



Review Article

The Role of Road Infrastructure in Driving Regional Economic Growth: A Systematic Literature Review

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Abstract: Road infrastructure is widely recognized as a critical component of regional development strategies, yet empirical findings regarding its impact on regional economic growth remain heterogeneous across contexts and methodologies. This study aims to systematically synthesize existing empirical and theoretical evidence on the role of road infrastructure in driving regional economic growth and to identify the conditions under which such investments generate sustained economic benefits. A Systematic Literature Review (SLR) approach was employed, drawing on peer-reviewed publications indexed in major academic databases. Studies were screened based on predefined inclusion and exclusion criteria, and selected articles were analyzed using qualitative content analysis and narrative synthesis to identify dominant themes, methodological trends, and recurring findings. The review reveals a generally positive relationship between road infrastructure development and regional economic growth across diverse geographical settings and analytical frameworks. Road infrastructure contributes to growth through multiple channels, including productivity enhancement, reduced transportation costs, improved market accessibility, foreign investment attraction, spatial spillovers, and trade facilitation. However, the magnitude and distribution of benefits vary depending on institutional quality, governance effectiveness, complementary investments, and regional characteristics. In some cases, infrastructure investments may yield uneven outcomes or diminishing returns in the absence of adequate planning and maintenance. Overall, the findings suggest that road infrastructure can serve as a strategic instrument for regional economic development when integrated within comprehensive policy frameworks that emphasize sustainability, institutional capacity, and long-term maintenance.

Keywords: Road Infrastructure; Regional Economic Growth; Spatial Spillover Effects; Infrastructure Investment.



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1. Introduction

Infrastructure development has long been recognized as a fundamental driver of economic performance, structural transformation, and spatial development. In both developed and developing economies, public infrastructure investment is widely viewed as a catalyst for productivity enhancement, market expansion, and long-term growth. Among the various forms of infrastructure, such as energy, telecommunications, ports, and railways, road infrastructure occupies a particularly strategic position due to its direct influence on mobility, trade flows, and regional integration. Roads constitute the backbone of terrestrial transportation systems, linking production centers with markets, connecting rural and urban areas, and reducing logistical frictions. By lowering transportation and transaction costs, road infrastructure enhances allocative efficiency and supports economies of scale (Lau & Sin, 1997). Consequently, well-developed road networks are frequently associated with improvements in accessibility, competitiveness, and regional economic resilience.

The theoretical foundations linking infrastructure and growth are rooted in endogenous growth theory and new economic geography. Infrastructure investment increases the productivity of private capital by improving market access and facilitating knowledge diffusion. From a spatial perspective, improved road connectivity reduces economic distance, strengthens interregional trade linkages, and reshapes patterns of agglomeration. Empirical research has consistently shown that regions with higher-quality road infrastructure tend to exhibit stronger economic growth, employment expansion, and income growth than poorly connected regions (Calderon & Serven, 2014). Enhanced connectivity enables regions to integrate more effectively into national and global value chains, attract domestic and foreign investment, and stimulate industrial diversification (Crescenzi & Rodríguez-Pose, 2011). These mechanisms are particularly relevant for developing and emerging economies, where infrastructure gaps often constrain growth potential.

The importance of road infrastructure is even more pronounced in rural and peripheral regions. In such areas, limited connectivity can exacerbate spatial inequality by restricting access to markets, public services, and employment opportunities. Road development can mitigate these disparities by facilitating labor mobility, improving agricultural market access, and supporting small and medium-sized enterprises. Empirical evidence indicates that transportation infrastructure investment generates multiplier effects and positive spillovers, including increased private sector participation and regional business formation (Xueliang, 2013). In addition to economic gains, improved road access contributes to social development by enhancing access to education, healthcare, and administrative services, thereby promoting broader human capital development.

