privacy and protecting cyber assets from security threats is becoming a need for businesses regardless of their industry. Demand for cybersecurity is strong in Missouri with 43,784 unique postings in last three years and 3,660 employers competing for talent. The median posted salary for cybersecurity focused jobs was \$50.15 per hour.

### Missouri Cybersecurity & Data Security Unique Job Postings



Source: EL estimates based on Lightcast 2023.4

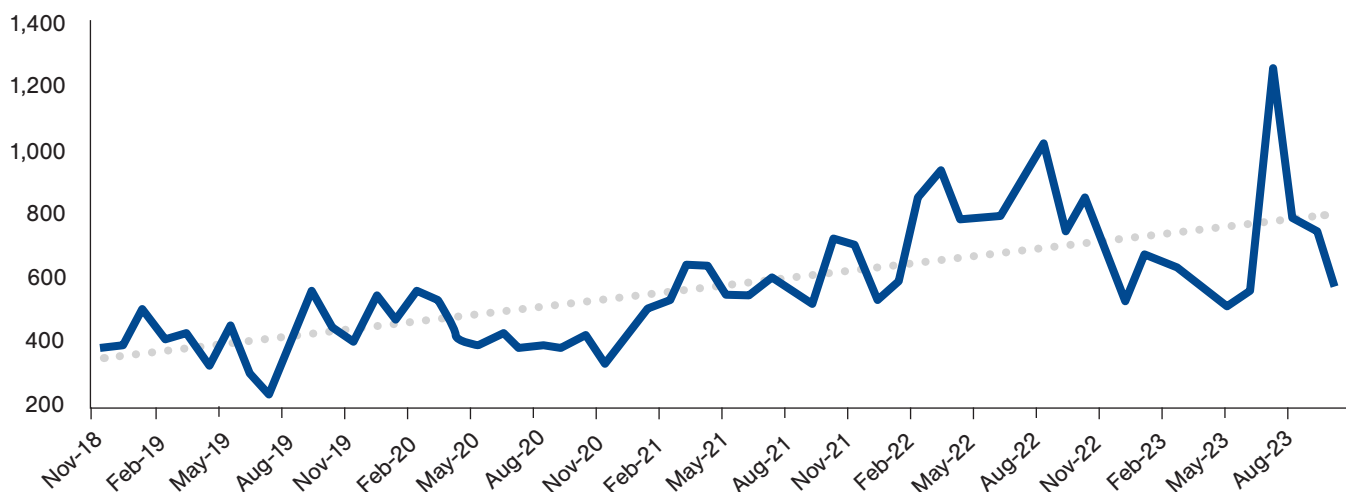
### Top Missouri Companies Posting for Cybersecurity:

- Edward Jones
- Boeing
- Wells Fargo
- Deloitte
- General Dynamics
- Mastercard

## Generative AI

The newest disruptive technology, generative AI, has created a stir in the economy. The biggest product, chatGPT, has been available for use for about a year. In Missouri, demand for AI skills in job postings is rising steadily but is not close to overtaking the market as some have predicted. In the last three years, 24,683 unique jobs have been posted with 2,905 employers competing for talent. The median posted salary for jobs requiring AI skills was \$51.63 per hour.

### Missouri AI Unique Job Postings



Source: EL estimates based on Lightcast 2023.4

### Top Missouri Companies Posting for AI:

- Deloitte
- Boeing
- Edward Jones
- Bayer
- Wells Fargo
- IBM

# VIII

## State Comparison ● of Technology Infrastructure Metrics

Like other parts of the economy, the technology sector needs a solid infrastructure to flourish. Logistics firms must have good highways to conduct their business, agriculture needs good ports for export and many manufacturers need robust water systems. A strong technology infrastructure can be essential to a “knowledge-based economy”. The World Bank defines strong knowledge-based economies on four pillars:

- Entrepreneurship incentives,
- Skilled and educated labor force,
- Physical infrastructure access for technology and communications and
- Innovation ecosystem that fosters collaboration between academia, private sector and government.

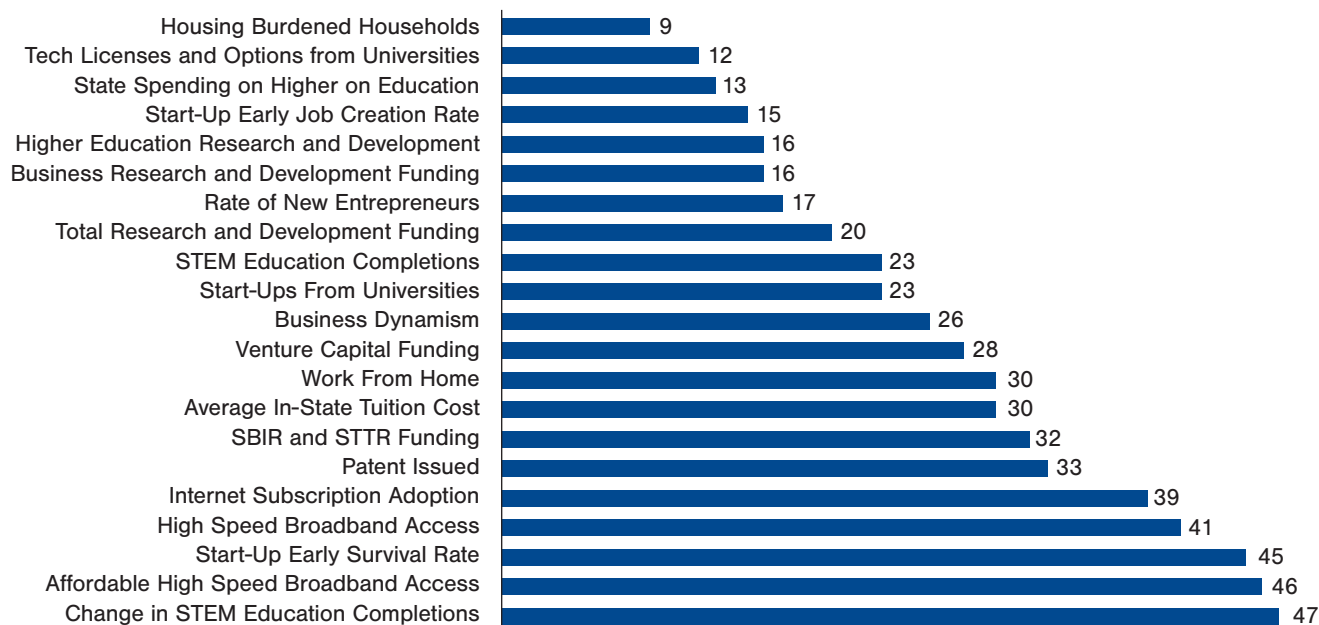
Using this framework, the technology infrastructure of Missouri was evaluated by comparing factors such as funding access, patents, STEM education and university technology transfer. This section compares indicators

that reflect a state’s technology infrastructure and assesses Missouri’s position amongst other states.

Missouri ranked in the top 15 states for four of these indicators, including tech transfer from universities, low housing cost burden and start-up job creation. This report also identifies areas that need improvement. Missouri did not compare as well in broadband access, internet adoption and start-up survival rates. The five-year decline in STEM program completions placed Missouri in 47th place.

Full details of each metric are available in the appendix of the report. Another highlight is that Missouri is improving its venture capital funding. Venture capital investment has grown sharply in the last nine years, outpacing the U.S. average in 2020 and 2021.

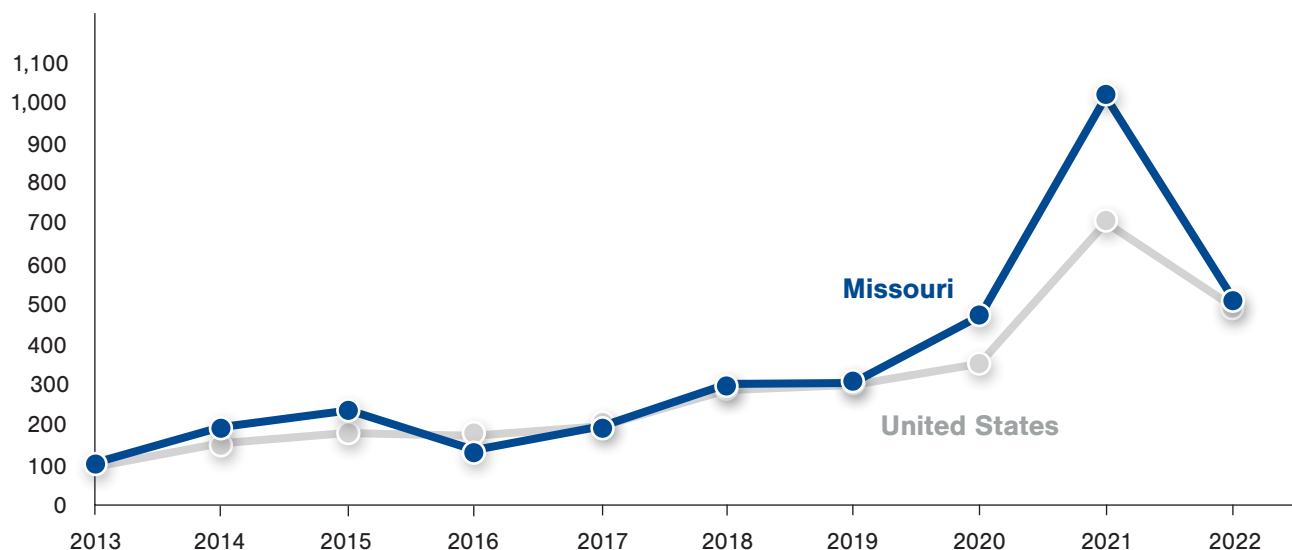
## Missouri State Rankings for Tech Infrastructure Indicators



Source: EL estimates based on Lightcast 2023.4

## Venture Capital Funding Change, 2013-2022

100 = 2013 Levels



Source: EL calculations based on Lightcast 2023.4



# IX

## Key Takeaways for Tech Sector

This analysis highlights the tech industry's role in the Missouri economy. Both tech companies and tech jobs are predicted to grow at robust rates into the future. While the state is not among the fastest growing tech economies, the state has some unique advantages. These advantages include having a lower cost of living and a more diverse tech workforce than other states. The biggest challenges for the sector moving forward will be maintaining growth and finding strategic advantages to compete with the surging tech states in the Southeast and Intermountain West. The tech infrastructure in the state can be improved by addressing the decline in STEM education, access to affordable broadband and helping regional start-ups thrive. Tech saw a surge during the post-pandemic recovery. As the economy renormalizes and demand cools slightly, stakeholders will need to stay diligent on ensuring there is a sufficient tech workforce pipeline for the state in the future.



## Sources

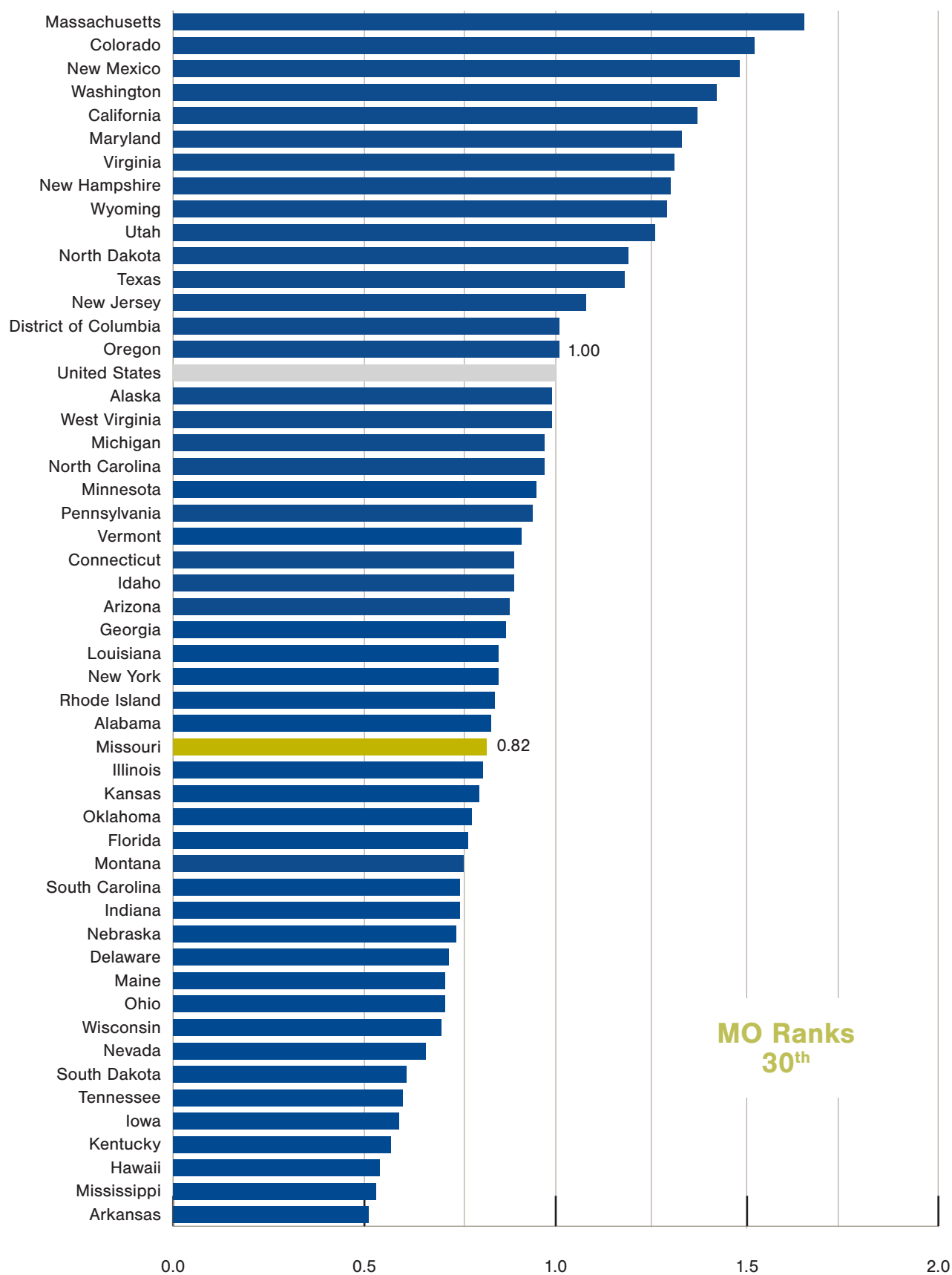
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# A Appendix

## Missouri State Comparison Charts

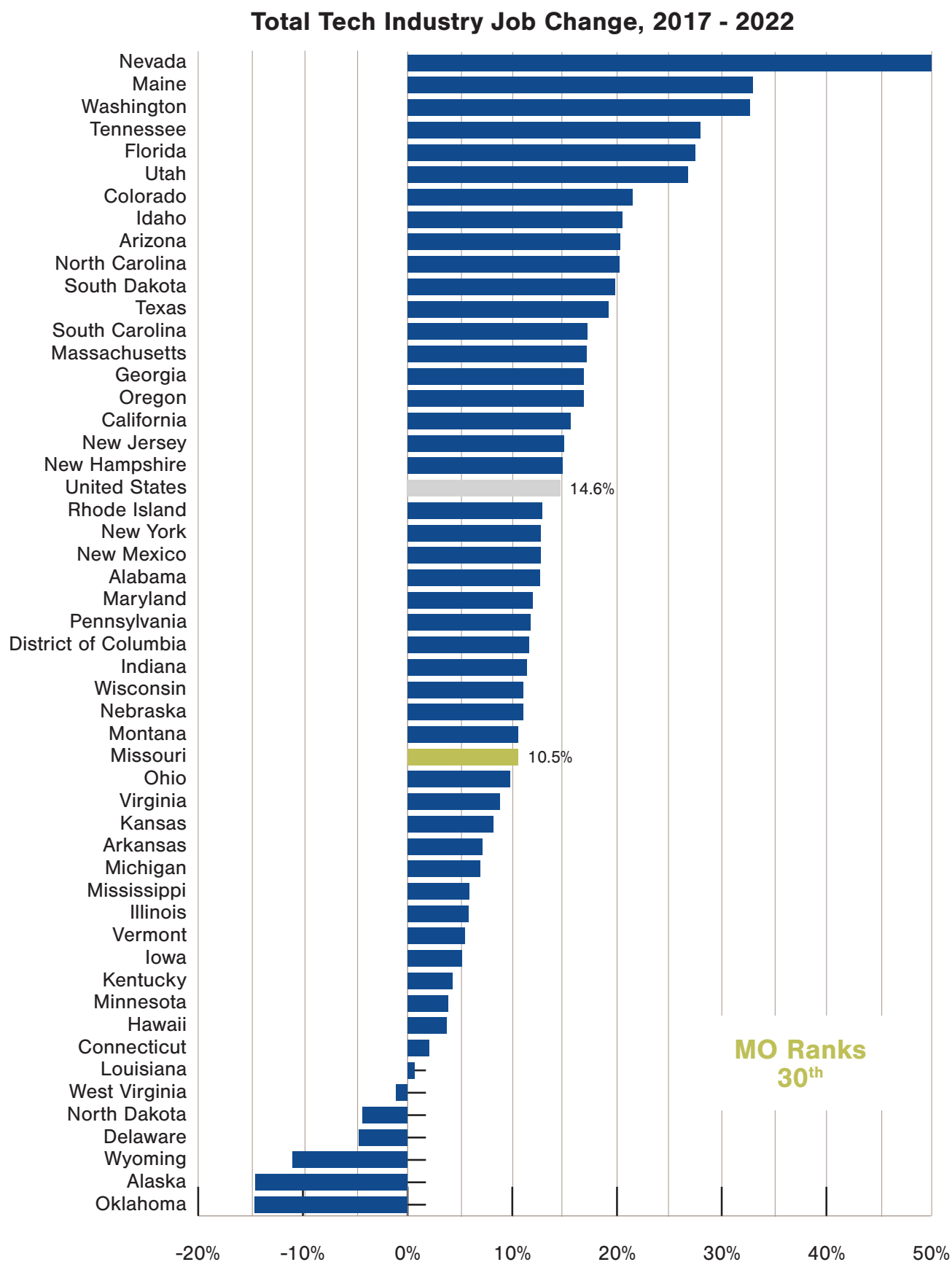
Missouri's tech industry accounts for 5.6 percent of total employment in the state, or an employment concentration value of 0.82. This indicates tech is less concentrated in the state than the national average. Missouri has a diverse state economy that is not uniquely reliant on the tech industry.

## Total Tech Industry Employment Concentration, 2022



Source: EL calculations based on Lightcast 2023.4

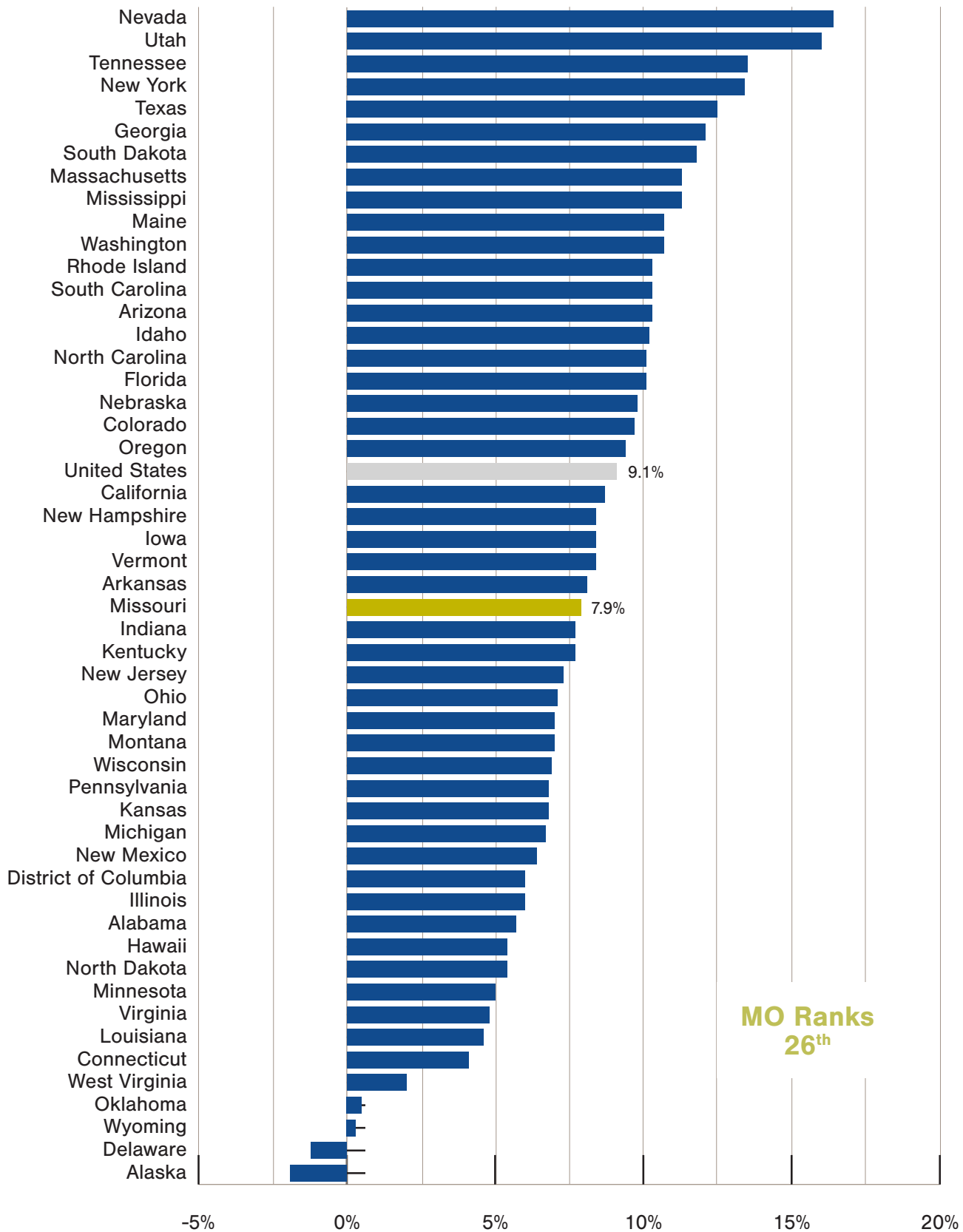
In the past five years, jobs in this industry have grown by over 10 percent in the state. That is the 30th highest growth rate and four points below the national average. The number one state, Nevada, is growing at a high rate due to the rapid expansion at the Tesla Gigafactory in Reno.



