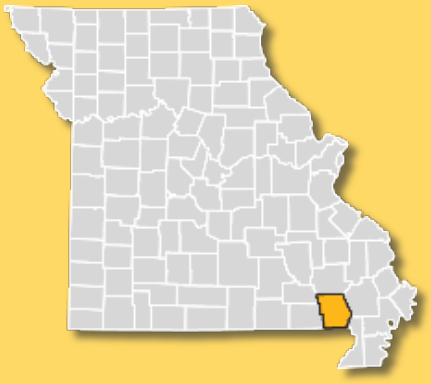
Economic Benefits of Expanding Broadband in Missouri

Butler County



Extension
University of Missouri

Exceed

Table of Contents

This study was funded by a Broadband Technical Assistance grant offered through the U.S. Department of Agriculture Rural Development-Rural Utilities Service.

Author:
Alan Spell, Assistant Extension Professor
Division of Applied Social Sciences
College of Agriculture, Food and Natural Resources
University of Missouri
alan.spell@missouri.edu

July 2025

Executive Summary

Drivers of economic benefits

Measuring broadband's economic impact—on jobs, income, and wealth—is challenging because its benefits are closely linked to broader gains in technology, business practices, and digital skills. Quality-of-life improvements, like staying connected with distant family, add further value that is hard to quantify. Additionally, since broadband rollout and adoption happen over time, the resulting economic gains often emerge gradually.

While challenges persist, recent causal research is shedding light on the tangible ways broadband expansion strengthens local economies:

- **Broadband investment:** Installing broadband infrastructure to previously unserved households stimulates construction-related economic activity for several years.
- **Telemedicine:** Virtual healthcare reduces household costs by limiting emergency room visits and doctor's office trips, and saves income associated with travel and missed work.
- **Education productivity:** Access to online resources increases teacher productivity.
- **Income:** Broadband technology enables more effective job matching, online training and access to goods and services that can increase incomes. It also improves productivity, potentially raising household and farm incomes.
- **Employment:** Community job growth, especially in knowledge-intensive service industries, fosters entrepreneurial, investment and productivity gains.

While broadband access is essential, it alone does not guarantee economic growth. For communities to truly benefit, residents and businesses must widely adopt broadband services and gain digital skills. **Increased broadband adoption and utilization drive long-term economic gains.**

About this study

This study estimates the 10-year economic benefits that would result from expanding broadband access and adoption in Butler County, Missouri. The study considered minimum and maximum broadband adoption scenarios to capture a range of economic outcomes over ten years. The minimum scenario assumes a 10 percentage point increase in household broadband adoption. In the maximum scenario, household broadband adoption increases by 20 percentage points.

Key study findings

The following describes how jobs, labor income and gross domestic product would change assuming the minimum and maximum broadband adoption gains.

Job and labor income growth are the most tangible economic benefits expected from expanded broadband adoption:

- In both scenarios, Butler County sees sizable employment growth in the 10-year period. Exhibit 1 shows a gain of 340 jobs by year 10 in the minimum adoption scenario. Job gains double in the maximum scenario. These gains may seem modest, but are more substantial when considering past employment trends.
- For context, Exhibit 1 shows the annual average number of new jobs per year as a percentage of 2023 employment and compares these rates to past county job growth trends. The minimum scenario shows annual job growth of 1.0% of 2023 employment, and 1.7% in the maximum scenario. These gains substantially exceed the annual 2018-23 employment growth rate of 0.3% for Butler County.
- Labor income would also increase as broadband use expands, as shown in Exhibit 1. From $138 million in income gains in the minimum scenario to $248 million for Butler County in the maximum scenario. These gains would increase spending in local communities and benefit businesses and residents alike.

How Significant is GDP Growth?

Gross domestic product (GDP) measures the final value of goods and services sold in a county, contributing to new income and profits circulating within the community.

Under the minimum growth scenario, inflation-adjusted GDP would increase annually by 0.9% for Butler County.

These gains allow for significant economic expansion. For example, Butler County experienced a 1.2% annual GDP growth rate from 2018 to 2023. The minimum scenario adds an annual boost of 0.9% in new GDP over 10 years.

Adding 0.9% to Butler County's annual GDP over 10 years, all else equal, would grow the county's economy by

9.3%

as compared to 2023.

Gross domestic product (GDP) communicates the value of all final goods and services produced in a county. It represents the most comprehensive measure of economic benefits from broadband expansion.

- The study projects that GDP would increase significantly under both minimum and maximum scenarios. Butler County gains a cumulative $195 million in GDP over 10 years in the minimum scenario and $346 million in the maximum scenario.
- With modest 10 percentage point broadband adoption gains, Butler County would increase its annual GDP by 0.9% relative to its 2023 GDP levels. In the maximum scenario, annual GDP gains increase by 1.6% compared to 2023 levels.

Exhibit 1 shows how Butler County benefits from fixed broadband expansion in terms of county employment, labor income and GDP growth under the two scenarios.

Exhibit 1. Economic Benefits of Broadband Adoption in Butler County Under Minimum and Maximum Scenarios

Butler County	Minimum Scenario	Maximum Scenario
10-Year Economic Benefits of Broadband Expansion		
Employment Gain in Year 10	340	684
Total Gain in Labor Income over 10 Years *(in millions)*	$137.8	$247.6
Total Gain in Gross Domestic Product over 10 Years *(in millions)*	$195.3	$346.3
Average Annual Gains Compared to 2023 and Prior 5-Year Trends		
Annual Avg. Employment as % of 2023 Employment	1.0%	1.7%
*Reference: Annual Employment % Change, 2018-23**	*0.3%*	*0.3%*
Annual Avg. GDP as % of 2023 GDP	0.9%	1.6%
*Reference: Annual GDP % Change, 2018-23**	*1.2%*	*1.2%*

**Notes: Reference source is U.S. Bureau of Economic Analysis data. Average annual employment and GDP are divided by 2023 county figures to show the percentage of that figure compared with 2018-23 growth rates. Annual GDP % change for 2018-23 is the compound annual growth rate in real dollars. Income and GDP are in 2025 dollars.*

Economic Benefits of Broadband Expansion

This analysis documents the economic benefits of expanded broadband availability and adoption in a community. We begin by defining important terms in this study.

The term "broadband" or "fixed broadband" is used interchangeably in this analysis, and it refers to moderate-to-high speed broadband services delivered by fiber, cable or DSL (digital subscriber line) technologies.