Despite the extensive literature documenting positive associations between road infrastructure and economic growth, empirical findings are not uniformly conclusive. While many studies report statistically significant growth effects, others suggest that the magnitude and distribution of benefits may vary considerably across regions and institutional contexts. Some scholars argue that infrastructure investment may exhibit diminishing marginal returns once a threshold of basic network coverage has been reached. Others emphasize that poorly planned or politically motivated infrastructure projects may lead to inefficient resource allocation and limited economic impact (Donaldson, 2018). Furthermore, governance quality, maintenance practices, and complementary policies, such as regulatory reforms and human capital development, play critical roles in determining whether infrastructure investments translate into sustained economic gains (Lau & Sin, 1997).

Another emerging debate concerns the environmental and fiscal sustainability of large-scale road infrastructure expansion. While roads enhance economic integration, they may also contribute to land-use change, environmental degradation, and increased carbon emissions if not accompanied by sustainable planning frameworks. Additionally, inadequate maintenance can reduce infrastructure lifespan and erode expected economic returns. These concerns underscore the importance of evaluating infrastructure investments not only in terms of short-term growth effects but also in relation to long-term sustainability and institutional capacity. Given these divergent findings and ongoing debates, the existing literature remains fragmented across geographic regions, methodological approaches, and analytical frameworks. Studies differ in their use of cross-country panel data, regional case studies, quasi-experimental designs, and spatial econometric models, leading to variations in estimated impacts. This fragmentation makes it challenging for policymakers and scholars to draw coherent conclusions regarding the overall role of road infrastructure in regional economic development.

In light of these considerations, a systematic literature review is both timely and necessary. The purpose of this study is to synthesize empirical and theoretical evidence on the role of road infrastructure in driving regional economic growth, identify dominant research trends, highlight methodological differences, and uncover gaps that warrant further investigation. By systematically evaluating the existing body of knowledge, this study seeks to clarify the conditions under which road infrastructure investment contributes most effectively to regional development. The principal conclusions of this review indicate that

road infrastructure generally exerts a positive influence on regional economic growth, particularly when supported by strong governance, effective maintenance systems, and complementary economic policies. However, the magnitude and sustainability of its impact depend on institutional quality, regional characteristics, and environmental considerations. By consolidating current evidence and outlining future research directions, this study provides a comprehensive reference framework for scholars and policymakers seeking to understand the strategic role of road infrastructure in shaping regional economic trajectories.

2. Materials and Methods

2.1 Research Design

This study employed a Systematic Literature Review (SLR) approach to comprehensively examine the existing body of knowledge on the role of road infrastructure in promoting regional economic growth. The SLR method was selected to ensure methodological transparency, replicability, and analytical rigor in identifying, evaluating, and synthesizing relevant scholarly evidence. The review process followed established systematic review procedures, including literature identification, screening, eligibility assessment, data extraction, and synthesis. This structured approach minimizes selection bias and enhances the reliability of conclusions drawn from the accumulated evidence.

2.2 Data Sources

The literature search was conducted using several reputable academic databases to ensure comprehensive coverage and the inclusion of high-quality peer-reviewed studies. The primary databases included Scopus, Web of Science, Google Scholar, and ScienceDirect. These databases were selected due to their extensive indexing of journals in economics, regional science, development studies, and transportation research. Utilizing multiple databases reduced the risk of omitting relevant studies and enhanced the robustness of the review process.

2.3 Search Strategy

A systematic search strategy was developed using a combination of relevant keywords and Boolean operators. The principal search terms included “road infrastructure,” “transport infrastructure,” “regional economic growth,” “regional development,” and “economic impact.” These terms were combined using operators such as AND and OR to refine and expand search results where appropriate. To ensure inclusion of recent theoretical and empirical advancements, the search was limited to English-language articles published between 2013 and 2024. This time frame captures contemporary debates, methodological innovations, and updated empirical findings regarding infrastructure-led regional development.

