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The State of the Missouri Economy and Workforce

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EXECUTIVE SUMMARY

This article presents an overview of the state of the Missouri economy. We begin by assessing measures of economic output. Compared to the nation and to neighboring states, Missouri's economy has hardly grown over the past 20 years. We identify several sources for this lackluster record. Perhaps one of the most important is the observation is that productivity in Missouri—output per worker—is lower than the national average. This poor productivity record quite possibly stems from two sources. One is problematic trends in labor force quality. A key factor here is a lack of commitment by the state to a higher educational system that is capable of producing a sufficient number of college-educated individuals. The other is an environment that not only does not attract well-educated individuals from outside the state, but induces domestic residents to leave for better opportunities elsewhere. This "brain drain" is detrimental to the state's economic future. The other is the composition of the state's industries. Perhaps a relic of past industrial policy, Missouri's industrial make-up today is one that is weighted too heavily toward non-growth industries. This mix of industries has proved to be a drag on the state's economic growth. Based on our analysis, we offer several policy prescriptions. In the final analysis, Missouri needs more productivity, more highly educated workers, and more jobs for these productive and highly educated workers.

1. INTRODUCTION

Missouri's economy is stagnating. Missouri's economic growth rate is below the national average and below that of several surrounding states. Missouri's labor force participation rate is somewhat higher than the overall USA participation rate, but output per worker is lower. Missouri's real GDP per worker—a common measure of productivity—is lower than the national average across all types of industries. Not only is Missouri's productivity low, it is increasing at a rate slower than the national average. This partly explains the undesirable trend in Missouri's wages.

This article presents an overview of the state of the Missouri economy. Our analysis begins by assessing measures of output and move to a discussion of the sources of economic growth. The industry composition of Missouri is compared to the USA aggregate, and to several surrounding states. Labor force issues, including migration and education are stressed. To preview our conclusions, we highlight two keys to understanding the anemic level of economic growth in Missouri: the state's composition of industries and the problematic trends in labor force quality.

The mix of industries in Missouri is a clear drag on its economic growth. Missouri's industrial composition is weighted towards sectors that are not growing in terms of employment (e.g., manufacturing) or

that experience relatively low growth in terms of output per worker (e.g., Trade, Transport and Utilities). Missouri is not participating materially in the oil and gas boom, a sector with high output per worker. And sectors that are growing rapidly in Missouri (such as the information sector) are growing even more rapidly in other states.

Labor market trends also are a drag on Missouri's economy. Not only is Missouri is suffering net out-migration of individuals with college degrees, but Missouri's production of college degrees has stagnated in recent years. Compounding the effects of this trend is the fact that Missouri does not attract many foreign-born workers compared to the national average. Finally, evidence suggests that Missouri is not "keeping up with the Jones" when it comes to investments in higher education. Perhaps as a result, Missouri universities are slipping on a common metric of research quality —the level of National Science Foundation funding.

The remainder of the study is as follows. In Section 2 we assess the state of the Missouri economy. This primarily is a look at the record of the economy over the past two decades. Following that, Section 3 focuses on what economists identify as the main sources of economic growth; namely, the growth of the labor force, the changes in the stock of capital over time, and other factors that give rise of productivity. Section 4 then examines the composition of industries in Missouri, with special attention placed on how Missouri's industrial make-up makes it a candidate for continued slow growth in the future. In Section 5, we look into with several issues regarding the labor force in Missouri. This includes population growth along with patterns of migration. Section 6 focuses on the educational environment in the state, with special emphasis on higher education. There we find that the state has been neglectful of funding higher education, the consequence of which is partly a source of the state's slow growth. We close the study in Section 7 with some policy considerations.

2. THE STATE OF THE MISSOURI ECONOMY

A common measure of economic output is Real Gross Domestic Product, or RGDP. RGDP is an estimate of the inflation-adjusted value of the output of goods and services for final use in an economy. By measuring goods and services for final use, RGDP attempts to avoid double counting that would occur if we added together all the times goods or parts of goods were bought and sold as they moved through the process of production and assembly through wholesalers and distributors and on to final consumers.

Missouri's RGDP in 2016 was $262.0 billion.[1] By itself, this number may not mean much, but consider it in relation to the USA and to other states. In 2016 RGDP in the United States was $16,385.20 billion, making Missouri's RGDP 1.60% of the total for the nation. To put that in perspective, in 1998 Missouri made up 1.92% of national RGDP. Missouri's share of total RGDP has been shrinking over time. Stated somewhat differently, Missouri has grown slower than the overall U.S. economy over the last 20 years.

How have surrounding states fared over this time period? Arkansas's RGDP was 0.69% of total national RGDP in 1998, and its share fell slightly, to 0.67%, in 2016. Iowa's RGDP was 0.94% in 1998 and increased slightly, to 0.99%, in 2016. Kansas RGDP was 0.88% of the US total in 1998 and fell slightly, to 0.82% in 2016. Although other states also suffered a decline in the size of their economies relative to the U.S. economy, Missouri's decline was much larger than these states. Only Illinois shows as steep of a decline, from 4.90% of total U.S. RGDP in 1998 to 4.25% in 2016.

If the Midwest was shrinking in terms of its contribution to total RGDP, who was growing? Texas, for one. Texas saw its share of total U.S. RGDP grow from 7.47% in 1998 to 9.03% in 2016.

A more direct indicator of Missouri's growth in output is to calculate the percentage change of RGDP over time. Missouri's RGDP increased from $222.481 billion in 1998 to $262.026 billion in 2016, an increase of 19.8%. This is an average compounded growth rate of 0.91% per year. Real GDP for the United States was $16,385.170 billion in 2016, an increase of 41.3% from the value of $11,598.235 billion in 1998. This is an annually compounded growth rate of 1.94%. Missouri's economy, by this measure, grew only half as fast as the nation over the past 20 years.

How did neighboring states fare? The Arkansas economy grew 1.73% annually from 1998 to 2016; Illinois by 1.14%; Iowa by 2.28%; and Kansas by 1.52%. Arkansas and Kansas grew somewhat slower than the overall US average, while Iowa grew somewhat faster. Illinois expanded at a much slower rate than the nation, at 1.14%. In comparison, Missouri's 0.91% average annual growth ranks it as

the slowest. As a comparison, Texas grew at an annual average 3.02% over this period.

Real GDP is one measure of a state's output, but it is not without fault. Real GDP, for example, is higher in more populous states partly because of the larger population. In addition, RGDP tends to grow faster in states with a growing population. Because of these issues, it is often more informative to consider a measure of output per person, a measure of average output of individuals residing in a particular area. Two measures considered here are RGDP per individual in the population, and RGDP per individual in the workforce.[2]

For the United States, the civilian noninstitutionalized population in 2015 was 250.801 million. With real GDP equal to $16,148.378 billion, the RGDP per person for the country was $64,387.[3] The civilian noninstitutionalized population in Missouri in 2015 was 4.736 million. With Missouri's RGDP of 261.247 billion, its real GDP per person was $55,157, much lower than the national figure. One way to think about this is that Missouri's population, per person, produced $9,230 less than the average production per person in the United States. Another way to say this is that the average person in Missouri produced only 85.7% as much as the average person in the United States.

But it was not always this way. In 1998 Missouri's RGDP per person of $53,416 was 94.5% of the US value of $56,516. It is also interesting to note that Missouri's RGDP per person in 2015 ($55,157) was almost equal to the national level of real GDP per person in 1998. In this sense, Missouri is about two decades behind the national average in RGDP per person.

Figure 1 plots real GDP per person for Missouri and for the United States, using two different measures of population—the civilian noninstitutionalized population and the labor force. The labor force consists of all people of working age who are working or looking for work (note that all figures are at the end of the paper). It is clear from Figure 1 that the difference between output per person in the United States and Missouri was smaller in 1998. Just as clearly, the gap has grown over time, widening gradually from 1998 to about 2007, narrowing slightly in 2009, but then expanding again after 2010. Importantly, Missouri's RGDP per person in 2015 was below its value 15 years earlier in 2000! As is evident in Figure 1, Missouri's RGDP per person peaked at $55,887 in 2005 and has been lower ever since.

Figure 1 also shows that Missouri's relative decline in RGDP per person is not strictly due to the Great Recession, which began in late 2007 and ended in 2009. In 2006, at the peak of the last economic expansion, RGDP per person for the nation was $62,823 compared to $55,887 for Missouri. Even at the end of the economic expansion, Missouri was already down to 86.6% of the national value.

This aspect of the Missouri's slow-growing economy shows up elsewhere in the data. If we look at RGDP per member of the labor force, we see that Missouri's RGDP per person has declined relative to the US average even more than Missouri's RGDP per person. This also is shown in Figure 1. Missouri's labor force had a RGDP per person of $84,364 in 2015, while the national value was $102,768, making Missouri's RGDP per person 82.1% of the national figure. In contrast, Missouri was 90.6% of the national figure in 1998. In other words, Missouri's RGDP per member of the Missouri labor force in 2015 ($84,364) is essentially the same as the US RGDP per member of the labor force 20 years ago.

One somewhat bright spot is Missouri's labor force participation rate. This statistics measures the fraction of the population that is working or looking for work. The participation rate for Missouri has been higher than the US value, and has not declined as much as the US value. Missouri's labor force participation rate was almost 70% in 1998 and has declined to 65.4% in 2015. The nation's participate rate was about 67.1% in 1998 and declined to just over 62.7% in 2015.

The relatively high participation rate in Missouri explains why in 1998 Missouri's output per capita was 94.5% of the US average, while Missouri's output per member of the labor force was 90.5% of the US average. Missouri did better on a per capita basis because a higher fraction of Missouri's population was actually in the labor force.

Missouri's labor force participation rate has recovered from its low point in 64.4% in 2013. Meanwhile the US participation rate continued to decline through 2015. Figure 2 graphs the labor force participation rate over time for Missouri and the United States. Missouri's population continues to participate in the work force at a higher rate than the national average.

