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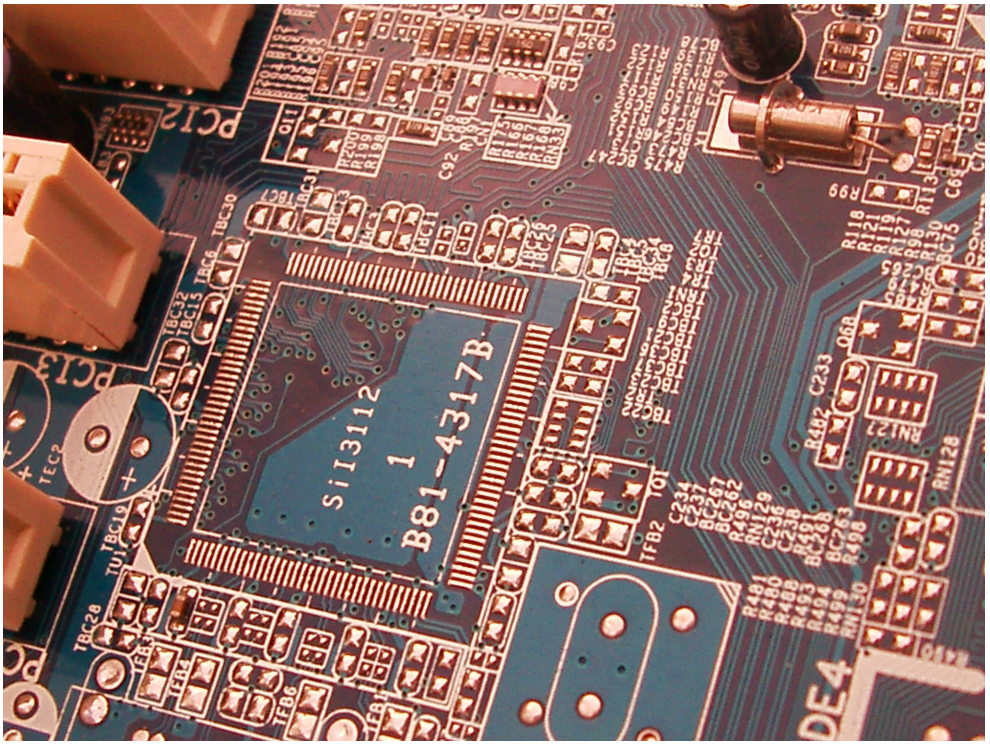
OCTOBER 2014



The 49th State: Revisiting Missouri's GDP Sector by Sector

By Joseph H. Haslag

Introduction

In many ways, Missouri's economic history mimics the national economic history. If you measure economic growth rates, Missouri has grown at about the same rate as the rest of the country. If you look at business cycle expansions and contractions, the Missouri economy has moved in sync with the national economy. Thus, conventional wisdom maintains that the Missouri economy marches in stride with the national economy.

Unfortunately, conventional wisdom does not match the facts. In particular, the Missouri economy has been growing more slowly than the national economy for more than a decade. The United States Bureau of Economic Analysis (BEA) has data on the value of goods and services produced within each of the 50 states and the District of Columbia for the period 1997 through 2013. During that period, the United States' real Gross Domestic Product (GDP) grew at a 2.23 percent annual average rate while Missouri's GDP increased at a 1.08 percent average annual rate. Only Michigan recorded an average annual growth rate lower

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than Missouri over the same period. Thus, we can summarily reject the notion that the Missouri economy grows at about the same rate as the national economy. Rather, the evidence indicates that Missouri has become a laggard relative to other states in the union.

Regular readers of Show-Me Institute essays are aware of Missouri's relatively poor economic performance. Over the past several years, the Institute has published several articles describing Missouri's growth-rate experience and comparing it to the performance in the other 50 states.[1] So, in this essay, I go a little deeper. Rather than present evidence with one more year of data, I describe what is going on in major industrial sectors within the state economy. By computing the growth rates for each major industrial sector, we can see which sectors are performing well in Missouri and which ones are performing poorly.