Source: EL calculations based on Lightcast 2023.4

Using Lightcast forecasting models, the expected growth of the tech industry for all 50 states and the District of Columbia was calculated for the next five years. Missouri's tech industry is predicted to increase by 7.9 percent. This ranks Missouri 26th out of all the states and just below the national average.

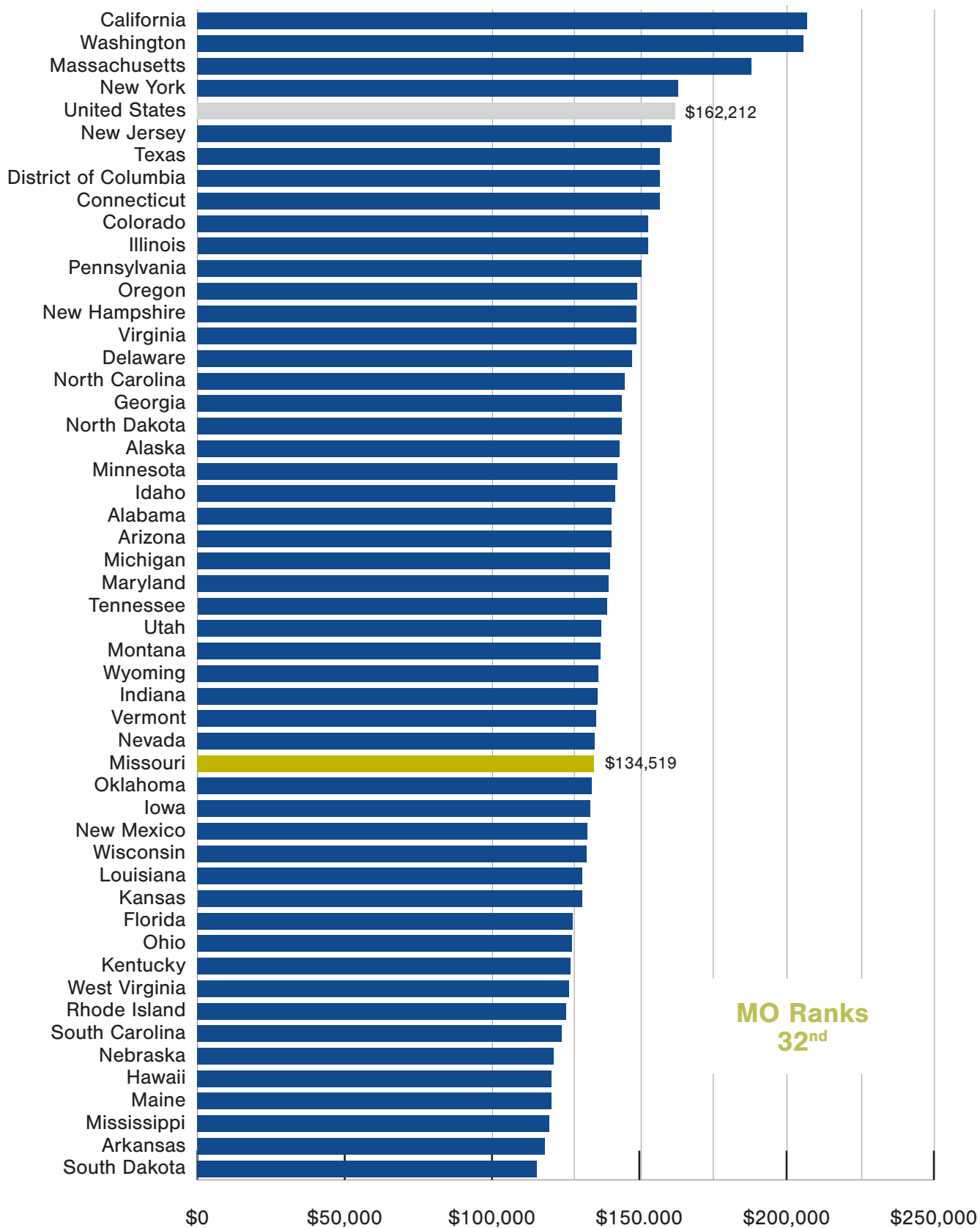
### Expected Total Tech Industry Job Change, 2023–2028



Source: EL calculations based on Lightcast 2023.4

Normalizing tech industry wages by purchasing power, or accounting for the lower cost of living in Missouri, the annual wage moves closer to the national average but still ranks 32nd. Tech powerhouse states like New York, California and Washington are able to offer the most competitive wages to tech industry workers. This can make it difficult for a state like Missouri to compete for the highest skilled talent.

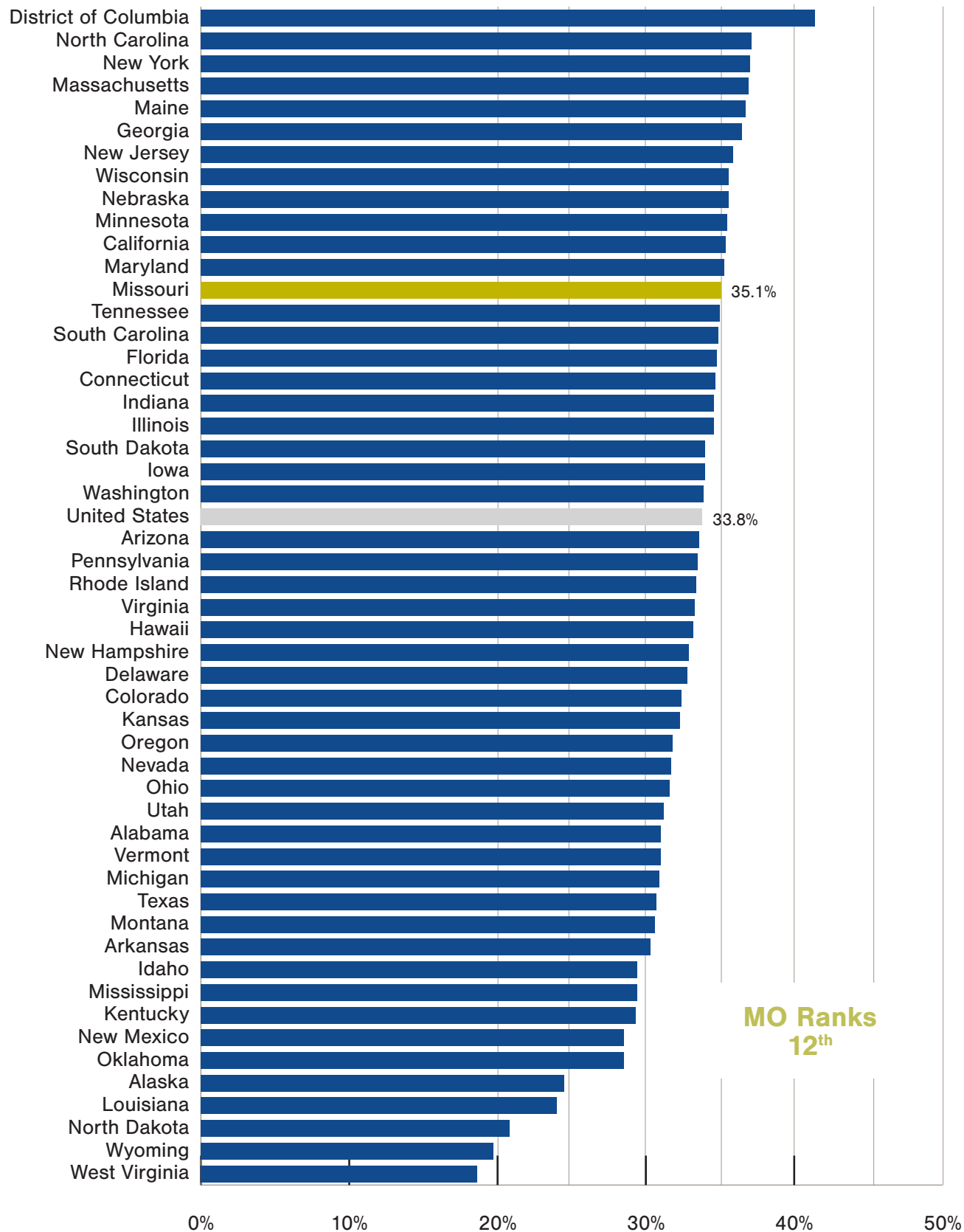
### Total Tech Industry Average Earnings with Purchasing Power, 2022



Source: EL calculations based on Lightcast 2023.4

The gender make-up of the tech industry across all 50 states was evaluated. The tech industry has been traditionally, and is still, male dominated. States are making efforts to encourage women into STEM careers and education. While almost every state has far from equal representation in this industry, Missouri performs well compared to other states. At 35.1 percent of the workforce, Missouri has the 12th highest rate of women in the tech industry workforce.

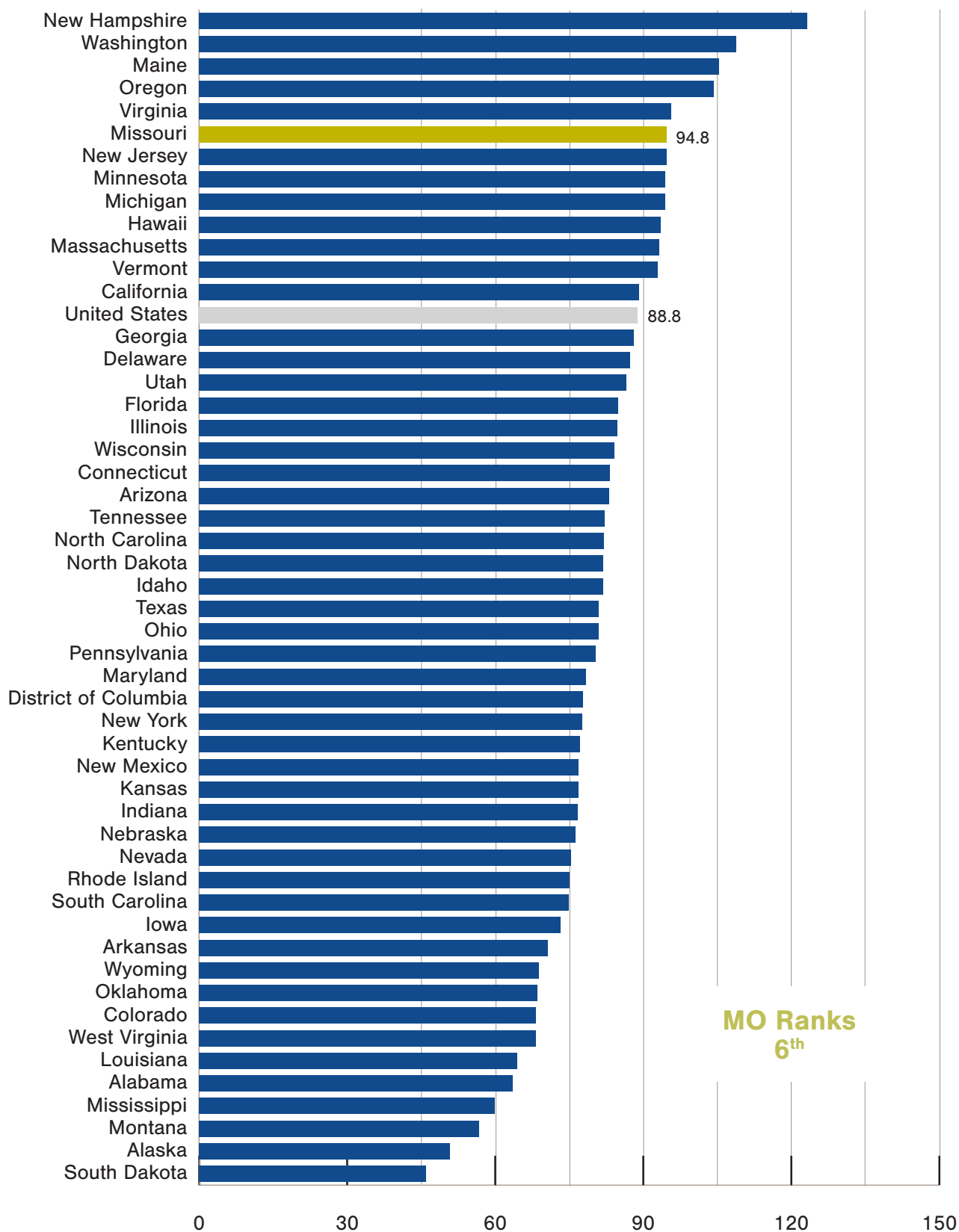
### Percentage of Women in Total Tech Workforce, 2022



Source: EL calculations based on Lightcast 2023.4

The tech industry diversity index is calculated by dividing the percentage of tech industry workers who identify as people of color or in the Hispanic community by the ratio present in the overall population. Therefore, if a state has a tech industry diversity index lower than 100, this indicates that the tech industry is less diverse compared to the state's overall population. A value of 100 would mean the tech industry is representative of the state's overall population. Only four states had a diversity index score above 100. Missouri has the 6th highest diversity index at 94.8.

### Total Tech Industry Diversity Index, 2022

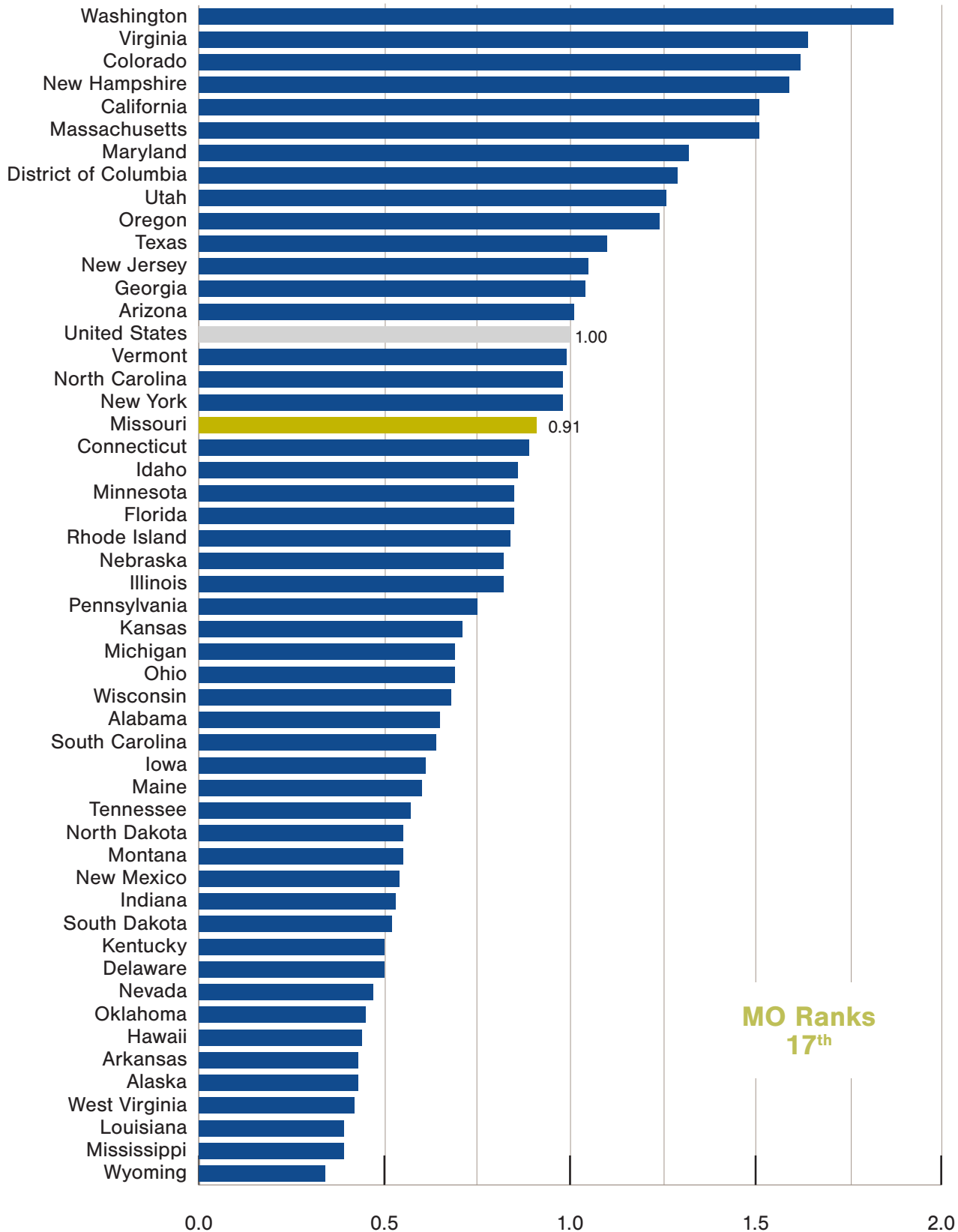


Source: EL calculations based on Lightcast 2023.4



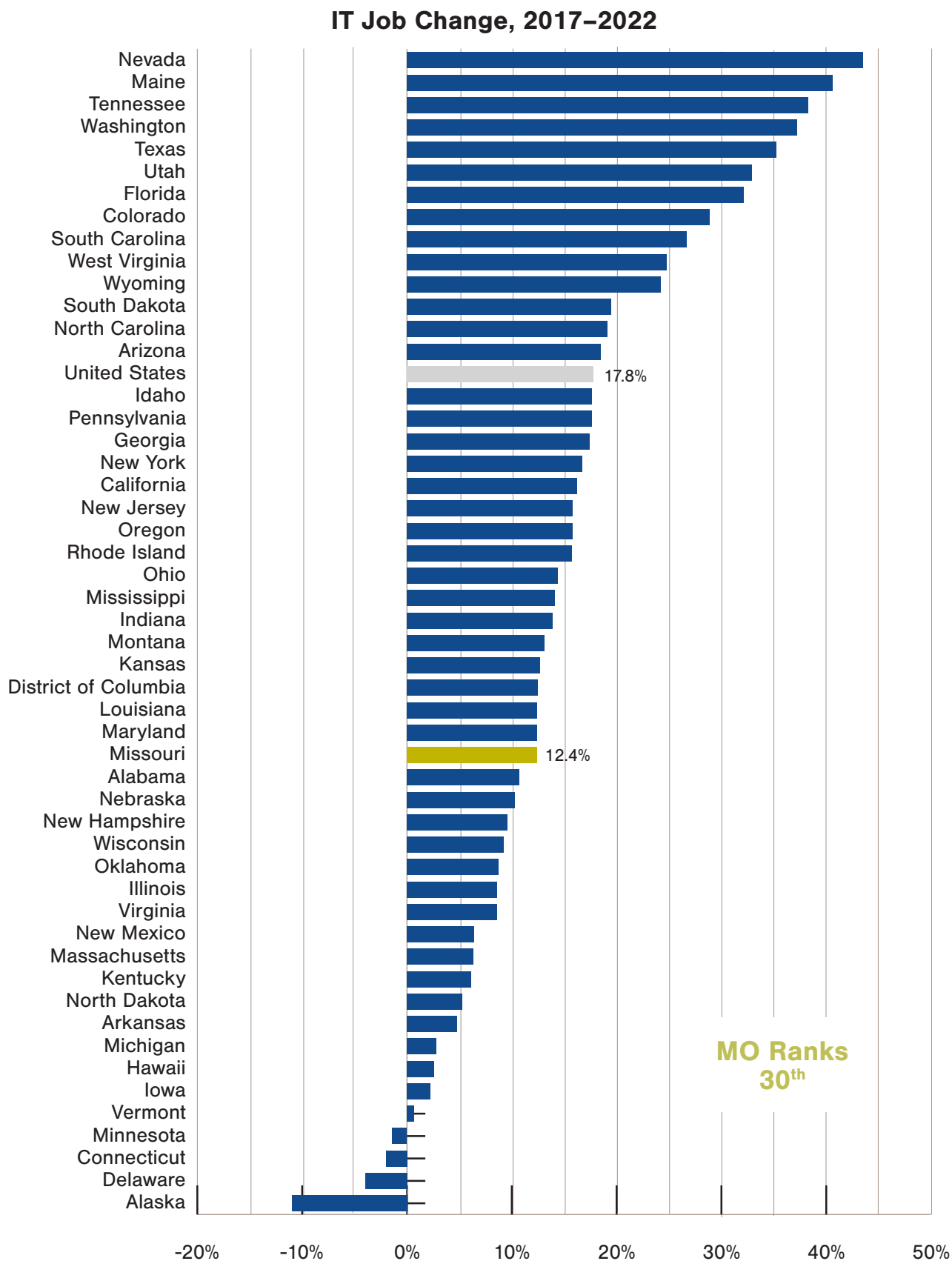
Next, the IT sub-industry was evaluated specifically. This group of industries represents the high-tech core including hardware manufacturing, internet, telecommunications and software companies. In 2022, the IT industry accounted for 3.4 percent of total state employment with a location quotient of 0.91. The concentration of IT industry employment in Missouri is just under the national average and ranks 17th across the states in terms of IT concentration.