Missouri's relatively poor performance in terms of RGDP is reflected in wages. This is indirectly indicated by Missouri's performance

in RGDP per person, but there are more direct measures provided by the Bureau of Labor Statistics (BLS). The BLS recently revised their data making it harder to compare wages in the states over long historical periods. Still, one can get a sense of movement in real wages form the data. And the data do not tell a good story for Missouri workers. Real hourly earnings for all employees in private industry in Missouri declined from $22.26 in 2007 and $22.09 in 2016. In contrast, real hourly earnings for the country as a whole was $23.96 in 2007 and increased to $25.37 in 2016. Missouri's real wage was 93% of the USA in 2007, but fell to only 87% of the national figure in 2016. The nationwide stagnation of real wage growth has been widely discussed, and Missouri is performing even worse.

Figure 3 shows the growth of wages of college-educated workers over the period 1997 to 2015.[4] Missouri again is below the US average, and its relative position has worsened over time. The wage level in Missouri was at 91% of the USA average in 1997. By 2008, Missouri started deviating even further from the US experience, so that by 2015 the wage level in Missouri stood at 88% of the USA average. For sake of comparison, Texas wages are included. Texas wages tracked USA averages until about 2008, at which point Texas wages started increasing faster than the USA average.

3. SOURCES OF ECONOMIC GROWTH IN MISSOURI

Economists consider economic growth to arise from increases in economic inputs, including the stock of physical capital and the labor force, and from the productivity of those underlying factors. The anemic economic growth of Missouri highlighted above is traceable to relatively slow growth in two of these three components: the labor force and productivity.

3.A. Growth in the Labor Force

Missouri's labor force has grown slowly over time. The labor force in 1998 was 2.917 million people and it had risen to 3.097 million by 2015. This is an increase of 6.2% over these 17 years, or less than half of one percent a year. Even though that growth has not been steady, and there was a post-recession decline after the Great Recession, Missouri's labor force in 2015 is as large as it ever has been. In comparison, the US labor force has grown more rapidly, from 137.680 million in 1998 to 157.134 million in 2015, an increase of 14.1%. To make the growth in the labor forces comparable, Figure 4 shows the behavior of the Missouri and US labor force over this time, with the initial values in 1998 of both series set to 100. The divergence of Missouri from the nation beginning in 2003 is clear, and the gap widens until 2012. Starting in 2013 there are signs that Missouri is starting to converge back with the overall USA, but the gap remains large.

3.B. Growth in the Capital Stock

Measures of the stock of physical capital—e.g., plant and equipment—are difficult and certainly subject to measurement error, especially at the state level. One estimate of Missouri's stock of physical capital puts its value $244.293 billion in 1998, rising to $314.189 billion in 2015, a 28.6% increase.[5] The estimated stock of physical capital for the United States increased over this same time period by 40.0%, from $14,168.870 billion to $19,839,.660 billion. Figure 5 illustrates this increase. In this graph, we again set the initial values of the capital stocks equal to 100 in 1998. The changes from 1998 indicate that the Missouri and USA capital stocks are largely trending together until the most recent few years. This means that Missouri's longer-term period of slow economic growth does not seem attributable to the overall growth rate in the stock of capital.

This look into the relative behavior of the Missouri and national labor forces and capital stocks tells us that U.S. RGDP would have grown relative to Missouri's GDP strictly due to the increase in the national labor force relative to Missouri's, and more recently due to the increase in the U.S. capital stock relative to Missouri. A lack of growth in the capital stock, however, does not seem responsible for Missouri's slow growth over this entire period

3.C. Productivity Growth

Economists call the change in the growth of output (or real GDP) that is not attributable to changes in the growth of the stock of physical capital and the labor force "total factor productivity," or TFP. Total factor productivity thus represents a change in productivity of all factors, not just labor and capital, effecting production. An increase in TFP indicates an economy is producing more output for a given level of capital and labor inputs. Estimates of total factor productivity, or TFP, are in fact based on estimates of RGDP, the labor force, and the capital stock, so errors in measuring these variables (and again, especially the capital stock) lead to errors in measuring total factor productivity. That said, one estimate of the increase in Missouri's TFP suggests it rose 3.3% over the period

between 1998 and 2015, an annual rate of 0.20%. For comparison, TFP in the United States rose 13.4%, an annual rate of 0.74%.[6] Neither the United States nor Missouri have shown large increases in TFP during this period, but the fact remains that Missouri's TFP growth is far below the national rate. The widening gap over time is clear in Figure 6, where we graph these estimates of TFP per year, again normalized so both Missouri and the USA TFP have values of 100 in 1998.

Overall Missouri has fallen behind the national average in in growth of total output, growth of output per worker, growth of the labor force, and growth of total factor productivity. Even the growth in the capital stock shows signs of diverging from the national growth rate in recent years. There is just no silver lining in this message.

4. THE COMPOSITION OF MISSOURI'S INDUSTRIES

Is it possible that the relatively poor performance of the Missouri economy is due to the composition of its industries? Compared to the national economy, in 2016 Missouri gets relatively higher contributions to its RGDP from Trade, Transport and Utilities (18.68% versus 16.94%), from Manufacturing (13.40% versus 11.91%), from Education and Health Services (9.83% versus 8.50%), and from Professional and Business Services (13.34% versus 12.84%). Compared to the national composition, Missouri is underweighted in Mining and Logging (0.30% versus 2.12%), in Financial Activities (18.69% versus 20.19%), in Information (4.30% versus 5.74%), and in Construction (3.56% versus 4.02%). Figure 7 illustrates the differences in industry composition between Missouri and the country.

The fastest growing sectors of the U.S. economy since 1999, in terms of contributions to RGDP, were Information (103.15% growth), Professional and Business Services (54.73% growth), Education and Services (52.45%), Financial Activities (47.21% growth), and Mining and Logging (43.88% growth). Missouri's overall growth rate was lower than the US average, and its growth rate in all five of these sectors was slower than the US average. Mining and Logging in Missouri actually shrank by 42.52%. Missouri's relative emphasis on industrial sectors experiencing slower growth than in the aggregate economy certainly provides a formidable headwind for Missouri's own overall economic growth rate.

In terms of relative size, Missouri is over-represented in most of the faster-growing sectors; those being Information; Education and Health Services; Professional and Business Services; and Financial Activities. In these sectors Missouri's growth rates from 1999 to 2016 were 41.90%, 34.10%, 33.12%, and 26.10%, respectively, compared to the national growth rates of 103.15%, 52.45%, 54.73%, and 47.21%, respectively. While Missouri has large sectors of its economy devoted to Information, Education and Health Services, Professional and Business Services, and Financial Activities, these sectors in Missouri have been growing more slowly relative to the United States overall.

Mining and Logging is a relatively fast growing industry at the national level and particularly in certain states. The technological innovations that made fracking a success have paid dividends in terms of RGDP growth in certain states and this shows up in the overall national economy, but not in Missouri. While Mining and Logging is not large absolutely in the country or in Missouri, it does tend to have a high value added for certain activities, such as oil and gas. Absent the right geology there seems little that Missouri can do about this particular shortfall. The point is that a lack of these opportunities in Missouri lead to headwinds preventing the Missouri economy from growing as fast as the aggregate US economy.

Information is the fastest growing industry at the aggregate US level, and it is the fastest growing industry in Missouri. Unfortunately, the growth in Missouri is less than half the national growth rate, so Missouri is falling behind in this important sector.

Manufacturing has a slightly larger share of the Missouri economy than the national average. Missouri's manufacturing sector has been growing much more slowly than the US manufacturing sector, however. Between 1999 and 2016, manufacturing output grew 27.17% nationally, but only by 2.67% in Missouri. Missouri is thus disproportionately a manufacturing state: But while this sector has been almost stagnant in Missouri for the last 17 years, it has been growing elsewhere.

One final peek at the effect of industry composition is to look at RGDP at the industry level on a per-employee basis. This allows us to ask: "What is the productivity in terms of creating RGDP by an employee in the various industries, and how does Missouri compare to the nation?" Table 1 shows the values for RGDP per employee by industry. Missouri's values are

lower than the US average across every industry group in the table. The largest differences between productivity in Missouri and in the nation as a whole are in Mining, Information, Manufacturing, Financial Activities, and Construction, though the differences between Missouri productivity and US productivity in other industries are also large on a percentage basis.

Table 2 reports the growth rate of employment across industries in the United States and in Missouri. Employment growth is higher in the United States in almost all industries. In sharp contrast, only in Financial Activities is Missouri's average growth rate in employment higher than the national rate, but the difference is a minute 0.01%.

5. LABOR FORCE TRENDS

Missouri's population, and its labor force, have grown over time, but at a slower pace than the national average. From 2005 to 2016, Missouri experienced a labor force growth of 4.33% compared to 10.64% for the country. Over this period, the population of Missouri has grown by 10.33% while in the national the growth has been 15.42%.

Because worker productivity is related directly to educational attainment, what are the educational levels of the population and of the labor force in Missouri? Answering this question provides a guide, albeit a rough one, to the level of human capital—a key element in determining economic growth—in the Missouri workforce.

How does Missouri compare to the national averages? Using data for 2016, the Missouri population over age 25 has slightly higher proportion of high school graduates than the national average, 89.68% versus 87.43%. Missouri has a somewhat lower proportion with a bachelor's degree compared to the nation, 28.55% versus 31.33%, and a lower proportion with an advanced degree (masters, Ph.D., etc.), 10.65% versus 11.95%.[7] In surrounding states, Illinois has a lower proportion of high school graduates, 88.70%, but higher proportions of individuals with a bachelor's degree, 33.83%, and with an advanced degree, 12.92%. Kansas has a higher proportion of high school graduates, 90.52%, and a higher proportion of bachelor's degrees, 33.02%, and advanced degrees, 12.25%. (These numbers are from the U.S. Census, American Community Survey, and differ somewhat from numbers presented by the U.S. Department of Education.)

5.A. Migration and the Labor Force

The growth in population and in the labor force are only part of the story. Population changes come about from births and deaths, but also from movements of people between states. States can see an increase in their workforce human capital come about in several ways, including education, training, and experience. Looking just at education levels, as we just did, we cannot tell whether those adults were educated in Missouri or educated elsewhere and migrated to the state. Missouri can educate more students, and retain them within Missouri, or Missouri can entice students educated elsewhere to migrate to Missouri. We now examine that link.