High-speed "broadband services" are defined by the Federal Communications Commission (FCC) as broadband speed of at least 100 Mbps (transfer of "megabits per second") of download speed and 20 Mbps of upload speed, often referred to as 100/20. This definition, updated in March 2024, is an increase from the prior broadband specification of 25/3 Mbps speed.

"Broadband availability" refers to the presence of broadband infrastructure so that a household or business can request and receive that service. The FCC provides 2024 broadband availability information that is viewable through a Missouri Office of Broadband Development mapping portal.

"Broadband adoption" refers to the number or percentage of households that subscribe to fixed broadband services. This figure typically comes from the U.S. Census Bureau's American Community Survey (ACS) 2019-23 5-Year estimates.[1] The household fixed broadband adoption level is an important driver of economic benefits. If consumers perceive that broadband service is too costly, they will not adopt the service even if it is available. Other reasons for non-adoption include digital illiteracy or simply not wanting broadband services.

Because U.S. Census broadband adoption data reflects an older 5-year period (2019–23), it likely underestimates current adoption levels. To provide a timelier estimate, this study uses expert input, informed by a 2025 internet engineering assessment for Butler County, to estimate current household adoption levels.

For more information on defining broadband, availability and access, see the University of Missouri Extension guide DM601, Broadband Technologies: A Primer on Access and Solutions.

Economic Benefits by Category

Many studies document the relationships, or correlations, between broadband adoption and economic gains. However, causal research findings statistically isolate those relationships to suggest cause-and-effect. These studies are particularly useful in broadband economic benefit analysis, as gains are described by specific measures. This section reviews some of the key economic benefits researchers have found after the introduction of broadband services.

Telemedicine

Telemedicine creates many benefits for healthcare providers and the patients they serve. Healthcare providers benefit from rural hospital cost savings due to outsourcing services and increased lab and pharmacy work that can be performed locally.[2] Telemedicine allows patients to reduce travel time and the associated lost work income. Virtual health care consultations can also save patients money, as these services cost less and can reduce the number of emergency room visits.[3,4]

Enabled by broadband adoption, the benefits of telemedicine to patients are easy to understand from a cost perspective. However, the benefits to healthcare providers and communities are more nuanced, as local spending can be transferred in different directions. For example, a rural hospital can reduce costs by contracting with a larger city hospital to provide specialized services. That spending would, in turn, benefit the urban community while reducing the need for doctors at the rural location. This can lower the overall cost for a rural hospital, but it does mean less high-income employment in the community. However, a rural community can benefit from spending at local labs or pharmacies because the telemedicine patient is less likely to travel to a larger city hospital for diagnosis. In these instances, urban labs and pharmacies lose income.

Education Productivity

The COVID-19 pandemic brought urgent attention to the need for remote learning. It highlighted how learning losses resulting from school closures have disadvantaged students, especially those from lower-income families, perhaps diminishing their lifetime earnings.[5] While broadband service is a basic requirement for remote learning, many rural school districts in 2020 struggled to help students who lacked home broadband access.[6] COVID-19 created a large experiment on the benefits and costs of remote learning that will take years to understand. Before the pandemic, research on causal educational benefits from broadband expansion largely focused on cost savings to schools to provide education or on teachers' time to find information.[7]

Research has also demonstrated that having broadband access to learning resources positively correlates with better school outcomes for students.[8] However, quantifying the benefits in a causal manner has proven difficult. The economic benefits of educational gains are also complicated at a community level due to the extended time it takes for a student to become a working adult, and where they will find employment.

Household Income

The potential to raise incomes with broadband adoption seems intuitive, as people can bolster their pay with greater access to online educational resources, productivity tools, and the ability to find more job opportunities. Yet isolating income gains from broadband adoption can prove challenging, as gains are strongly linked with other factors such as educational attainment and job selection. One often-cited study estimated household income gains from increased broadband adoption that can be interpreted as causal.[9] The research shows that as nonmetro counties move from moderate to higher levels of broadband adoption, the median household income rises by 1.3% over 10 years.

The reasons for income increases are complex and related to other benefits used to measure economic gains from broadband. Educational attainment, employment opportunities, productivity and other factors are intertwined with income, so estimating separate gains from these factors can risk overestimating economic benefits. Conversely, including modest income gains with other related measures can serve as a proxy for benefits, such as quality of life or the ability to work remotely, which are harder to quantify.

Farm Income

Broadband access is becoming increasingly important for agricultural producers. An early study of farming-related broadband benefits suggested that economic gains came from real-time information on weather, pricing and management practices. [10] This 2011 study found that U.S. Department of Agriculture broadband loans administered in the early 2000s had a positive impact on farm profits of 3%, driven mainly by increased crop sales. Livestock or animal production operations were less sensitive to broadband access. Many agricultural producers now have access to real-time market and weather data using smartphones, so many of these benefits are already integrated into the farm economy.

However, a more recent study of farming gains confirmed the ongoing benefit of broadband to crop production. [11] The 2020 study found that broadband availability had a small, but statistically significant, impact — a 1% increase in broadband access caused a 0.1% increase in crop yields. Explanations for these gains include the use of precision farming techniques and machinery.

Employment

Installing broadband infrastructure in a community spurs immediate, but temporary, employment gains in construction and supply-chain industries. While important, these short-term job gains can be minimal, as some spending for specialized workers and materials goes to firms outside the community. However, increased broadband adoption creates lasting community job gains.

Employment gains from broadband expansion encompass the positive impacts that this technology has on business growth, investment, entrepreneurship, and productivity gains. Whether broadband facilitates a new business location or enables the expansion of current commercial activities, employment increases are tangible economic benefits that can be seen, and by extension, can lower unemployment levels. While research shows a correlation between broadband and economic development, a handful of studies attempt to isolate the cause-and-effect, or causal, relationship between greater access and specific business and workforce gains.

Business formation is an important benefit arising from broadband expansion. A 2024 study indicated that business births increased with the availability of high-speed internet, especially for metro areas.[12] For example, the analysis found that within five years of introducing 250 Mbps internet service, a metro area of 200,000 people would see one additional business birth. Studies have found that broadband expansion has positive impacts on new firm creation in rural counties as well.[13] Another study found that the number of knowledge-intensive professional and business service firms grew as the number of broadband providers increased.[14] Similar findings from 2012 research confirmed that the benefits of broadband expansion can be seen in service industries that rely most heavily on information technology.[15] The research indicated that even though broadband expansion is associated with employment growth, it does not increase average pay. One explanation is that the draw of employment opportunities increased the population, and therefore the labor supply, which suppressed wage increases.