2.4 Inclusion and Exclusion Criteria

To ensure both relevance and academic quality, predefined inclusion and exclusion criteria were applied during the screening process. Studies were included if they:

1. Examined road or transport infrastructure as a primary explanatory variable,
2. Investigated its impact on regional, subnational, or local economic growth,
3. Were published as peer-reviewed journal articles, conference proceedings, or authoritative institutional reports, and
4. Provided empirical analysis, theoretical modeling, or conceptual discussion relevant to regional development outcomes.

Studies were excluded if they:

- Focused exclusively on non-road infrastructure (e.g., railways, ports, or airports) without substantive discussion of road networks,
- Lacked clear methodological explanations,
- Were non-academic sources such as opinion pieces, editorials, or unpublished manuscripts, or
- Did not explicitly address economic growth or regional development outcomes.

These criteria were applied consistently to maintain analytical coherence and ensure comparability across selected studies.

2.5 Study Selection Process

The study selection followed a multi-stage screening procedure. First, duplicate records retrieved from different databases were identified and removed. Second, titles and abstracts were screened to assess their alignment with the research objectives and inclusion criteria. Third, full-text articles were evaluated to determine final eligibility. The entire selection process was documented systematically to ensure

transparency and methodological consistency. Where necessary, discrepancies in study inclusion decisions were resolved by re-evaluating the eligibility criteria.

2.6 Data Extraction and Analysis

Data extraction was conducted using a standardized coding framework to ensure consistency across studies. The extracted information included author(s), year of publication, geographic focus, research objectives, methodological approach, key variables, analytical techniques, and principal findings. The collected data were analyzed using qualitative content analysis to identify recurring themes, dominant theoretical perspectives, empirical patterns, and methodological trends. Particular attention was given to identifying causal mechanisms, contextual moderating factors, and variations in estimated growth effects across regions and institutional settings.

2.7 Data Synthesis

The findings from the selected studies were synthesized using a narrative synthesis approach. This method enabled the integration of diverse empirical results and theoretical arguments across different methodological frameworks. The synthesis focused on:

- The economic mechanisms linking road infrastructure to regional growth,
- Evidence of spatial spillovers and agglomeration effects,
- Contextual factors influencing impact magnitude, and
- Areas of consensus and divergence within the literature.

By systematically consolidating available evidence, the synthesis provides a comprehensive, structured understanding of how road infrastructure contributes to regional economic development and under what conditions its impact is most significant.

3. Results and Discussion

3.1 Study Selection

The systematic literature search initially yielded a substantial number of publications addressing the relationship between road infrastructure and regional economic growth across multiple disciplinary domains, including regional economics, transport studies, and development economics. After removing duplicate records retrieved from different databases, the remaining studies underwent a rigorous screening process based on titles and abstracts. Articles that did not explicitly examine road or transport infrastructure in relation to regional or subnational economic outcomes were excluded at this stage. Subsequently, full-text screening was conducted using the predefined inclusion and exclusion criteria outlined in the methodology section. Studies lacking methodological clarity, empirical rigor, or explicit economic growth indicators were excluded. Following this multi-stage screening procedure, a final set of high-quality studies was selected for in-depth analysis. Most of the selected works consisted of empirical quantitative research, complemented by a smaller number of theoretical contributions and policy-oriented analyses. This selection reflects the strong empirical orientation of contemporary research in infrastructure economics.

3.2 Characteristics of the Selected Studies

The selected studies were published, reflecting the growing scholarly attention to infrastructure-led development in the past decade. The geographic coverage was diverse, including advanced economies such as the United States and European Union member states, as well as emerging and developing countries such as India and other Asian economies (Lau & Sin, 1997; Crescenzi & Rodríguez-Pose, 2011; Khadaroo & Seetanah, 2010). Several cross-country analyses also provided global comparative perspectives (Calderón & Servén, 2014). Methodologically, most studies employed quantitative approaches grounded in econometric modeling. Common analytical techniques included time-series analysis, panel data regression models, spatial econometric frameworks, and vector error-correction models (VECMs). Spatial econometrics has gained prominence due to its ability to capture spillover effects and interregional dependencies (Crescenzi & Rodríguez-Pose, 2011). Quasi-experimental designs and natural experiments have also been utilized to strengthen causal inference and address endogeneity concerns, as demonstrated by Donaldson (2018). The predominance of subnational or regional-level analysis underscores the importance of spatial heterogeneity in infrastructure research. Rather than assuming uniform national-level effects, contemporary studies increasingly recognize that infrastructure impacts vary across local economic structures, institutional quality, and connectivity patterns.