Missouri has had significant flows of in-migration and out-migration over the period from 2005 to 2016, with overall small positive net in-migration in most years.[8] Kansas looks much like Missouri in this regard, while Illinois has seen a relatively large net out-migration in most years. Texas is included for the sake of comparison, and has large positive net in-migration in all these years.

Figure 8 graphs net migration over time for Missouri, Kansas, Illinois, and Texas. As mentioned above, Missouri has a positive net in-migration over time, adding 91,364 individuals over the past decade. In comparison, Kansas added only 254 people, but Illinois lost 1,017,605 residents. Texas, as a large state attracting in-migration, had a net inflow of 1,413,008 over this same time. Missouri's net inflow of individuals in the labor force is smaller but still positive, 31,199 individuals. Kansas on net lost 4,001, and Illinois lost 435,678. Texas gained on net 795,610. Figure 9 illustrates these features.

If we look within Missouri, the two population hubs are Kansas City Missouri, on the Kansas-Missouri border, and St. Louis Missouri, on the Illinois-Missouri border. Looking at Kansas City, the growth rate of Kansas City, Kansas was 5.9% over between 2010 and 2016, more than twice the growth rate of Kansas City, Missouri at 0.7%. Meanwhile, the growth rate of St. Louis, Missouri was 1.5%, much lower than Kansas City, but equal to the statewide average growth rate of 1.5%, and above the growth rate of the Illinois portion of the St. Louis MSA, which shrank at a 2.0% rate over this period. There was a domestic migration net inflow to Kansas City, Kansas (14,390 persons over 2010-2016) and Kansas City, Missouri (9,298 persons over this period), while there was a domestic migration net outflow from both St. Louis,

Missouri (-11,036 persons over this period) and from the Illinois side of St. Louis (-21,167 persons over this period). More telling is interstate migration of those with college degrees. Here Missouri suffered a net outflow of individuals with a BS, losing 23,544, while Kansas lost 23,032 and Illinois 51,897. In contrast, Texas on net gained 304,797 individuals with a BS degree.

Figure 10 graphs the movement of these net migration flows over time of those with a BS degree and in the labor force. Among those who were in the workforce with a BS degree, Missouri suffered a net outflow of 18,524, similar to Kansas (18,076) and Illinois (27,388). Texas saw a net inflow of 256,827. This is evidence of a "brain drain" from Missouri (and Kansas and Illinois, for that matter) to other states in the USA.

Figure 11 shows these net migration flows over time of those individuals with a BS degree in a Science, Technology, Engineering or Mathematics (STEM) field and in the labor force.[9] Among those who were in the workforce with a BS degree in a STEM field, Missouri suffered a net outflow of 5,627, smaller than that of Illinois (10,054). Texas and Kansas saw net inflows of 65,959 and 4,380, respectively. This is again evidence of a brain drain in the STEM area from Missouri to other states in the USA.

5.B. Labor Force and Immigration from Abroad

Another component of the labor force is immigration from abroad. The US population aged 16 and over in 2016 consisted of 17.82% foreign-born, and the labor force consisted of 18.60% foreign-born individuals. Both figures indicate that the foreign-born are more likely to be in the labor force compared to native-born individuals.[10]

Figure 12 shows the changing percentage of foreign-born among the U.S. labor force and in Missouri between 2005 and 2016. In Missouri, these numbers are somewhat amazingly lower than in the USA. According to the Current Population Survey, Missouri, with a 2016 civilian noninstitutionalized population aged 16 and over of 4.87 million, and a labor force of 3.07 million, had only 0.28 million non-native born in the population aged 16 and over and only 0.19 million in the labor force. That is, Missouri's the proportion of non-native born in the civilian noninstitutionalized population aged 16 and above was 5.74% of the total, and 6.09% of the labor force. Compared to the national average these numbers are small, and have been for many years.

Figure 13 shows the absolute number of foreign-born members of the labor force in the United States and in Missouri. Because of the vastly different scale, we graph the national numbers on the right hand scale and the Missouri numbers on the left hand scale. This difference in scaling makes the growth rates of these variables difficult to see, but Missouri's increase in the number of foreign born in the labor force increased by 29.37% over this period, while the USA's numbers increased 25.33%. Missouri's increase is greater than that for the United States comes from the fact that Missouri is starting from such a low base.

Surrounding states, while below the national average, have proportionally more foreign-born in the labor forces. Kansas, for example, has a non-native born proportion of the labor force equal to 10.49%, and Illinois 18.40%. Arkansas was 6.95% and Iowa 7.28%. Among states with the very highest proportion of non-native born in the labor force, California (35.04%), Florida (29.89%), Nevada (27.93%), New Jersey (30.46%), New York (30.00%), and Texas (23.38%) all stand out. States with lower proportion of non-native born in the labor force, relative to Missouri, include Maine (5.07%), Mississippi (3.55%), Montana (3.71%), North Dakota (5.28%), South Dakota (4.46%), West Virginia (2.81%), and Wyoming (5.68%).

The states with the highest level of non-native born are surely attractive to immigrants because of favorable economic conditions, especially in the labor market. The states with low levels of non-native born are surely not attracting immigrants because of relatively less favorable economic conditions. Still, it is telling that Missouri is rather unattractive, relatively speaking, to immigrants from abroad, even when compared to surrounding states.

6. EDUCATION

6.A. Production of College Graduates

In terms of production of college graduates, Missouri colleges and universities granted 427,384 BS degrees during the period from 2005 to 2015. For comparison, Kansas granted 199,534, 46.7% of Missouri's total, and with 46.5% of Missouri's population. Illinois granted 780,984, 183% of the Missouri total, but Illinois has a population that is 212% of Missouri's population. These numbers are counts of all BS degrees granted within a state, to both in-state and out-of-state

students. Missouri's production of BS degrees was much higher than the net outflow of college educated individuals. However, a deeper look into the issue of production of college diplomas within the state raises some concerns.

In 2015, the last year for which we have data, Missouri schools produced 41,161 BS degrees. This number is down from a high of 43,688 in 2012. In contrast, Kansas produced 20,081 BS degrees in 2015, a bit lower than an all-time high for the state in 2014 of 20,274. Illinois produced 74,317 BS degrees in 2015, third to 75,992 in 2013 and 74,958 in 2014. Across the USA, there were 1,894,934 BS degrees awarded in 2015, an all-time high for the USA. Thus, in Missouri there is a slowing in the production of BS degrees while the rest of the country is showing an aggregate increase in BS degrees. Figure 14 shows the decline in Missouri production of undergraduate degrees starting in 2012, and a flattening of production of degrees in Illinois a year later.

Missouri awards proportionally fewer BS degrees in the natural sciences, computer sciences, and engineering than the US average. These three types of BS degrees made up 16.35% of Missouri BS degrees in 2015, but 17.76% of BS degrees awarded across the USA. Missouri's proportion is slightly higher than Kansas (15.66%), but lower than Illinois (16.57%) or Texas (17.71%). The production of STEM degrees in the USA has increased by 3.43% per year between 2000 and 2015. Illinois production of STEM degrees increased 1.94% per year over this period, Kansas 1.99%, and Missouri 2.59%. All three states increased STEM degree production, but by less than the US average. (Texas increased STEM degree production by 4.02% per year over this period.) Figure 15 plots production of STEM degrees over this period, for these states and for the USA.

Missouri does grant proportionally more BS degrees in health professions and related programs, 13.18% versus a national average of 11.41% in 2015; more in business management, 21.67% versus a national average of 19.20%; and more in education, 7.45% versus a national average of 4.84%. Missouri offers proportionally fewer degrees in the humanities, 12.72% versus 14.83% for the USA, and in the social sciences, 5.20% versus 8.81%.

6.B. Research and Higher Education

Universities produce research as well as producing college graduates. That research contributes to total factor productivity growth. Research funding is thus one way of keeping score when assessing the "quality" of higher education institutions.[11]

Several recent studies find evidence supporting the potential role of university research as an engine of state economic growth. Bruce Weinberg, a respected labor economist at Ohio State, has co-authored a series of papers that identify important links between external research grant funding and state economic activity.[12] These papers utilize data from major Midwestern universities—all public universities in two studies and mostly public universities in the third.

One link is grant purchases from regional businesses. Research spending on goods and services from U.S. vendors and subcontractors is substantial. In 2012, nine sample Midwest universities spent almost $1 billion on such purchases. Importantly, more than 32% of those expenditures went to vendors in the university's home state, with over 16% going to vendors in the university's home county.

A second mechanism for university research to fuel economic growth is through the training of graduate students. Weinberg and his co-authors followed the post-graduation paths of doctoral recipients employed by research grants and found that almost 40% of those grant-funded students took initial positions in the nonacademic sector. More importantly, those Ph.D. graduates disproportionately landed jobs at nonacademic establishments with high payroll per worker and located in high-tech/high R&D and professional service industries. Those establishment characteristics are all signals of higher productivity firms.

This is important return on investment news in the aggregate, but what about the return to the home state? The Weinberg study finds that more than one in five doctoral recipients stayed in the state in which they earned their degree and about 13% stayed within 50 miles of their campus home. Although the talent exodus is substantial, a 20% within-state retention rate is not trivial. This is particularly true for a state that is not a major destination for Ph.D.'s migrating from institutions in the other 49 states. In the Weinberg Midwestern public university sample, among the doctoral recipients who left the state in which their university was located, 19% exited to a job in California, 7.3% to Illinois, 4.8% to New York, and 4.2% to Texas. These graduates did not flock to the neighboring

state of Missouri (only 1.3%). An attractive strategy would be for Missouri to grow and keep their own Ph.D.'s.

Given the positive evidence of potential returns at the state level to research grant activity at local universities, what is happening on the research-funding front at Missouri institutions? There are various sources of research funding to a university, but a typical focus is on the National Science Foundation and its awards of research dollars. NSF research awards are extremely competitive and highly sought after. In 2017, the National Science Foundation awarded $5,628.8 million in research funds to universities. Of this, Missouri's universities landed $58.2 million.[13]

What should be Missouri's expected share of NSF research funding? Missouri is one of 50 states, so it might be expected to get 2% of NSF funding. That would be $112.6 million, almost twice the amount Missouri actually received. Missouri's population of 6.093 million is 1.886% of the nation, so on an equal per-capita basis Missouri might be expected to receive $106.1 million in NSF funding. Again, this is 80% higher than the amount that Missouri actually received.

