

Macroeconomic Impact of Infrastructure Investment in the United States

Zihang Liu *

Beijing Huijia Private School, Beijing, China

* Corresponding Author Email: 26liuzihang@huijia.edu.cn

Abstract. Federal and state investment in infrastructure is seen as a key engine to drive economic growth and promote long-term sustainable development. Given the historic underinvestment, this article provides an in-depth look at the current state of infrastructure spending in the United States and the macroeconomic implications of recent policy and legislative actions to address infrastructure deficiencies and gaps. Greater investment in basic areas such as transport networks, Internet connectivity and clean water not only drives job growth by increasing the demand for workers in the Labour market, but also significantly increases the productivity of infrastructure reconstruction and the flexibility of supply chains. These investments have become important factors in boosting potential output growth and gross domestic product (GDP), especially the "multiplier effect" that further amplifies the return on infrastructure investment, injecting a strong impetus to economic growth. Sustained and stable infrastructure investment is therefore critical to achieving macroeconomic stability and long-term prosperity.

Keywords: Policy and legislation; economic growth; employment.

1. Introduction

Infrastructure, serving as the core framework and system underpinning economic development, can be broadly classified into two categories: hard infrastructure and soft infrastructure. Hard infrastructure refers to the tangible, physical assembly including roads, highways, and harbors. In contrast, soft infrastructure embodies human capital and the provision of crucial services to the population, including healthcare, education, and regulatory systems. Infrastructure is not only a pivotal factor in driving national economic growth, enhancing productivity, and improving people's quality of life but also an indispensable cornerstone for the development of modern societies. However, in recent years, the investment by the United States in the field of infrastructure has consistently appeared inadequate. As illustrated in Figure 1, since the historical peak of infrastructure spending as a percentage of Gross Domestic Product (GDP) in the 1950s, which reached approximately 3%, this key indicator has significantly declined to about 1.8% in 2019. Although the American Recovery and Reinvestment Act in 2009 successfully stimulated the recessionary economy and increased infrastructure investment, the overall infrastructure spending in the U.S. is in a declining trend [1]. Such a trend of underinvestment places significant burdens on existing infrastructures. American Society of Civil Engineers (ASCE) graded American infrastructures as "C-" or "mediocre" in 2021, and 43 percent of the public roads are in poor condition [2]. Additionally, according to ASCE, the United States faces an estimated funding gap of around \$2.1 trillion for hard infrastructure over the next decade [2].

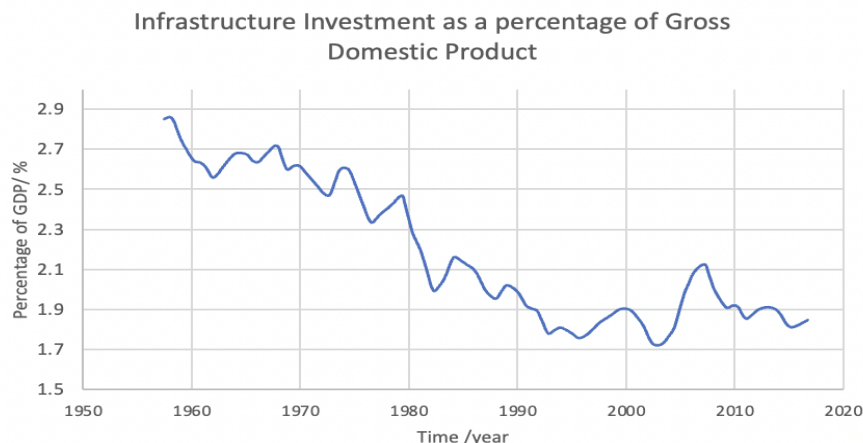


Fig 1. Infrastructure investment as a percentage of GDP has declined over decades [1].

Federal investment in essential infrastructures, encompassing transportation, water treatment systems, and power plants, is crucial for long-term economic growth and employment in the United States. Well-maintained infrastructure facilitates reduced operational costs for businesses by enhancing the efficiency of transportation and logistics, which in turn lowers production costs and leads to more affordable goods and services, helping to stimulate the economy during downturns. Furthermore, national investment in public infrastructure stimulates employment within the economy. Large-scale projects, such as constructing highways, bridges, and public transit systems, generate enormous job vacancies and boost employment opportunities not required for workers with high education levels and high skills. According to the Bureau of Labor Statistics (BLS), since the implementation of the Bipartisan Infrastructure Law in January 2021, the highway, street, and bridge construction industry has added nearly 38,300 jobs [3], demonstrating the employment-boosting potential of infrastructure investment, as shown in figure 1.