Next, I extend the decomposition to look across all 50 states and the District of Columbia. Armed with this data, I ask a simple question: Are the growth rates in individual sectors correlated with the state's overall economic growth rate?

The answer raises another question that has deeper policy implications. Policymakers frequently use the notion of correlations between growth in individual sectors and the state's overall economic growth to justify subsidies and tax credits. Indeed, the working hypothesis is that a high correlation between industrial sectors—Information, for example—and overall economic growth is the chief motivation for state governments to implement policies that raise the after-tax returns for such an anointed industry. By looking at these correlations, I confront this notion directly. In particular, I review the underlying causes of economic growth.

Once we understand what causes economic growth, it is possible to interpret these correlations as proximate relationships as opposed to sources of economic growth. For example, many states have sought to attract "high tech" companies. By focusing on such industries, the idea is that the state can attract a critical mass of these companies. The agglomeration will then be self-sustaining, as similar companies will relocate to be near the other similar companies and near the mass of highly skilled workers. This is what happened in Silicon Valley, right?

Such notions are apparently the kind of thinking behind the numerous times we have seen Missouri State Government attempt to apply subsidies and tax credits to increase the state's economic growth rate. By having a better understanding of why economies grow, we can view such policy efforts with a different, more skeptical, eye.

A Primer on Economic Growth

There are hundreds of scholarly papers that explain economic growth. This is not the paper to deliver a thorough presentation of the development of economic growth theory. Rather, here is an overview of technological progress as a source of economic growth.

Since Robert Solow's seminal paper in the 1950s, technological progress has been viewed as the engine of economic growth. At the Solow level of aggregation, technological progress can be thought of as any change in the production process that uses the same number of workers and machines to produce even more goods and services that people want. Technological progress can be high-concept, like breakthroughs in minimizing electrical circuits, or more straightforward—the discovery of lighter, stronger materials. Either way, the bottom line is that technological progress equates to higher efficiency and productivity.

With Solow's insight, we saw technological progress as something dropped on mankind. Technological progress may arrive at a steady pace, but Solow stopped at a point where the rate of progress was determined by some outside force. Since Solow, researchers have been trying to understand the process that yields technological progress. In these research papers, there is a random component inherent in the rate at which technological progress arrives. People, however, can make decisions that result in technological progress.

By deciding how to allocate resources, we can affect the arrival rate. For example, education and research and development are viewed as being related to economic growth. In the case of education, the idea is that a more highly educated person has better problem-solving skills. These skills can be applied to understanding the existing technology. With research and development spending, new methods can be developed that will, on average, improve the existing technology. In other words, education and research and development are investments in which the return occurs through technological progress.[2]

It seems plausible to say that if Silicon Valley were the outcome of prescient government policy, then every state would have one. The interpretative warning of this paper is that the source of economic growth is not capable of being planned. Governments can put forth rules and provide amenities like infrastructure that are complementary to higher rates of economic growth. But there is simply no evidence that governments can effectively plan for faster economic growth. This is crucial because, frequently, states consider policies that are directed toward subsidizing or attracting specific industries. This view puts the cart before the horse in terms of understanding the process of economic growth.

I proceed by looking at Missouri and the composition of its economic growth by major industrial sectors.

The Facts for the Missouri Economy, 1997–2013

Beginning in 1997, the BEA collected data on real GDP across all industries using the North American Industrial Classification System (NAICS).[3] The sum across all industries is the state's total real GDP.

Real GDP adjusts for changes in the quantity of final goods and services produced within a state's borders for a given year.

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The bottom line is that technological progress equates to higher efficiency and productivity.