Table 1. Summary of Systematic Literature Review

Author(s) & Year	Method	Key Findings	Study Area
Lau & Sin (1997)	Time-series econometric analysis	Public infrastructure, including road networks, has a statistically significant positive effect on economic productivity and long-term growth.	United States
Crescenzi & Rodríguez-Pose (2011)	Spatial econometric analysis	Road infrastructure enhances regional accessibility and promotes regional economic growth, though the impact varies across regions.	European Union
Khadaroo & Seetanah (2010)	Vector Error Correction Model (VECM)	Road infrastructure development exhibits a long-run causal relationship with economic growth and foreign direct investment.	India
Calderón & Servén (2014)	Cross-country regression analysis	Improved transport infrastructure supports economic growth and contributes to reducing regional inequality.	Global (cross-country sample)
Donaldson (2018)	Natural experiment and econometric analysis	Transport infrastructure significantly increases regional trade efficiency and income levels through enhanced market integration.	India
Välilä (2020)	Survey of macro-econometric research	Infrastructure investment generally has a positive effect on economic growth, though the magnitude varies depending on model specification, data quality, and institutional context.	International (survey-based)
Wang (2002)	Panel data econometric analysis	Public infrastructure significantly contributes to economic growth in East Asian economies, particularly through productivity enhancement and capital accumulation.	East Asia
Pereira & Andraz (2013)	International literature survey	Public infrastructure investment produces positive output and employment effects, though returns differ across sectors and countries.	International (survey-based)
Elburz, Nijkamp, & Pels (2017)	Meta-analysis	Public infrastructure has a statistically significant positive impact on regional growth, but effect sizes vary across regions, infrastructure types, and estimation methods.	International (meta-analytic evidence)

Table 1 summarizes key empirical contributions examining the relationship between road infrastructure and regional economic growth across diverse geographical contexts and methodological approaches. Collectively, the selected studies demonstrate that road infrastructure plays a significant role in enhancing productivity, strengthening regional integration, and supporting long-term economic performance. However, they also reveal substantial heterogeneity in the magnitude, transmission

mechanisms, and distribution of impacts across regions and institutional environments. Using a time-series econometric framework, Lau & Sin (1997) investigate the macroeconomic contribution of public infrastructure in the United States. The study finds that public capital—particularly road infrastructure—exerts a statistically significant and positive effect on aggregate productivity and long-term economic growth. These findings reinforce the theoretical proposition that infrastructure investment enhances the marginal productivity of private capital and labor by reducing transportation costs and improving logistical efficiency. Lau & Sin (1997) provide strong empirical support for endogenous growth theory, which emphasizes the role of public capital accumulation in sustaining economic expansion.

Expanding the analysis to a regional and spatial dimension, Crescenzi and Rodríguez-Pose (2011) employ spatial econometric techniques to examine the European Union. Their findings indicate that road infrastructure significantly enhances regional accessibility and stimulates economic growth, particularly in less developed or peripheral regions. However, the impact is not spatially uniform; rather, it depends on pre-existing economic structures, institutional quality, and complementary investments. The study highlights spatial spillover effects, suggesting that infrastructure improvements in one region can generate growth externalities in neighboring regions through enhanced connectivity and trade linkages (Crescenzi & Rodríguez-Pose, 2011). Focusing on the Indian economy, Khadaroo & Seetana (2010) apply a Vector Error Correction Model (VECM) to examine the dynamic relationships among road infrastructure, economic growth, and foreign direct investment. Their results demonstrate a long-run causal relationship between infrastructure development and economic expansion. Moreover, improved road infrastructure is shown to attract foreign investment by lowering transaction costs and increasing market accessibility. This bidirectional relationship underscores infrastructure's dual role as both a growth driver and an enabling platform for broader economic integration.