### IT Employment Concentration, 2022



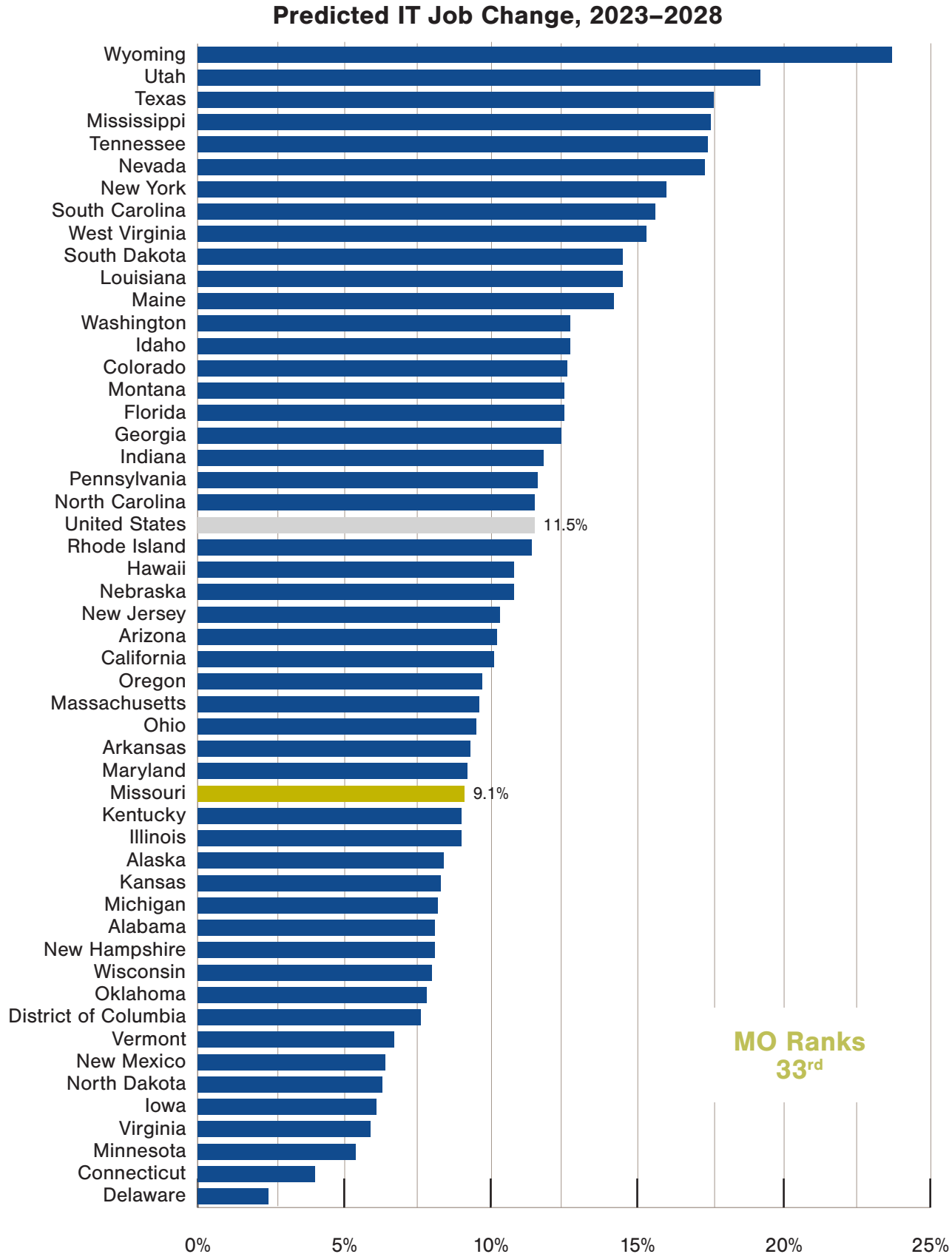
Source: EL calculations based on Lightcast 2023.4

The employment growth rate in IT from 2017 to 2022 for Missouri is more than 12 percent. This was the 30th fastest growth rate across all 50 states. In previous iterations of this report, Missouri ranked in the top 15 states for this metric. Missouri's growth has remained positive but has not spiked in the same way seen in other states, thus bumping the state down in the rankings.



Source: EL calculations based on Lightcast 2023.4

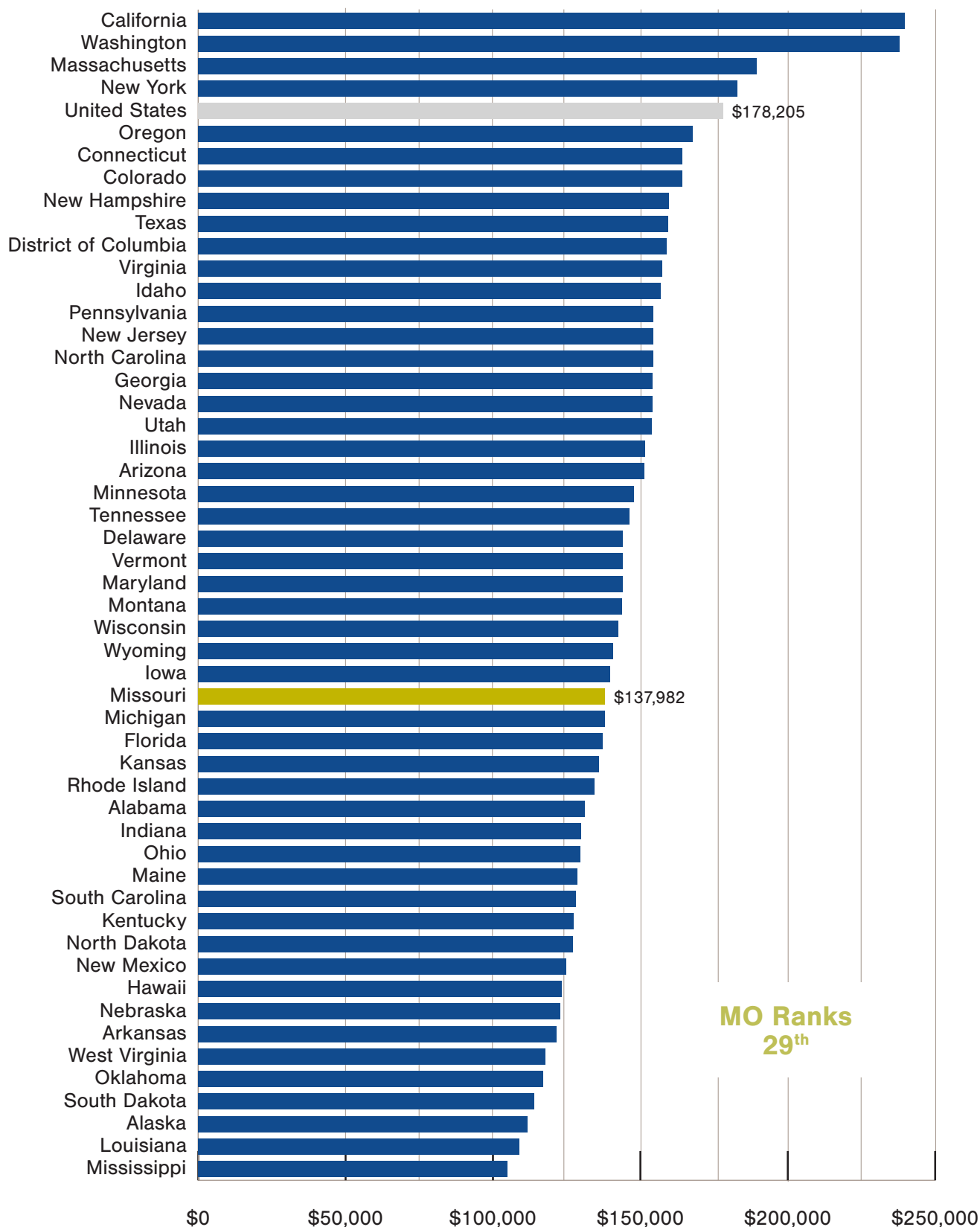
Missouri's IT industry is projected to grow from 2022 to 2027 by more than 9 percent. While strong, this rate is not as fast as the national average or 32 other states. States in the Southeast and Intermountain West are predicted to continue to have the fastest growth in IT.



Source: EL calculations based on Lightcast 2023.4

Like the total tech industry, the IT industry's wages are lower in Missouri than the national average. The state ranks 29th across states for IT industry average wage when purchasing power is considered. The lower cost of living in the state can make it attractive to tech firms looking for lower operating costs.

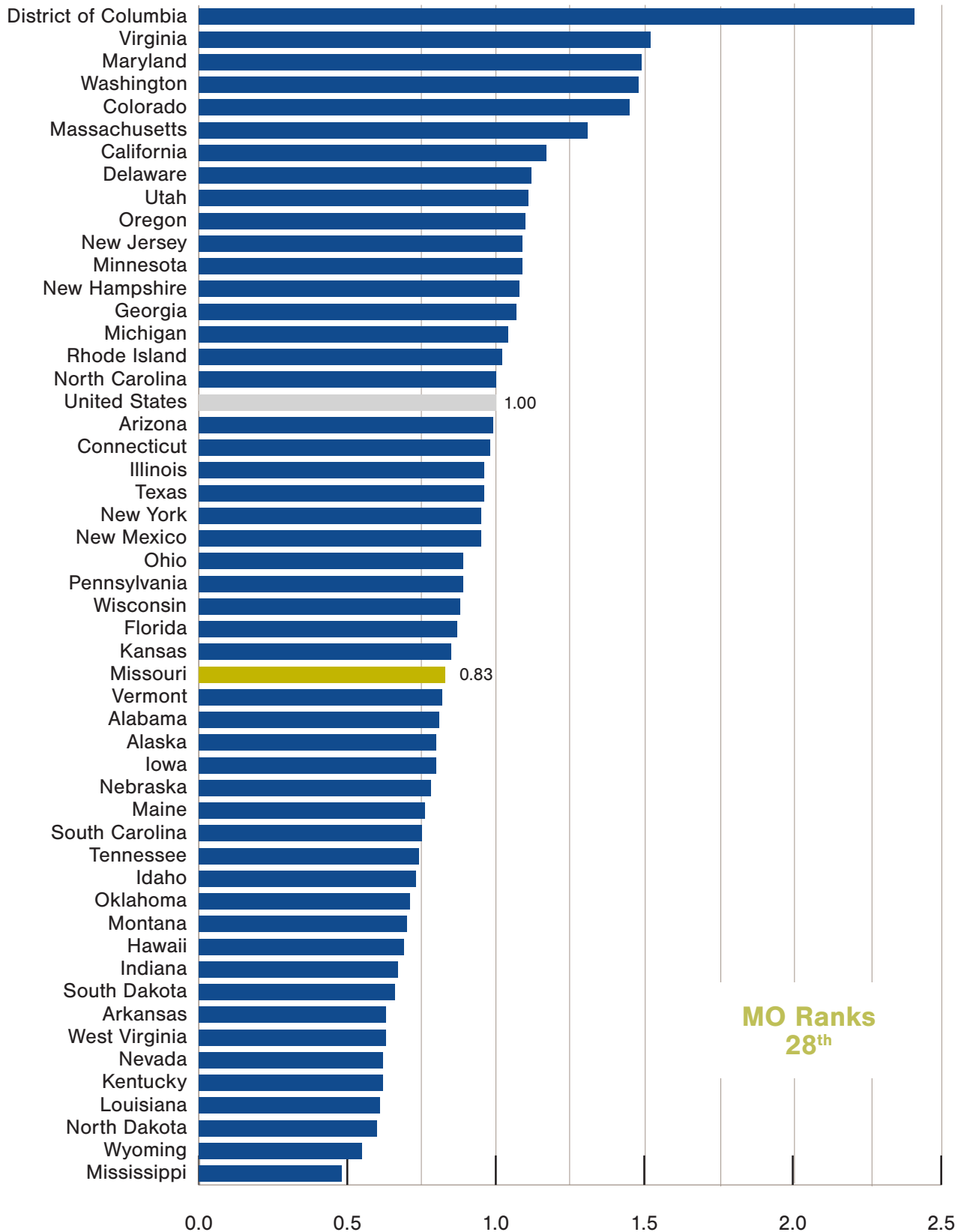
### IT Average Earnings Per Worker Adjusted for Purchasing Power, 2022



Source: EL calculations based on Lightcast 2023.4

The next group of charts focuses on tech occupations. This group of industries represents workers who perform tech roles regardless of the company's industry. In 2022, the tech occupations accounted for 7.3 percent of total state employment with a location quotient of 0.83. The concentration of tech occupations in Missouri is lower than the national average and ranks 28th across all states.

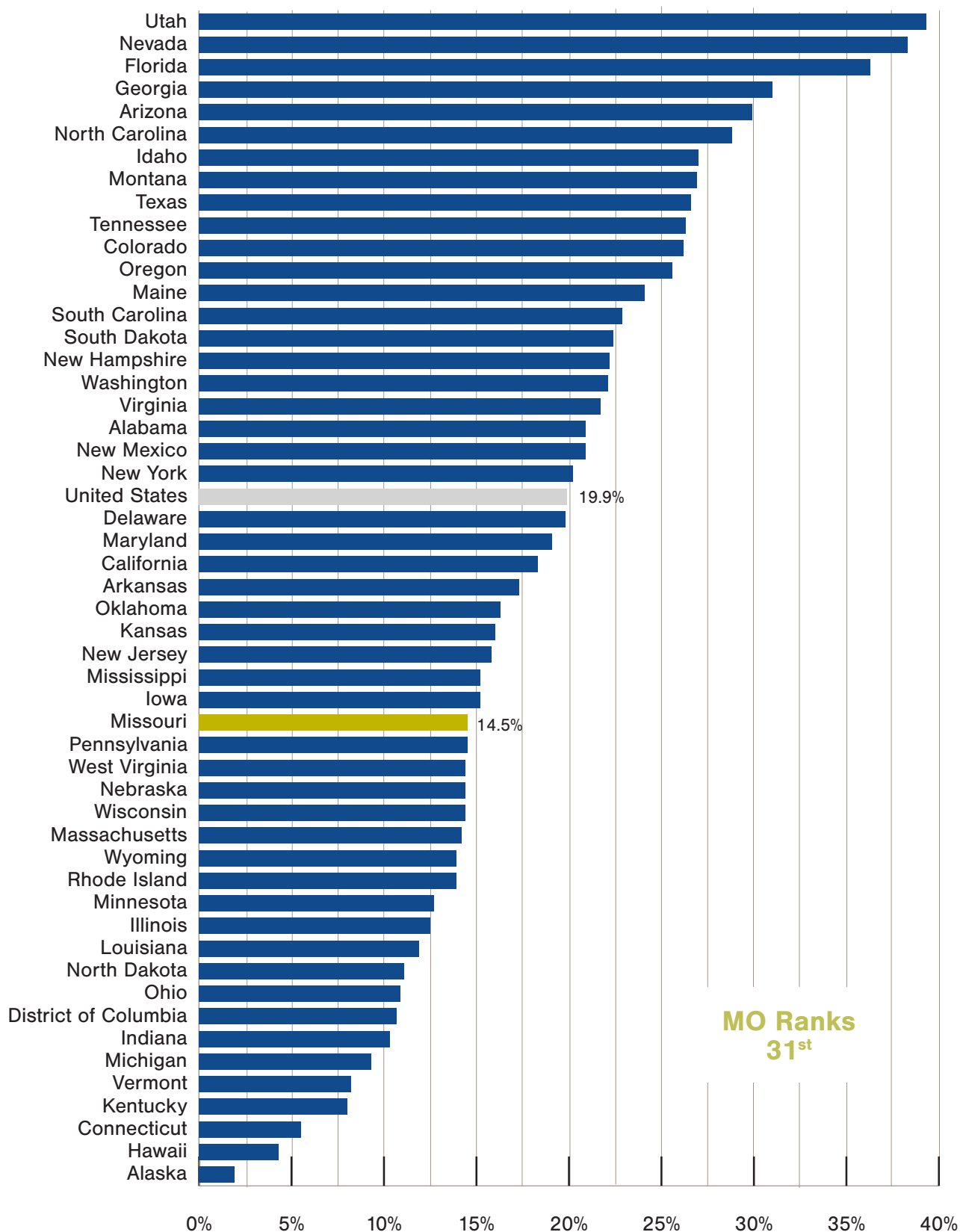
### Tech Occupations Employment Concentration, 2022



Source: EL calculations based on Lightcast 2023.4

Like the data for the tech and IT industries, growth in state employment for tech occupations was robust from 2017 to 2022. Tech occupations grew by 14.5 percent, but this growth was still lower than the national average and many other states.

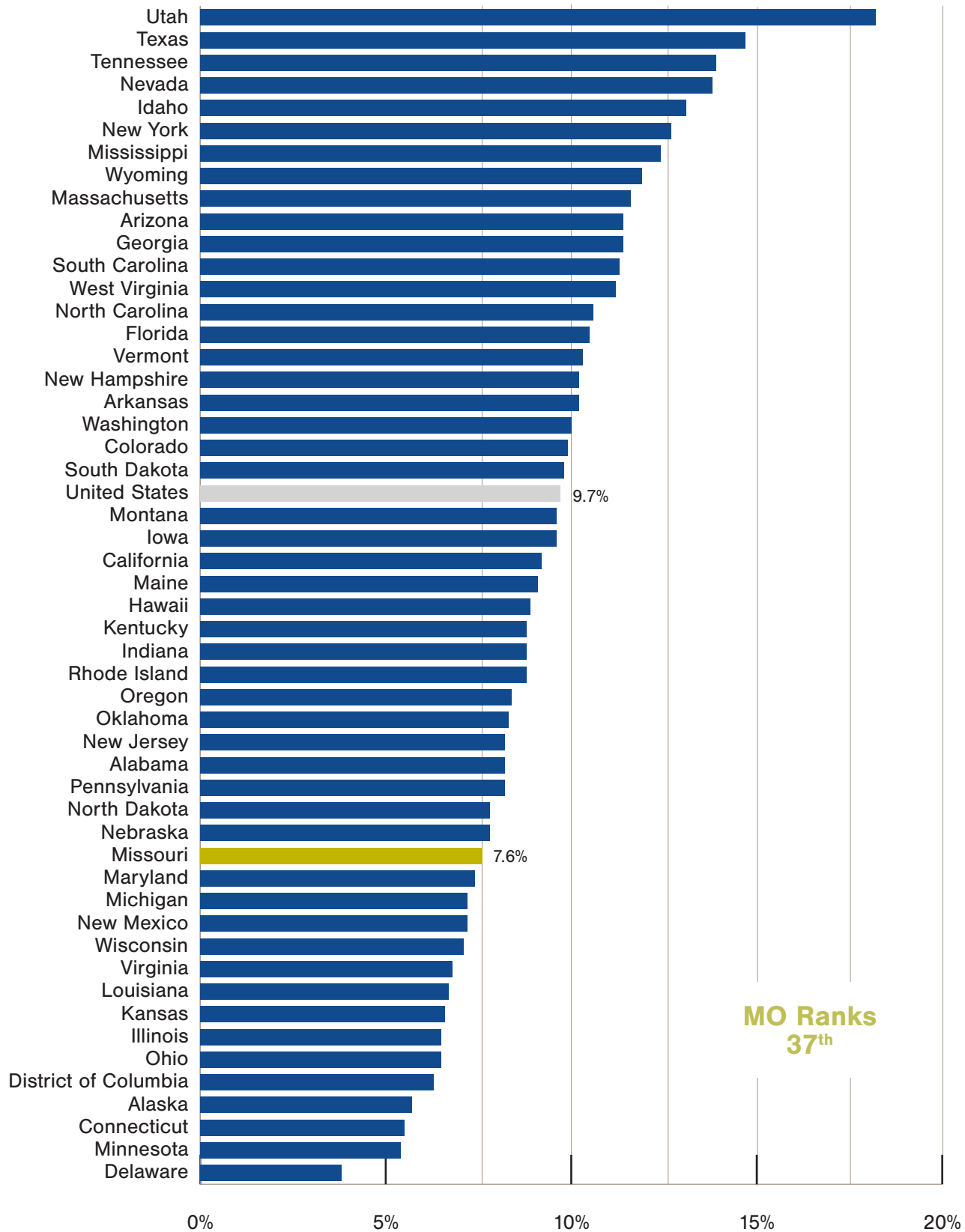
### Tech Occupations Job Change, 2017–2022



Source: EL calculations based on Lightcast 2023.4

Using Lightcast's models of forecasted growth, Missouri is expected to grow its tech occupations by 7.6 percent by 2028. This ranks the state 37th in predicted growth. While tech occupations are a crucial part of job growth within Missouri, this growth is just not as strong as other states are experiencing.