The modifier "real" describes the process of holding prices constant over time so that the measurement captures only the changes in the value of the total quantity of final goods and services. The BEA uses a chain-weight index—considered a more accurate measurement of inflation than the consumer price index—of the price level to control for movements in the price of final goods and services. Formally, the measurement is real GDP by state in 2009 chain-weighted dollars.[4]

Figure 1 plots the values of Missouri's real GDP for the period 1997 through 2013. In 2013, Missouri reported the production of final goods and services to be slightly more than $258 billion in constant dollars. Compared with real GDP in 1997, which stood at $217 billion, the average annual growth rate between 1997 and 2013 was 1.08 percent.

Table 1 presents the 11 major sectors of industry. The Appendix details which firms fall under which category. Note that the Finance, Insurance, Real Estate, Rental and Leasing sector is the largest, accounting for nearly 18 percent of the final goods and services produced in Missouri. The Manufacturing sector is the second largest, and it accounts for slightly more than 13 percent of the Missouri economy. Other sectors are as follows: Government (12 percent), Educational Services, Healthcare, and Social Assistance (10 percent), Retail Trade (6 percent), Wholesale Trade (6 percent), Information (5 percent), Construction (3 percent), Utilities (2 percent), Agriculture, Forestry, Fishing, and Hunting (1 percent), and Mining (less than 1 percent). Overall, these 11 sectors

Figure 1

Real GDP for Missouri, 1997–2013

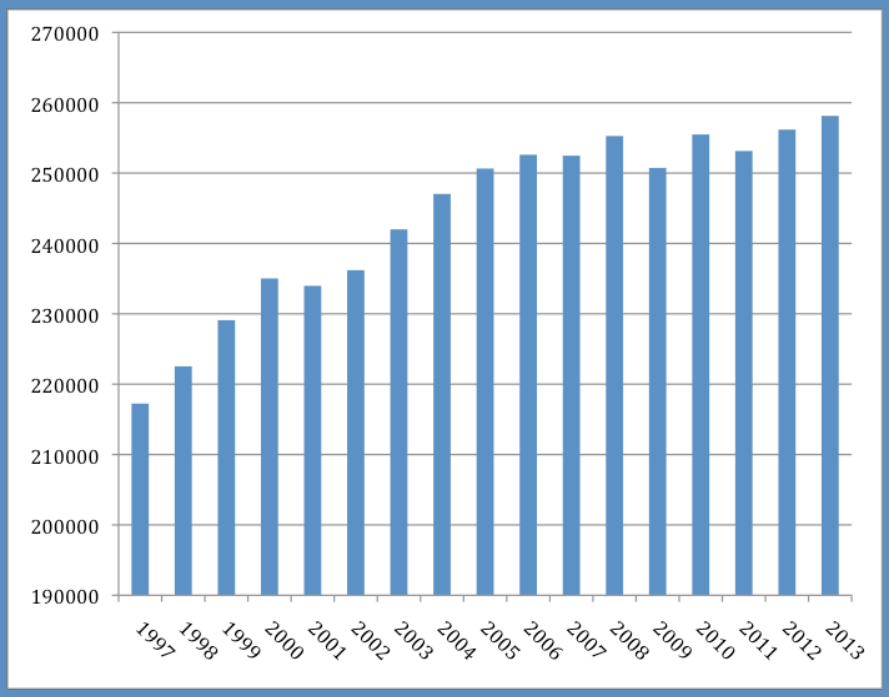

Table 1

List of Major Industrial Sectors and Share of Missouri Real GDP, 2013

Major Industrial Sectors	Share of MO Real GDP
Agriculture, Forestry, Fishing, and Hunting	0.0102
Mining	0.0053
Utilities	0.0224
Construction	0.0359
Manufacturing	0.1342
Wholesale Trade	0.0614
Retail Trade	0.0627
Information	0.0509
Finance, Real Estate, Rental and Leasing	0.178
Educational Services, Healthcare, and Social Services	0.097
Government	0.122

account for approximately 80 percent of Missouri's total real GDP.[5]

Figure 2 (see page 6) plots the annual average growth rate for 11 major industrial sectors in Missouri. At the statewide level, two sectors—Construction and Manufacturing—contracted between 1997 and 2013. The Information sector was the fastest growing, recording a 3.9 percent average annual growth rate over the 1997 through 2013 period. In addition, the Mining, Finance, Agriculture, Retail Trade, Wholesale Trade, and Utilities sectors recorded growth rates that exceed the growth of Missouri's real GDP for the 1997–2013 period.