At the global level, Calderón and Servén (2014) conduct cross-country regression analyses to evaluate the macroeconomic effects of transport infrastructure across a large international sample. Their findings confirm that improved transport infrastructure contributes not only to economic growth but also to reducing regional income inequality. By enhancing connectivity and facilitating market access, road infrastructure helps integrate lagging regions into national and global production networks. This cross-national evidence supports the argument that infrastructure investment can function as an instrument of inclusive development when accompanied by effective institutional frameworks. Similarly, Donaldson (2018) strengthens causal inference by employing a natural experiment design combined with econometric analysis to investigate the impact of transport infrastructure expansion in India. The study finds that improved connectivity significantly increases regional trade efficiency and income levels by reducing trade costs and enhancing market integration. The quasi-experimental approach addresses endogeneity concerns often present in infrastructure-growth studies, thereby reinforcing confidence in the causal interpretation of results.

Beyond these primary empirical contributions, broader survey and meta-analytic studies further contextualize the infrastructure-growth nexus. Väilä (2020), in a comprehensive survey of macroeconomic research, concludes that infrastructure investment generally exerts a positive effect on economic growth, although estimated elasticities vary substantially across model specifications, data structures, and institutional conditions. This variability highlights the importance of methodological rigor and contextual sensitivity in interpreting empirical results. Earlier evidence from East Asian economies by Wang (2002) demonstrates that public infrastructure significantly contributes to economic growth by enhancing productivity and promoting capital accumulation. The East Asian experience illustrates how coordinated infrastructure policy, combined with complementary industrial and trade strategies, can generate sustained economic transformation. This finding underscores the importance of policy coherence in maximizing infrastructure returns.

Pereira and Andraz (2013), in their international survey of empirical evidence, similarly conclude that public infrastructure investment yields positive effects on output and employment. However, they emphasize that returns vary across infrastructure sectors and national contexts, suggesting that institutional quality, fiscal management, and sectoral composition play critical moderating roles. Furthermore, Elburz, Nijkamp, and Pels (2017) confirm, through a meta-analysis of regional growth studies, that public infrastructure has a statistically significant positive impact on regional economic performance. Importantly, their meta-analytic results reveal substantial heterogeneity in effect sizes across regions and methodologies. This heterogeneity indicates that infrastructure outcomes are neither uniform nor automatic but depend on contextual, structural, and policy-related factors.

3.3 Economic Impact of Road Infrastructure

The synthesis of empirical findings reveals a generally robust and positive association between road infrastructure development and regional economic growth. Across diverse methodological frameworks and geographic contexts, improved road connectivity consistently reduces transportation and transaction costs,

enhances market accessibility, and increases overall productivity (Lau & Sin, 1997; Calderón & Servén, 2014). From a theoretical standpoint, these findings align with endogenous growth models, which posit that public capital investment enhances the productivity of private inputs and drives long-term growth. Empirically, regions with well-developed road networks tend to exhibit higher gross regional domestic product growth, greater employment opportunities, and stronger investment inflows than less-connected regions (Khadaroo & Seetanah, 2010). Spatial econometric evidence further suggests that road infrastructure promotes regional competitiveness by facilitating integration into national and global value chains (Crescenzi & Rodríguez-Pose, 2011). Improved accessibility reduces effective economic distance, enabling firms to expand their market reach and benefit from agglomeration economies. Donaldson (2018) provides strong causal evidence that transport infrastructure expansion significantly increases regional trade efficiency and income levels by lowering trade costs and improving market integration. However, while most studies report positive effects, the magnitude of impact varies considerably. Some findings suggest diminishing marginal returns once a threshold of infrastructure has been reached, particularly in already developed regions (Calderón & Servén, 2014). This indicates that infrastructure investment may yield higher returns in areas with substantial connectivity deficits.