How do other states fair in the competition for NSF dollars? Table 3 provides a comparison. Kansas, with a population slightly less than half of Missouri received $41.4 million in NSF funding. Iowa received $46.9 million, with a population slightly more than half of Missouri. Illinois, with a population slightly more than double that of Missouri, received $292.0 million. Arkansas received $13.5 million, again with a population just about half of Missouri. For comparison with a more distant state, Texas received $343.6 million, with a population 4.6 times larger than Missouri. On a per capita basis, all states we discuss here, except Arkansas, receive more NSF funding than does Missouri. Which universities in Missouri receive NSF funding? Washington University in St. Louis and by the University of Missouri – Columbia receive the vast majority of funds. Smaller amounts flow to the Missouri University of Science and Technology, and to St. Louis University. See Figure 16.

How has this changed over time? The National Science Foundation in 2008 awarded $4,464.5 million in research funds to universities, of which Missouri's universities landed $57.3 million. Texas' universities received $198.0 million. Illinois universities received $258.5 million and Kansas $30.2 million. In other words, NSF awards to universities nationwide increased by 26% between 2008 and 2017. NSF awards to Illinois increased by 13.0%, and awards to Kansas increased by 37.2%. NSF awards to Texas Universities increased by 73.5%. The increase in NSF awards to Missouri universities was significantly less, only 1.6 percent.

A recent study by Kantor and Whalley[14] provides evidence that university spending to support the full range of university activities generates positive and significant knowledge spillovers to local firms and workers. Kantor and Whalley are able to identify a causal effect and estimate that a 1% increase in university expenditures in a county increases local labor income in other sectors by 0.08%. This effect is magnified for research universities. Innovation partnerships make flagship universities vessels of growth and attractive targets for state investment spending.

In terms of state and local appropriations to higher education, the sum of state and local appropriations to public degree-granting post-secondary institutions in Missouri has hardly changed in nominal terms – unadjusted for inflation – from the 2000-2001 academic year to the 2014-2015 academic year.[15] In 2000-2001 Missouri spent $945.7 million of state funds and $101.6 million of local funds on higher education. In 2014-2015 Missouri spent $907.3 million in state funds and $139.3 million in local funds. This is actually a decrease in total nominal spending on its public institutions of higher education over this 14-year period. The growth rate was a negative 0.1%. Meanwhile average nominal spending nationally rose 23.5% during these 14 years, while spending in Iowa increased 14.7%, spending in Illinois 24.0%, spending in Kansas 24.4%, spending in Arkansas 31.4%, and spending in Texas 55.8%. The bottom line is that Missouri has been reducing its spending on higher education while most other states, including its immediate neighbors, have been increasing it. This is not a recipe for improving the state's economic growth prospects in the future.

Figure 17 illustrates the distribution of spending changes by state over this period. For comparison, the CPI increased by 133.6% from May 2001 to May 2015. In part, all states moved toward having students pay a higher portion of the cost of public education, by raising tuition and fees relative to state support. In addition, states with growing populations (such as Texas) saw spending increase in part because of the growth in the number of students attending public colleges

and universities. Still, the evidence indicates that Missouri is yet again falling behind other states in its support for public higher education. As noted by Haslag and Austin,[16] the decline in real state spending on education could be an important contributing factor to the anemic growth in Missouri output.

The majority of students attending public colleges and universities come from local public schools. While others discuss this issue in more depth, the commitment of Missouri to its public K-12 schools and to attracting the highest quality teachers may be lacking relative to surrounding states. Consider, for example, the relative wages facing teachers in Missouri's two major metropolitan areas. The starting salary for teachers in the Kansas City School District in Kansas City, Missouri was $38,124 while in Unified School District 500 (Kansas City, Kansas) it was $41,410. The St. Louis Public Schools in St. Louis, Missouri reported a starting salary of $39,015 versus a starting salary in the East St. Louis School District (Illinois) of $42,786.[17] There are many reasons for differences in starting salaries across school districts, but in the competition for teachers across state boundaries Missouri seems to be lagging behind its closest competitors.

7. SOME GENERAL POLICY PRESCRIPTIONS

The overall situation In Missouri is one with few bright spots. In order to increase its tepid pace of economic growth, Missouri needs more productivity, more highly educated workers, and more jobs for these productive and highly educated workers. There is a chicken-and-egg problem here, with no quick and easy solutions. However, we have a few ideas.

Missouri would be wise to encourage higher enrollment of high school graduates into colleges and universities within the state. This may require improvements in Missouri's elementary and secondary schooling, as well as tuition and scholarship incentives for students enrolling in colleges. Growth in Missouri's support for its public institutions of postsecondary education has been almost nonexistent, falling far behind the USA and surrounding states over the past several years. Missouri needs to address this important issue. Policy makers in Missouri also should consider creating incentives for universities to seek more research funding, especially National Science Foundation Funding, to further basic research at its universities.

Encouraging growth in more high-tech industries also would serve the state well. This may involve giving priority for government incentives to high-tech industries over other industries in competing with other governments and other geographic areas.

Missouri is a state with two major population centers, both located on borders with another state. This means that Missouri must compete for residents, as residents of its two population centers face the choice of living outside Missouri. The implication is that Missouri must be competitive, especially with Kansas and Illinois, when it comes to government spending and taxation policies. The ability to move across state lines also means that Missouri, and especially the metropolitan areas of St. Louis and Kansas City, needs to supply an attractive set of amenities to garner additional tech jobs and tech workers. Amenities include good jobs, good schools, and good neighborhoods. Achieving such amenity packages may require resources and efforts to reduce crime rates and other neighborhood problems, and improving public education venues and student achievement.

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NOTES

[1] Data on US and state RGDP come from the Bureau of Economic Analysis (the BEA), "Real GDP by state (millions of chained 2009 dollars), downloaded from the BEA website January 16 2018.

[2] Data on state-level civilian noninstitutionalized population ("population"), civilian labor force ("labor force"), and civilian labor force employment ("employment") are from the Bureau of Labor Statistics document "States and selected areas: Employment status of the civilian noninstitutionalized population, 1976 – 2016 annual averages," downloaded January 16 2018. Data for the USA is from the St. Louis Federal Reserve's Federal Reserve Economic Data (FRED) database, and is the civilian noninstitutionalized population (series CNP16OV), the civilian labor force (CLF16OV), and civilian employment level (CE16OV), downloaded January 16 2018.

[3] Here we refer to data from 2015, because we will be discussing growth of RGDP along with growth of the labor force and

the capital stock in the various states, and our capital stock series is only available up to 2015.

[4] The NCES Comparable Wage Index describes the prevailing wage for college-educated workers who are not educators for the period 1997 to 2005. One of the authors (Lori Taylor) has extended that series through 2015 here..

[5] The capital stock data is supplied by Steven Yamarik based on methods he developed in two paper. These are "Regional Convergence: Evidence from a New State-by-State Capital Stock Series" (with Gasper Garofalo), The Review of Economics and Statistics 84 (May 2002): 316-323, and "State-Level Capital and Investment: Updates and Implications," Contemporary Economic Policy (January 2013): 62-72. Professor Yamarik updated and extended his capital stock series to 2015 and provided it to one of us (Dennis Jansen). A copy of that data is available upon request.

[6] Author calculations based on state-level RGDP, employment, and capital. The assumed capital share of output is .38 and the labor share .62.

[7] Data from the American Community Survey (ACS) Public Use Microdata Sample (PUMS) File.

[8] Data from the American Community Survey (ACS) Public Use Microdata Sample (PUMS) File.

[9] We define STEM degrees, as consisting of the natural sciences, computer sciences, and engineering degrees.

[10] Data from the American Community Survey (ACS) Public Use Microdata Sample (PUMS) File. Some numbers differ slightly from those reported by the Bureau of Labor Statistics.

[11] For example, see Luc Anselin, Attila Varga, and Zoltan Acs. "Local geographic spillovers between university research and high technology innovations." Journal of Urban Economics, 42(3) (1997). 422-448.

[12] Bruce A. Weinberg, Jason Owen-Smith, Rebecca F. Rosen, Lou Schwartz, Barbara McFadden Allen, Roy E. Weiss and Julia Lane. "Science Funding and Short-Term Economic Activity." Science, 344(6179) (2014). 41-43. Nikolas Zolas, Nathan Goldschlag, Ron Jarmin, Paula Stephan, Jason Owen-Smith, Rebecca F. Rosen, Barbara McFadden Allen, Burce A. Weinberg, Julia I. Lane. "Wrapping it up in a person: Examining employment and earnings outcomes for Ph.D. recipients. Science, 350(6266) (2015). 1367-1371. Nathan Goldschlag, Sefano Bianchini, Julia Lane, Joseba Sanmartin Sola, Bruce Weinberg,. "Research Funding and Regional Economies." NBER Working Paper Series, Working Paper 23018 (2017). 1-25.

[13] Downloaded January 18, 2018 from https://dellweb.bfa.nsf.gov/awdlst2/default.asp

[14] Shawn Kantor and Alexander Whalley. "Knowledge Spillovers From Research Universities: Evidence From Endowment Value Shocks." Review of Economics and Statistics, 96(1) (2014), 171-188.

[15] Data on appropriations come from the Digest of Education Statistics, 2016, US Department of Education. Data on the CPI-U come from the US Bureau of Labor Statistics.

[16] Joseph H. Haslag and Michael Austin. "Was Missouri Always Like This? A comparison of Missouri's Growth with that of The United States." Show-Me Institute Essay, (2017). 1-13.

[17] See the starting salary at step 1 of the base tier in the following. For Unified School District 500 (Kansas City, Kansas Public Schools), see here, (page 22). For the Kansas City School District in Kansas City, MO, see here. For St Louis Public Schools in St. Louis, MO see here. For the East St. Louis School District in East St. Louis, IL see here, (page 6).