The evidence tells a story. With only one observation, that story is mostly descriptive and not causal. There is no way to observe one state's economic growth rate and the growth rates of the major industrial sectors and to be able to infer that for this particular 16-year period one industry caused the Missouri economy to fall behind the other states. For one thing, we do not know yet what happened in the other states. More importantly, the changes in these sectors over time reflect deeper, underlying forces—causal forces. As such, we should hesitate before taking these facts and putting forward a theory that explains why the Missouri economy grew slower than most

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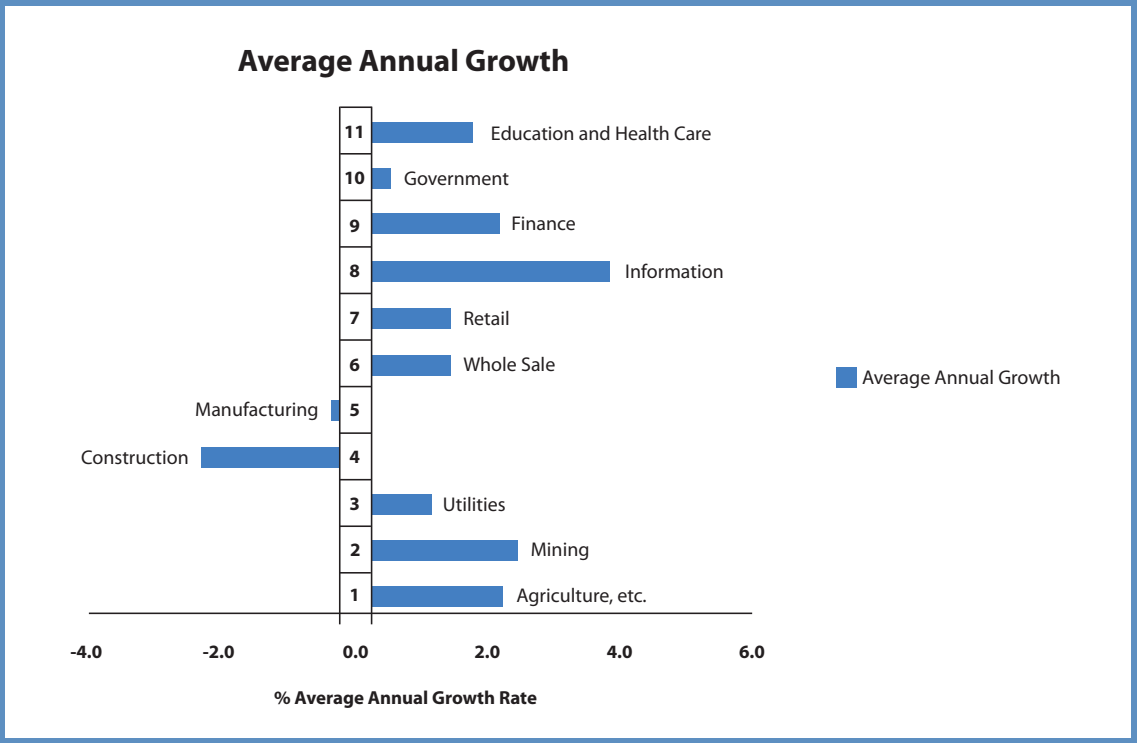
Figure 2
Growth Rates by Major Industrial Sectors for Missouri, 1997–2013



There is simply no evidence that governments can effectively plan for faster economic growth.

states between 1997 and 2013. The comparison across states will be revealed in the next section.