This paper mainly explores the macroeconomic impact of enhanced infrastructure investment on employment, social welfare, and economic growth. The remainder of the paper has the following organization. Section 2 includes an analysis of the current situation of infrastructure investment in the United States. Section 3 analyses the macroeconomic impact of the increased infrastructure investment in the United States. Section 4 concentrates on one typical case analysis of infrastructure investment in the United States in recent years.

2. Macroeconomic Analysis of Current Infrastructure Investment

2.1. Investment Structure

The investment structure for infrastructure in the United States is quite complex, involving multi-layered funding from federal, state, and local governments, while also incorporating active participation from the private sector. Within this framework, the public sector, as a key entity controlled by the government, plays a crucial role in U.S. infrastructure investment. At the state government level, municipal bonds serve as an effective financial instrument for raising funds required for infrastructure construction. Issued by states, municipalities, and counties, municipal bonds are specifically designed to provide financial support for large-scale infrastructure projects, with repayment mechanisms typically relying on the revenues generated by the infrastructure projects themselves or related taxes [4]. This model ensures the recovery of construction costs and the sustainable operation of the projects. Investors will repay the construction costs through revenues generated by the infrastructure itself or tax collections. An essential federal mechanism is the Highway Trust Fund (HTF), which is financed by a federal fuel tax of 18.4 cents per gallon on gasoline [4], providing a reliable source of funding for interstate highway construction in the 1960s. This system facilitates significant infrastructure development while distributing financial responsibility across different levels of government.

In recent decades, there has been a growing interest in public-private partnerships (PPPs) as a financing strategy for funding infrastructure investment in the United States. PPPs involve collaboration between the public and private sectors, where private entities assist in financing and operating infrastructure projects [4]. Private businesses recover their investments through long-term contracts, user fees, and other revenue streams. In the energy provision and telecommunication sector, the private sector plays a dominant role in investment and operations. Telecommunication infrastructure in the U.S., which is vital for the current digital economy, has been greatly driven by large private corporations such as AT&T, Verizon, and Comcast.

2.2. Policies and Regulatory Systems

After decades of deliberation on rebuilding America's crumbling infrastructure, especially after experiencing extreme supply shocks and most deaths during the pandemic, President Joe Biden and the nation took decisive action. Bipartisan Infrastructure Law, also known as the Infrastructure Investment and Jobs Act, was introduced in 2021 to authorize funds for supporting Infrastructure in the United States such as healthcare, supply chains, and transportation systems. As the largest long-term infrastructure investment in U.S. history, this law allocates \$1.2 trillion into the United States infrastructure system to enhance and modernize the development and improvement of America's infrastructure [5].

The Bipartisan Infrastructure Law aims to provide clean water to all American communities. Up to 10 million households and 400,000 schools and childcare centers lack access to safe and pure drinking water [5]. This legislation plans to invest \$55 billion toward America's water infrastructure to replace lead pipes and address wastewater contamination from urban to rural regions, upgrading water conservation and drought resilience across multiple states.

The transportation system in the United States is another indispensable focus of the Bipartisan Infrastructure Law. According to Whitehouse.gov, one of five miles of highways and roads and approximately 45,000 bridges are in substandard condition [5]. The Law addresses aging transits by investing more than \$110 billion to fund the repair and reconstruction of fundamental infrastructure, involving airlines, bridges, and transformational projects that will modernize the nation's transportation network to enhance traffic safety, stabilize supply chains for businesses, and boost long-term economic resilience. Additionally, the Bipartisan Infrastructure Law invests \$7.5 billion in building electric vehicle charge stations across the country. This initiative is crucial to providing cleaner transportation alternatives and promoting renewable energy consumption for long-term sustainability.

3. Macroeconomic Impact of the Increased Infrastructure Investment in the United States

3.1. Employment Effect

Strengthening investment in infrastructure will generate substantial employment opportunities across the nation. When federal funds are allocated toward massive infrastructure programs that repair and construct new infrastructure, significant workers are required to execute these ongoing programs. Therefore, demand for labor will surge in the labor market for infrastructure, resulting in numerous jobs created across multiple industries in the nation. Additionally, as a portion of government spending, a rise in infrastructure investment in the United States leads to a greater level of output by boosting aggregate demand, thus reducing cyclical unemployment, which stems from insufficient demand during economic downturns.

According to Whitehouse.gov, employment in heavy and civil engineering after implementing the Bipartisan Infrastructure Law has added 92,400 jobs to their workplace [6]. In Figure 2, the graph presents a notable boost in the employment rate in heavy and civil engineering construction since 2010. From the initial post-2008 global financial crisis, where construction employment was highly

influenced by the devastating economic recession to below the basis, there has been a resilient upward trend in employment within this sector. Despite the setbacks of the COVID-19 pandemic, this recovery gained significant momentum, peaking at an employment level of around 1,155,000 in September 2024 [7].