New and expanding firms increase employment, but growth from broadband expansion can be harder to detect in urban areas. A 2014 study found that employment gains from broadband adoption are seen in nonmetro counties, with no meaningful relationship uncovered in metropolitan counties.[16] One reason may be that the gains in urban areas are already incorporated into the economy or that other factors contribute to job growth. Lower unemployment levels, expected when employment increases, were also found in this research and, more recently, from a 2020 study of high-speed broadband benefits.[17]

Broadband productivity benefits in knowledge-intensive industries have also been documented, along with a dilemma for rural areas with less educated or skilled workers.[18]

A 2013 study found that broadband produces positive productivity impacts when used by a highly educated or skilled workforce. Rises in productivity also impact income as more productive employees can be paid more. The research suggests that rural areas with broadband availability, but with lower workforce education/skill levels, may see employment losses as businesses outsource work to other areas or use technology to substitute for workers. That is the other impact of productivity; while it benefits businesses and worker income, it can mean less employment in the local area.

A 2020 study also found productivity benefits from broadband that were influenced by factors such as distance to metropolitan areas and educational attainment.[19] The research supported similar findings from other studies that a more educated workforce, in closer proximity to a metropolitan area, is related to higher productivity gains.

While it is still too early to fully assess the economic impacts of increased artificial intelligence (AI) use, particularly as it is enabled by broadband access, it is reasonable to expect that productivity gains will benefit both industries and workers that effectively leverage AI. As with previous waves of digital innovation, these advancements are likely to contribute to higher overall income levels, though the effects on employment growth may be more modest.

Other Benefits

Expanded broadband adoption spurs additional gains that are harder to quantify in monetary terms. They are not explicitly captured in this economic benefit analysis but are nevertheless important to recognize as attempts to measure their influences will likely be the work of future research.

A 2020 study of high-speed broadband in Chattanooga, Tennessee, highlights several important benefits found in the metro community over 10 years.[20] Many of these gains are difficult to measure, but the study discusses benefits that include improvements to:

- **Civic services:** The city utility implemented “smart grid” technologies to reduce outages from major weather events, lower long-term operating costs and lower rates to customers. Other potential benefits included more efficient transportation services and increased public safety.
- **Quality-of-life:** The ability to shop online and learn skills remotely, such as fixing a broken faucet, can provide cost savings and convenience to consumers.
- **Remote work/learning:** Telecommuting gives some workers the ability to earn income during events like COVID-19. Over the long term, it can also reduce traffic congestion and lower costs for both workers and businesses. Similarly, the ability of students to learn from home enabled the continuation of learning during the pandemic.

There is certainly no way to capture all the positive and, sometimes disruptive, effects of broadband expansion. The challenges of COVID-19 illustrate how quickly technologies, like broadband, can shift benefits to different populations, businesses and places. Over the long term the impact of broadband, just like highways and other connecting technologies, will benefit and shape the economy to create new jobs, industries and institutions. However, the pandemic has shown that those unable to access broadband—either by their location, type of work or financial situation—are quickly at a comparative disadvantage as the economy evolves.

The appendix provides details on how the research noted in this section influenced the methods and assumptions used in this analysis.

Selected County Characteristics and Direct Model Inputs

Butler County, home to Poplar Bluff, is in the southeastern Ozark region of Missouri. The Ozarks are characterized by hilly terrain and, in most places, poor broadband access. This region is more economically distressed, with higher poverty and unemployment rates than most other Missouri communities. The following provides additional details about Butler County's economy ending in 2023, the most recent year with available demographic and economic data from the U.S. Census Bureau and Bureau of Economic Analysis.

Butler County

Butler County had a population of 41,910 in 2023, 0.4% less than its 2020 population of 42,063. Median household income was $49,213 according to 2019-23 five-year Census estimates. This compares to a Missouri median household income of $68,920.

2023 employment in Butler County was just over 24,800, including full- and part-time payroll, self-employed, and secondary job holders. This definition counts jobs, not people, which is used by the U.S. Bureau of Economic Analysis to better understand economic activity. The health care and social assistance sector was the largest employer in Butler County, providing over 4,300 jobs or 18% of employment. Government, mostly public schools, and retail employment were the next largest employers, accounting for 15% and 14% of jobs, respectively. Top private-sector employers in Butler County include the Poplar Bluff Regional Medical Center, Briggs & Stratton, Gates Corporation, and Walmart.

Exhibit 2 provides baseline characteristics and model inputs for Butler County. The minimum scenario assumes a broadband adoption gain of **10 percentage points** over 10 years. The maximum scenario assumes an adoption gain of **20 percentage points**.

Exhibit 2. County Characteristics and 10-Year Model Inputs

County Characteristics	Butler County
2023 Population	41,910
2023 Employment	24,845
2023 Labor Income *(in millions)*	$1,265
2023 GDP *(in millions)*	$2,102
2019-23 Households	16,490
Household Broadband Access	60.0%
Minimum Scenario: 10 Percentage Point Gain in Broadband Adoption	
10-Year Direct Model Inputs	
10-Year Broadband Adoption Gain (in pp)	10.0%
Broadband Investment *(in millions)*	$58.5
Total Direct Income Gains *(in millions)*	$31.8
Direct Employment Gain by Year 10	211
Maximum Scenario: 20 Percentage Point Gain in Broadband Adoption	
10-Year Direct Model Inputs	
10-Year Broadband Adoption Gain *(in pp)*	20.0%
Broadband Investment *(in millions)*	$58.5
Total Direct Income Gains *(in millions)*	$64.1
Direct Employment Gain by Year 10	422

Notes: Input dollar values represent 10-year total benefits in nominal figures. Adoption gains are in percentage points (pp).

The direct model inputs show the total broadband investment, income gains and employment used in the analysis under each scenario. These direct inputs spur additional, indirect spending in the county economy that generates further economic benefits.

Broadband investment costs are based on a 2025 Finley engineering study. Direct income gains are from the telemedicine, education productivity, household and farm income benefits derived from the number of new households adopting fixed broadband. Direct employment gains represent an annual employment increase that scales up over 10 years.

The appendix provides additional details on investment cost and direct gain assumptions.

Economic Benefits Summary

Four measures show the total gains to Butler County in: employment, county taxes, labor income and gross domestic product (GDP) as seen in Exhibit 3. The average annual gain in jobs, income and GDP is compared to 2023 figures for context. The annual average GDP increase is also compared to the 2018-2023 annual average growth rate.