Growth in All 50 States

I constructed a dataset that consists of the same elements as the Missouri dataset in the previous section, extended to all 50 states and the District of Columbia. Also, I computed the annual average growth rate for the 1997–2013 period for real GDP and the output produced in each of the 11 major industrial sectors.[6] For the period 1997–2013, every state recorded positive growth. North Dakota grew at a 5.5 percent average annual rate during the period, the fastest growing state. In terms of real GDP growth, Missouri ranked 49th among the states. Only Michigan, which reported a 0.2 percent annual average growth rate, grew slower than Missouri.

As we look across states, there is one prominent question. What is the correlation between the growth rate in individual sectors and the growth rate for real GDP? Overall, there are 51 observations. I compute 11 separate correlation coefficients, one for each industry growth rate paired with real GDP growth.

In order to answer this question, it is essential to understand the concept

of the correlation coefficient. The correlation coefficient is a statistic that lies between -1 and 1. It tells you how closely two random variables move together. So, for example, if you are looking at the growth rate of the Information sector and the real GDP growth rate across states, you have 51 values that comprise our sample. If the correlation coefficient is positive, for example, the sign of the correlation coefficient tells us that states with higher growth rates in the Information sector, on average, tend to have higher total real GDP growth rates. Conversely, if the correlation coefficient is negative, for example, then the evidence indicates that states with Information sectors growing faster, on average, are states that have lower real GDP growth rates.

Correlation does not mean causation. This is an important distinction. From the correlation coefficient, we cannot distinguish between three alternatives: (i) the faster growth in the Information sector is causing real GDP to grow faster; (ii) faster growth in real GDP is causing the Information sector to grow faster; (iii) both the Information sector and real GDP growth are growing faster because of some external driving force, such as faster productivity growth that could be occurring in some other sector and spilling over to the Information sector.[7] Therefore, the interpretation of the correlation coefficient does not necessarily support the view that states need to target specific industries in order to grow faster.

Table 2 reports the pairwise correlation coefficient between the growth in each of the 11 major industrial sectors and real GDP growth across the 50 states and the District of Columbia. The standard error of the correlation coefficient is given by $\frac{1}{\sqrt{N-1}} = \frac{1}{\sqrt{50}} = 0.141$. Thus, if the null hypothesis is that the correlation coefficient is equal to zero, one can reject that hypothesis at the 5 percent confidence level for any coefficient value greater than 0.2764 or less than -0.2764.

Based on the evidence in Table 2, there are a number of major industrial sectors in which the growth rate is systematically related to real GDP growth across the states. The four largest correlation coefficients are the Retail Trade, Wholesale Trade, Manufacturing, and Finance sectors. Correspondingly, such evidence is consistent with the notion that faster growth in any of these sectors

There is no way to observe one state's economic growth rate and the growth rates of the major industrial sectors and to be able to infer that for this particular 16-year period one industry caused the Missouri economy to fall behind the other states.

Table 2

Correlation Coefficients for Major Industrials Sectors and Real GDP Growth

Industrial Sector	Correlation Coefficient With Real GDP Growth Rate
Agriculture	0.359
Mining	0.132
Utilities	0.444
Construction	0.446
Manufacturing	0.68
Wholesale Trade	0.667
Retail Trade	0.714
Information	0.287
Finance	0.698
Educational Services and Healthcare	-0.516
Government	-0.255

In terms of real GDP growth, Missouri ranked 49th among the states.

at the state level, on average, is positively related to faster state real GDP growth. In other words, most frequently, we see states that report higher economic growth rates also are states with faster growing Manufacturing sectors, for example.