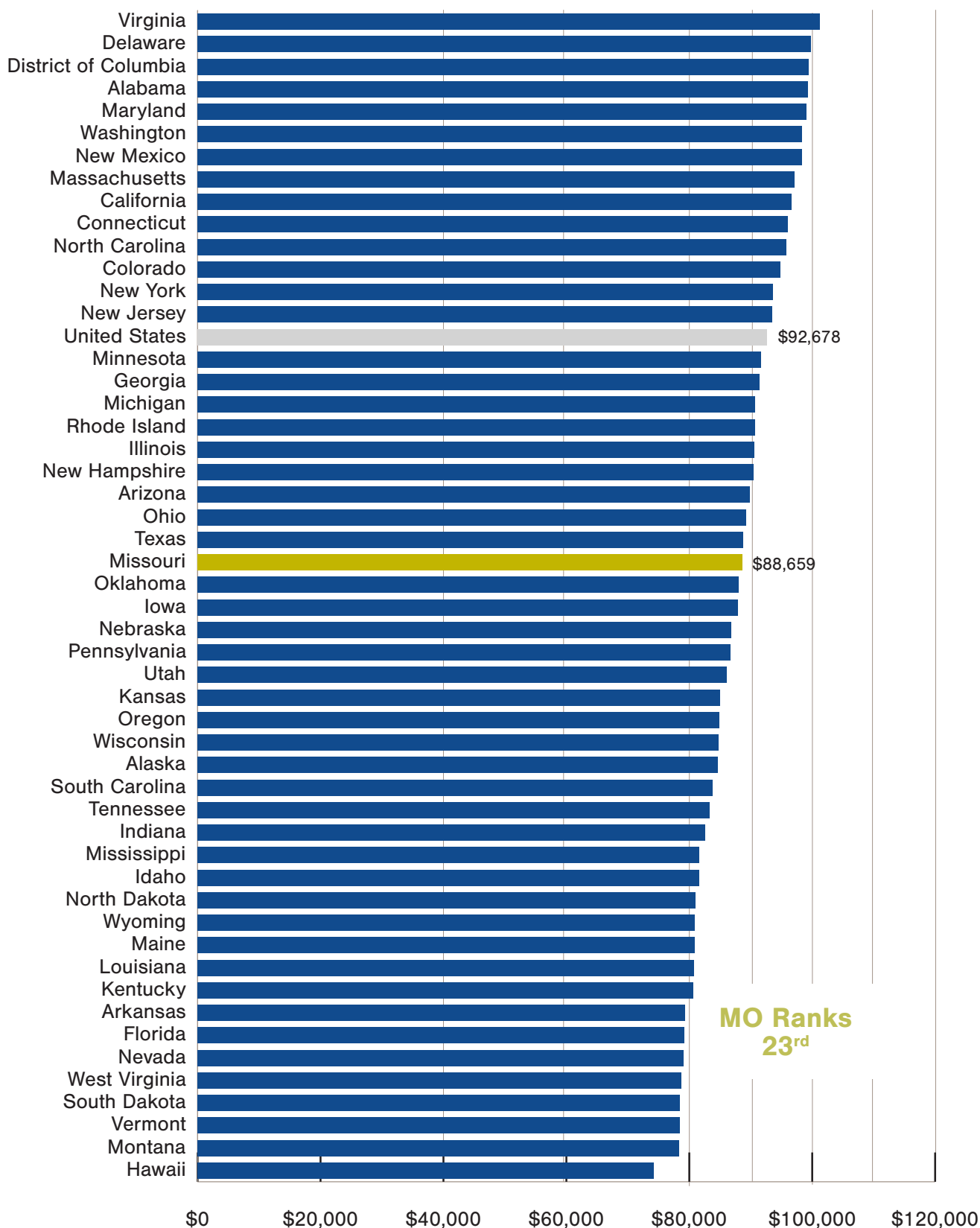
### Predicted Tech Occupations Job Change, 2023–2028



Source: EL calculations based on Lightcast 2023.4

When evaluating tech occupations, median annual earnings data is available. For the tech industry analysis, only average annual earnings data is available, which can be skewed by the presence of outliers. This median estimate provides us with the middle of the bell curve measure on wages. The typical tech worker in Missouri earns around \$88,700 a year when accounting for purchasing power by state. The state ranks in the top 25 for this metric.

### Tech Occupations Median Annual Earnings Adjusted for Purchasing Power, 2022



Source: EL calculations based on Lightcast 2023.4

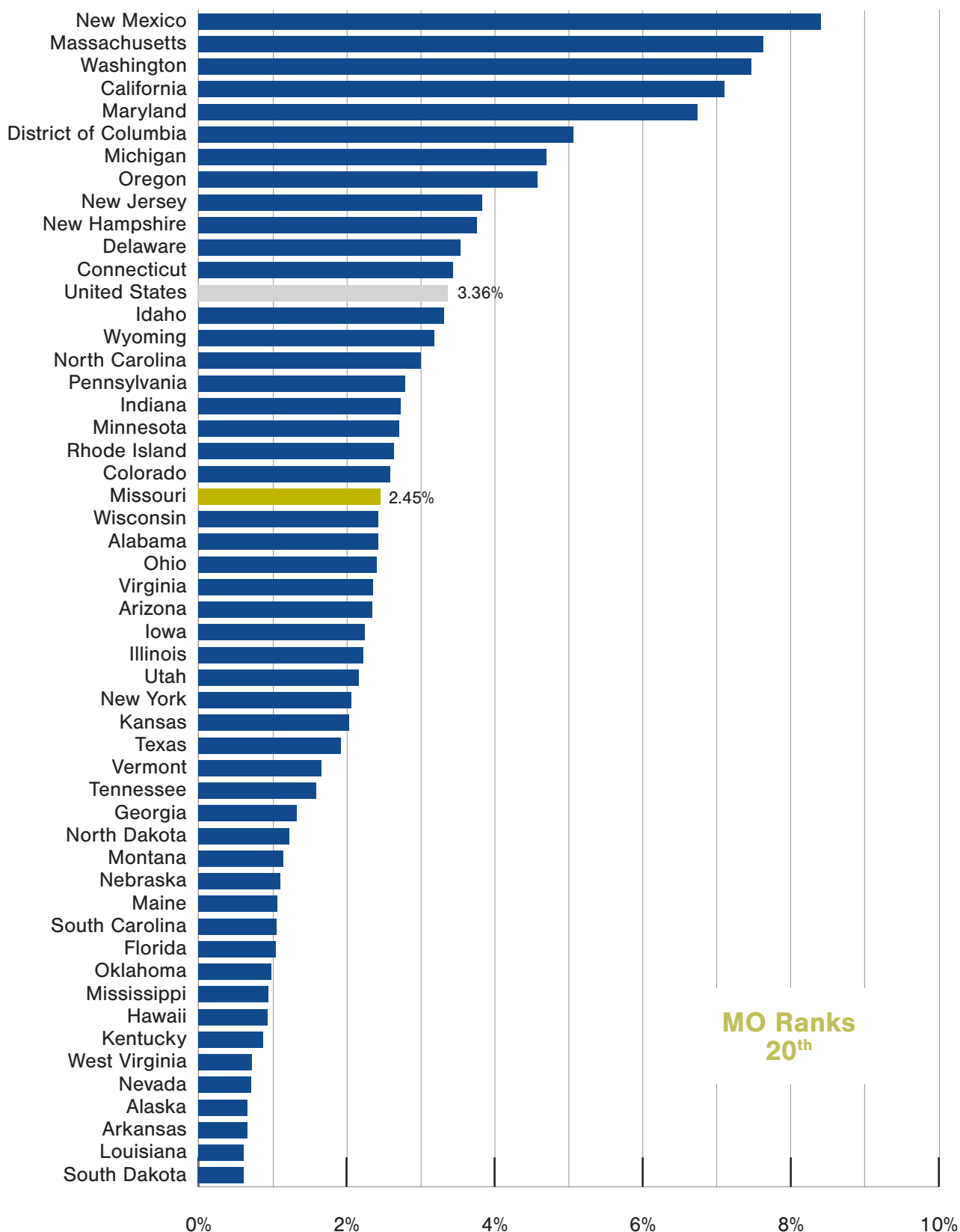


Research and development funding is a major component of a technology sector's infrastructure. Research and development funding helps companies and universities develop new technologies that can be commercialized and spur tech growth. We looked at the total obligations, including federal, state and private funding sources, across all states and found that Missouri ranks 20th across the states in this indicator. As the chart shows, significant amounts of federal research and development is concentrated in the states with large federal facilities. New Mexico understandably ranks first in this list with its high levels of funding to federal labs, Los Alamos National Lab and the Sandia National Laboratory, relative to the state's gross product.

## Tech Occupation State Comparisons

Funding Source	MO Ranking
Federal	35th
Business	16th
Academic	20th
Non-Profits	25th
State	24th
<b>Total Research and Development</b>	20th

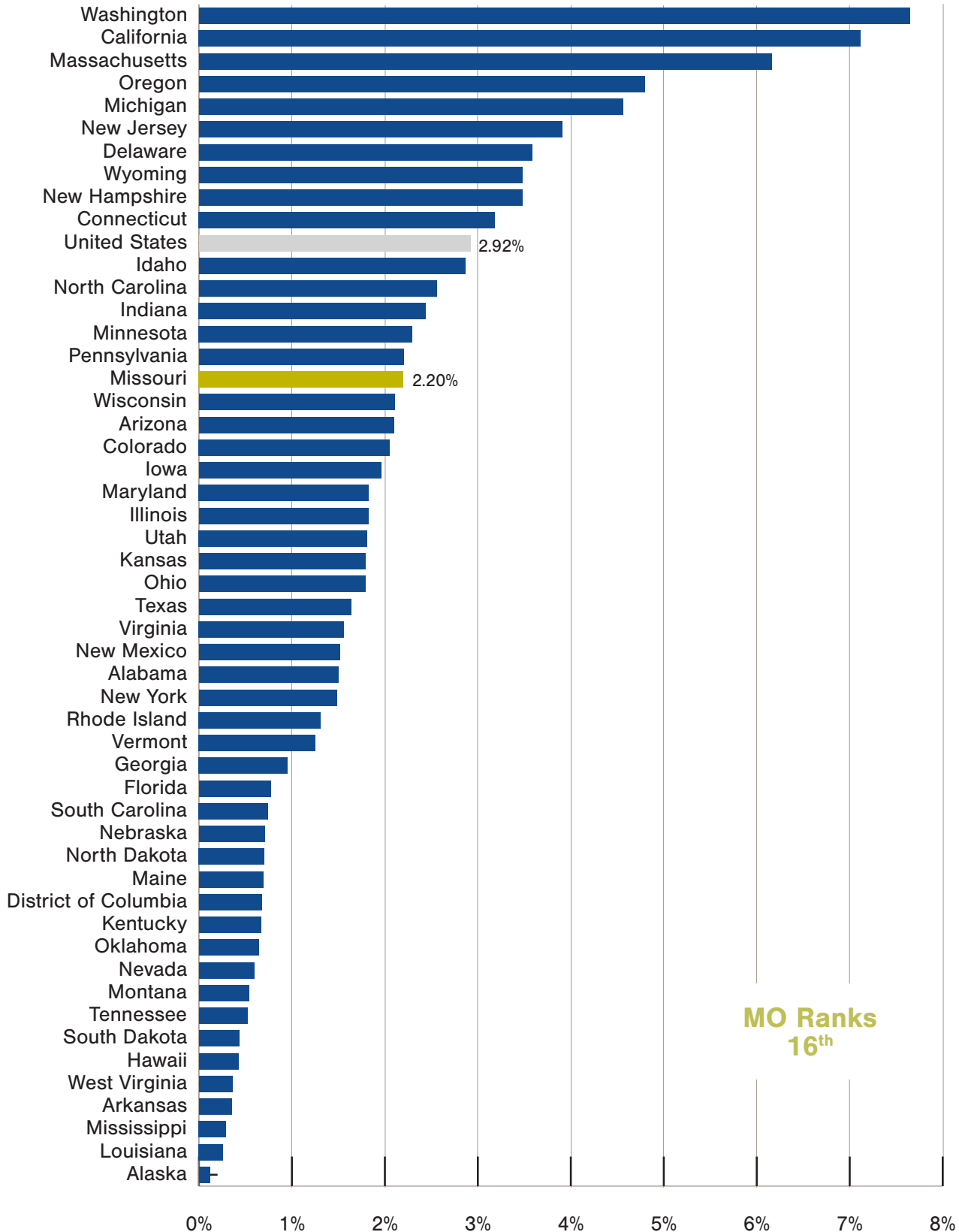
### Total Research and Development as a Percentage of GDP, 2020



Source: EL calculations based on NSF (2023) and BEA (2023)

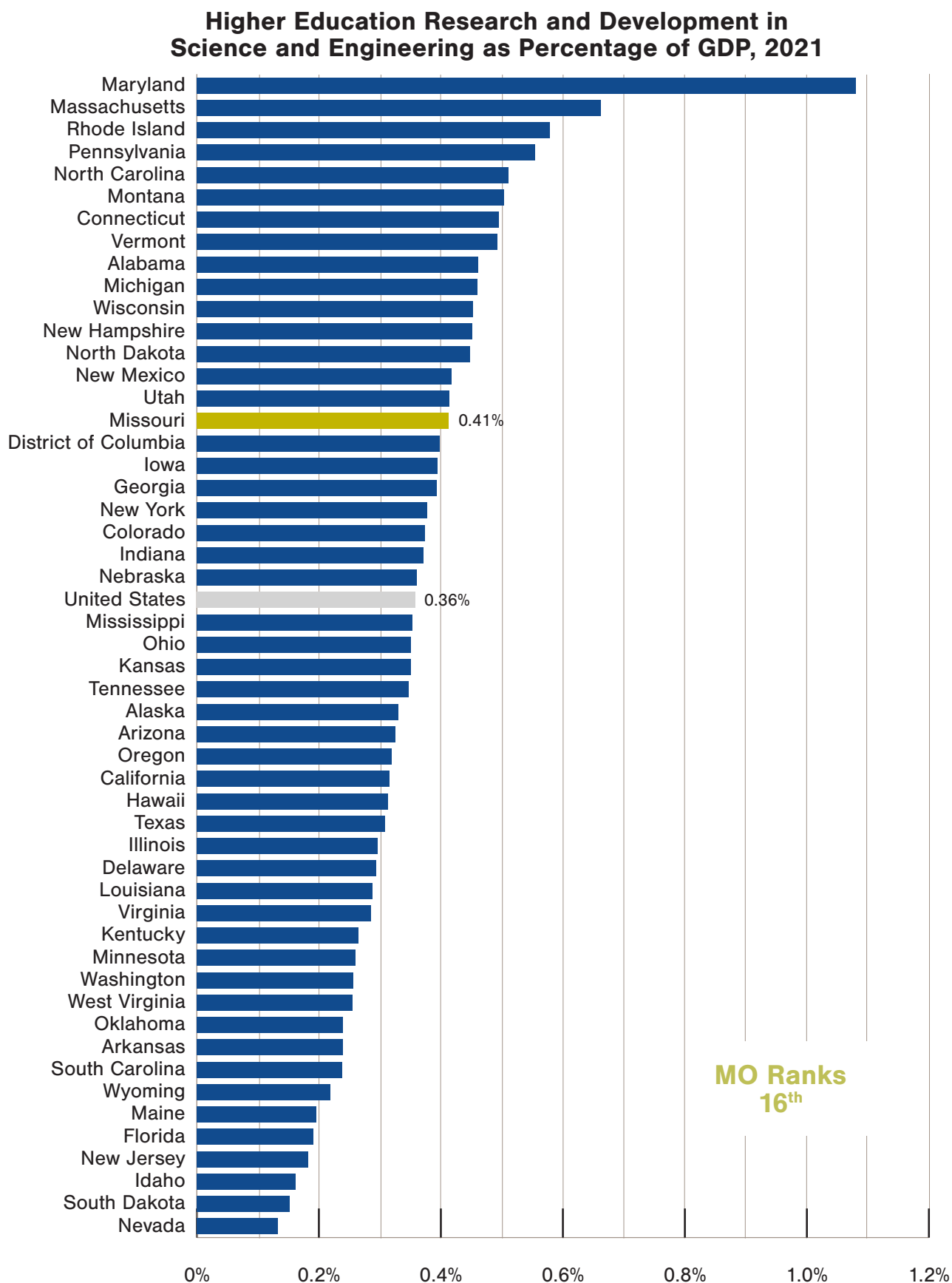
Missouri's highest ranking by research and development source is from the private sector. This is the amount of private research and development spending as a percentage of the state's private output. This demonstrates research and development driven by companies themselves for profit driven innovation. Business performed research and development funding made up 2.2 percent of Missouri's private GSP in 2020, ranking it 16th among the states.

### Business Performed Research and Development as Percentage of Private GDP, 2020



Source: EL calculations based on NSF (2023) and BEA (2023)

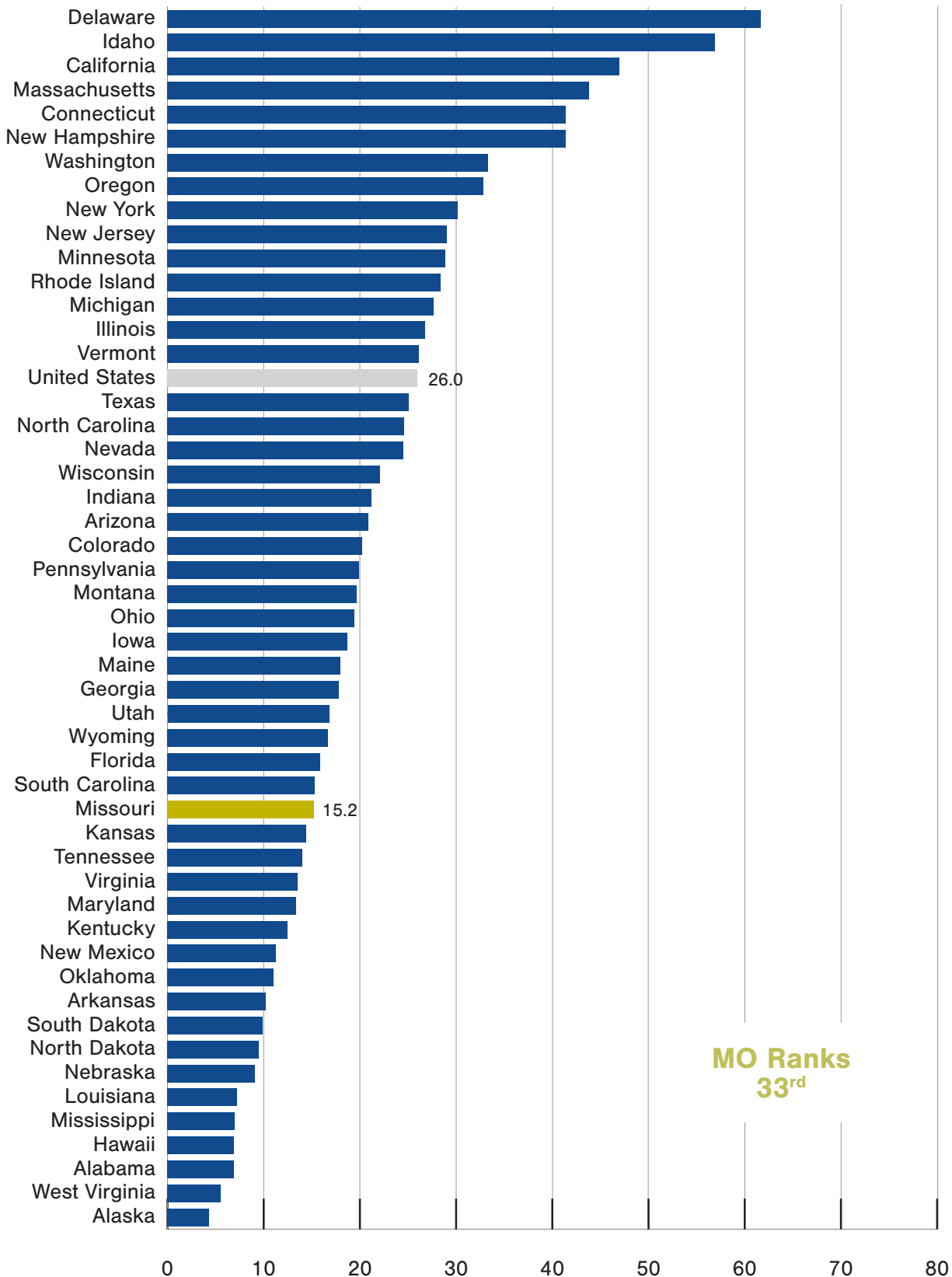
Another indicator of relevant research and development funding is science and engineering funding in higher education. The technology that comes from this research can be spun off to create new companies. Missouri ranked 16th amongst all states and above the national average in 2021.



Source: EL calculations based on NSF (2023) and BEA (2023)

Patents are another indicator of the level of innovation occurring in a place. Patents usually spur growth, particularly in high-cost industries like pharmaceuticals. For this metric, patents are standardized by the number of science and engineering workers. Missouri averaged 15.2 patents per 1,000 science and engineering workers in 2022. This ranks 33rd among all states.