Employment gains

Under the minimum scenario, by the tenth year, employment increases by 340 jobs in Butler County. The annual average increase in jobs during the 10 years represents a 1.0% employment gain over 2023 levels. Employment gains are greater in the maximum scenario. Butler County jobs increase by 684 in the tenth year. The job gains represent an annual average increase of 1.7% over 2023 levels.

Exhibit 3. 10-Year Total Economic Benefits Summary

	Butler County
Minimum Scenario: 10 Percentage Point Gain in Broadband Adoption	
10-Year Total Economic Benefits of Broadband Expansion	
Employment Gain in Year 10	340
Total County Taxes *(in millions)* *	$3.7
Total Labor Income *(in millions)*	$137.8
Total Gross Domestic Product *(in millions)*	$195.3
Average Annual Gains Compared to 2023 and Prior 5-Year Trends	
Annual Avg. Employment as % of 2023 Emp.	1.0%
Annual Avg. Labor Income as % of 2023 Income	1.1%
Annual Avg. GDP as % of 2023 GDP	0.9%
*Reference: Annual GDP % Change, 2018-23***	*1.2%*
Maximum Scenario: 20 Percentage Point Gain in Broadband Adoption	
10-Year Total Economic Benefits of Broadband Expansion	
Employment Gain in Year 10	684
Total County Taxes *(in millions)* *	$6.4
Total Labor Income *(in millions)*	$247.6
Total Gross Domestic Product *(in millions)*	$346.3
Average Annual Gains Compared to 2023 and Prior 5-Year Trends	
Annual Avg. Employment as % of 2023 Emp.	1.7%
Annual Avg. Labor Income as % of 2023 Income	2.0%
Annual Avg. GDP as % of 2023 GDP	1.6%
*Reference: Annual GDP % Change, 2018-23***	*1.2%*

*Notes: All income and GDP totals are in 2025 dollars. *County tax estimates are based on U.S. Census Bureau state tax data that is allocated to counties. **U.S. Bureau of Economic Analysis, 2018-23. GDP is the compound annual growth rate in real dollars.*

County tax gains

Under the minimum scenario, Butler County will have $3.7 million in sales and property tax gains over the 10 years. Under the maximum scenario, tax collections increase to $6.4 million for Butler County. Tax estimates are based on U.S. Census Bureau state-level data that are allocated by the economic model to counties using a variety of factors, so figures should be considered a broad estimate.

Labor income gains

Labor income gains over the 10 years include all employee compensation—wages, health and retirement benefits—and proprietor income. Income gains are estimated at $138 million in Butler County, under the minimum broadband adoption scenario. In the maximum scenario, labor income gains totaled $248 million.

Gross domestic product gains

Gross domestic product (GDP) is a key indicator showing the total economic gains a community is expected to see from fixed broadband adoption. The minimum scenario estimates GDP gains of $195 million over 10 years for Butler County. Under the maximum scenario, GDP increases by $346 million.

The annual average GDP growth rate puts these gains in context. In the minimum scenario, the annual GDP growth rate is expected to be 0.9% higher than 2023 GDP levels. For the maximum scenario, the growth rate increases to 1.6% of 2023 GDP levels.

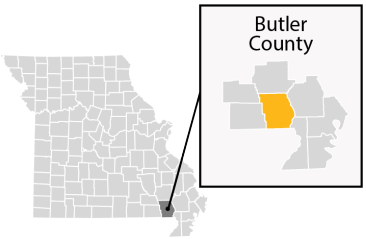
Annual GDP increases are especially significant over time. For example, Butler County experienced an annual GDP increase of 1.2% from 2018 to 2023. Even under the minimum scenario, the expected annual GDP gains of 0.9% would greatly accelerate economic growth beyond baseline figures.

County Summary

The following pages provide a two-page summary for Butler County, including the two broadband adoption scenarios, direct model inputs by category, and the economic benefits by year for the study period.

Butler County Broadband Expansion Economic Benefit Analysis

Butler County, located in Missouri's southern Ozarks and home to Poplar Bluff, had fixed broadband access at nearly 76% of locations in 2024, below the state average of 84%. It is estimated that 60% of county residents currently subscribe to (adopt) broadband services.



Two expansion scenarios estimate the benefits to Butler County if broadband adoption increased by 10 (minimum) and 20 (maximum) percentage points. Exhibit B1 shows the number and percentage of households assumed to have broadband by year 10. Exhibit B2 shows the benefit model inputs for each scenario.

Exhibit B1. 10-Year Fixed Broadband Household Adoption Scenarios

Characteristic	Base Value	Minimum Scenario	Maximum Scenario
Total Households	**16,490**	**16,490**	**16,490**
Households that Have Adopted Broadband	9,894	11,543	13,192
Households that Have Not Adopted Broadband	6,596	4,947	3,298
Percent of Households Adopting Broadband	**60.0%**	**70.0%**	**80.0%**

Sources: U.S. Census 2019-23 ACS. Adoption rate estimate from a 2025 engineering study.

Exhibit B2. 10-Year Economic Benefit Direct Model Inputs

Basic Assumptions	Minimum Scenario	Maximum Scenario
Percent of Households that Adopted Broadband by Year 10	70.0%	80.0%
Broadband Installation Investment to Serve Remaining Households	$58,524,605	$58,524,605
Telemedicine Benefits		
Patient Savings from Reduced Use of Emergency Departments	$8,977,294	$17,954,588
Patient Savings from Initial Health Consultation via Internet	$3,470,995	$6,941,989
Patient Transportation Savings due to Telemedicine	$126,283	$252,567
Missed Work Income Savings to Patient	$97,576	$195,153
Education Productivity Benefits		
K12 Teacher Productivity Savings	$3,539,261	$3,539,261
Income and Employment Benefits		
Household Income Increases	$2,014,496	$8,070,463
Farm Income Changes	$13,556,708	$27,113,415
Annual Average Direct Employment Increases by Year 10	211	422

Notes: Dollar values represent 10-year benefit in nominal figures.

Butler County 10-Year Broadband Expansion Benefit Results

Benefits arise from both fixed broadband infrastructure construction and broadband adoption. Construction investment benefits start in year one and household adoption benefits begin in year two. The temporary construction activity and associated jobs conclude in year four. In each scenario, new jobs, labor income and GDP include the total impact of direct inputs (from Exhibit B2) and indirect purchases, such as new local spending in the county spurred by those inputs.

Minimum Scenario: 10 Percentage Point Gain in Fixed Broadband Adoption over 10 Years

In the minimum scenario, the annual average increase of 340 jobs is realized in year 10. On average, annual employment is 1.0% higher than 2023 county employment. This scenario adds an annual average of 1.1% and 0.9% to county labor income and GDP, respectively, compared with 2023 levels.