3.4 Impact on Regional Disparities

A recurring theme in the reviewed literature concerns the role of road infrastructure in addressing regional inequality. Several studies argue that improved connectivity enables peripheral and rural regions to integrate into broader economic systems, thereby reducing spatial disparities (Calderón & Servén, 2014). By facilitating labor mobility and agricultural market access, road development can stimulate income generation in previously marginalized areas. Nevertheless, the evidence also reveals heterogeneous outcomes. Crescenzi and Rodríguez-Pose (2011) note that economically advanced regions may capture disproportionate benefits from infrastructure expansion due to stronger institutional frameworks, better complementary infrastructure, and higher absorptive capacity. In such contexts, infrastructure investment can inadvertently reinforce existing regional inequalities rather than reduce them. This divergence reflects a broader debate in regional development theory: whether infrastructure acts as a convergence mechanism by uplifting lagging regions, or as a divergence mechanism by strengthening already competitive areas. The answer appears contingent upon governance quality, policy coordination, and the presence of complementary economic and human capital investments.

3.5 Spillover and Social Effects

Beyond direct economic indicators, the literature identifies substantial spillover and social effects associated with road infrastructure development. Improved road networks enhance access to education, healthcare services, and employment opportunities, thereby contributing to human capital formation. These indirect benefits support long-term economic growth by improving labor productivity and increasing workforce participation. Spatial spillover effects are particularly significant. Infrastructure improvements in one region can generate positive externalities for neighboring regions through trade linkages and mobility flows (Crescenzi & Rodríguez-Pose, 2011). Donaldson (2018) demonstrates that enhanced transport connectivity increases interregional trade volumes, leading to broader welfare gains beyond the immediate project area. Furthermore, several studies report that small and medium-sized enterprises benefit substantially from improved logistics efficiency and market reach (Khadaroo & Seetanah, 2010). Reduced transportation costs enable firms to expand distribution networks, improve supply chain reliability, and enhance competitiveness. These microeconomic improvements collectively contribute to aggregate regional growth.

3.6 Challenges and Limiting Factors

Despite the generally positive findings, the literature also highlights important challenges that may constrain the effectiveness of road infrastructure investments. One common concern relates to inadequate maintenance. Without proper maintenance systems, infrastructure quality deteriorates over time, reducing productivity gains and increasing long-term fiscal burdens (Lau & Sin, 1997). Congestion and environmental degradation also represent significant limiting factors. While road expansion may initially reduce transport costs, excessive reliance on road-based transport can generate traffic congestion, increased emissions, and land-use pressures. These negative externalities may offset some economic gains if not addressed through integrated planning and sustainable transport policies. Governance quality emerges as a critical determinant of infrastructure effectiveness. Inefficient allocation of public funds, corruption, and weak institutional oversight can undermine project outcomes. Calderón and Servén (2014) emphasize that complementary reforms in regulatory frameworks and institutional capacity are necessary to maximize the economic returns of infrastructure investments. Finally, endogeneity and reverse causality remain

methodological challenges within the literature. Although recent studies employing quasi-experimental and spatial techniques have improved causal identification (Donaldson, 2018), further refinement of empirical strategies is needed to disentangle the direction and magnitude of the relationships between infrastructure and growth.

