The Impact of Sufficient Infrastructure Investment on Regional Macro-economy – Taking California High-Speed Rail Project vs LaGuardia Airport Reconstruction Project as Examples

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Abstract. This paper employs case study methodologies to scrutinize the macroeconomic ramifications of the California High-Speed Railway project and the LaGuardia Airport reconstruction project on the regional economy and explore the multidimensional impact of infrastructure initiatives on their regional economies. It delves into the multifaceted impacts of infrastructure investments in fostering regional economic expansion, augmenting employment opportunities, and bolstering regional competitiveness. The research approach integrates qualitative analysis, invoking pivotal economic theories to substantiate the comprehensive assessment of these two monumental projects' effects on the regional economy, encompassing social responsibility, sustainability, and governmental governance. The California High-Speed Railway Project facilitates the circulation of economic resources within California and the connectivity and commercial development of small and medium-sized cities by building a convenient high-speed transportation network that reduces dependence on car travel. Conversely, the LaGuardia Airport Redevelopment Project strengthens New York's function as a global transportation hub and an important port on the East Coast by upgrading the airport's aviation infrastructure and logistics clearance efficiency. Studies have shown that these infrastructure investment projects create many jobs, improve the labor market's employment flexibility and social inclusiveness, and promote sustainable development that reduces costs and increases efficiency through green building and energy-saving and emission-reduction technologies. This paper comprehensively verifies the endogenous growth theory and regional competition theory as a strategy for future investment in the construction of metropolitan infrastructure. It provides empirical support and scientific optimization suggestions for policy.

Keywords: Infrastructure investment; macroeconomic growth; regional competitiveness; California High-Speed Rail; LaGuardia Airport.

1. Introduction

Historically, infrastructure has served as a cornerstone of economic development, a macroeconomic principle widely studied during the Roosevelt New Deal. The endogenous growth theories proposed by Romer and Lucas further emphasize the long-term role of public infrastructure in promoting economic development [1, 2]. In developed economies, the positive correlation between infrastructure investment and economic output is particularly evident, particularly in the high marginal productivity of public capital [3]. In recent years, local and federal governments in various countries and regions have increased investment in large-scale infrastructure construction to improve transportation and transport efficiency, improve the quality of public services, promote coordinated regional economic development, and achieve the macroeconomic development goals of overall economic revitalization.

According to Landis, the construction of infrastructure projects worldwide is experiencing a continuous surge [4]. The California High-Speed Rail Project and the LaGuardia Airport Redevelopment Project are among the most notable large-scale infrastructure endeavors in the United States in recent years. The California High-Speed Rail Project is the first high-speed rail project in the United States. It aims to alleviate traffic congestion in California and promote the integration of the California economy through convenient high-speed transportation tracks. The LaGuardia Airport Redevelopment Project represents a pivotal upgrade of New York City's aviation hub. It enhances its global transportation connectivity and accessibility by bolstering aviation infrastructure and

transportation capacity, thereby preserving its status as a leading global financial center. These two projects, situated in the dynamic economies on the East and West coasts, share numerous similarities in terms of investment scale, technological innovation, and urban planning. However, they also embody the drive to propel structural economic reforms within their regional economic hinterlands.

Therefore, this paper delves into an exhaustive examination of these two transportation infrastructure revitalization projects, exploring how adequate and strategically distributed infrastructure investment can optimize the regional macroeconomic redistribution mechanism through multiple channels and dimensions. It unveils the projects' multifaceted impacts on promoting economic growth, creating employment, and enhancing regional competitiveness, providing a scientific basis and reference for future infrastructure investment.

2. California High-Speed Rail Project – Case Study

2.1. Project Background and Overview

The California High-Speed Rail Project is the first high-speed railway project in the United States, aiming to connect San Francisco with Los Angeles seamlessly. The rail, with a projected speed of 350 kilometers per hour and a total length of 1,300 kilometers, is estimated to require an investment of over 80 billion U.S. dollars [5, 6]. Sources of investment include federal government grants, state government investment, and private joint ventures, combining the advantages of public-private partnerships. The construction of the project is divided into multiple cycles. The first construction phase is the Central Valley Segment, which runs through central California and is scheduled to be fully operational in 2030 [6]. The goal of the project is to alleviate the pressure on existing transportation that relies heavily on aviation and highways through sustainable transportation options, improve accessibility, reduce carbon emissions from urban sprawl, and ultimately promote the integration of the regional economy in California.