It is interesting to note that the correlation coefficient on Government and Educational Services and Healthcare are the only two sectors in which the correlation coefficient is negative. For the Government sector, the correlation coefficient is significant at the 10 percent level, meaning that there is less than a 10 percent probability that you are wrong if you reject the null hypothesis that the correlation coefficient is actually zero.[8] The correlation coefficient for the Educational Services and Healthcare sector is significant at the 1 percent level. The sign of the correlation means that real GDP growth is lower, on average, in states in which the Government sector or the Educational Services and Healthcare sectors are growing faster. Let me emphasize, this is a correlation and not a causal relationship.

So, what is the best explanation that ties all the cross-state correlations together? The key underlying force is most likely the rate of technological progress. On average, those sectors that grew the fastest are reflecting the rate of technological progress in that sector. More specifically, the evidence is consistent with the idea that the rate of technological progress in the Wholesale Trade, Retail Trade, Manufacturing, and Finance sectors, for example, were correlated with technological progress in the overall state economy. The message is that growth in both the specific industrial sectors and the overall state economy reflect the underlying cause: that is, technological progress.

It is important to distinguish between the fundamental driving force and the endogenous responses. By pointing to technological progress, the story is more like a rock dropped into water. The initial splash and the ripples are both caused by the force of gravity acting on the rock. In a similar way, new insights through research and development and experiments affect the rate at which technological progress occurs. When technological advances are realized at a faster rate, the growth rate in the industry and in the overall economy will increase. This is very different than the story that says growth in these industries, whether planned or by dumb luck, were driving the overall state economic growth. From this viewpoint, it is natural to seek to grow specific industries.

I report two cases in which the correlation is negative between industry output growth rate and the state's economic growth rate. Faster growth in government, for example, may reflect political forces rather than technological progress in the production of government goods and services. In other words, faster growth in the Government sector owes to political decisions. Based on this analysis, one could account for the observed, negative correlation reported by arguing that faster growth in the Government sector results in greater spending in an industry that experiences low rates of technological progress. Or, alternatively, when the Government sector grows faster,

the goods and services produced impede technological progress in other sectors. For instance, when Government sector growth results in greater regulatory intervention in private production, thus raising the costs of doing business, this amounts to a measured decline in technology.

Overall, the evidence tells us something about the closeness of the relationship between growth rates in particular major industrial sectors and real GDP growth at the state level. There is a basic "adding up" condition that is at work; that is, the sum of all the sectors comprises a majority of the value of final goods and services produced within a state. As such, it may not be terribly surprising that there are some correlation coefficients that are in the 0.7 range. But remember that the evidence is about what is going on across states. In that view, the correlations tell us something about the similarity between growth in particular major industrial sectors and overall economic growth. The results raise an interesting point for future research; namely, can one construct a model economy that would account for the pattern of correlation coefficients reported in this paper?

Summary

Missouri continues to languish near the bottom of the states when ranked by economic growth rate over the last 16 years. After considering growth in the major industrial sectors in Missouri, I saw two things. First, the fastest-growing sectors are Information, Mining, and Finance, which are contrasted against those sectors that are shrinking, such as Construction and Manufacturing. Second, I learned the size of each sector is in terms of that sector's contribution to the total production of Missouri's final goods and services.

Next, I extended the idea of looking at major industrial sectors to all of the states. In particular, I was interested in learning whether there is a systematic correlation between the growth rate in an industry and the state economy's overall economic growth rate. I reported the correlation coefficients for 11 different major industrial sectors and real GDP growth across the 50 states and the District of Columbia. The evidence indicates that growth rates in the Retail Trade, the Information, the Manufacturing, and the Wholesale Trade sectors are most closely correlated with real GDP growth across the states.