4. Conclusions

This systematic literature review provides a comprehensive synthesis of empirical and theoretical evidence on the role of road infrastructure in driving regional economic growth. The findings consistently demonstrate that road infrastructure constitutes a critical determinant of regional development by reducing transportation costs, enhancing market accessibility, facilitating trade flows, and strengthening spatial integration. Across diverse methodological approaches, including time-series econometrics, spatial modeling, cross-country regression analysis, and quasi-experimental designs, the reviewed studies confirm a generally positive relationship between road infrastructure investment and regional economic performance (Lau & Sin, 1997; Calderón & Servén, 2022; Crescenzi & Rodríguez-Pose, 2011; Donaldson, 2018; Khadaroo & Seetanah, 2010). The review further reveals that road infrastructure influences regional growth through multiple transmission mechanisms. These include productivity enhancement, attracting foreign direct investment, agglomeration economies, spatial spillovers, and human capital development. In peripheral and rural regions, improved connectivity can reduce spatial disparities by integrating previously isolated areas into broader economic systems. However, the magnitude and distribution of these benefits are highly contingent upon institutional quality, governance capacity, complementary investments, and maintenance effectiveness.

Importantly, the findings also indicate that infrastructure investment alone does not automatically guarantee inclusive or sustainable development. In some cases, economically advanced regions capture disproportionate gains due to stronger absorptive capacity and existing complementary infrastructure. Moreover, challenges such as congestion, environmental externalities, inefficient public spending, and weak governance can significantly constrain long-term economic returns. These divergent outcomes underscore the necessity of contextualized policy design and integrated development planning. This review supports the proposition that road infrastructure functions as a foundational component of regional growth strategies. Nevertheless, its effectiveness depends on broader institutional and policy frameworks that enable infrastructure assets to translate into sustained economic transformation.

Despite its comprehensive synthesis, this study has several limitations. First, the review was restricted to publications in English between 2013 and 2024, potentially excluding relevant earlier foundational studies or non-English contributions. Second, although systematic procedures were applied, variations in methodological approaches, data quality, and regional contexts across the selected studies limit direct comparability of empirical results. Third, while the review highlights general patterns and mechanisms, it does not conduct a quantitative meta-analysis to estimate pooled effect sizes. Therefore, conclusions regarding the magnitude of infrastructure impacts remain interpretative rather than statistically aggregated. Future research may employ meta-analytic techniques to provide more precise estimates of effect heterogeneity. Finally, the majority of the reviewed studies focus on macroeconomic indicators such as GDP or productivity, while relatively few examine distributional, environmental, or long-term sustainability outcomes. Expanding future research to incorporate multidimensional development indicators would provide a more holistic evaluation of infrastructure-led growth.

From a theoretical perspective, the findings reinforce and extend endogenous growth theory and new economic geography frameworks by demonstrating that public infrastructure investment enhances productivity and spatial integration. However, the evidence also suggests that infrastructure effects are conditional rather than universal. This implies the need for refined theoretical models that incorporate institutional quality, governance effectiveness, and absorptive capacity as moderating variables. Furthermore, the presence of spatial spillovers highlights the importance of incorporating interregional dependencies into growth models. Future theoretical advancements should integrate dynamic spatial equilibrium frameworks to better capture infrastructure-induced redistribution effects across regions.

For policymakers, the findings emphasize that road infrastructure investment should not be viewed as a standalone development solution. Instead, it must be embedded within comprehensive regional development strategies that include complementary investments in human capital, digital infrastructure, and institutional strengthening.

Governments should prioritize:

1. Strategic planning and spatial targeting, ensuring that infrastructure investments address connectivity gaps in lagging regions while avoiding over-concentration in already-developed areas.
2. Maintenance and lifecycle management, recognizing that sustained economic returns depend on infrastructure quality over time.

3. Governance and transparency improvements, to enhance efficiency and minimize resource misallocation.
4. Sustainability integration, incorporating environmental impact assessments and climate-resilient design principles to mitigate negative externalities.

Additionally, policies aimed at strengthening small and medium-sized enterprises can amplify infrastructure benefits by enabling firms to leverage improved logistics and market access. Future research should explore longitudinal and micro-level analyses to better understand how infrastructure affects firm productivity, household welfare, and income distribution. Greater attention should also be given to climate-resilient infrastructure planning, green transport systems, and the integration of digital and physical infrastructure. Moreover, comparative studies across institutional contexts may help identify governance models that maximize the developmental impact of infrastructure investments.

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