Exhibit B3. Minimum Scenario – Total Economic Benefits by Year

Characteristic	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	10-Year Total*	Avg. Annual Change**
New Annual Average Employment	72	319	316	182	160	196	232	268	304	340	**340**	**1.0%**
New Labor Income *(in millions)*	$3.21	$15.0	$15.5	$10.2	$9.9	$12.2	$14.5	$16.8	$19.1	$21.4	**$137.8**	**1.1%**
New GDP *(in millions)*	$4.80	$22.2	$22.9	$14.9	$14.1	$17.1	$20.2	$23.3	$26.4	$29.4	**$195.3**	**0.9%**

*Notes: All income and GDP figures in 2025 dollars. *Total employment is for year 10 as jobs are not cumulative, and other figures are cumulative totals. **Average annual change compared to 2023 county employment, income and GDP totals.*

Maximum Scenario: 20 Percentage Point Gain in Fixed Broadband Adoption over 10 Years

In the maximum scenario, the annual average increase of 684 jobs is seen in year 10. On average, annual employment is 1.7% higher than 2023 county employment. This scenario adds an annual average of 2.0% and 1.6% to labor income and GDP, respectively, compared with 2023 levels.

Exhibit B4. Maximum Scenario – Total Economic Benefits by Year

Characteristic	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	10-Year Total*	Avg. Annual Change**
New Annual Average Employment	72	360	399	306	321	393	466	539	611	684	**684**	**1.7%**
New Labor Income *(in millions)*	$3.21	$17.5	$20.6	$17.8	$19.8	$24.5	$29.1	$33.7	$38.3	$43.0	**$247.6**	**2.0%**
New GDP *(in millions)*	$4.80	$25.7	$30.0	$25.5	$27.9	$34.1	$40.3	$46.5	$52.7	$58.9	**$346.3**	**1.6%**

*Notes: All income and GDP figures in 2025 dollars. *Total employment is for year 10 as jobs are not cumulative, and other figures are cumulative totals. **Average annual change compared to 2023 county employment, income and GDP totals.*

Conclusion

The COVID-19 pandemic made the need for broadband expansion more apparent and urgent as residents shifted to remote work, learning, shopping and healthcare. Federal and state funding for broadband expansion and adoption followed the pandemic with hopes of closing the gap between communities that benefit from broadband and those that feel left behind. Given these changes, estimating future broadband benefits is a challenge. However, causal research provides a reasonable approach to understanding broadband expansion's economic benefits.

In this study, broadband expansion's economic gains resulted from the temporary boost in broadband infrastructure spending within the community and the longer-term economic impacts resulting from higher broadband adoption levels among area households. Adoption benefits stemmed from more telemedicine services, elevated education productivity, greater household and farm incomes, and employment growth.

This economic analysis found that large increases in broadband adoption can spur significant economic gains over time. Modest 10-year adoption gains of 10 percentage points for Butler County increased annual average GDP by 0.9% above 2023 levels. When adoption gains reached 20 percentage points, average annual GDP growth was 1.6% higher than base 2023 levels.

Annual employment increases were also significant in both scenarios. In the minimum broadband adoption scenario, Butler County had annual job increases averaging 1.0% of its 2023 employment level. With broadband adoption gains of 20 percentage points, annual employment increases by 1.7% above the 2023 level.

This study provides a practical method for analyzing broadband expansion's economic benefits to a community, as gains are driven primarily by a population that adopts and uses the technology once it is accessible. Investing in broadband benefits a community, but access alone will not spur long-term economic gains. Building out broadband to communities represents a first step. However, arguably more important are successful efforts to increase adoption and the digital literacy skills needed to harness these economic benefits.

Appendix: Methodology

A 2018 Purdue University study informs the methodological approach used in this analysis, while several causal research papers underpin the assumptions for economic benefit inputs.[21] Economic modeling assumptions are divided into investment needs and household broadband adoption gains followed by assumptions covering the long-term benefits of telemedicine, education productivity, income and employment spurred by broadband adoption.

Investment and Adoption Assumptions

Broadband investment needs

Broadband investments represent a direct cost to internet service providers (ISP) for materials and labor. These ISP investments create community-level economic benefits as workers are paid and supplies are purchased. During the investment period, temporary construction activities add new income to the county through local spending, which in turn spurs indirect benefits as some of that spending circulates throughout the community. Therefore, the first part of this analysis requires estimating broadband investment needs for the county.

A 2025 Finley engineering study provided cost estimates to deploy buried and aerial fiber to locations in Butler County where there was a gap in access to 100/20 Mbps broadband services. Exhibit A shows fixed broadband costs provided by the study. Broadband installation is expected to occur over four years, so anticipated inflation costs were included in the model inputs. Exhibit D provides the cumulative broadband investment year timing assumptions.

Exhibit A. Fixed Broadband Investment Estimates

Fixed Broadband Investment Needs	Butler
Underground and Aerial Fiber Deployment	$56,815,609