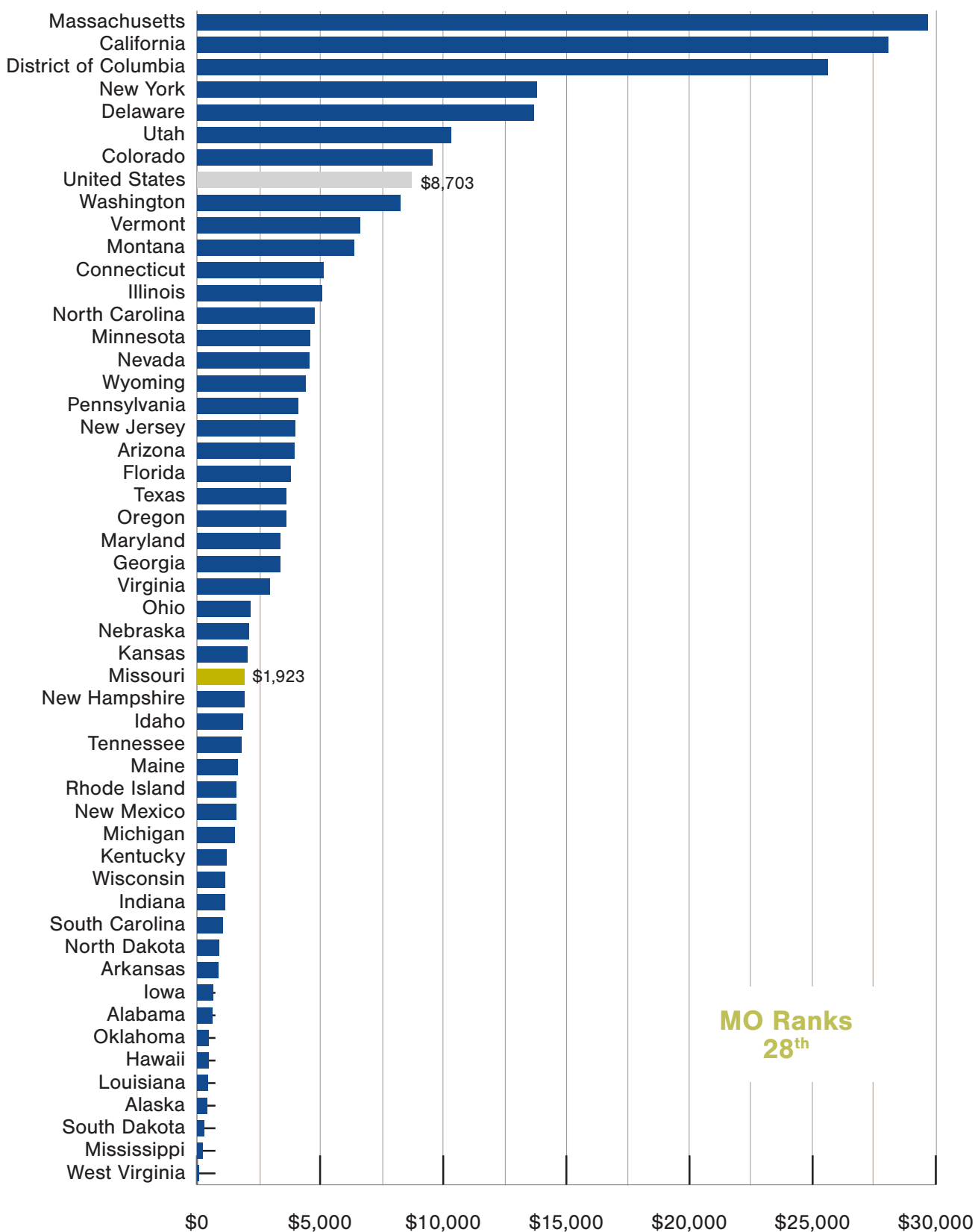
### Patents Issued Per 1,000 Science and Engineering Workers, 2022



Source: EL calculations based on USPTO (2023) and Lightcast 2023.4

Venture capital is often an essential tool for start-up companies to grow into a tech leader and to get to market quickly. Traditional tech economies like California, Massachusetts and New York are still accumulating much of the nation's venture capital. This year the state ranked in 28th place, but the overall value of venture capital funding in Missouri has risen in recent years.

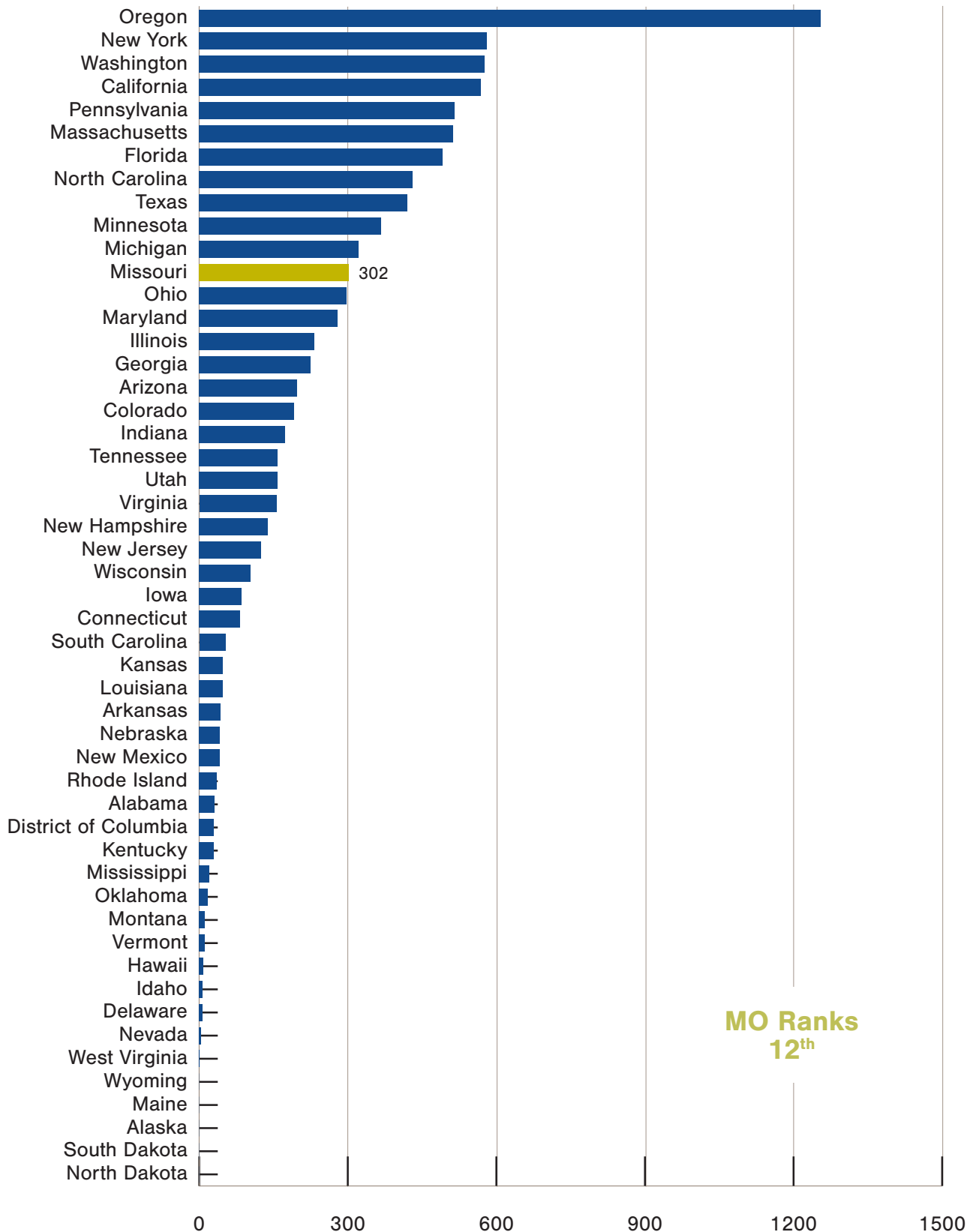
### Venture Capital Invested Per \$1 Million of GDP, 2017–2022



Source: EL calculations based on NVCA (2023) and BEA (2023)

Technology transfer utilizes the innovation assets at universities and turns them into commercialized opportunities. The ability of a state to capitalize on its research capabilities and turn them into marketable concepts means more tech start-ups and jobs. In 2022, Missouri ranked 12th among states in terms of options and licenses that its universities were able to execute.

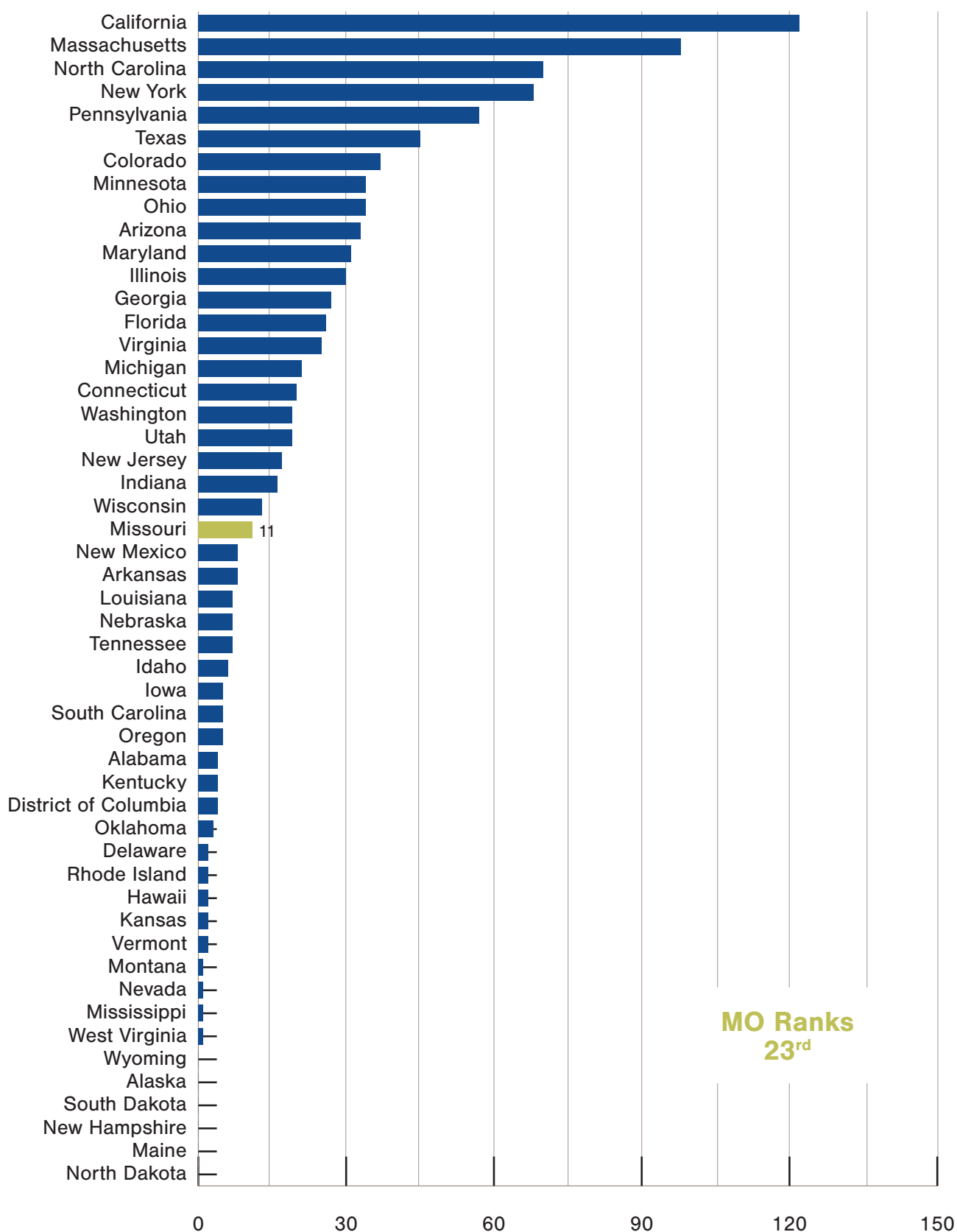
### Technology Licenses and Options Executed from Universities, 2022



Source: AUTM (2023)

Another measure of technology transfer, the number of start-ups from universities, can indicate the level of entrepreneurship interest within a state's universities as well as its ability to convert research assets and public funding into economic opportunities. Missouri had the 23rd highest number of start-ups spun off from its universities in 2022 with 11 new companies established.

### Start-Ups from Universities, 2022

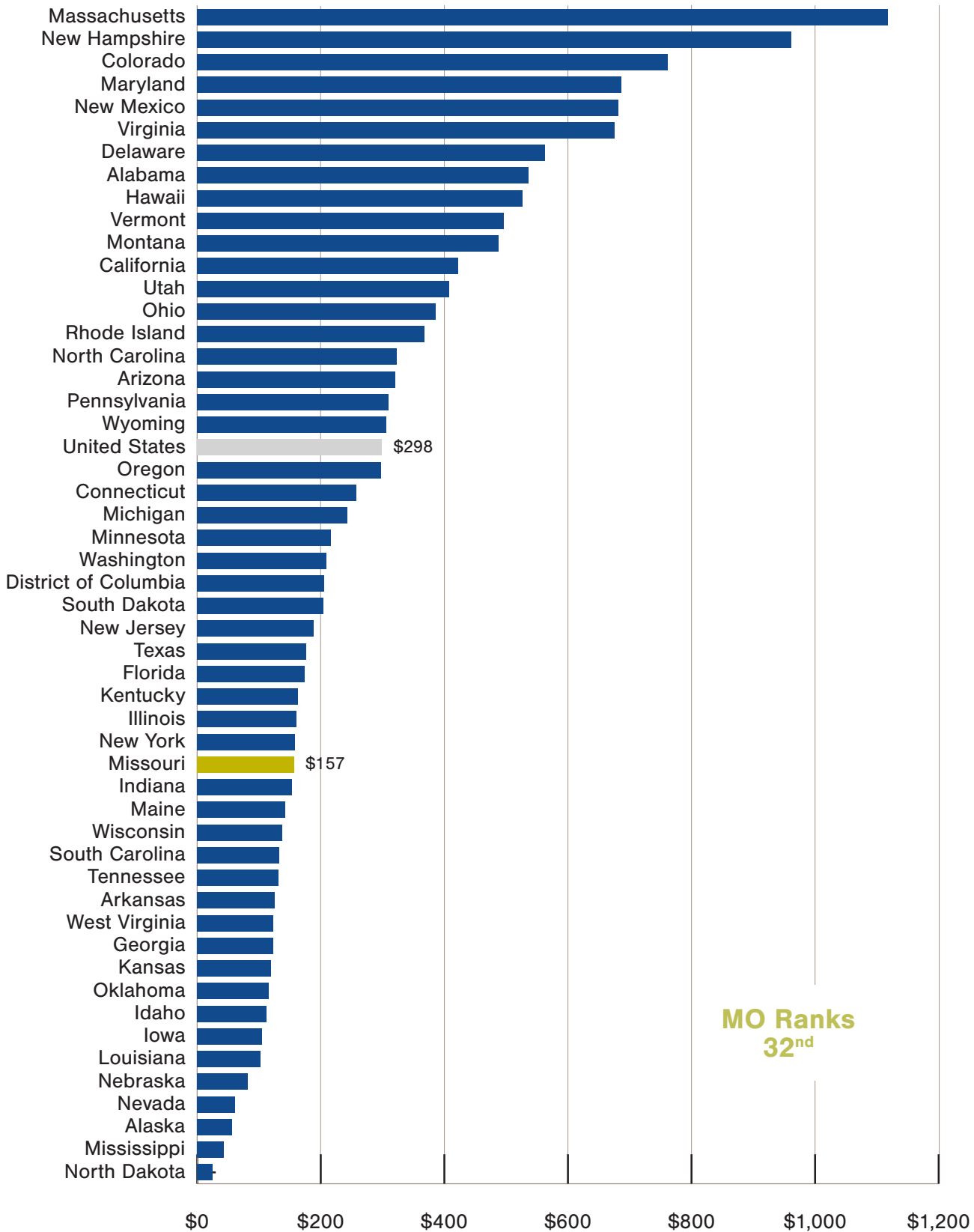


Source: AUTM (2023)



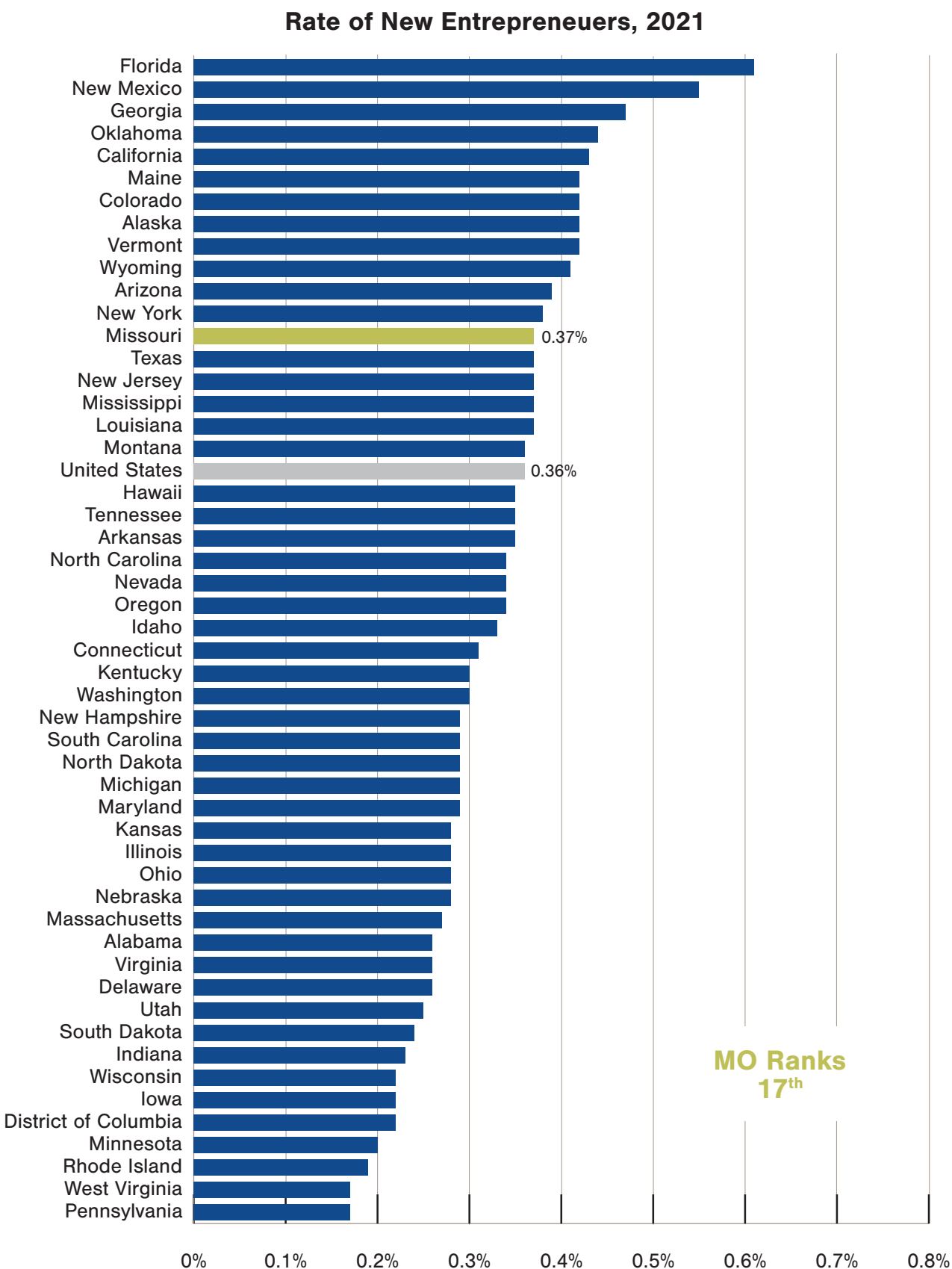
The federal government's SBIR/STTR funding program supports and encourages innovation in small business. The program acts as an angel investor and helps high-tech concepts move toward commercialization. Missouri funding per \$1 million in GSP averaged less than the national average and ranked 32nd amongst other states. Helping local start-ups apply and receive SBIR/STTR funding can lead to critical early-stage funding for high-reward concepts.

### SBIR and STTR Funding Per \$1 Million of GDP, 2017–2022



Source: EL calculations based on SBIR (2023) and BEA (2023)

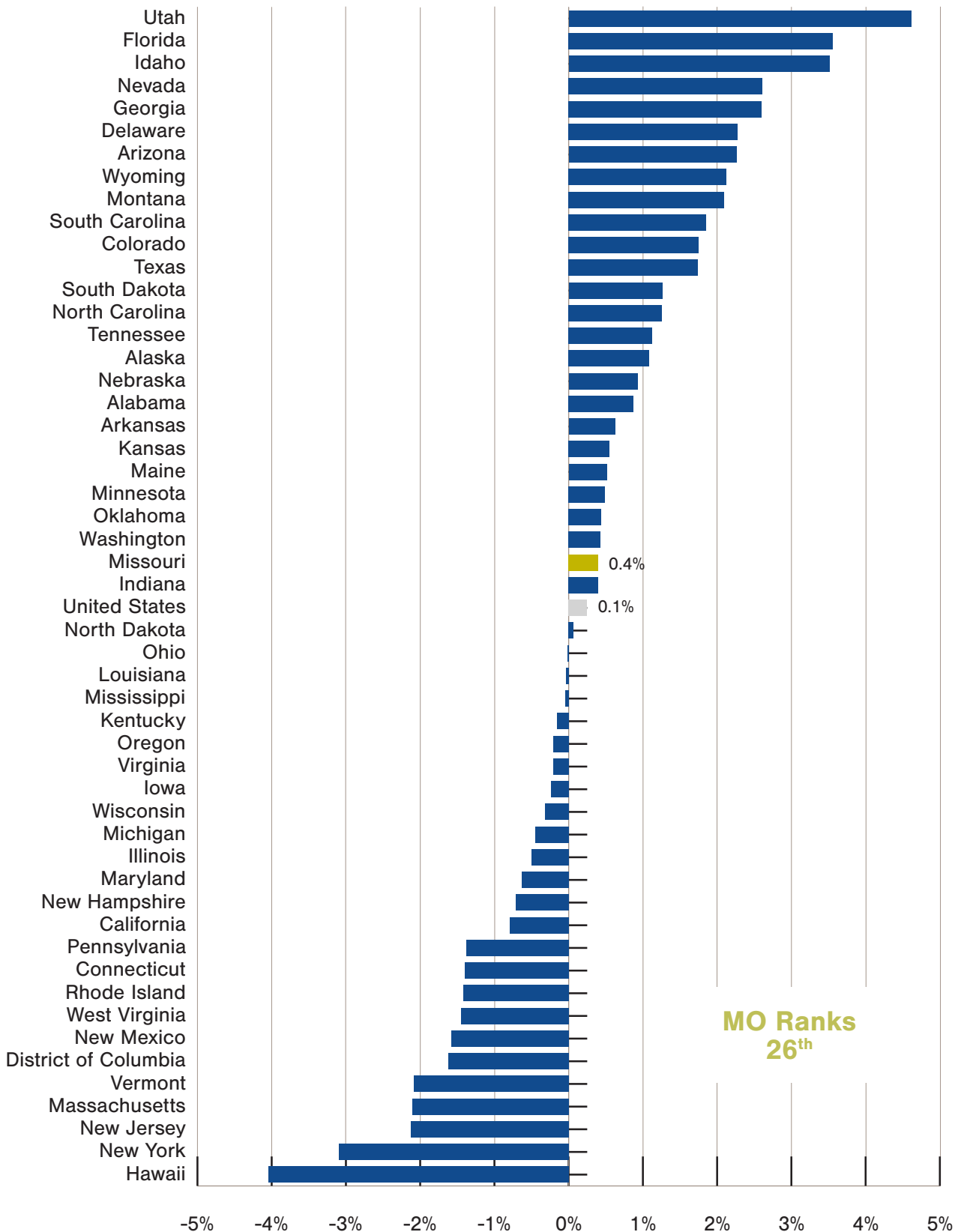
Entrepreneurs are the lifeblood of a knowledge-based economy. Each year the economy is replenished and re-energized by entrepreneurial activity. Businesses that originate in one location often look to grow in that same region. In 2021, out of 100,000 people about 370 people started a new business in Missouri. Missouri ranks 17th across the nation and just higher than the national average.