TABLES AND FIGURES

Table 1. Real GDP per Employee by Industry in 2016

	USA	Missouri
Total Nonfarm	$111,709	$90,734
Mining and Logging	$503,830	$190,631
Construction	$96,591	$76,178
Manufacturing	$155,452	$131,532
Trade, Transport, Utilities	$100,264	$88,281
Information	$333,575	$208,705
Financial Activities	$392,910	$285,171
Professional & Business Svcs.	$102,845	$90,815
Education & Health Svcs.	$60,588	$55,455
Leisure & Hospitality	$40,444	$33,453
Other Services	$60,065	$49,891
Government	$88,549	$70,932

Source: The Bureau of Economic Analysis and the Bureau of Labor Statistics.

Table 2. Average Annual Employment Growth by Industry 1999 – 2016

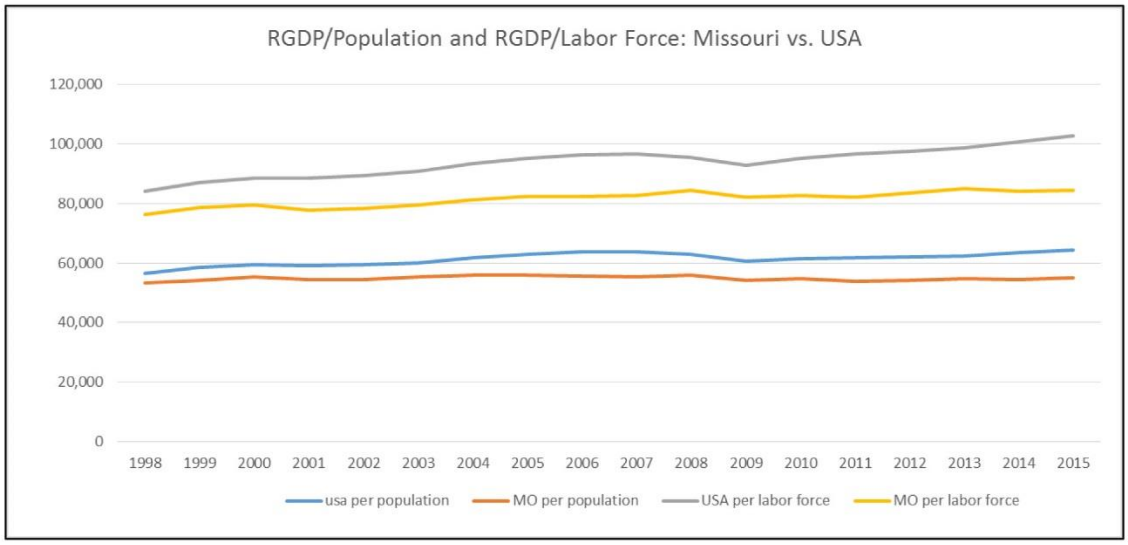
	USA	Missouri
Total Nonfarm	0.65%	0.25%
Mining and Logging	0.73%	-1.85%
Construction	0.15%	-0.69%
Manufacturing	-1.97%	-2.04%
Trade, Transport, Utilities	0.33%	-0.06%
Information	-1.22%	-2.00%
Financial Activities	0.39%	0.40%
Professional & Business Svcs.	1.38%	1.20%
Education & Health Svcs.	2.47%	1.91%
Leisure & Hospitality	1.79%	1.01%
Other Services	0.66%	0.21%
Government	0.53%	0.17%

Source: The Bureau of Labor Statistics.

Table 3. NSF Funding in Missouri and Surrounding States

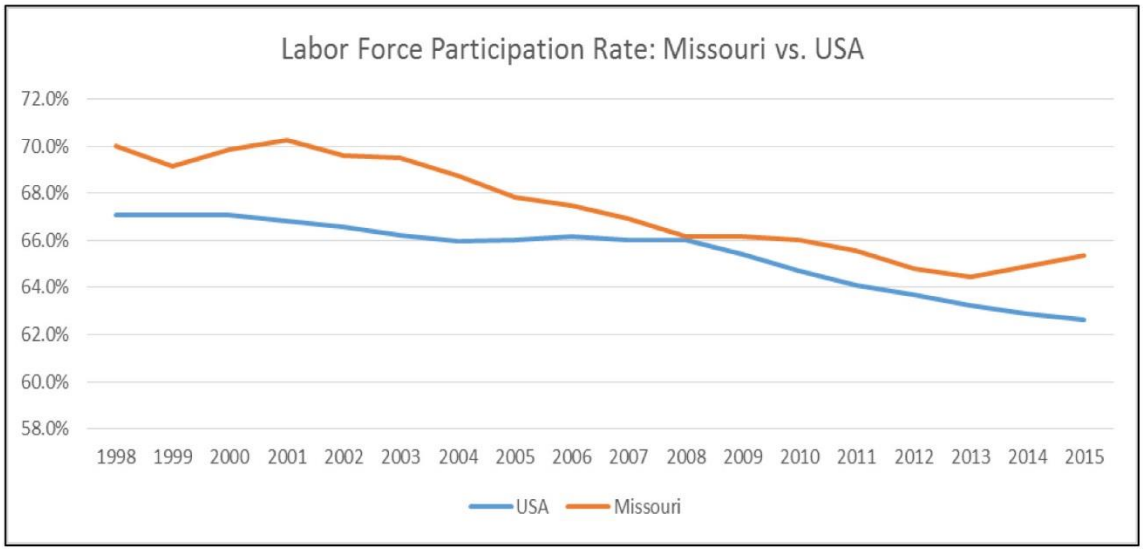
	NSF Funding in 2017 (millions)	Population in 2016 (millions)	NSF funding per capita in 2017	NSF funding in 2008	Growth in NSF funding from 2008 - 2017
USA	$5,628.776	323.127	$17.42	$4,464.479	26.1%
Missouri	$58.206	6.093	$9.55	57.287	1.6%
Arkansas	$13.487	2.988	$4.51	12.645	6.7%
Illinois	$292.027	12.802	$22.81	258.541	13.0%
Iowa	$46.887	3.135	$14.96	42.840	9.4%
Kansas	$41.371	2.907	$14.23	30.164	37.2%
Texas	$343.622	27.863	$12.33	198.008	73.5%

Figure 1



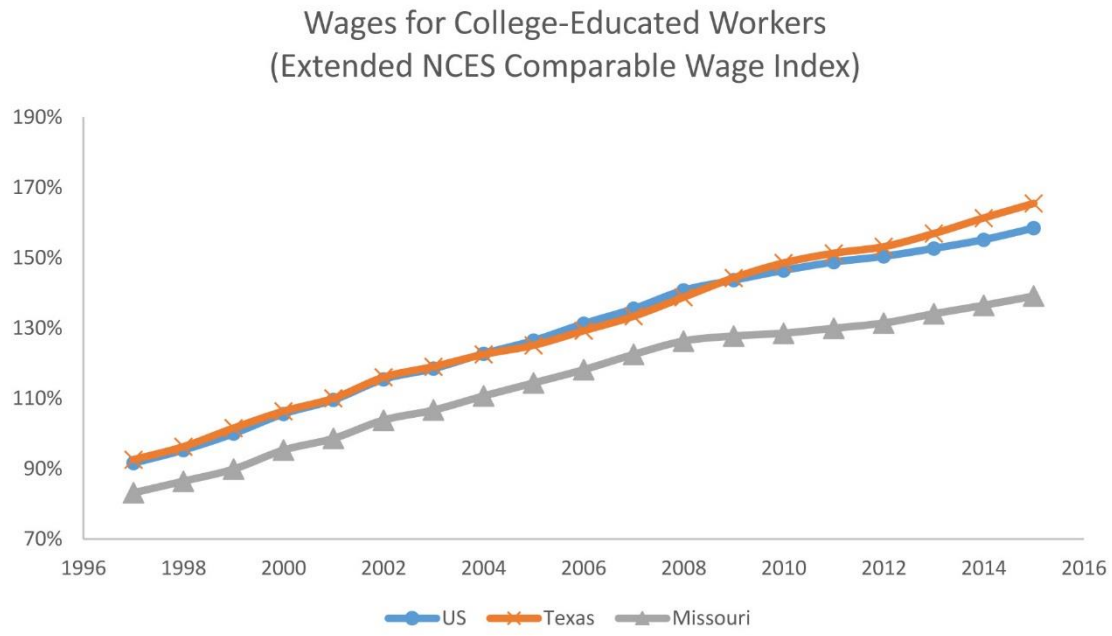
Source: Bureau of Economic Analysis, Bureau of Labor Statistics, and author calculations.

Figure 2



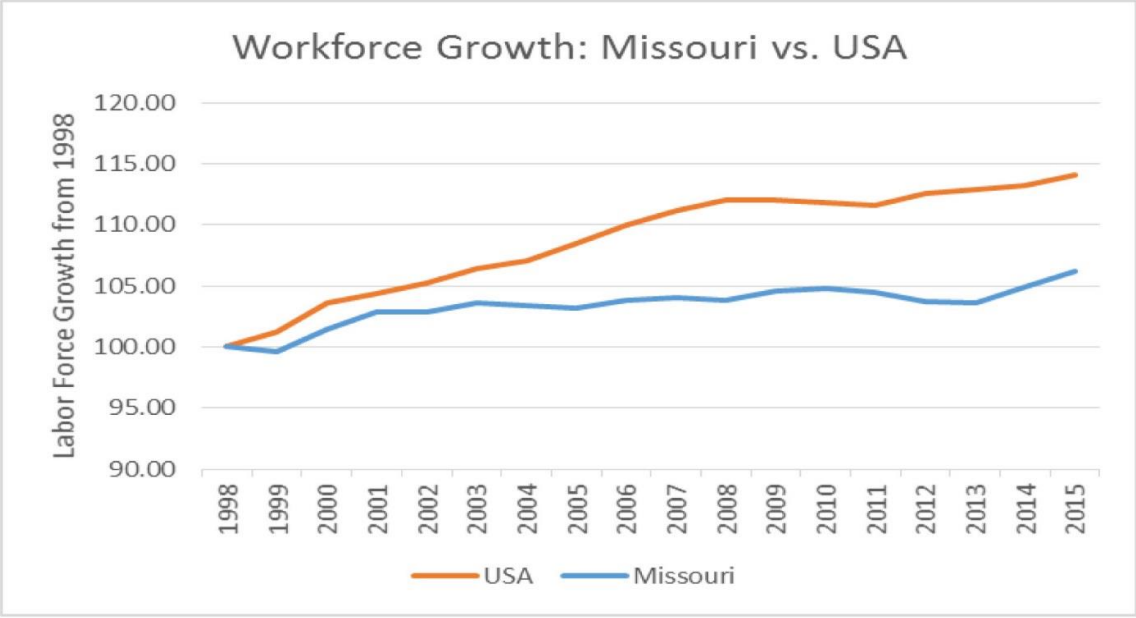
Source: Bureau of Labor Statistics, and author calculations.