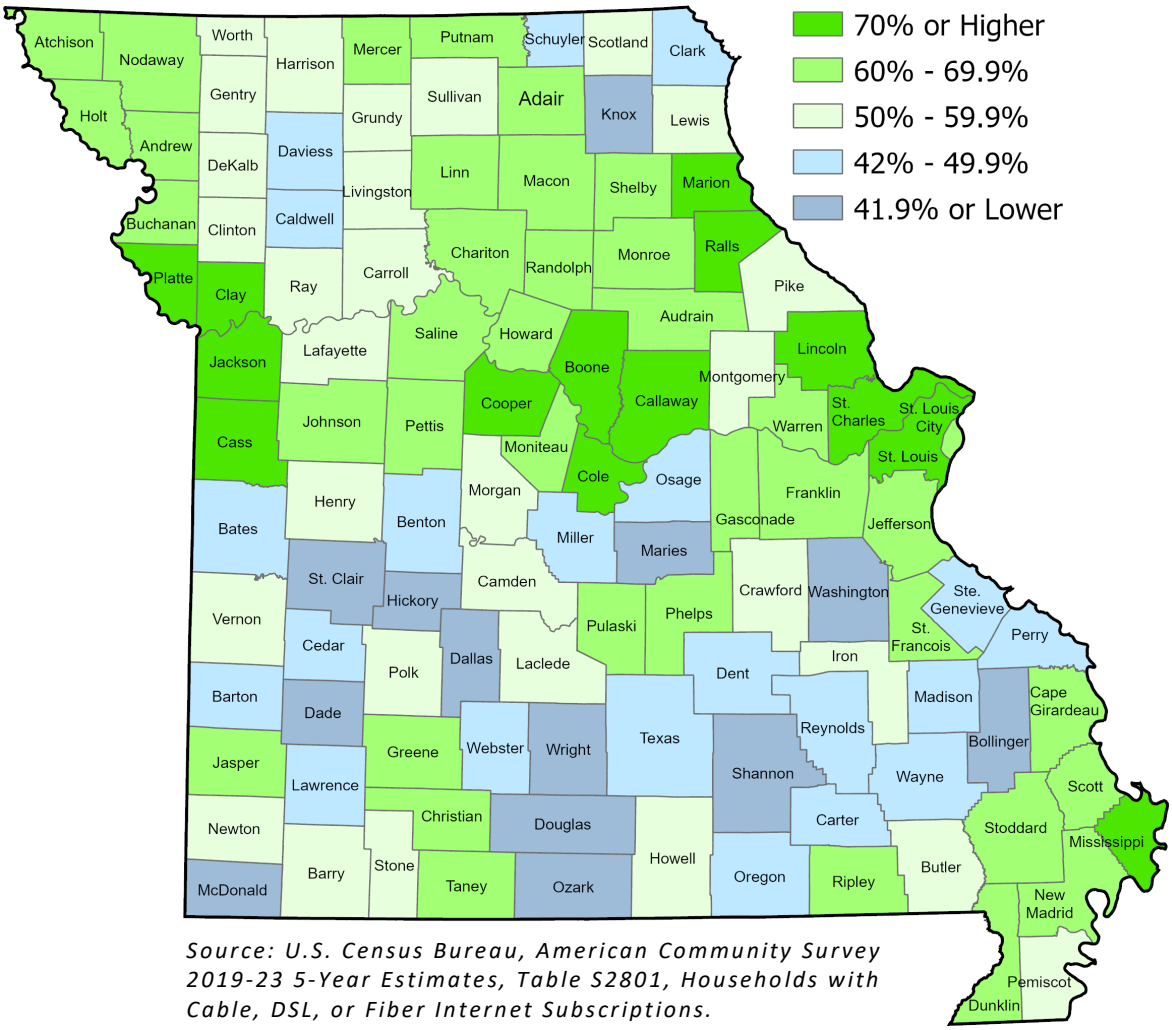
Source: Finley 2025 engineering study. Figures do not include inflation expectations.

Household broadband adoption rate increases and timing

Household broadband adoption is the key causal factor in realizing the economic benefits of broadband investments. Although broadband services must be available, if households do not purchase these services, the community will see limited economic benefits.

Exhibit B shows the percentage of households that have adopted fixed broadband services over the years 2019-23, according to U.S. Census estimates. For Butler County, 51.6% of households had fixed broadband services, compared to a state average of 69.4%.

Exhibit B. Fixed Broadband Household Adoption



Source: U.S. Census Bureau, American Community Survey 2019-23 5-Year Estimates, Table S2801, Households with Cable, DSL, or Fiber Internet Subscriptions.

The fixed broadband household adoption estimates from the U.S. Census cover an older five-year period (2019-23), which is less ideal given the renewed interest in internet access during and after the COVID-19 pandemic. Supplementing the adoption estimates, the 2024 FCC broadband data provide a timelier measure of broadband access in the county. The FCC data shows that 75.7% of Butler County locations have access to fixed broadband, compared to 84% of all Missouri locations. However, this is an access figure that will be higher than actual adoption rates. Fortunately, a 2025 internet engineering assessment for Butler County, supplemented by expert input, supports a reasonable baseline adoption

estimate of 60%. This is higher than the Census 2019-23 figure of 51.6%, but below the 75.7% access level noted in the 2024 FCC data. While useful, the baseline estimate is less important than modeling realistic adoption growth scenarios over the next decade, since it is rising adoption levels that drive long-term economic benefits for communities.

Discussions with subject-matter experts and a Pew Research Center survey that tracks U.S. broadband adoption growth trends informed the scenarios for assumed gains in broadband adoption rates. The Pew survey broke down responses by urban, suburban and rural communities. Over a five-year period ending in February 2024, internet usage levels increased by 5% in urban areas, 4% in suburban areas and 10% in rural areas.

These increases reflect that urban and suburban areas, which typically have higher adoption levels than rural communities, are slowing in relative gains as more remote populations catch up with broadband infrastructure.

This analysis assumes two broadband household adoption level increases:

- **Minimum scenario:** A gain of 10 percentage points over a 10-year period in household adoption from the base level estimate.
- **Maximum scenario:** A gain of 20 percentage points over a 10-year period in household adoption from the base level estimate.

Exhibit D indicates the assumed timing of broadband investments and broadband adoption gains. As broadband investments occur, households are expected to rapidly increase adoption during the first four years to equal 90% of total gains. The remaining 10% of the gains occur in years five to ten.

Exhibit D. Broadband Investment and Household Adoption Gains over 10 Years

Characteristic *Year*	**Year 1** *2025*	**Year 2** *2026*	**Year 3** *2027*	**Year 4** *2028*	**Year 5** *2029*	**Year 6** *2030*	**Year 7** *2031*	**Year 8** *2032*	**Year 9** *2033*	**Year 10** *2034*
Broadband investment	11.2%	54.7%	91.0%	100%	100%	100%	100%	100%	100%	**100%**
Minimum Scenario - Household Broadband Percentage Point Adoption Increases above Base Adoption Rate										
Household adoption gains	0.0%	3.0%	6.0%	9.0%	9.2%	9.4%	9.6%	9.8%	9.9%	**10.0%**
Maximum Scenario - Household Broadband Percentage Point Adoption Increases above Base Adoption Rate										
Household adoption gains	0.0%	6.0%	12.0%	18.0%	18.4%	18.8%	19.2%	19.6%	19.8%	**20.0%**

Broadband Benefit Assumptions

Broadband investment and household adoption timing inform the speed at which these technologies benefit communities economically. However, the economic gains come from different components that, when combined, form the basis for describing the potential benefits over time to a community.

Telemedicine

Telemedicine benefits were informed primarily by research from Whitacre (2011), Gordon et al. (2017), and Nord et al. (2019). While healthcare providers benefit, Whitacre's research notes there are questions about where the gains would accrue. This study focuses on the telemedicine benefits to patients, which alone are significant.