2.2. Social Benefits

2.2.1. Unemployment and employment stability

The California High-Speed Rail Project has generated over 135,000 job opportunities across its construction and operation phases, encompassing crucial technical roles in engineering construction, design, and project management, alongside supportive non-functional positions vital for project progression [5]. Notably, many of these new job positions cater to low-skilled workers, predominantly from low-income families with limited educational and cultural backgrounds who previously held unstable and low-paying jobs. In other words, the project has absorbed many middle-aged and unemployed people in the California-centered radiation area, providing them practical work experience and jobs with social welfare security. This practical work experience can be brought to the project's follow-up operation and management work, providing them with long-term employment and promotion possibilities. Furthermore, these workers can transfer these general skills to the private sector and other local community endeavors, fostering an overarching improvement in real estate and infrastructure construction. This represents a historical accumulation of societal knowledge and vitality.

According to statistics from the California Employment Development Department, the unemployment rate in several cities in the central part of the California region is as high as 10% to 12%, higher than the national average [7]. The main reason for the high unemployment rate in this region is that the local GDP mainly depends on agricultural production. In recent years, droughts and water shortages caused by climate change have made seasonal unemployment problems even more severe. Fresno and Bakersfield mainly grow large-scale fresh vegetables, fruits, and nuts. The planting and harvesting of these crops require a high demand for seasonal labor. These workers face job instability due to the manual nature of planting and harvesting agricultural production. A smooth transportation infrastructure allows a large number of workers to quickly rotate to the following

employment site during different seasons, reducing the state of unemployment among workers, lowering the training costs for farmers to train new skilled workers, and reducing the subsidies invested by the government and unions for the unemployed. Simultaneously, efficient transportation plays a pivotal role in transporting and storing fresh produce. High-quality infrastructure minimizes the loss rate of fresh fruits and vegetables, enhancing their purchase rates at final sales points.

2.2.2. Sustainable construction and ecological protection

During its construction, the project has embraced several sustainable development measures. It utilizes low-carbon recycled concrete materials and energy-saving technologies to mitigate environmental impacts and bolster the growth and application of green industries. Sufficient buffer zones have been set aside in collaboration with environmental protection organizations for the migration and protection of wildlife. This approach ensures the integrity of the ecosystem and promotes local tourism development. Project development and environmental protection have been carried out simultaneously so that water resource damage in the construction area has been minimal. Ecological compensation measures have also been taken to support wetland restoration and afforestation. This series of measures reduces the potential annual property damage and casualties caused by forest fires. After the project is completed, the high-speed railway will be fully electrically powered, significantly reducing per capita energy consumption and carbon emissions compared to traditional aviation and public transportation while increasing public transportation transfer rates. This initiative will elevate the air quality of cities along the route, which have long grappled with air pollution in the Central Valley, effectively lowering the risk of respiratory diseases among residents and decreasing medical and public health expenditures.

2.2.3. Improving regional transportation

The high-speed rail project serves as a potent remedy for the housing pressures residents of major urban centers face. It provides many families the convenience of working in San Francisco and Los Angeles and commuting to the city's suburbs. By reducing commuting times, this project enhances the feasibility of hybrid work arrangements—balancing remote and on-site duties—thereby fostering social inclusivity and elevating the quality of life for many. As for the transportation connectivity of small and medium-sized cities, the high-speed rail project has brought new vitality to areas lacking transportation hubs. It enables low and middle-income households in rural and town areas to access the offering of large chain enterprises more frequently and conveniently, reducing grocery expenses, broadening product options, and mitigating the exodus of labor from remote regions.

Furthermore, establishing high-speed railway stations has catalyzed the growth of adjacent real estate and commercial sectors. In certain cities, the commercial real estate market has witnessed rental increases surpassing 18%, a testament to the fervent interest from investors [8]. Both potential commercial investors and individual stakeholders are willing to bear these heightened rental costs, thereby averting the pitfalls of gentrification and underscoring the transformative impact of infrastructure investments on urban progression.

2.3. Challenges

However, this project has specific problems with cost control. These issues are mainly attributed to conflicts between the two levels of government in land expropriation, rising prices of infrastructure materials, investigations and requirements from environmental protection departments, and higher requirements for a unified coordination mechanism for stakeholders. Regulatory authorities should promote implementing transparent systems and public review of procurement department lists. Additionally, establishing more avenues for public feedback is imperative to ensure accountability and responsiveness to community concerns.

3. LaGuardia Airport Reconstruction Project - Case Analysis

3.1. Project Background and Overview

LaGuardia Airport, nestled in Queens, New York, is a renowned landmark and a pivotal hub in the East Coast's bustling aviation landscape. Transforming from a private airfield into a public air transport center in 1939 to the small-scale renovations in the 1960s, LaGuardia Airport's aging facilities and cramped spaces have resulted in frequent flight delays. To meet modern air travel's comfort and convenience and firmly establish New York as a global aviation hub, the Port Authority of New York and New Jersey launched the LaGuardia Airport Redevelopment Program in 2016. This project is one of the most significant public-private partnerships in New York State history, with a total investment of more than 8 billion U.S. dollars [9].