Figure 3



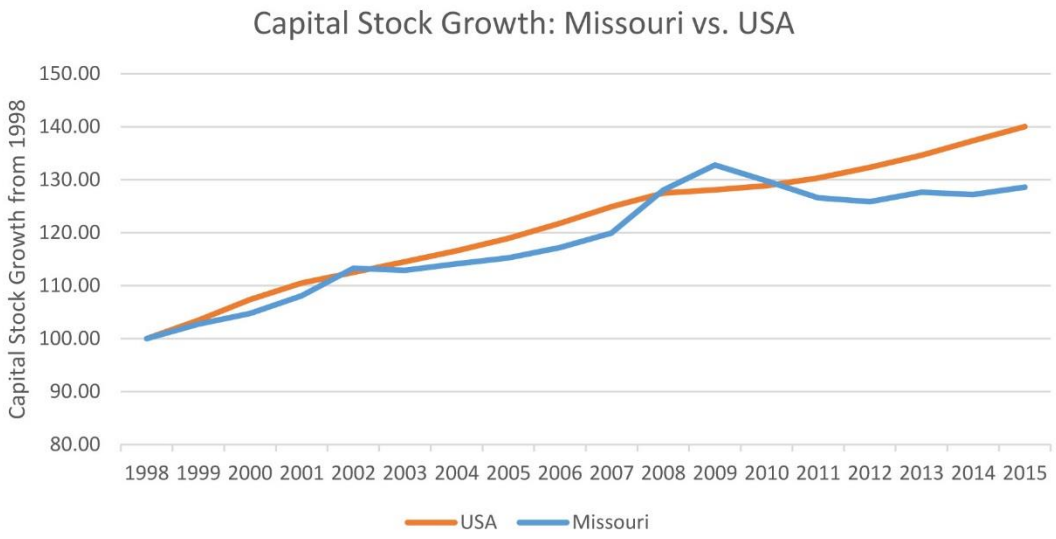
Source: National Center for Education Statistics.

Figure 4



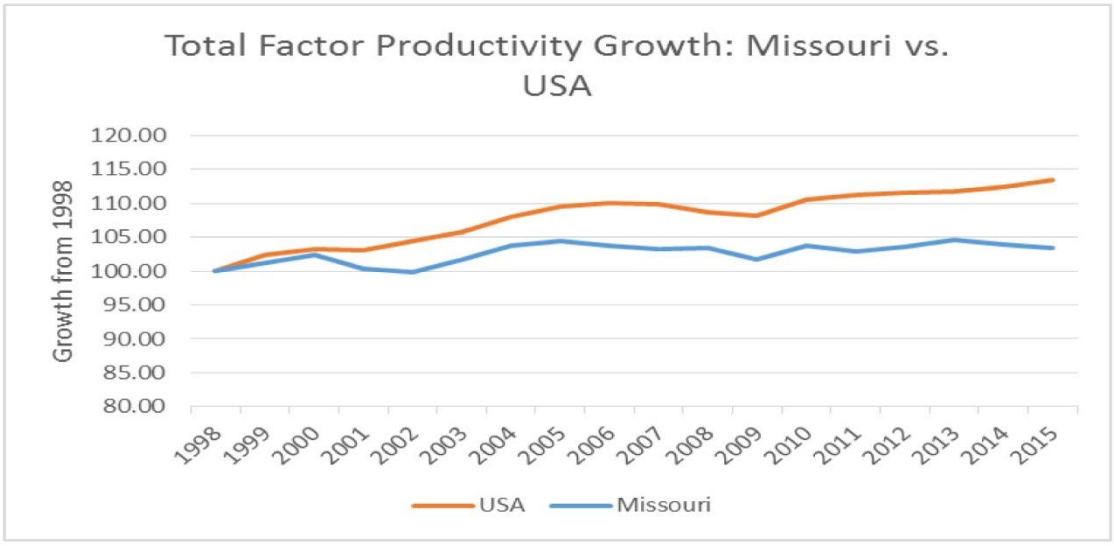
Source: Bureau of Labor Statistics, and author calculations.

Figure 5



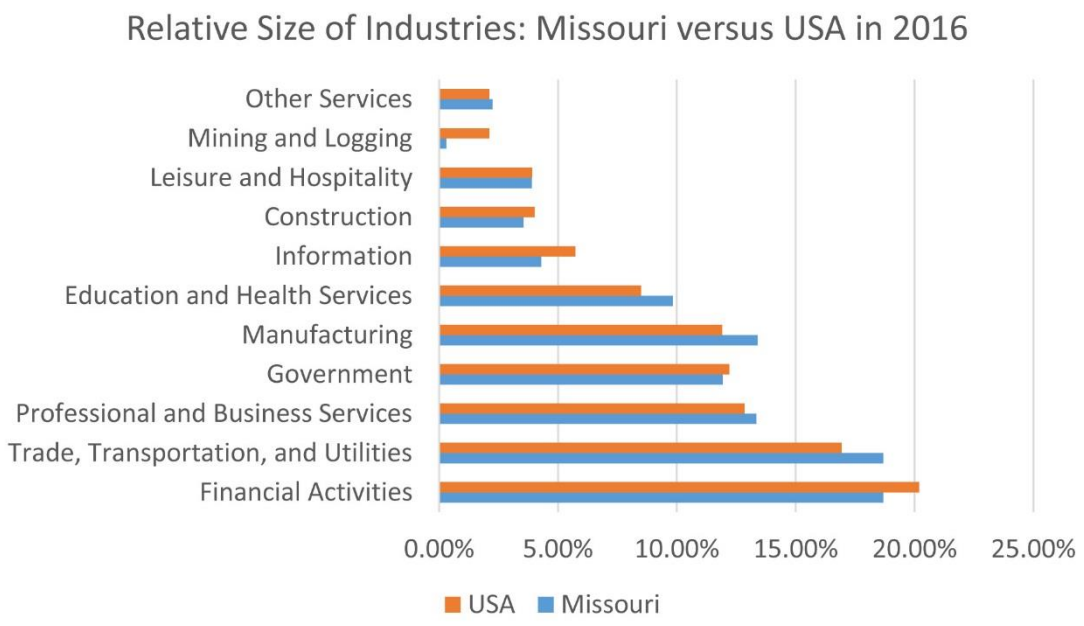
Source: Professor Steven Yamarik, California State University at Long Beach, and author calculations.

Figure 6



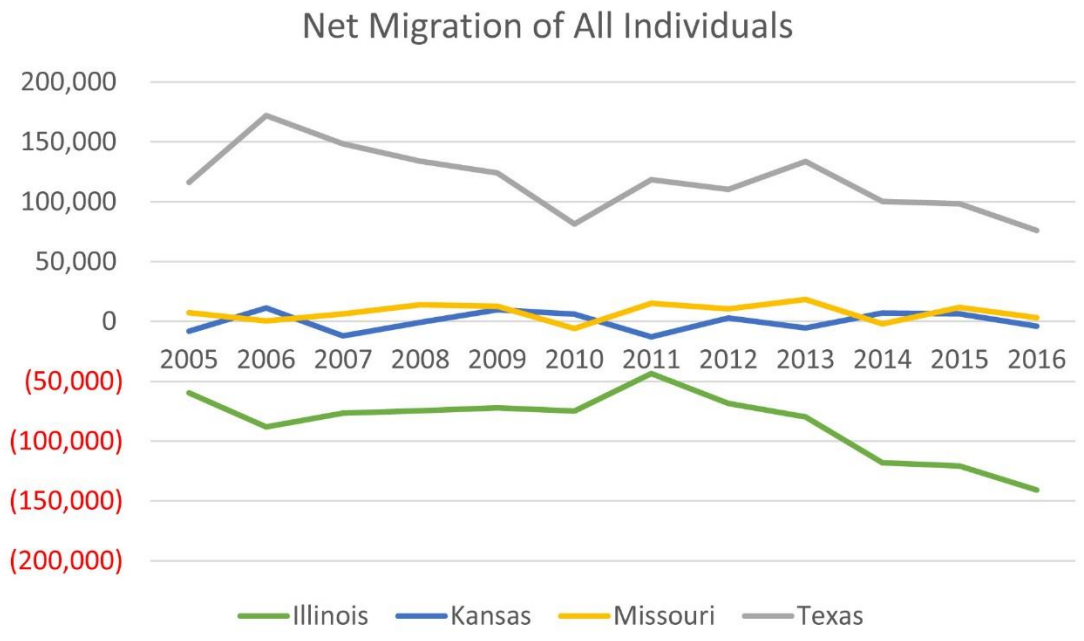
Source: Author calculations.

Figure 7



Source: The Bureau of Economic Analysis.

Figure 8



Source: The American Community Survey (ACS) Public Use Microdata Sample (PUMS) File.