There is a deeper message that underlies these statistics. The process of economic growth comes from technological progress. Formally, it is the ability to combine capital and labor into the final goods and services. This process depends on education and basic research. So, the most natural way to interpret the evidence is that technological progress in the Retail Trade sector, for example, is most closely correlated with overall economic growth. Progress is the cause of the economic growth at both the sectoral level and the state level. The policy message is that efforts devoted to attract a specific, "fast-growth" industry is a winner's curse. Using TIF and tax credits may achieve the desired industrial goal, but it will miss the underlying force that actually causes the state economy to grow.

Therefore, the interpretation of the correlation coefficient does not necessarily support the view that states need to target specific industries in order to grow faster.

The message is that growth in both the specific industrial sectors and the overall state economy reflect the underlying cause: that is, technological progress.

Appendix

Glossary of Major Industrial Sectors

(Source: Bureau of Labor Statistics and Bureau of Economic Analysis)

Agriculture, Forestry, Fishing, and Hunting comprises establishments primarily engaged in growing crops, raising animals, harvesting timber, and harvesting fish and other animals from farms, ranches, or natural habitats.

Mining comprises establishments that extract naturally occurring mineral solids, such as coal and ores; liquid minerals, such as crude petroleum; and gases, such as natural gas. The term mining is used in the broad sense to include quarrying, well operations, beneficiating (e.g., crushing, screening, washing, and flotation), and other preparation customarily performed at the mine site, or as a part of mining activity.

Utilities comprises establishments engaged in the provision of the following utility services: electric power, natural gas, steam supply, water supply, and sewage removal. Within this sector, the specific activities associated with the provided utility services vary by utility: electric power includes generation, transmission, and distribution; natural gas includes distribution; steam supply includes provision and/or distribution; water supply includes treatment and distribution; and sewage removal includes collection, treatment, and disposal of waste through sewer systems and sewage treatment facilities.

Construction comprises establishments primarily engaged in the construction of buildings or engineering projects (e.g., highways and utility systems). Establishments primarily engaged in the preparation of sites for new construction and establishments primarily engaged in subdividing land for sale as building sites also are included in this sector.

Manufacturing comprises establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products. Establishments in the Manufacturing sector often are described as plants, factories, or mills and characteristically use power-driven machines and materials-handling equipment. However, establishments that transform materials or substances into new products by hand or in the worker's home and those engaged in selling to the general public products made on the same premises from which they are sold, such as bakeries, candy stores, and custom tailors, may also be included in this sector. Manufacturing establishments may process materials or may contract with other establishments to process their materials for them. Both types of establishments are included in manufacturing.

Wholesale Trade comprises establishments engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The merchandise described in this sector includes the outputs of agriculture, mining, manufacturing, and certain information industries, such as publishing. The wholesaling process is an intermediate step in the distribution of merchandise.

Retail Trade comprises establishments engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The retailing process is the final step in the distribution of merchandise; retailers are, therefore, organized to sell merchandise in small quantities to the general public. This sector comprises two main types of retailers: store and nonstore retailers. Store retailers operate fixed point-of-sale locations, located and designed to attract a high volume of

walk-in customers. Nonstore retailers, like store retailers, are organized to serve the general public, but their retailing methods differ. The establishments of this subsector reach customers and market merchandise with methods like broadcasting and publishing direct-response advertising, publishing catalogs, selling from portable stalls (street vendors, except food), and selling through vending machines.

Information comprises establishments engaged in the following processes: (a) producing and distributing information and cultural products, (b) providing the means to transmit or distribute these products as well as data or communications, and (c) processing data. The main components of this sector are the publishing industries, including software publishing, and both traditional publishing and publishing exclusively on the Internet; the motion picture and sound recording industries; the broadcasting industries, including traditional broadcasting and those broadcasting exclusively over the Internet; the telecommunications industries; web search portals, data processing industries, and the information services industries.