The redevelopment project encompasses three key projects. First, the new Terminal B is 1,300,000 square feet and includes 35 additional gates [9]. Adopting an island-bridge connection design, the airport has increased its lateral capacity by 50% towards Central Avenue. Second, upon completion, the direct airport railway will emerge as a novel transportation hub, enhancing connectivity between the city and the airport and broadening the road network surrounding it. Third, the reconstruction project uses low-carbon building materials and new energy technologies that have been certified to international standards so that the transformation of the environment around the airport is in line with sustainable development.

3.2. Social Benefits

3.2.1. Economic growth

The airport's reconstruction has facilitated increased flights by various airlines, boosting its annual passenger throughput from 30 million to 40 million [9]. It is expected to increase economic activity in the New York metropolitan area by 6.5 billion U.S. dollars [10]. Whether through transit flights or the expansion of exchanges such as tourism, business meetings, or academic collaborations, these direct increases in visitor numbers have amplified New York's influence within North America's and the world's cultural, political, and economic networks.

Moreover, the airport's modernization has also increased the frequency of logistics and commercial activities, which aligns with New York's status as an international port. The new cargo handling center has an automated cargo sorting and information collection system, which has shortened cargo transportation time by 10% to 15% [11]. A reliable and efficient supply chain has dramatically improved cargo turnover and customs clearance efficiency. This has reduced the cross-border logistics costs of companies in industries with high time-sensitive requirements, such as pharmaceuticals, fresh food, and electronic chip products, and reduced the problems of overseas inventory backlogs and transportation losses.

The reconstruction project has boosted investment enthusiasm in commercial real estate in the area surrounding the airport. Data shows that commercial rents in the area surrounding the airport have increased by 12% over the past three years, compared with an increase of only 5% in commercial real estate rents in New York City [12]. This airport economic circle effect has not only been formed because the reconstruction project has provided efficient logistics and transportation conditions for enterprises, attracting more office buildings and offices to set up offices and business centers around the airport, but also driven the construction of high-end services and entertainment facilities such as high-end hotels, shopping malls, and casinos in the area.

3.2.2. Employment growth

At the construction peak, the project directly created more than 18,000 construction-related jobs, and the local employment rate during this period was as high as 8% [13]. This initiative was the government's direct response to the post-pandemic unemployment crisis. The rebuilt airport is also expected to create more than 6,000 long-term jobs, mainly in airport operations, commercial retail, food and beverage services, ground crew, and logistics. These subsequent jobs provide lower barriers

to age, skill, experience, and gender than construction workers and airline designers. In addition to the expansion of airport-related commercial facilities, these labor forces are needed. Airlines and corresponding service providers and partners will also need more jobs as new routes are developed. The New York City government's collaboration with training institutions has enabled low-income groups in the surrounding areas to participate in these jobs. The most notable achievement is that the employment rate of trainees after training exceeds 30%, dramatically increasing Queens's economic prosperity and employment flexibility [14].

3.2.3. Transportation network and regional economic connectivity

The renovation of the airport's fundamental aviation facilities included the incorporation of new taxiways and an optimized runway configuration. These enhancements reduced flight delays from 26.62% to 20.75% and cross-shift congestion time by 15% to 20% [9]. The improvement in on-time rates has given airlines more scheduling flexibility at the airport, significantly increasing the overall flight capacity and attracting more flights to choose to take off and land at the airport. Airlines' enhanced ability to deploy flights and operations with greater precision translates into more passenger options, elevating the airport's market competitiveness and satisfaction.

In addition, a multi-level shuttle system and more reasonable road planning have been arranged around the airport to alleviate traffic congestion during peak periods. This keeps passengers at the airport for a shorter period, increases the airport's accessibility and traffic accessibility, reduces the time and energy passengers spend on airport transportation, and reduces the personal and market economic losses caused by missed flights.

3.2.4. Water resources and carbon emissions

The LaGuardia Airport redevelopment used low-carbon concrete and all-electric ground service equipment, and the construction lighting used an efficient LED system. Overall, construction energy consumption was reduced by 25% compared to traditional methods, and carbon emissions were reduced by 30% [10]. These energy-saving measures reduced the overall construction and secondary treatment costs of industrial waste. They also improved the airport's surrounding community's urban air quality and flight visibility.