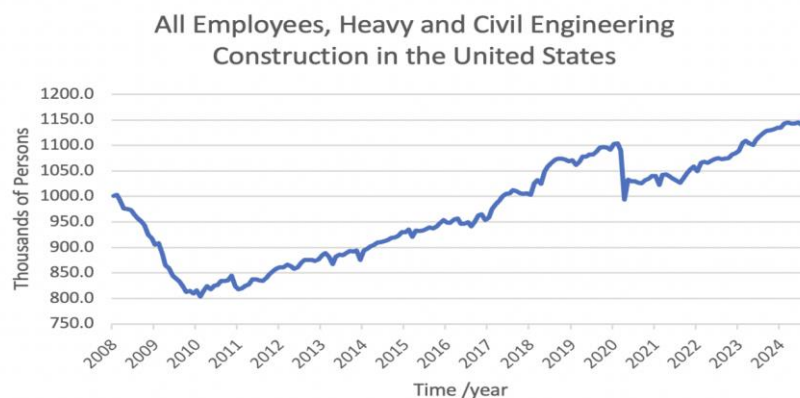


Fig 2. All employees, heavy and civil engineering construction in the United States [7].

Moreover, Figure 3 highlights a similar long-term recovery trend in employment within highways, streets, and bridges after the substantial decline in the 2008 Great Recession, with an employment level of approximately 373,000 reaching its heights in the last two decades [8]. This growth reinforces the sustained development and efforts done in American infrastructure sectors, which contributes to high employment as one of the essential objectives in achieving macroeconomic stability.

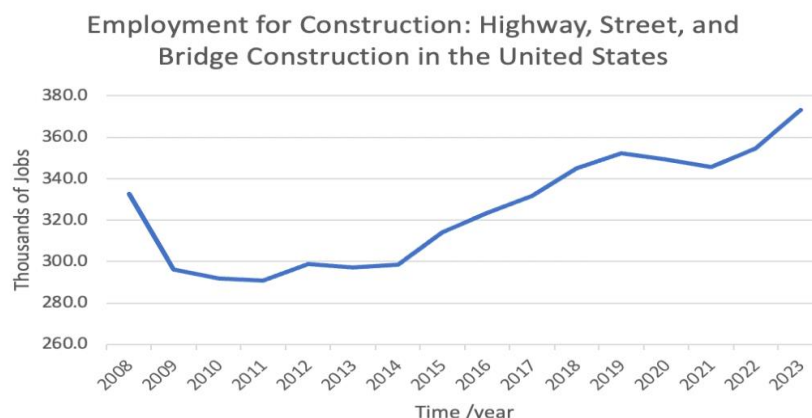


Fig 3. Employment for construction: highway, street, and bridge construction in the United States [8].

3.2. Social Welfare Effect

Increasing infrastructure investment strengthens the supply chains in the United States by creating more resilient and sustainable transit systems—encompassing ports, airlines, bridges, and railways. With upgraded and enhanced infrastructure, goods and services can move efficiently and reliably through various stages of value addition, reducing transportation delays and bottlenecks. This enhances delivery predictability and cuts costs for businesses with smoother operations, bolstering supply chains in the nation and supporting stable and efficient trade and commerce.

Furthermore, federal and government expenditures on infrastructure have positive impacts on the nation's economic growth. A rise in infrastructure expenditure as an investment in physical capital increases the capacity and efficiency of the economy. Enhanced infrastructure facilitates smoother and more reliable transportation of goods and services, reducing logistical costs by cutting transit time and enhancing productivity [9]. By supporting economic activities for businesses and enabling

efficient production processes, the investment will boost potential economic output in the long run, leading to sustained economic growth in the nation.

Additionally, investing in infrastructure has a powerful multiplier effect on the economy. As the proportion of income that households decide to spend grows after gaining more disposable income from infrastructure programs [10], the marginal propensity to consume (MPC) tends to be higher, raising the multiplier in the economy. As workers and businesses earn more income from infrastructure programs, they spend their wages and profits on goods and services, which generates income for others in the economy and facilitates further consumption and investment, magnifying any change in aggregate demand and enhancing Gross Domestic Product (GDP) and potential output growth in the United States [10].

According to the Federal Reserve Economic Data (FRED), in figure 4, the real GDP has demonstrated a continuous upward trend since 2000, particularly notable between 2020 and 2023, with the real GDP growth from \$19056.62 billion in 2020 and \$ 22249.46 billion in 2023 [11]. This growth during the pandemic highlights the role of infrastructure investment in boosting economic output and stimulating overall economic health in the United States.



Fig 4. Real gross domestic product in the United States [11].