Figure 9

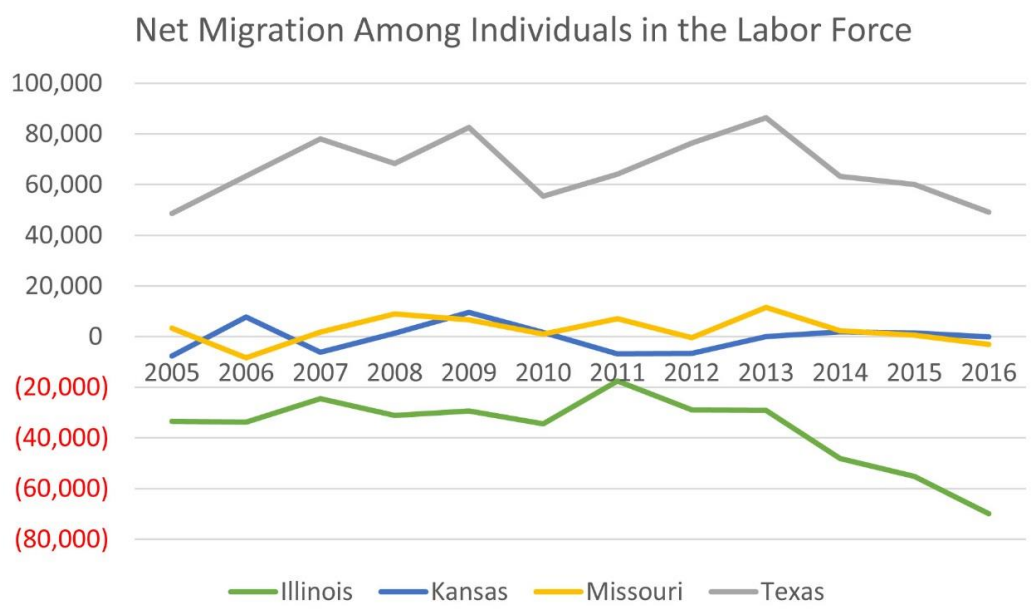


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Figure 10

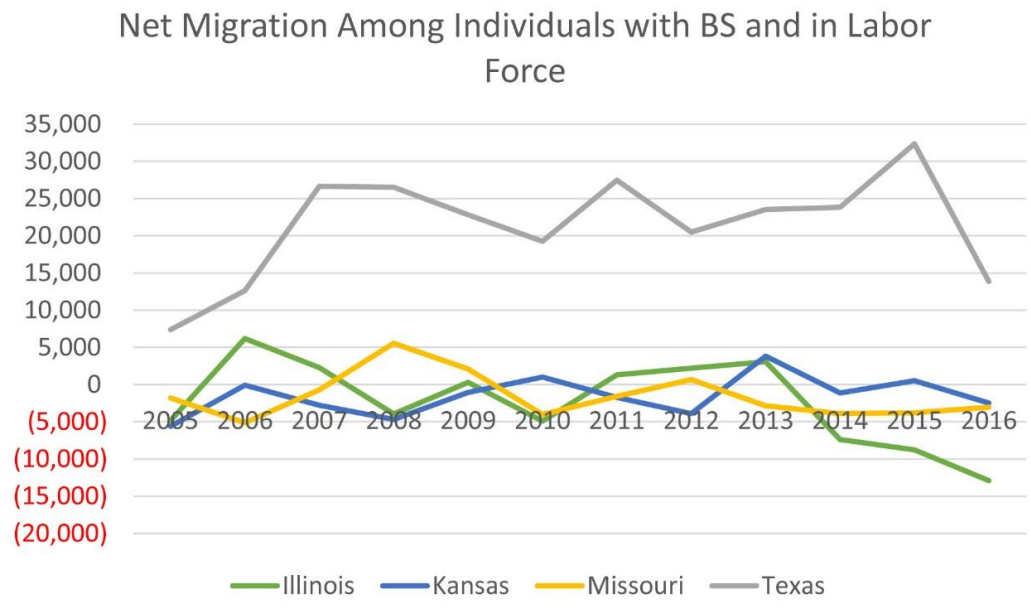

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Figure 11

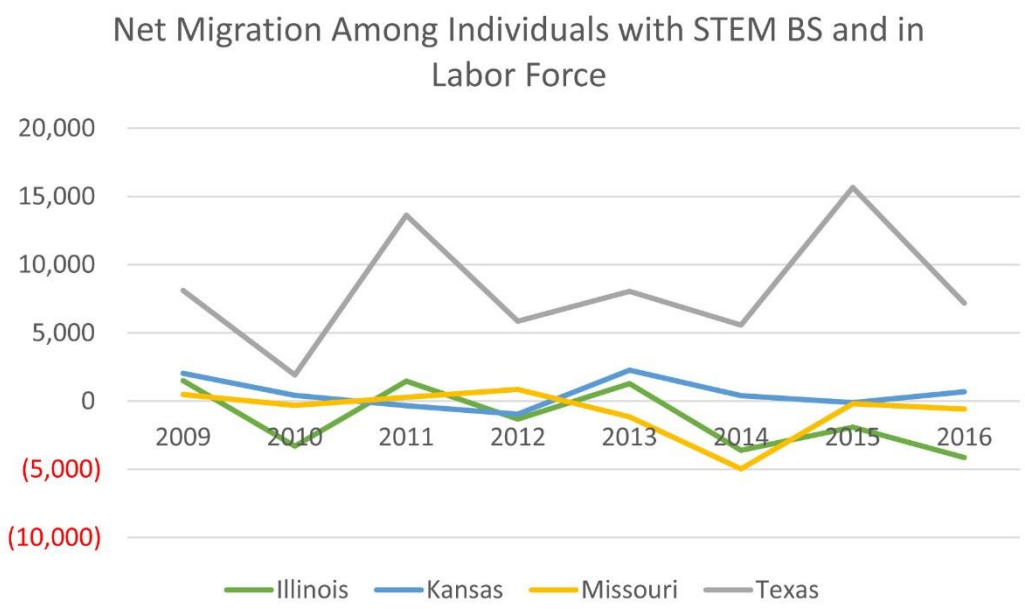

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Figure 12

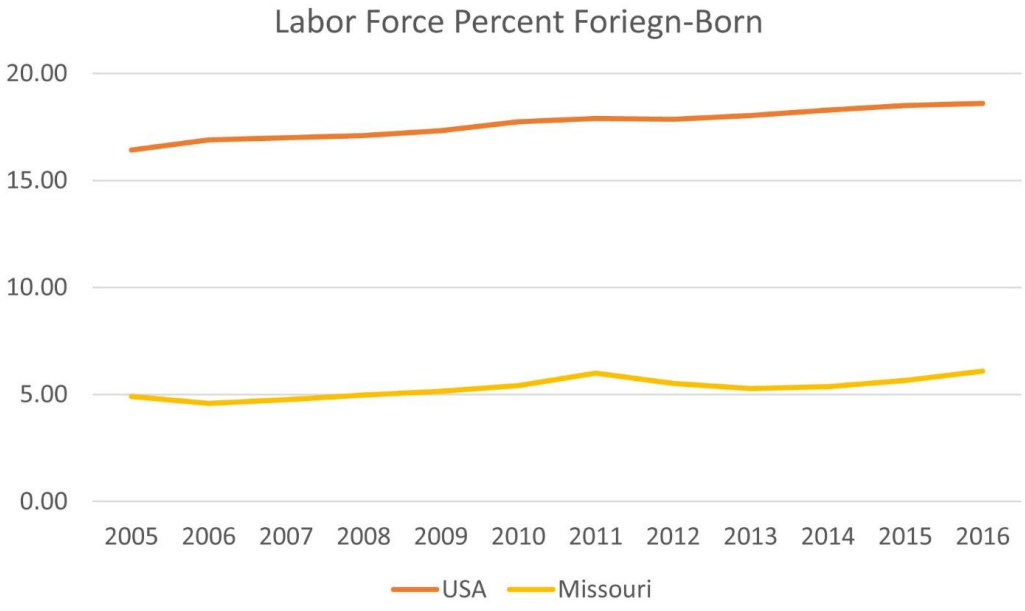

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Figure 13

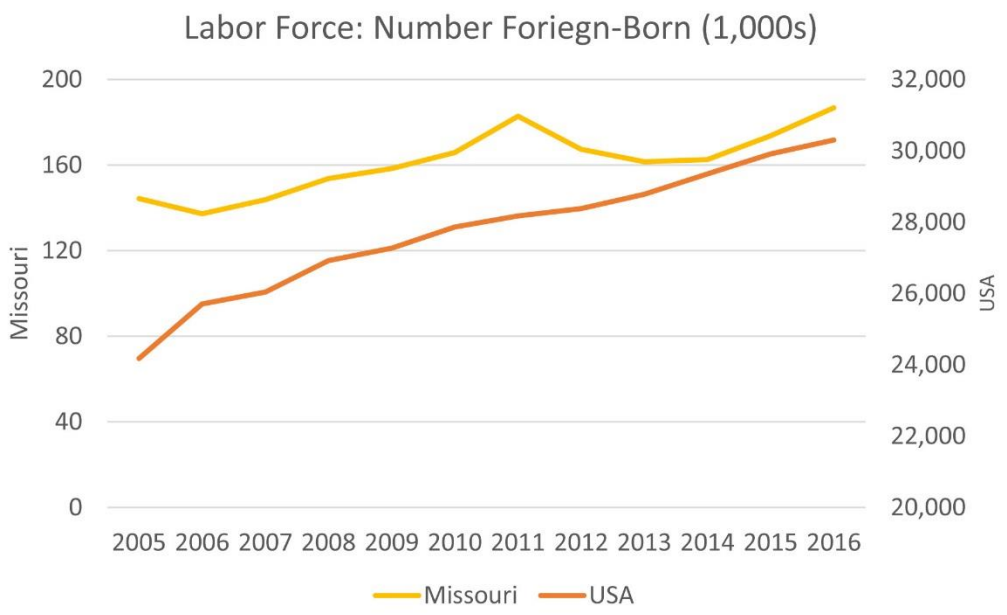