The new terminal building is designed to implement rainwater collection facilities to provide irrigation for green spaces, which is expected to save 30 million gallons of water annually [10]. This initiative improves the surrounding ecological restoration system. Airport facility cleaning also relies on this water reuse system, reducing the high demand for municipal water and ensuring the sustainability of the urban fringe ecology.

4. Comparative Analysis

The California High-Speed Rail Project and the LaGuardia Airport Redevelopment Project, despite their different historical backgrounds, geographical locations, construction periods, and investment scales, demonstrate the multiple positive impacts of infrastructure investment on the regional economic and social environment.

The California High-Speed Rail project is a long-term construction project focusing on a consistent transportation network throughout California. Its main goal is to promote the integration of the regional economy, allowing significant cities with economic vitality, such as San Francisco and Los Angeles, to interact with small towns in the central part of California affected by seasonal labor flows in terms of goods and capital. A long investment cycle, slow return efficiency, and a wide radiation area characterize the high-speed rail project. It is good news for transforming and upgrading small and medium-sized towns.

The reconstruction of LaGuardia Airport focuses on upgrading the infrastructure of a single airport, improving its operational efficiency and service quality, stimulating the post-pandemic economy, and partially renewing New York's old town in the short term. The reconstruction project is dedicated to modernizing the airport and building its authority as an aviation hub. It emphasizes directly driving

the development of individual dot-com economy entities and the commercial value added to the tourism and service industries through agglomeration effects.

Regarding social benefits, both projects create jobs during the construction period and improve the employment flexibility of low-income groups and temporary workers through long-term operations and government-provided vocational training techniques. This reflects the government's more profound understanding of social inclusion in employment and economic resilience in the cycle.

Regarding environmental impact, the electrically powered high-speed railway passes through more nature reserves and rural areas, substantially reducing urban sprawl and gentrification. The airport redevelopment project also makes green buildings in the city achieve ecological and environmental improvements through innovative rainwater recycling designs and ESG-compliant construction processes.

Both projects faced challenges in cost control, time schedules, and legal compliance during construction. Large-scale public projects have approval complexities in the early stages of land expropriation, environmental regulations, and multi-level government finances. In the medium term, they must deal with the technical challenges of procuring and constructing high-cost new environmentally friendly materials and pollution-free construction. In the later stage, they need to meet the multidimensional challenges of human rights and well-being regarding personnel mobilization and retraining.

5. Conclusion

This article delves into how infrastructure investment can optimize the multidimensional resource redistribution mechanism of the regional economy, analyzing the California High-Speed Railway project and the LaGuardia Airport reconstruction project as a case study. Consequently, infrastructure investment can propel economic growth, boost employment, and ultimately enhance the region's core competitiveness. By comparing these two cases, this paper reveals the profound impact of infrastructure investment on the regional economy and validates the importance of economic theory in practice.

First, the study commences with endogenous growth theory, which emphasizes the pivotal role of public infrastructure investment in fostering long-term development. This theory finds corroboration in the California High-Speed Rail project, facilitating regional economic resource integration and capital flows between cities. The discussion on technology diffusion and capital accumulation in endogenous growth theory and the dividend spillover effect in the Bay Area corroborates how the high-speed rail project while promoting convenience through new public transportation, reduces transaction costs and improves regional production efficiency.

Second, the theory of regional competition supports the LaGuardia Airport Redevelopment Project. Modernized infrastructure renovations have enhanced its dominance among New York's three airports and New York City's status as a transportation hub on the East Coast and across the United States, strengthening New York's global financial city's radiance. The redevelopment project has enhanced New York City's economic attractiveness by supporting the development of airline services and investment in high-end commercial real estate around the airport. The industrial agglomeration effect shows that high-quality critical infrastructure is a vehicle for enhancing the region's economic strength.

Thirdly, both projects provide channels for skill enhancement and a platform for rapid employment for different social groups. The corresponding vocational training programs also improve the quality of employment for low-skilled, low-income, and low-education groups, which is favorable for reducing the poverty rate of marginalized communities and regulating the equilibrium of the labor market. This coincides with the core ideas of the theory of balanced regional development.

Finally, regarding environmental sustainability, the high-speed rail project reduces carbon emissions by using electric-powered transportation and increasing transfer points, which aligns with the intention to transition to a low-carbon economy. The airport renovation project improves the

traditional urban construction process by applying energy-saving technologies and green building materials, setting an example for future urban green building concepts.

This article analyzes economic theories and two large-scale infrastructure investment projects to elucidate the benefits of judiciously allocated infrastructure investments that adhere to ESG standards in promoting regional economic development, enhancing social welfare, and achieving sustainable development. Governments and related organizations should explore the green construction transformation of more large-scale public projects in the future to adapt to the development of a diversified economy and sustainable economic globalization.

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