4. Case Analysis of Infrastructure Investment in the United States

In February 2021, Texas experienced a historically devastating cold snap that impacted parts of the continental United States. The entire state was engulfed remarkably by this deep freeze with many counties experiencing wind chill values below zero, and millions of residents were in the dark, without power, water, and other essential services, lacking fundamental warmth to support their basic needs [12]. The state's electric grid is in shortage and failed to meet the surge in demand for energy operated by the Electric Reliability Council of Texas. The freezing precipitation caused the freeze of plants, natural gas supplies dwindled, and wind turbines stalled, exposing the vulnerabilities in Texas' infrastructure.

Following the Great Freeze, state and federal took action to address the shortcoming energy grid in Texas' infrastructure. The Texas legislature implemented Senate Bill 3, which mandated weatherization measurements of infrastructures encompassing natural gas and transmission lines with extreme weather conditions, requiring the energy plants to winterize their equipment to prevent energy failures in the future [13]. On the federal level, the Bipartisan Infrastructure Law passed by Biden in 2021 allocated enormous funds for infrastructure investment to modernize the grid and climate resilience, enhancing the abilities of Texas infrastructure to handle severe weather [13]. The investment in improving Texas power grid resilience has led to strong performance by energy corporations, recovering economic activities that boost further consumption and investment. Moreover, weatherization has led to a growth in the employment rate locally by raising demand for labor, boosting individual income, and generating more income tax revenue for both federal and state governments. The Texas cold snap reflects the fragility of the state's independent power grid and

reveals the importance of sustained investment in fundamental infrastructure in mitigating the likelihood of climate disaster and stimulating potential economic growth.

5. Conclusion

This paper has investigated the macroeconomic impact of America's infrastructure investment on employment effects and social welfare effects. The analysis of the current state of U.S. infrastructure investment reviewed its structure, scale, and the legislation implemented to address historical underinvestment.

Infrastructure investment has a positive effect on generating job opportunities and reducing the nation's unemployment rate. By funding fundamental infrastructure projects, such as transportation and clean water systems, the demand for workers in the labor market surges, generating substantial employment for running these programs. Additionally, as a form of physical capital expenditure, infrastructure investment boosts the aggregate demand of the nation, which reduces unemployment when the economy is experiencing its downturns.

Federal and state spending on infrastructure programs enhances societal benefits by strengthening businesses' supply chains and boosting long-term economic growth. Upgraded infrastructure improves the efficiency of transporting goods and services, lowering costs for businesses and strengthening resilient and reliable supply chains. Infrastructure investment also supports various economic activities and boosts operational productivity. The marginal propensity to consume (MPC) is high when infrastructure investment raises the disposable income for households by numerous job creation, amplifying the "multiplier effect" to facilitate further potential consumption and investments. Ultimately, these factors stimulate sustained GDP growth and support long-term economic stability. Spending on infrastructure in the United States should prioritize fostering creativity, innovation, and sustainability, developing environmentally friendly and energy-efficient systems to support future economic growth while addressing climate change and environmental concerns. The investment should be forward-looking to both address immediate economic needs and build a foundation for long-term and sustainable economic growth.

References

- [1] Gunnion L. Infrastructure investment: an economist's view from the ground up, 2021.
- [2] Gunnion L. 2021 Report card for America's infrastructure grades reveal widening investment gap, 2021.
- [3] Young D. BIL positively influences job growth within construction industry. Short Span Steel Bridges, 2023.
- [4] Beecher J. Funding and financing to sustain public infrastructure: why choices matter. Available at SSRN, 2021, 3766953.
- [5] House W. Fact sheet: the Bipartisan infrastructure deal, 2021.
- [6] House W. Job gains in construction after two years of the bipartisan infrastructure law, 2023.
- [7] Federal Reserve Economic Data. All employees, heavy and civil engineering construction, 2024.
- [8] Federal Reserve Economic Data. Employment for construction: highway, street, and bridge construction in the United States, 2024.
- [9] New study: reinvesting in U.S. infrastructure would raise average household disposable income by \$1,400 per year, 2019, Retrieved from <https://www.businessroundtable.org/new-study-reinvesting-in-us-infrastructure-would-raise-average-household-disposable-income-by-1400-per-year>
- [10] Ramey V A. The macroeconomic consequences of infrastructure investment. Cambridge, MA: National Bureau of Economic Research, 2020.
- [11] Federal Reserve Economic Data. Real gross domestic product, 2024.
- [12] Pechman C, Nethercutt E. Regulatory questions engendered by the Texas energy crisis of 2021. National Regulatory Research Institute: Washington, DC, USA, 2021.
- [13] Mulcahy S. Texas power generators could have to prep for extreme temperatures, 2024.