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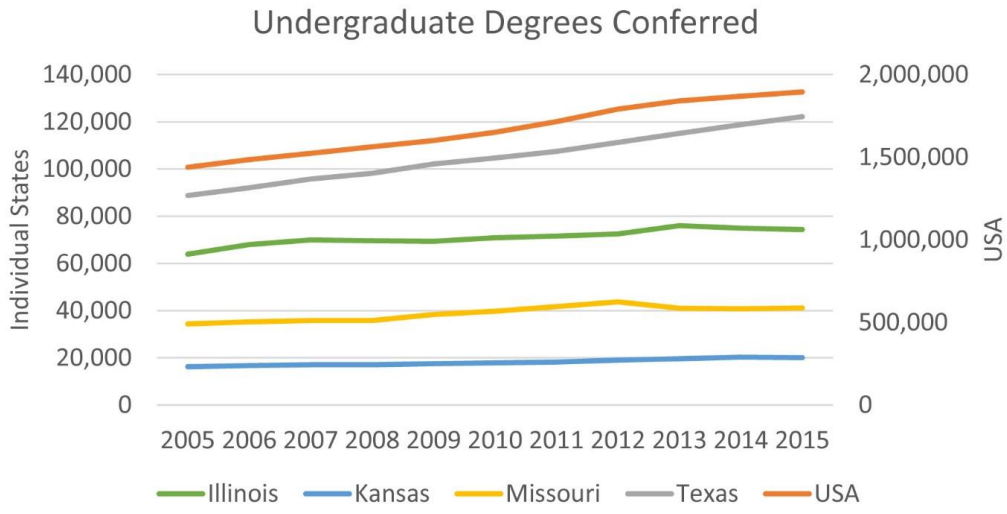
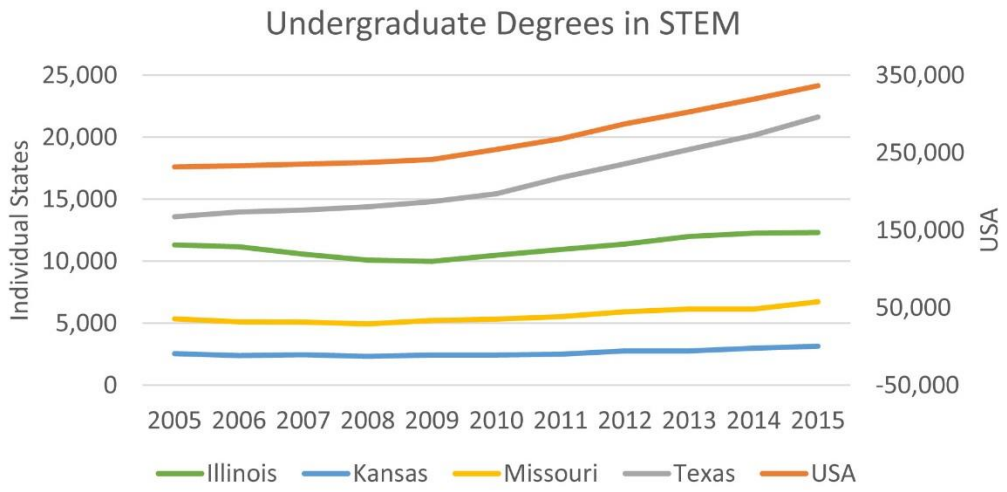
Figure 14



Source: The Digest of Education Statistics.

Figure 15



Source: The Digest of Education Statistics.

Figure 16

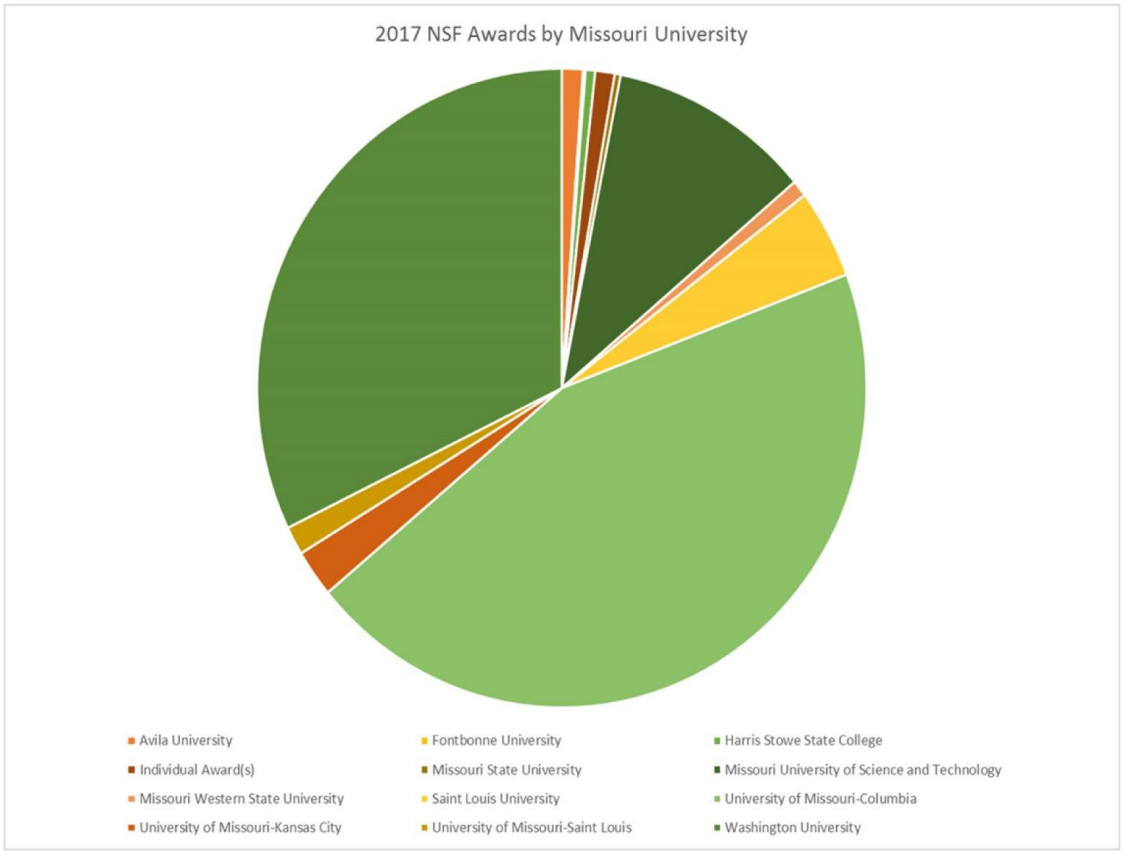
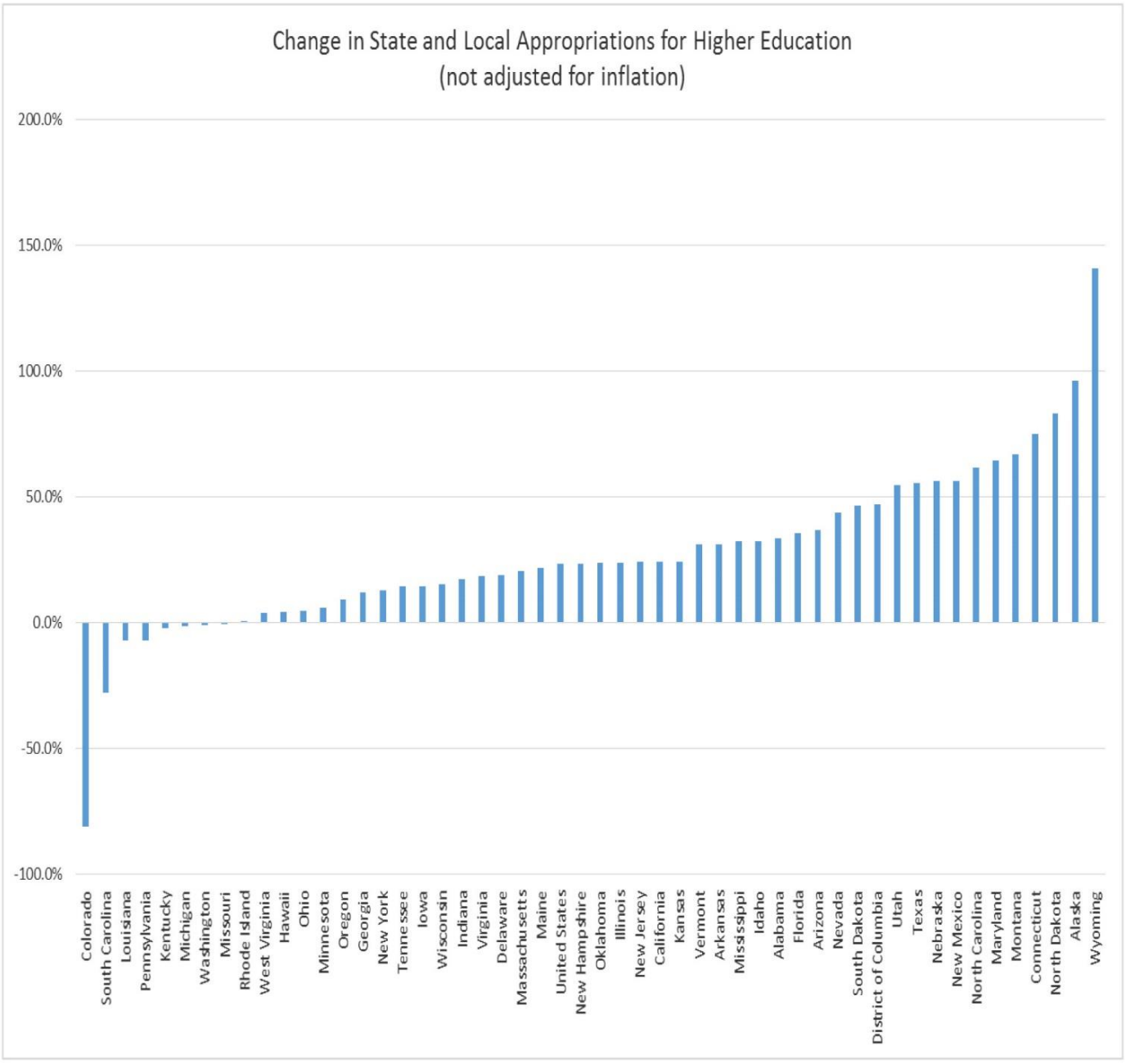


Figure 17



Source: US Department of Education, National Center for Education Statistics, Integrated Postsecondary Data Systems