Source: Kauffman Foundation (2022)

The U.S. Census Bureau tracks the number of companies opening and those who close. Comparing the rates of entrance and exit can provide a measure of business dynamism, an indicator of churn and innovation in an economy. Most of the job growth in an economy comes from new businesses. Missouri ranked 26th overall in this metric but was higher than the national average.

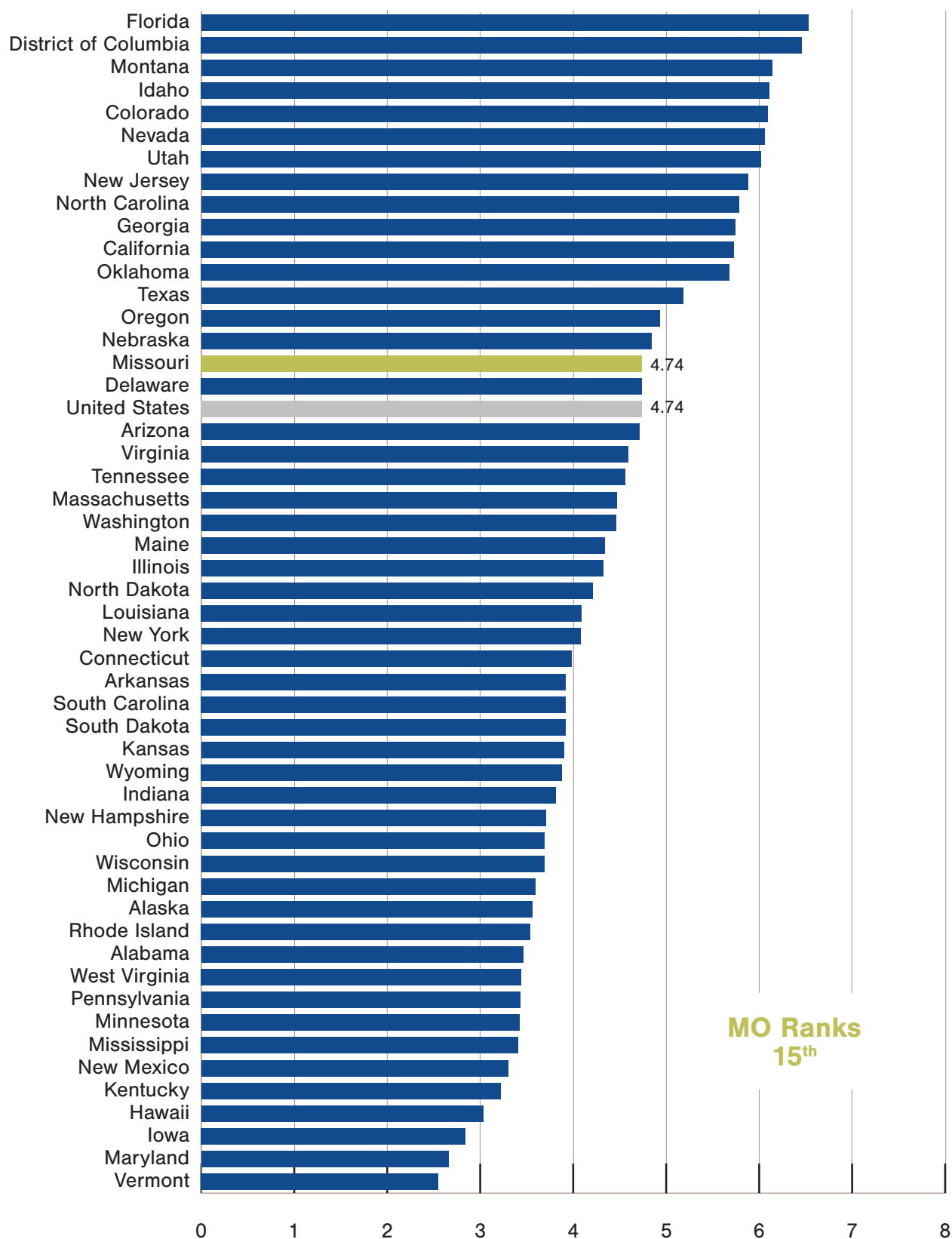
### Business Opening vs Closing Rate, 2021



Source: US Census Bureau (2023)

Another metric for the churn of new companies is the start-up job creation rate. This is the average number of jobs created by a start-up in their first year. For Missouri, this rate was an average of 4.74 employees for each start-up, ranking the state in the top 15 states for this metric.

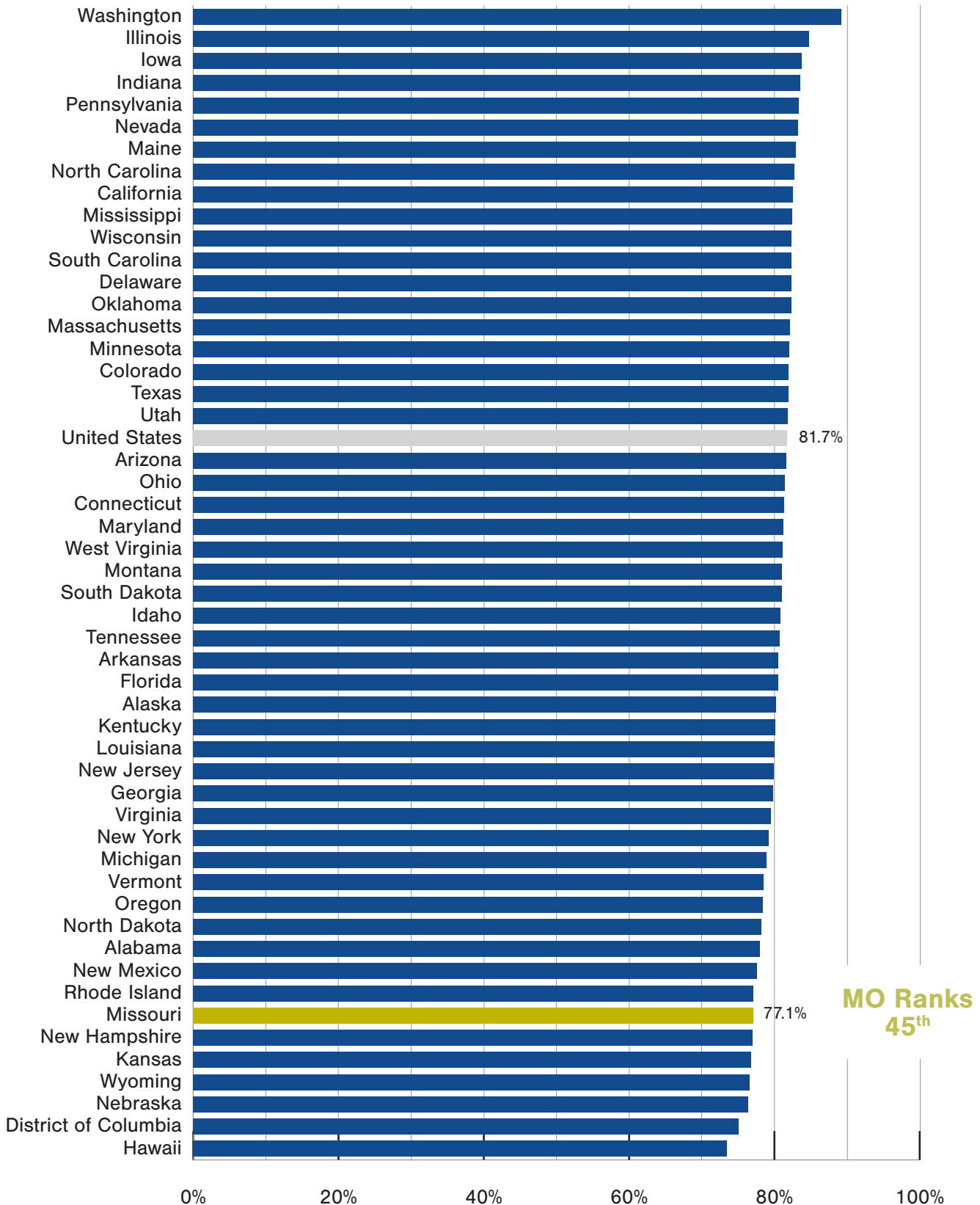
### Start-Up Early Job Creation Rate, 2021



Source: Kauffman Foundation (2022)

The final entrepreneurial indicator looks at the one-year survival rate of start-ups. In 2021, Missouri's survival rate was 77.1 percent. This was the 45th highest (5th lowest) ranking in the country. Missouri start-ups might need more wraparound support to help bring concepts to market and last.

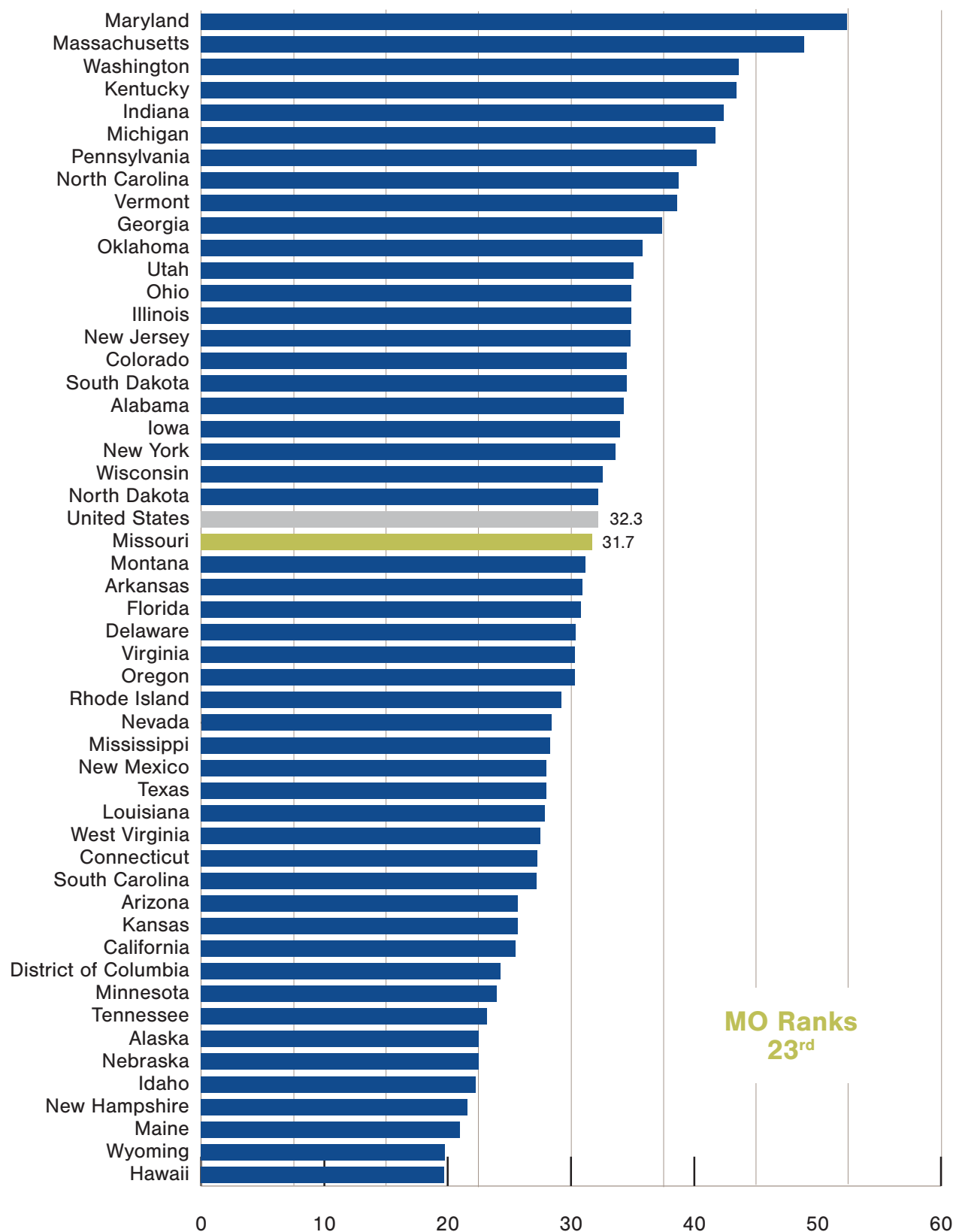
### Start-Up Early Survival Rate, 2021



Source: Kauffman Foundation (2022)

One of the essential components of infrastructure for a knowledge-based economy is a skilled labor force. Tech occupations often require STEM degrees for entry-level positions. In 2022, Missouri saw its students complete 10,100 education programs that were focused on STEM. This value is standardized by the number of enrolled postsecondary students in each state. Missouri averaged about 32 completed STEM programs per one thousand students. This rate is just below the national average and the state ranks 23rd.

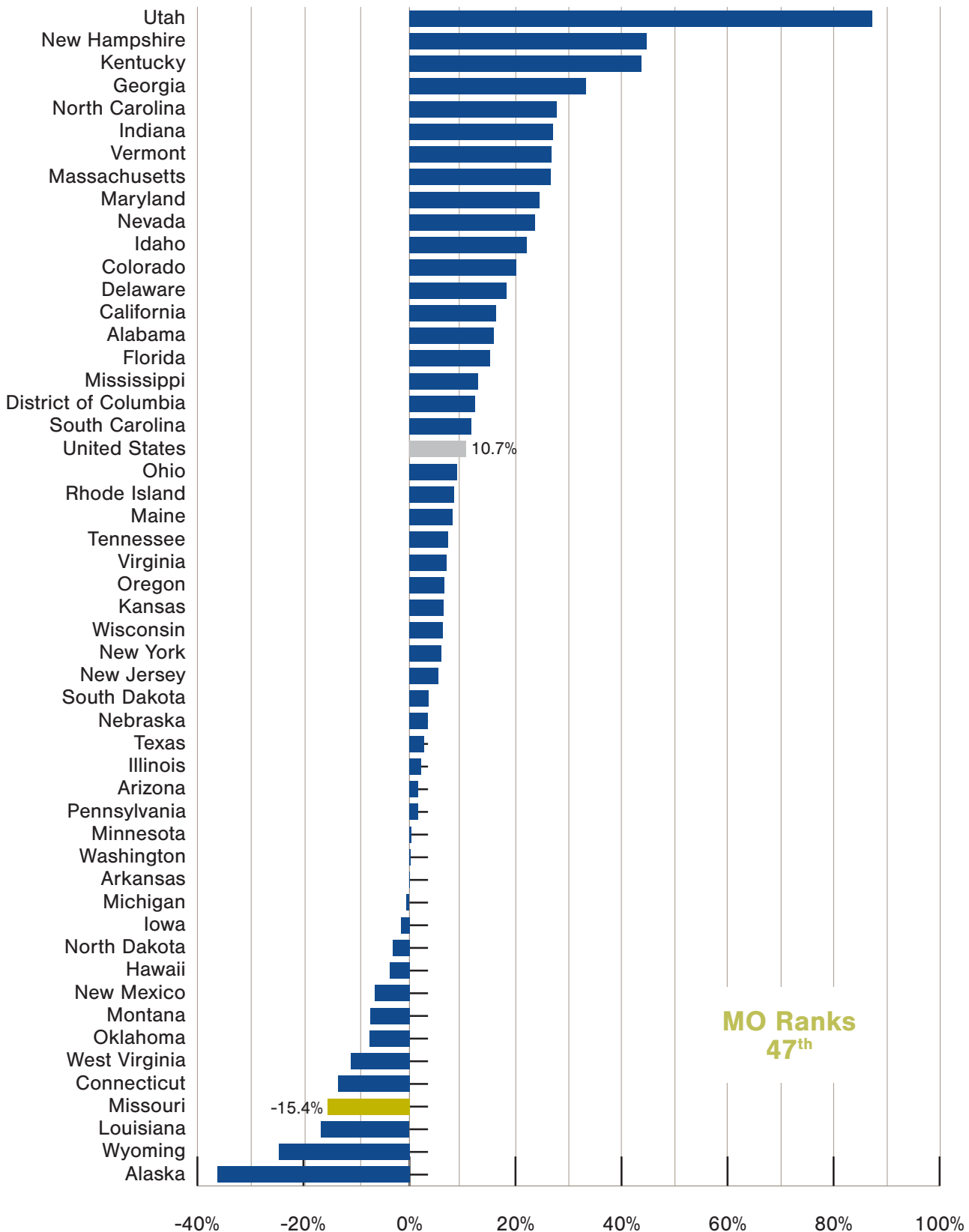
### Completed STEM Education Programs Per 1,000 Enrolled Students, 2022



Source: EL calculations based on Lightcast 2023.4 and NCES (2022)

Over the past few years, many states have focused their efforts on growing the number of STEM students in their educational systems. But change in STEM program completions from 2017 to 2022 indicate that Missouri is producing fewer STEM graduates. Missouri's STEM decline of 15.4 percent ranks the state 47th.

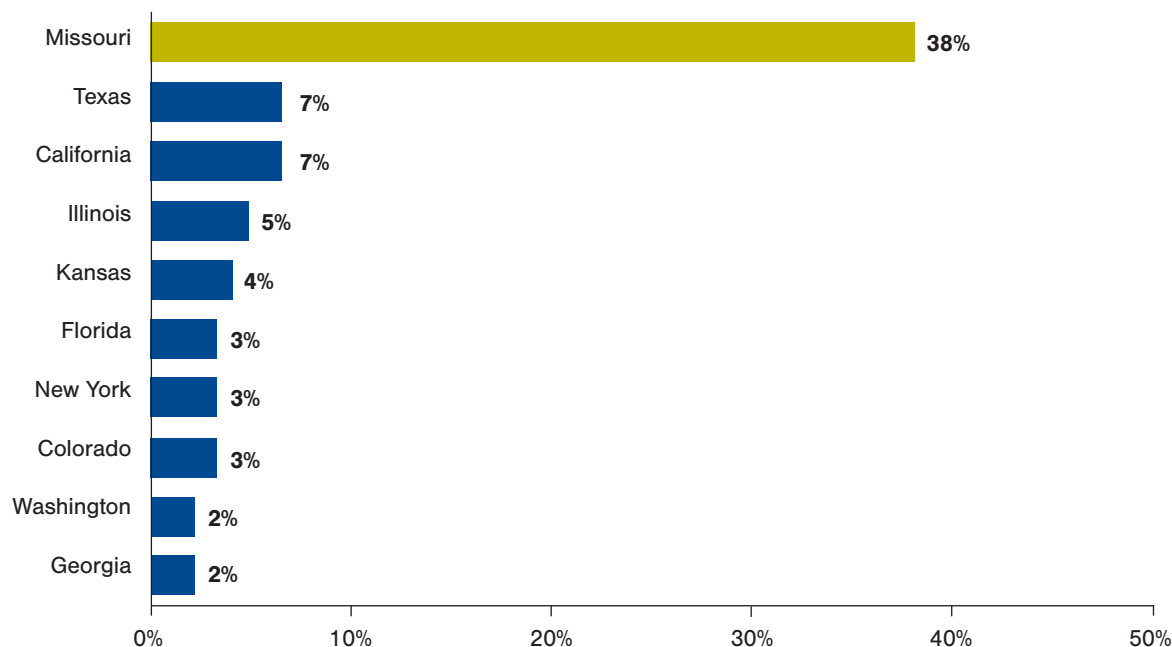
### Percent Change in STEM Education Program Completions, 2017–2022



Source: EL calculations based on Lightcast 2023.4

When online professional profiles for individuals who had received a STEM degree, award or certificate from a Missouri postsecondary institution were reviewed, about 38 percent were currently working in Missouri. While this analysis of online profiles is not a total accounting of all the STEM graduates coming out from Missouri schools, it does provide some indication that the majority do not stay and work in the state. This highlights how connecting local postsecondary institutions with local employers can help expand the local tech labor pool.