This analysis used four subcategories of telemedicine benefits:

- **Patient savings from reduced use of emergency departments:** Patients with broadband access to telemedicine are assumed to have fewer emergency room (ER) visits per year. Nord et al. show that the average ER visit costs $928, while a telehealth consultation averages $45, resulting in net savings of $883 per patient. That figure is updated to $1,045 per patient, in this study, to account for price inflation. 2022 Center for Disease Control (CDC) data for the Midwest indicates that there were 49.5 ER visits per 100 people that year.[22] This analysis uses the 2022 CDC figure and assumes that of the 49.5% of the population in new households with broadband service, half receive savings from avoiding one ER visit during the year.
- **Patient savings from initial health consultation via internet:** Like ER savings, patients with access to telemedicine are assumed to make fewer in-person doctor visits. Estimated net savings are based on Nord et al., showing average costs of urgent care ($131) and physician office ($108) visits, compared to $45 for telehealth consultations. It is assumed that one urgent care and two physician office visits are replaced annually with initial telehealth consultations. In 2018, that savings would be $211 a year per new household with broadband service. When adjusted for inflation, annual savings rise to $250 in 2025.
- **Patient transportation savings due to telemedicine:** The reduction in ER visits also saves transportation costs for patients traveling to the nearest hospital. Travel savings from avoided urgent care and physician office visits are included, but distance data is limited. Transportation savings are derived from the reduced ER visits per new household with broadband services, multiplied by the 2025 IRS rate of 70 cents per mile and average round-trip miles to a hospital for rural (21) and urban (9) travelers,

based on a Pew study.[23] If a county does not have a hospital, the round-trip miles are doubled to assume travel to an adjoining county for services.

- **Missed work income savings to patient:** The income lost from missed work due to travel and time spent at a hospital visit is calculated as an additional patient benefit. Lost time is estimated as the average round-trip time to a hospital for rural (0.57 hours) and urban (0.35 hours) patients, plus an hour visit for healthcare services, from the Pew study. If a county does not have a hospital, the round-trip times are doubled to assume travel to an adjoining county for services. The lost work time is multiplied by the county's median hourly earnings for visits saved by new households with broadband service.

Education Productivity

Kindergarten to 12th grade (K-12) teacher productivity gains were estimated using research from Smith et al. (2008). This research included a teacher survey where 20% of respondents indicated that online resources saved them up to one hour per week, with an additional 20% indicating they saved up to two hours per week. This time savings works out to an average of 0.6 hours saved per week due to online resources. Time savings scales up with broadband investment timing, as it is assumed that public schools would have these services as soon as available. The scaled-up time savings are then multiplied by the total costs of K-12 teacher salaries in the county based on data from the Missouri Department of Elementary and Secondary Education.[24] These productivity benefits will modestly accrue to the school district, which can save money over time by reducing labor needs through increased productivity.

Income

Household incomes are expected to rise in homes that adopt broadband. Research from Whitacre et al. (2014) estimates that for nonmetro counties, the increase in household income is 1.3% over 10 years for counties with higher levels of adoption (60% or more) compared to counties with moderate levels (40%-60%). These findings underpin the income growth assumption in this analysis, with the consideration that economic benefits do not scale uniformly across all geographies, as influences like proximity to metros and labor supply can impact income gains (Kim & Orazem (2016), Kolko (2012)). Whitacre et al. notes that various factors can drive income gains, including increased worker productivity.

The median household income (MHHI) rate of increase is adjusted by the final level of broadband adoption at the end of 10 years:

- MHHI is assumed to increase by 1.3% over 10 years if a county significantly gains in broadband adoption levels by 20 percentage points or more.

- MHHI is assumed to increase by 0.65%, or half of 1.3%, over 10 years if broadband adoption increases are less than 20 percentage points.

Median household income growth was applied to the number of new households with broadband service each year. Income growth is cumulative, so a household adopting broadband in year two will accumulate more income over the 10 years than a household gaining broadband service in year four.

Farm income can also be expected to increase in certain situations, and as a result, it was analyzed separately from household income. Two studies point to gains in crop farming from expanded broadband access, but gains to livestock production are less clear (Kandilov et al. (2011), LoPiccalo (2020)). LoPiccalo's 2020 crop yield research is used as the basis for assuming farm income growth.

This analysis assumes that for every 1% increase in new households adopting broadband, a 0.1% increase in crop sales can be expected due to advances in precision agriculture and crop marketing. Crop sales base data comes from the U.S. Department of Agriculture.

Employment

Employment from new and expanding firms is expected to rise as a county increases household broadband adoption. A study shows that employment growth was 3.4% less over 10 years for nonmetro counties with household adoption rates below 40% compared to counties with higher adoption levels (Whitacre et al. (2014)). The study did not find a meaningful relationship between jobs and broadband adoption in metro counties. This suggest that metro counties, typically with higher adoption levels, have already seen the gains of broadband expansion or that those gains are too intertwined with other factors to distinguish a causal relationship. This analysis uses the 2014 study findings as the foundation for employment growth assumptions. Based on other research findings (Kolko (2012), Mack & Faggian (2013)), it is assumed that direct employment increases are concentrated in knowledge-intensive industries, such as professional and business services.

It is assumed that over 10 years, knowledge-intensive employment will increase by 3.4% if there is a significant expansion of broadband adoption from the base county level. However, that rate of increase is adjusted based on a couple of underlying factors:

- Employment increases by 3.4% over 10 years if a county significantly gains in broadband adoption levels by 15 percentage points or more and the county is below a base adoption rate of 60%. If a county's base adoption rate is 60% or higher, the employment growth rate is half, or 1.7%, over 10 years under the assumption that much of the economic gains from broadband have already been realized.

- Employment increases by 1.7% over 10 years if broadband adoption gains are less than 15 percentage points over 10 years and the county is below a base adoption rate of 60%. If a county base adoption rate is 60% or higher the employment growth rate is half, or 0.85%, over 10 years assuming that much of the economic gains from broadband have already occurred.

In addition to the direct economic benefits from broadband expansion detailed in this section, there will be spillover effects from the new investments, savings, income and jobs that provide further gains. An economic model is used to estimate these additional spending impacts within each county.

Economic Model

An economic input-output model is used to understand the total benefits derived from broadband adoption. Without an economic model, only direct spending or savings activities could be described, missing important beneficial impacts. Economic models consider typical spending patterns, such as the types of goods or services purchased locally, to follow the flow of income that stays within a county and spurs additional gains in income, employment, taxes and GDP.