Finance, Real Estate, Rental, and Leasing comprises establishments primarily engaged in financial transactions (transactions involving the creation, liquidation, or change in ownership of financial assets) and/or in facilitating financial transactions. Authorities charged with monetary control also are included in this sector. In addition, the Real Estate and Rental and Leasing components comprise establishments primarily engaged in renting, leasing, or otherwise allowing the use of tangible or intangible assets, and establishments providing related services. The major portion of this sector comprises establishments that rent, lease, or otherwise allow the use of their own assets by others. The assets may be tangible, as is the case of real estate and equipment, or intangible, as is the case with patents and trademarks.

Educational Services and Healthcare

The Educational Services sector comprises establishments that provide instruction and training in a wide variety of subjects. This instruction and training is provided by specialized establishments, such as schools, colleges, universities, and training centers. These establishments may be privately owned and operated for-profit or not-for-profit, or they may be publicly owned and operated. Educational services are usually delivered by teachers or instructors that explain, tell, demonstrate, supervise, and direct learning. Instruction is imparted in diverse settings, such as educational institutions, the workplace, or the home, and through diverse means, such as correspondence, television, the Internet, or other electronic and distance-learning methods.

The Health Care and Social Assistance sector comprises establishments providing health care and social assistance for individuals. The services provided by establishments in this sector are delivered by trained professionals. All industries in the sector share this commonality of process, namely, labor inputs of health practitioners or social workers with the requisite expertise.

Government includes the executive, legislative, judicial, administrative, and regulatory activities of federal, state, local, and international governments.

Joseph Haslag is the chief economist at the Show-Me Institute, which promotes market solutions for Missouri public policy.

The process of economic growth comes from technological progress.

NOTES

1. See Joseph Haslag and Michael Podgursky, "Slip Sliding Away: The Relative Performance of the Missouri Economy" (Essay, Show-Me Institute, 2012), and R. W. Hafer and Michael Rathbone, "Missouri's Economic Record in the 21st Century" (Essay, Show-Me Institute, 2014), for example.

2. Throughout this analysis, I will interpret the evidence on economic growth as being the result of technological progress. There are models in which economic growth is sustained without technological progress. For example, according to the increasing returns approach, returns to certain investments may not diminish with increasing quantity. The increasing returns model highlights the role that agglomeration plays in determining the growth rate. To illustrate this, consider a business owner locating near another similar industry. The idea is that there are spillovers that occur. Instead of the return on investment declining as the quantity of investment increases—that is, diminishing marginal product of investment—the spillovers actually can result in higher returns, which induces people to invest even more. The agglomeration effect is used to explain things like Silicon Valley in California, Route 128 in Massachusetts, and even the existence of universities. In this case, growth is the result of accumulation of more productive inputs, especially capital, because its return increases as the quantity increases. As the rate of input acquisition increases, the rate of economic growth increases. Even in this framework, however, technological progress can play an important role in explaining the spillovers. As a practical matter, it is extremely difficult empirically to identify increasing returns at aggregations as large as states.

3. This is why the consistent measure of GDP only goes back to 1997. By changing from the Standard Industrial Classification, or SIC, to NAICS, the BEA effectively changed the construction method for calculating GDP. They completely stopped using the SIC approach in 2005, so there is no consistent measure of total real GDP before 1997.

4. The interested reader can go to the BEA webpage at www.bea.gov to learn more about the calculation of the chain-weight price index.

5. The other 20 percent is accounted for by utilities, transportation and warehousing, and professional business services. In this essay, I focused on sectors that tend to be thought as "causes" of economic growth and ones that frequently are targeted by state governments for tax incentives.

6. The complete dataset is available from the Show-Me Institute upon request.

7. There is a fourth alternative that allows for the growth rate in real GDP and the growth rate of the Information sector to be positively correlated, but without a structural relationship. Because the Information sector is part of real GDP, the view that the two are spuriously correlated is not very plausible.

8. This is called a Type I error in statistics. In other words, if you take the position that the estimated coefficient is zero—that is, the null hypothesis—the likelihood that you wrongly reject that position is less than 10 percent in the case of the Government sector.

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