### Current Location of STEM Program Completers from Missouri Schools



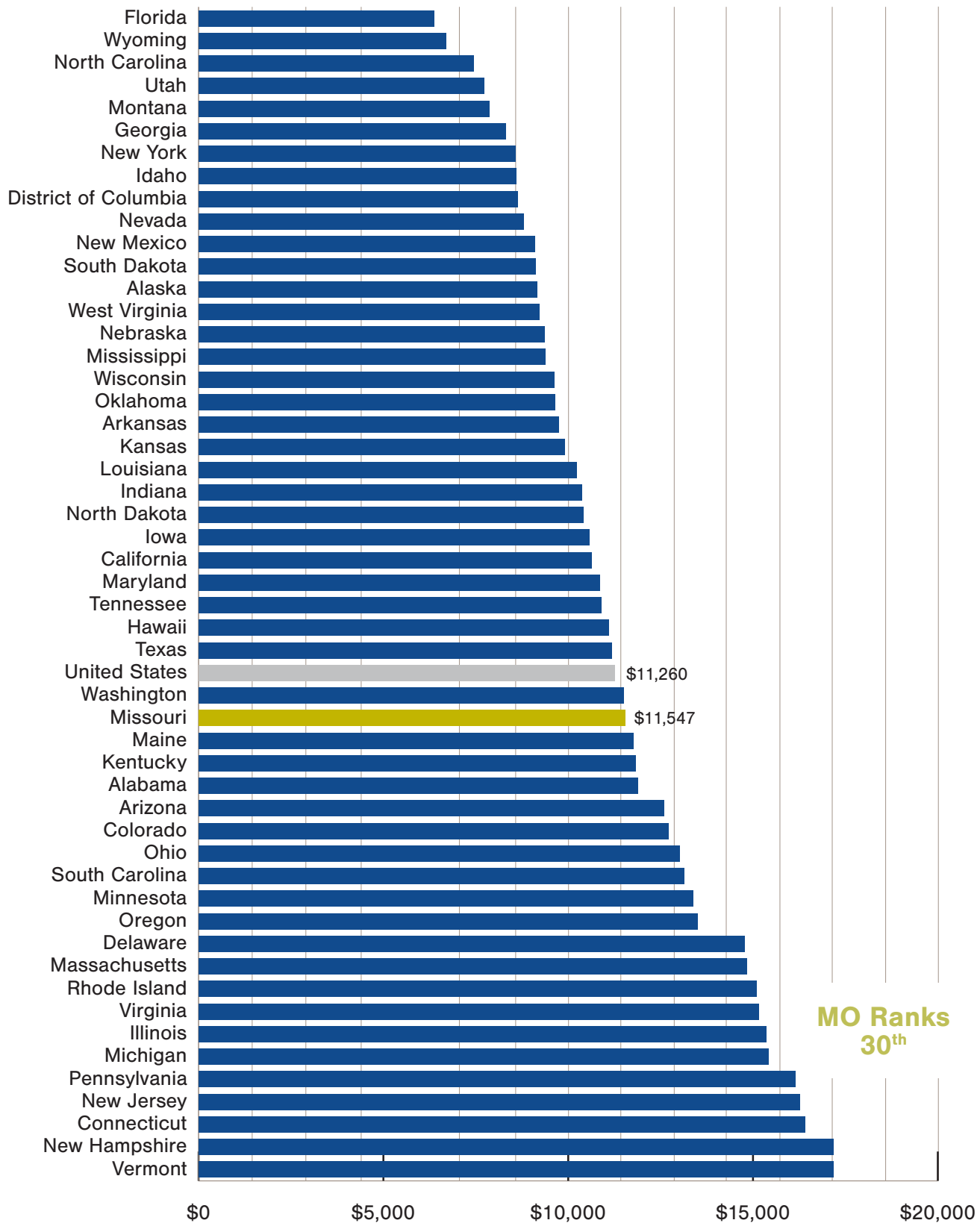
Source: Lightcast 2023.<sup>4</sup>

Note: This data comes from individuals who have updated their online profile since 2018.



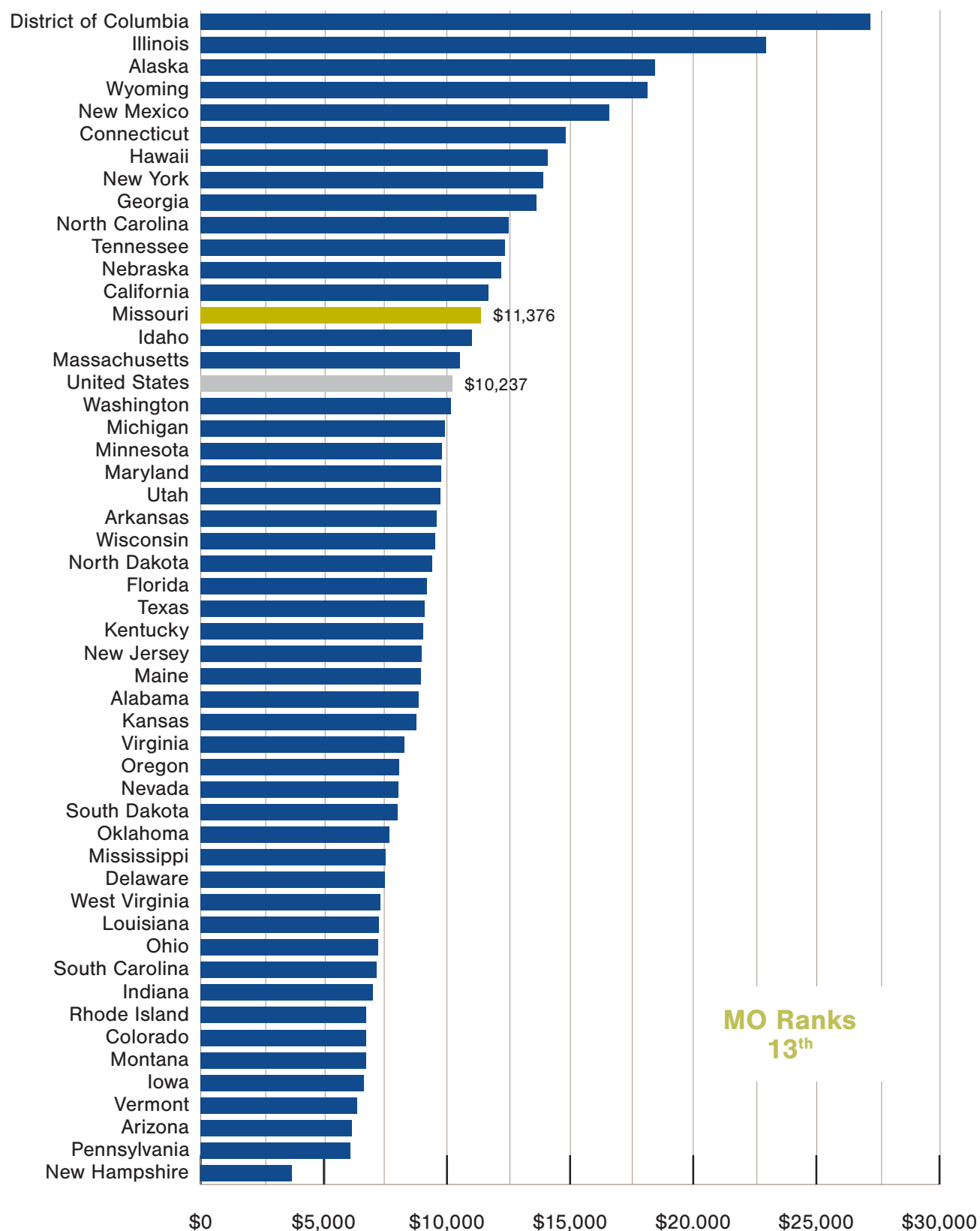
Students are looking to achieve their education with the lowest debt burden. Missouri tuition ranks in the middle of the pack at 30th. The cost of \$11,547 is just slightly more expensive than the national average. One of the reasons tuition costs are rising across all states is that funding for higher education was reduced during the Great Recession. Tuition increases have not been able to offset decreases in funding, resulting in reduced offerings at colleges and reduced research faculty. Still, Missouri boasts the 13th highest level of higher education funding per student.

### Average In-State Tuition, 2023–2024



Source: College Board (2023)

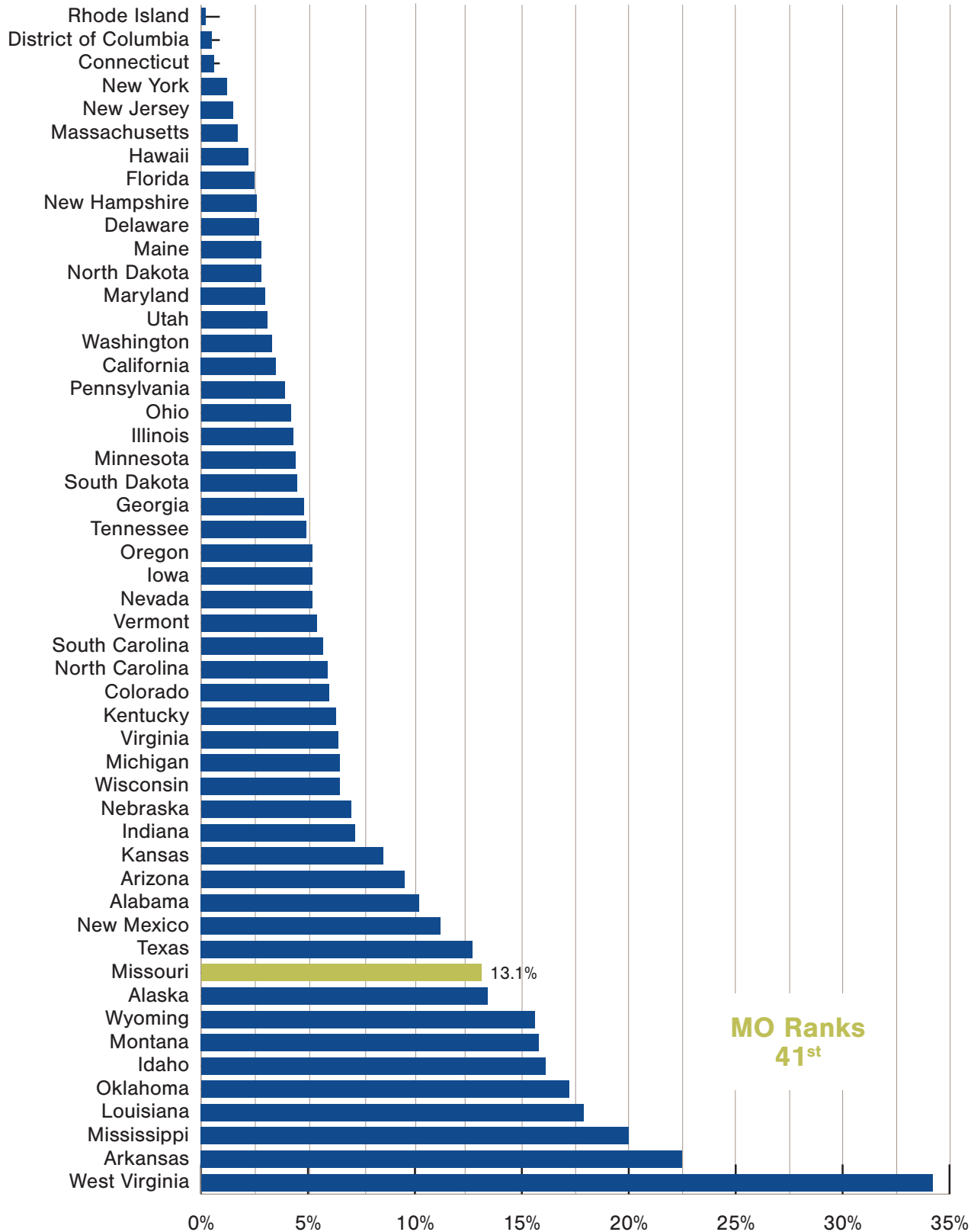
### State Investment in Higher Education Per FTE Student, 2022



Source: SHEF (2023)

High-speed broadband internet is a priority for many states and a good indicator of connectivity for a knowledge economy. Access is the first step in making sure everyone can be plugged into the information economy. The FCC defines broadband access at 25 megabytes per second (Mbps) for downloading and 3 Mbps for uploading. At this threshold, researchers found that over 13 percent of Missouri's population lacked access to this level of broadband in 2023. The state ranks in the bottom third of the country at 41st place.

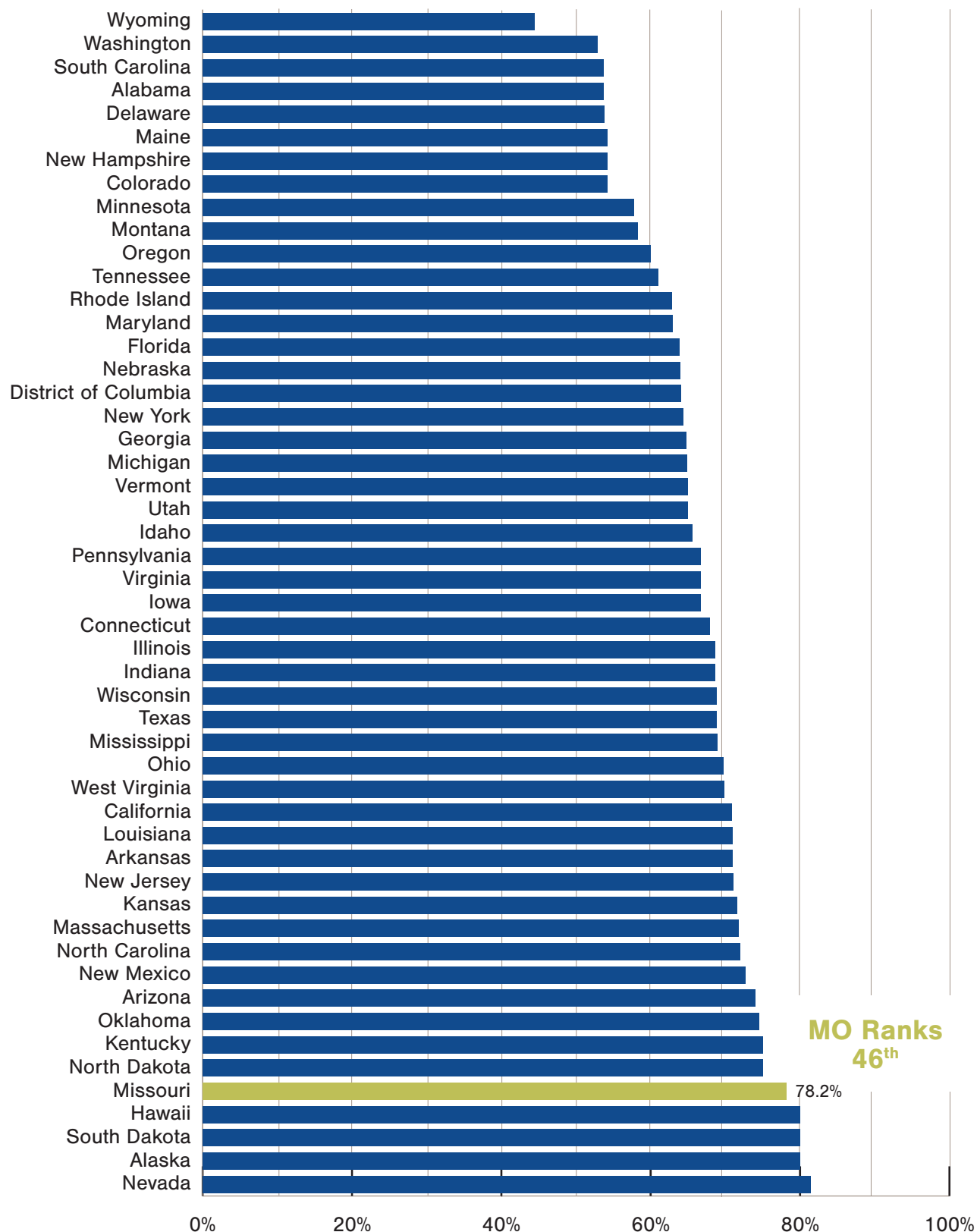
### Percentage of Population Without Access to High-Speed Broadband, 2023 (100/25 Mbps)



Source: BroadbandNOW Research (2023)

The availability of broadband must be paired with adoption by communities to ensure that all households are connected to the internet. Research has shown that adoption has a stronger link to economic benefit than just broadband availability. The central piece to adoption is affordability. Affordable plans were defined as under \$60 per month in 2023. Most Missourians, about 78.2 percent, do not have access to high-speed broadband at an affordable price. Missouri ranks even lower than regular broadband access at 46th when affordability is included. This indicates broadband pricing is making adoption difficult for many in the state.

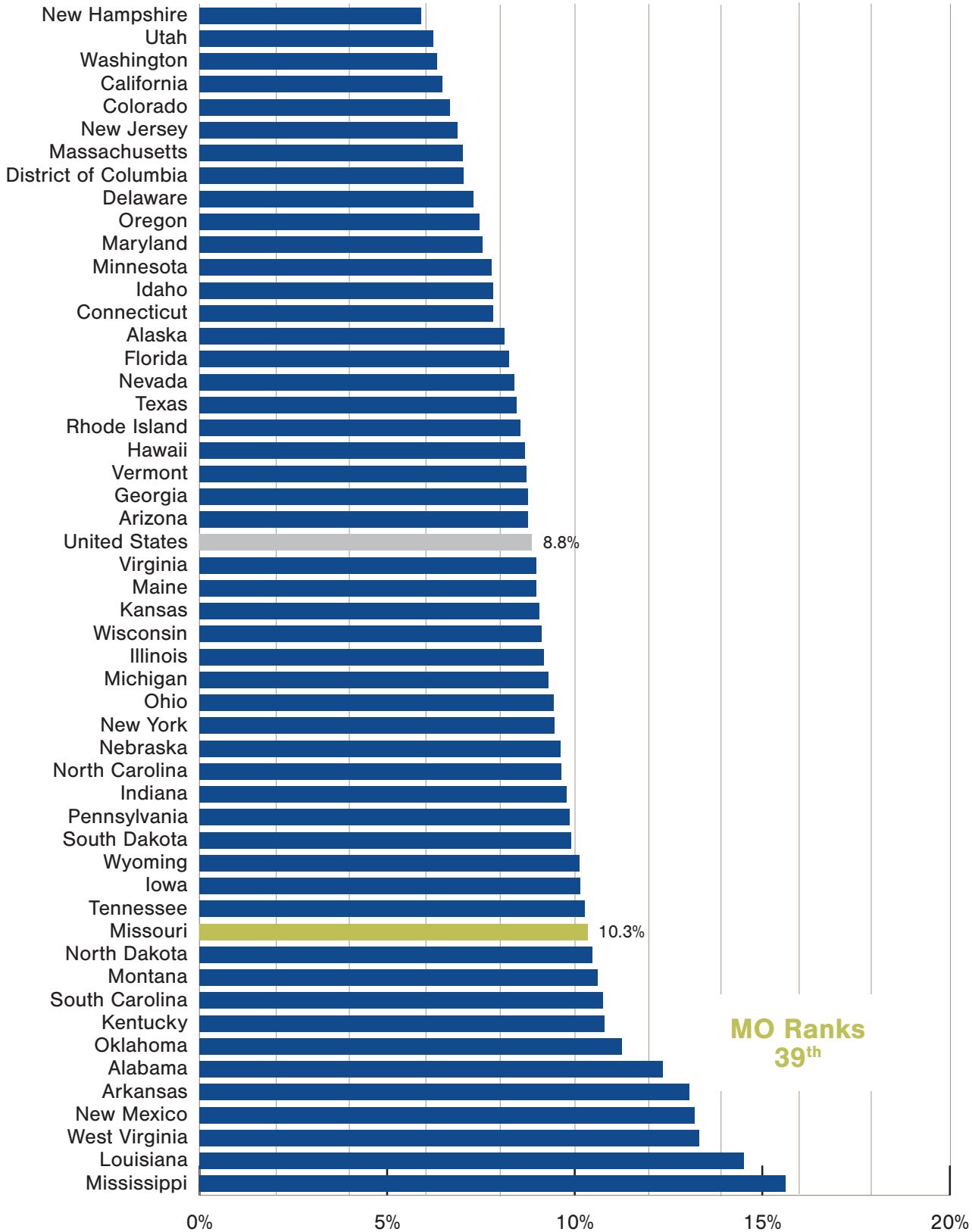
### Percentage of Population Without Access to Affordable Broadband, 2023



Source: BroadbandNOW Research (2023)

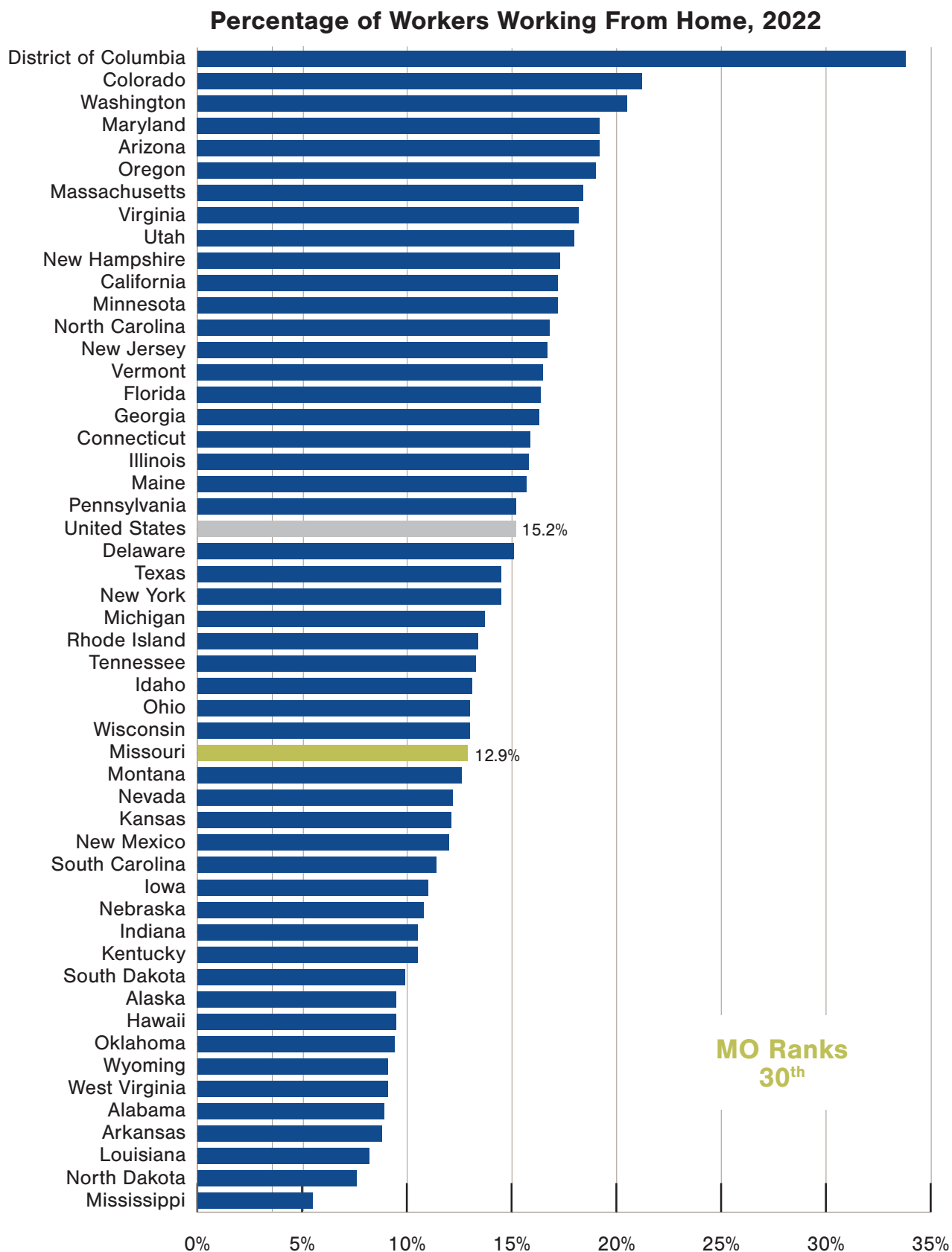
Another measure of adoption is from Census Bureau surveys that measure the number of households that have internet subscription services. In Missouri, 10.3 percent of the population is estimated to lack an internet subscription; this ranks 39th in the nation. While Missouri ranks below the national average, the value has improved from 11.3 percent in 2021.