IMPLAN, provided by the IMPLAN Group LLC, is a common economic input-output model and is used in this study. Key outputs from IMPLAN analysis include:

- **Employment:** This describes the annual average full- or part-time jobs in a county. The jobs can be held by county residents or workers commuting into the area for employment.
- **County taxes:** These are primarily estimates of county sales and property taxes, based on U.S. Census state-level data allocated to counties using various factors. Due to the tax allocation process, IMPLAN tax figures should be considered broad estimates that may not be suitable for fiscal cost-benefit analysis without further refinement.
- **Labor income:** This includes wages and benefits, such as healthcare and retirement, along with the income of sole proprietors.
- **Gross Domestic Product (GDP) or value added**: GDP represents the value of all final goods and services produced in the county. It is also equal to total sales minus the input cost of those goods and services, called value added, which leaves money to pay for labor income, rents, interests and taxes.

Endnotes

[1] U.S. Census Bureau, American Community Survey, 2023 5-Year Estimates, Table S2801
[2] Whitacre, B.E. (2011). Estimating the economic impact of telemedicine in a rural community. *Agricultural and Resource Economics Review*, 40(2): p. 172.
[3] Gordon, A.S., W.C. Adamson, and A.R. Devries. (2017). Virtual visits for acute, nonurgent care: a claims analysis of episode-level utilization. *Journal of Medical Internet Research* 19(2).
[4] Nord, G., Rising, K., Band, R., Carr, B., Hollander, J. (2019). On-demand synchronous audio video telemedicine visits are cost effective. *The American Journal of Emergency Medicine*, 37(5), 890-894.
[5] Hanushek, E. and Woessmann, L. (2020). The Economic Impacts of Learning Losses. Organization for Economic Co-operation and Development. Retrieved at: https://www.oecd.org/education/The-economic-impacts-of-coronavirus-covid-19-learning-losses.pdf
[6] "Rural school districts can be creative in solving the internet connectivity gap – but they need support". (Aug. 2020). The Brookings Institute, Brown Center Chalkboard blog. Retrieved at: https://www.brookings.edu/blog/brown-center-chalkboard/2020/08/10/rural-school-districts-can-be-creative-in-solving-the-internet-connectivity-gap-but-they-need-support/
[7] Smith, P., Rudd, P. and Coghlan, M. (2008), Harnessing Technology Schools Survey 2008: Report 1 . Coventry: Becta. Retrieved at: https://dera.ioe.ac.uk/1549/1/becta_2008_htssanalysis_report.pdf
[8] Hampton, K., Fernandez, L., Robertson C., and Bauer, J. (2020) Broadband and Student Performance Gaps. Michigan State University, Quello Center. Retrieved at: https://quello.msu.edu/wp-content/uploads/2020/03/Broadband_Gap_Quello_Report_MSU.pdf
[9] Whitacre, B., Gallardo, R., & Strover, S. (2014). Broadband's contribution to economic growth in rural areas: Moving towards a causal relationship. *Telecommunications Policy*, 38(11), 1011-1023.
[10] Kandilov, A., Kandilov, I., Xiangping, L., and Renkow, M. (2011). The impact of broadband on US agriculture: an evaluation of the USDA broadband loan program. *Applied Economic Perspectives and Policy*. 39(4): 635-661.
[11] LoPiccalo, K. (2020). Impact of Broadband Penetration on US Farm Productivity. Office of Economics and Analytics, Federal Communications Commission working paper. Retrieved at: https://docs.fcc.gov/public/attachments/DOC-368773A1.pdf
[12] Biedny, C., Whitacre, B., & Van Leuven, A. (2024). Do Gigabits Mean Business? "Ultra-Fast" broadband availability's effect on business births. *Information Economics and Policy*, (68), 101094.
[13] See for example: Kim, Y., & Orazem, P. F. (2016). Broadband internet and new firm location decisions in rural areas. *American Journal of Agricultural Economics*, 99(1), 1-18.; and Conroy, T. & Low, S.A. (2021). Broadband, Entrepreneurship and Gender: Evidence from Establishment Births in Rural America. *International Regional Science Review*. In press.
[14] Mack, E. A., Anselin, L., & Grubesic, T. H. (2011). The importance of broadband provision to knowledge intensive firm location. *Regional Science Policy & Practice*, *3*(1), 17-35.
[15] Kolko, J. (2012). Broadband and local growth. *Journal of Urban Economics*, 71(1), 100-113.
[16] Whitacre, B., Gallardo, R., & Strover, S. (2014). Does rural broadband impact jobs and income? Evidence from spatial and first-differenced regressions. *The Annals of Regional Science*, 53(3), 649-670.

[17] Lobo, B. J., Alam, M. R., & Whitacre, B. E. (2020). Broadband speed and unemployment rates: Data and measurement issues. *Telecommunications Policy*, 44(1), 101829.
[18] Mack, E., and Faggian, A. (2013). Productivity and broadband: The human factor. *International Regional Science Review*, 36(3), 392-423.
[19] Gallardo, R., Whitacre, B., Kumar, I., & Upendram, S. (2020). Broadband metrics and job productivity: A look at county-level data. *The Annals of Regional Science*, 1-24.
[20] Lobo, B. (2020). Ten years of fiber optic and smart grid infrastructure in Hamilton County, Tennessee. University of Tennessee at Chattanooga. Retrieved at: https://epb.com/about-epb/news/articles/new-economic-study-documents-269-billion-in-benefit-from-chattanoogas-community-fiber-optic-network
[21] Grant, A., and Tyner W. (2018). Benefit-Cost Analysis for Implementation of Rural Broadband in the Tipmont Cooperative in Indiana. Research and Policy Insights, Publication 005. Purdue University. Retrieved at: https://pcrd.purdue.edu/wp-content/uploads/2018/12/005-RPINsights-Tipmont-Broadband.pdf
[22] Center for Disease Control. (2022). National Hospital Ambulatory Medical Care Survey: 2022 Emergency Department Summary Tables. Retrieved at: https://www.cdc.gov/nchs/data/nhamcs/web_tables/2022-nhamcs-ed-web-tables.pdf
[23] Lam, O., Broderick, B., and Toor, S. (2018). "How far Americans live from the closest hospital differs by community type." The Pew Research Center. Retrieved at: https://www.pewresearch.org/fact-tank/2018/12/12/how-far-americans-live-from-the-closest-hospital-differs-by-community-type/
[24] Missouri Department of Elementary and Secondary Education. (2024). District faculty employment and salary information by county. Retrieved at: https://apps.dese.mo.gov/MCDS/home.aspx?categoryid=3&view=2