### Percentage of Households Without an Internet Subscription, 2022



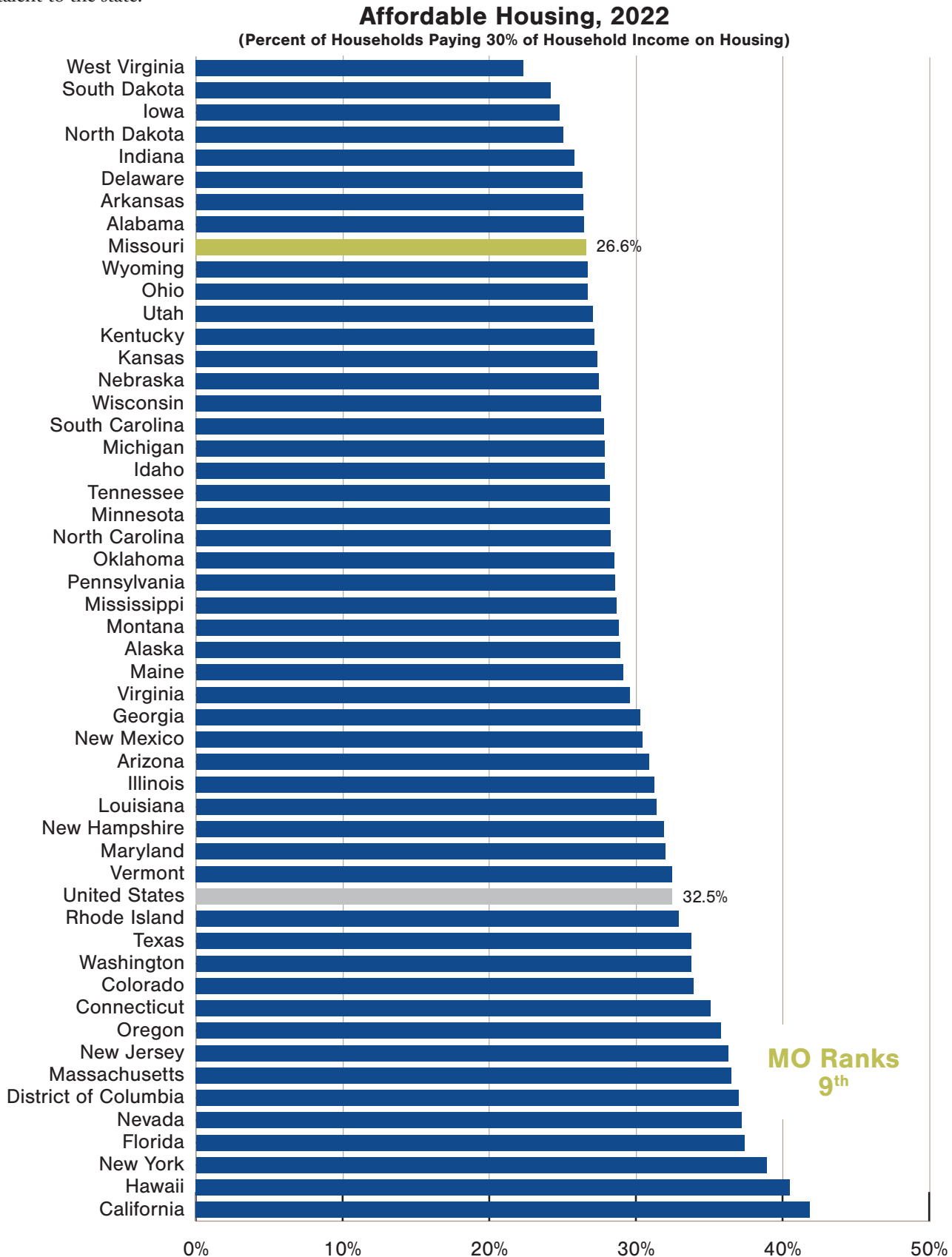
Source: US Census Bureau (2023)

High-speed broadband can help connect rural workers and others to the knowledge-based economy. When high-speed broadband is available, more workers can work from home. This allows the tech workforce to expand. People who might not have been able to participate in the workforce, like those with disabilities, are now able to access jobs via remote work. In 2022, about 13 percent of Missouri's workers worked from home.



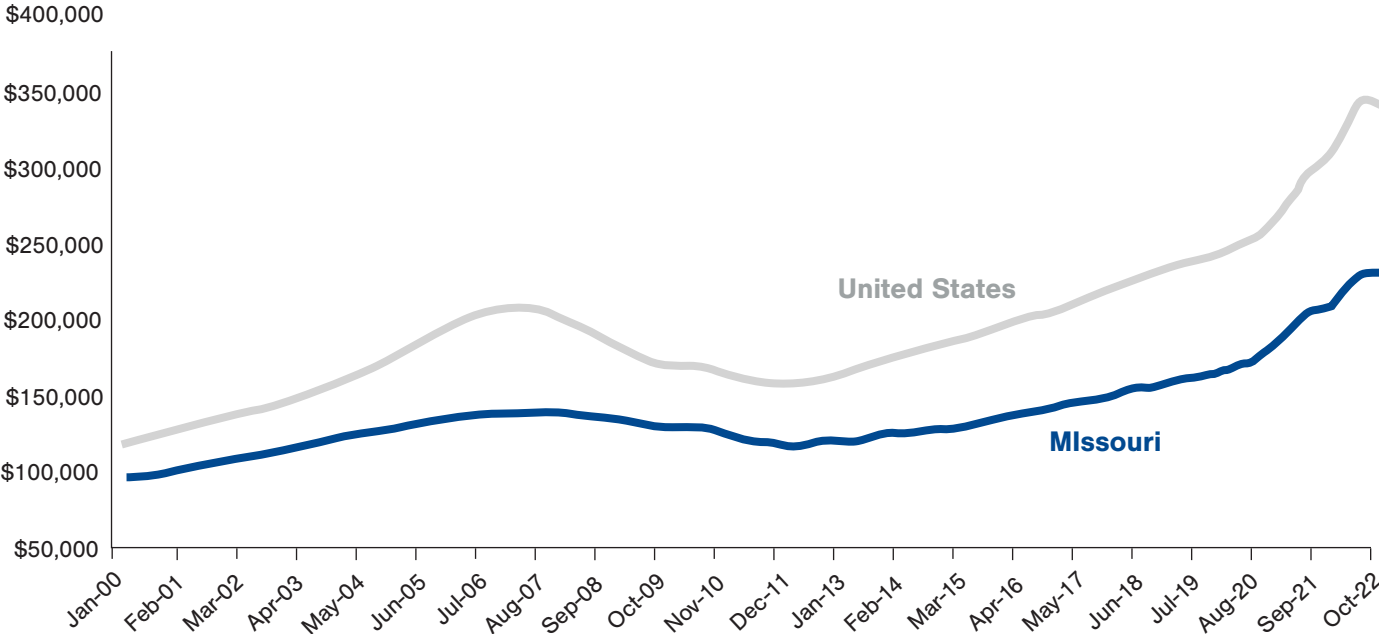
Source: US Census Bureau (2023)

Missouri has attracted many new residents to the state in recent years. One reason for this growth may be the lower cost of living in the state. Housing prices rose sharply in recent years and that has put increasing pressure on affordability in many markets. Missouri, however, has the 9th lowest percent of households considered housing burdened (paying more than 30 percent of household income on housing). Missouri's housing prices have increased like most areas across the country, but at levels still well below the national average. Affordability is an asset that Missouri can use to help recruit talent to the state.



Source: US Census Bureau (2023)

Typical Home Value, January 2000–September 2023



Source: Zillow (2023)



## Total Technology Industry 6-digit NAICS Code Breakdown

NAICS	NAICS Industry	Super Sub-Category	Sub-Category	Manufacturing or Service
325411	Medicinal and Botanical Manufacturing	Life Sciences Manufacturing	Life Sciences	Manufacturing
325412	Pharmaceutical Preparation Manufacturing	Life Sciences Manufacturing	Life Sciences	Manufacturing
325413	In-Vitro Diagnostic Substance Manufacturing	Life Sciences Manufacturing	Life Sciences	Manufacturing
325414	Biological Product (except Diagnostic) Manufacturing	Life Sciences Manufacturing	Life Sciences	Manufacturing
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing	Life Sciences Manufacturing	Life Sciences	Manufacturing
334516	Analytical Laboratory Instrument Manufacturing	Life Sciences Manufacturing	Life Sciences	Manufacturing
334517	Irradiation Apparatus Manufacturing	Life Sciences Manufacturing	Life Sciences	Manufacturing
339112	Surgical and Medical Instrument Manufacturing	Life Sciences Manufacturing	Life Sciences	Manufacturing
339113	Surgical Appliance and Supplies Manufacturing	Life Sciences Manufacturing	Life Sciences	Manufacturing
339114	Dental Equipment and Supplies Manufacturing	Life Sciences Manufacturing	Life Sciences	Manufacturing
541330	Engineering Services	Engineering, Environmental and Clean Tech	Life Sciences	Services
541380	Testing Laboratories	Research and Development and Testing	Life Sciences	Services
541690	Other Scientific and Technical Consulting Services	Research and Development and Testing	Life Sciences	Services
541713	Research and Development in Nanotechnology	Research and Development and Testing	Life Sciences	Services
541714	Research and Development in Biotechnology (except Nanobiotechnology)	Research and Development and Testing	Life Sciences	Services
541715	Research and Development in the Physical, Engineering and Life Sciences (except Nanotechnology and Biotechnology)	Research and Development and Testing	Life Sciences	Services
333242	Semiconductor Machinery Manufacturing	Electronics Hardware	IT	Manufacturing
334111	Electronic Computer Manufacturing	Electronics Hardware	IT	Manufacturing
334112	Computer Storage Device Manufacturing	Electronics Hardware	IT	Manufacturing
334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing	Electronics Hardware	IT	Manufacturing

NAICS	NAICS Industry	Super Sub-Category	Sub-Category	Manufacturing or Service
334210	Telephone Apparatus Manufacturing	Electronics Hardware	IT	Manufacturing
334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	Electronics Hardware	IT	Manufacturing
334290	Other Communications Equipment Manufacturing	Electronics Hardware	IT	Manufacturing
334310	Audio and Video Equipment Manufacturing	Electronics Hardware	IT	Manufacturing
334412	Bare Printed Circuit Board Manufacturing	Electronics Hardware	IT	Manufacturing
334413	Semiconductor and Related Device Manufacturing	Electronics Hardware	IT	Manufacturing
334416	Capacitor, Resistor, Coil, Transformer and Other Inductor Manufacturing	Electronics Hardware	IT	Manufacturing
334417	Electronic Connector Manufacturing	Electronics Hardware	IT	Manufacturing
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing	Electronics Hardware	IT	Manufacturing
334419	Other Electronic Component Manufacturing	Electronics Hardware	IT	Manufacturing
334511	Search, Detection, Navigation, Guidance, Aeronautical and Nautical System and Instrument Manufacturing	Electronics Hardware	IT	Manufacturing
334519	Other Measuring and Controlling Device Manufacturing	Electronics Hardware	IT	Manufacturing
335921	Fiber Optic Cable Manufacturing	Electronics Hardware	IT	Manufacturing
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing	Electronics Hardware	IT	Manufacturing
513210	Software Publishers	Software	IT	Services
516210	Media Streaming Distribution Services, Social Networks and Other Media Networks and Content Providers	Internet, Social Media and Telecom	IT	Services
517111	Wired Telecommunications Carriers	Internet, Social Media and Telecom	IT	Services
517112	Wireless Telecommunications Carriers (except Satellite)	Internet, Social Media and Telecom	IT	Services
517121	Telecommunications Resellers	Internet, Social Media and Telecom	IT	Services
517410	Satellite Telecommunications	Internet, Social Media and Telecom	IT	Services
517810	All Other Telecommunications	Internet, Social Media and Telecom	IT	Services
518210	Data Processing, Hosting and Related Services	Internet, Social Media and Telecom	IT	Services

NAICS	NAICS Industry	Super Sub-Category	Sub-Category	Manufacturing or Service
519290	Web Search Portals and All Other Information Services	Internet, Social Media and Telecom	IT	Services
541511	Custom Computer Programming Services	Software	IT	Services
541512	Computer Systems Design Services	Software	IT	Services
541513	Computer Facilities Management Services	Software	IT	Services
541519	Other Computer Related Services	Software	IT	Services
221310	Water Supply and Irrigation Systems	Engineering, Environmental and Clean Tech	Environmental Technology	Services
221320	Sewage Treatment Facilities	Remediation and Waste Management	Environmental Technology	Services
221330	Steam and Air-Conditioning Supply	Engineering, Environmental and Clean Tech	Environmental Technology	Services
334512	Automatic Environmental Control Manufacturing for Residential, Commercial and Appliance Use	Engineering, Environmental and Clean Tech	Environmental Technology	Manufacturing
334513	Instruments and Related Products Manufacturing for Measuring, Displaying and Controlling Industrial Process Variables	Engineering, Environmental and Clean Tech	Environmental Technology	Manufacturing
334514	Totalizing Fluid Meter and Counting Device Manufacturing	Engineering, Environmental and Clean Tech	Environmental Technology	Manufacturing
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	Engineering, Environmental and Clean Tech	Environmental Technology	Manufacturing
335910	Battery Manufacturing	Engineering, Environmental and Clean Tech	Environmental Technology	Manufacturing
541620	Environmental Consulting Services	Engineering, Environmental and Clean Tech	Environmental Technology	Services
562111	Solid Waste Collection	Remediation and Waste Management	Environmental Technology	Services
562112	Hazardous Waste Collection	Remediation and Waste Management	Environmental Technology	Services
562119	Other Waste Collection	Remediation and Waste Management	Environmental Technology	Services
562211	Hazardous Waste Treatment and Disposal	Remediation and Waste Management	Environmental Technology	Services
562212	Solid Waste Landfill	Remediation and Waste Management	Environmental Technology	Services
562213	Solid Waste Combustors and Incinerators	Remediation and Waste Management	Environmental Technology	Services
562219	Other Nonhazardous Waste Treatment and Disposal	Remediation and Waste Management	Environmental Technology	Services
562910	Remediation Services	Remediation and Waste Management	Environmental Technology	Services

NAICS	NAICS Industry	Super Sub-Category	Sub-Category	Manufacturing or Service
562920	Materials Recovery Facilities	Remediation and Waste Management	Environmental Technology	Services
562991	Septic Tank and Related Services	Remediation and Waste Management	Environmental Technology	Services
562998	All Other Miscellaneous Waste Management Services	Remediation and Waste Management	Environmental Technology	Services
211120	Crude Petroleum Extraction	Other Energy and Power Generation	Energy Technology	Services
211130	Natural Gas Extraction	Other Energy and Power Generation	Energy Technology	Services
212112	Underground Coal Mining	Other Energy and Power Generation	Energy Technology	Services
212114	Surface Coal Mining	Other Energy and Power Generation	Energy Technology	Services
213111	Drilling Oil and Gas Wells	Other Energy and Power Generation	Energy Technology	Services
213112	Support Activities for Oil and Gas Operations	Other Energy and Power Generation	Energy Technology	Services
213113	Support Activities for Coal Mining	Other Energy and Power Generation	Energy Technology	Services
221111	Hydroelectric Power Generation	Other Energy and Power Generation	Energy Technology	Services
221112	Fossil Fuel Electric Power Generation	Other Energy and Power Generation	Energy Technology	Services
221113	Nuclear Electric Power Generation	Other Energy and Power Generation	Energy Technology	Services
221114	Solar Electric Power Generation	Renewable Energy	Energy Technology	Services
221115	Wind Electric Power Generation	Renewable Energy	Energy Technology	Services
221116	Geothermal Electric Power Generation	Renewable Energy	Energy Technology	Services
221117	Biomass Electric Power Generation	Renewable Energy	Energy Technology	Services
221118	Other Electric Power Generation	Renewable Energy	Energy Technology	Services
221121	Electric Bulk Power Transmission and Control	Other Energy and Power Generation	Energy Technology	Services
221122	Electric Power Distribution	Other Energy and Power Generation	Energy Technology	Services
221210	Natural Gas Distribution	Other Energy and Power Generation	Energy Technology	Services
324110	Petroleum Refineries	Other Energy and Power Generation	Energy Technology	Services

## Total Technology Industry 6-digit NAICS Code Breakdown

SOC Code	Occupation Description
11-3021	Computer and Information Systems Managers
11-9041	Architectural and Engineering Managers
13-1081	Logisticians
13-1082	Project Management Specialists
13-1111	Management Analysts
13-1141	Compensation, Benefits and Job Analysis Specialists
13-1161	Market Research Analysts and Marketing Specialists
13-1199	Business Operations Specialists, All Other
13-2031	Budget Analysts
13-2041	Credit Analysts
13-2051	Financial and Investment Analysts
13-2054	Financial Risk Specialists
13-2099	Financial Specialists, All Other
15-1211	Computer Systems Analysts
15-1212	Information Security Analysts
15-1221	Computer and Information Research Scientists
15-1231	Computer Network Support Specialists
15-1232	Computer User Support Specialists
15-1241	Computer Network Architects
15-1242	Database Administrators
15-1243	Database Architects
15-1244	Network and Computer Systems Administrators
15-1251	Computer Programmers
15-1252	Software Developers
15-1253	Software Quality Assurance Analysts and Testers
15-1254	Web Developers
15-1255	Web and Digital Interface Designers
15-1299	Computer Occupations, All Other
15-2011	Actuaries

SOC Code	Occupation Description
15-2021	Mathematicians
15-2031	Operations Research Analysts
15-2041	Statisticians
15-2051	Data Scientists
15-2099	Mathematical Science Occupations, All Other
17-1021	Cartographers and Photogrammetrists
17-2011	Aerospace Engineers
17-2021	Agricultural Engineers
17-2031	Bioengineers and Biomedical Engineers
17-2041	Chemical Engineers
17-2051	Civil Engineers
17-2061	Computer Hardware Engineers
17-2071	Electrical Engineers
17-2072	Electronics Engineers, Except Computer
17-2081	Environmental Engineers
17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors
17-2112	Industrial Engineers
17-2121	Marine Engineers and Naval Architects
17-2131	Materials Engineers
17-2141	Mechanical Engineers
17-2151	Mining and Geological Engineers, Including Mining Safety Engineers
17-2161	Nuclear Engineers
17-2171	Petroleum Engineers
17-2199	Engineers, All Other
17-3021	Aerospace Engineering and Operations Technologists and Technicians
17-3022	Civil Engineering Technologists and Technicians
17-3023	Electrical and Electronic Engineering Technologists and Technicians
17-3024	Electro-Mechanical and Mechatronics Technologists and Technicians
17-3025	Environmental Engineering Technologists and Technicians
17-3026	Industrial Engineering Technologists and Technicians

SOC Code	Occupation Description
17-3027	Mechanical Engineering Technologists and Technicians
17-3028	Calibration Technologists and Technicians
17-3029	Engineering Technologists and Technicians, Except Drafters, All Other
17-3031	Surveying and Mapping Technicians
19-1021	Biochemists and Biophysicists
19-1031	Conservation Scientists
19-1042	Medical Scientists, Except Epidemiologists
19-1099	Life Scientists, All Other
19-2021	Atmospheric and Space Scientists
19-2031	Chemists
19-2032	Materials Scientists
19-2041	Environmental Scientists and Specialists, Including Health
19-2042	Geoscientists, Except Hydrologists and Geographers
19-2043	Hydrologists
19-2099	Physical Scientists, All Other
19-4012	Agricultural Technicians
19-4013	Food Science Technicians
19-4021	Biological Technicians
19-4031	Chemical Technicians
19-4042	Environmental Science and Protection Technicians, Including Health
19-4043	Geological Technicians, Except Hydrologic Technicians
19-4044	Hydrologic Technicians
19-4051	Nuclear Technicians
43-9111	Statistical Assistants
49-2011	Computer, Automated Teller and Office Machine Repairers
51-9141	Semiconductor Processing Technicians



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