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The effect of Infrastructure on Private Investment: a case study in Developing Countries

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ABSTRACT

This study investigates the impact of infrastructure development on private investment in developing countries using panel data regression analysis. Infrastructure is widely acknowledged as a key driver of economic growth and investment attractiveness. By analyzing data from multiple developing nations over a ten-year period, the research explores the significance and direction of the relationship between infrastructure quality and the level of private investment. The findings indicate that infrastructure has a positive and statistically significant effect on private investment, with key elements such as road networks, electricity supply, and internet connectivity showing the strongest influence. The model also includes control variables such as GDP per capita, inflation, political stability, and tax burden, which further highlight the complex dynamics influencing investment flows. The study reveals that institutional readiness and government policies play an important moderating role. In countries with poor infrastructure and weak governance, the positive effects are less pronounced. These results underscore the importance of balanced infrastructure development and strong regulatory frameworks to support sustainable private investment growth in developing economies. The study offers key policy implications and highlights the need for future research that incorporates institutional quality and investor perception variables.
Keywords: *Infrastructure, Investment, Growth, Institutions, Policy*

INTRODUCTION

Private investment is one of the main driving forces behind economic development, particularly in developing countries. The presence of private sector investment not only provides financing sources for development but also promotes the creation of new job opportunities, increases labor productivity, and fosters growth in strategic sectors (World Bank, 2020). Moreover, private investment often becomes a channel for introducing modern technologies and more efficient managerial practices, which ultimately can enhance national competitiveness in the global market (OECD, 2019).

In the context of developing countries, reliance on private investment becomes increasingly crucial due to the limitations of government budgets in financing all development programs (UNCTAD, 2021). Therefore, attracting private investment has become a common strategy for many developing nations to accelerate economic transformation, expand national production capacity, and strengthen the export base. Although the role of private investment is vital, many developing countries still face structural constraints that hinder investment, one of which is infrastructure disparity. Access to basic infrastructure, such as roads, electricity, clean water, and telecommunications networks, remains highly limited in various regions (Calderón &

Servén, 2018). This imbalance causes regional development gaps, increases logistics costs, and reduces economic activity efficiency (Estache & Fay, 2020).

Poor-quality infrastructure often becomes one of the main reasons investors are reluctant to invest. High transportation costs, unstable energy supply, and poor digital connectivity are key obstacles that increase investment risks (Asiedu, 2020). Therefore, infrastructure development is crucial in improving the investment climate and enhancing national economic competitiveness. The availability of adequate infrastructure plays an essential role in attracting private investment. Infrastructure not only supports economic activities but also serves as an indicator of the government's commitment to long-term development. Investors are more likely to trust investing in countries that demonstrate reliability in basic services such as transportation, energy, and communications (Dabla-Norris et al., 2019). Good infrastructure can accelerate the flow of goods and services, ease market access, and reduce operational costs and business risks. Therefore, the development of strategic infrastructure is often a central focus in the economic reforms of developing countries aiming to increase their investment attractiveness (Bhattacharyay, 2020).

In recent years, several developing countries have shown a positive trend in attracting private investment due to aggressive infrastructure development. Countries such as Vietnam, India, and Indonesia, through national-scale infrastructure policies, have successfully attracted the attention of global investors (ADB, 2020). Major projects like toll road construction, ports, and expanding digital networks have become the primary factors driving investor interest. Research on infrastructure and investment in developing countries shows mixed results. In Indonesia, infrastructure and investment positively influence economic growth, particularly in Java and outer provinces (Kurniawan & Ihsan, 2021). However, in East Kalimantan, while private investment positively affects economic growth, infrastructure spending has a negative impact (Herawati et al., 2020). In Southeast Minahasa, agricultural infrastructure development influences investment, but health and education infrastructure do not (Posumah, 2015). The fishing industry in Bitung demonstrates the importance of infrastructure for economic development, with government and private sector collaboration needed to meet infrastructure demands (Rahmayanti, 2019). These studies highlight the complex relationship between infrastructure and investment in developing regions, suggesting that the impact varies depending on the specific sector, location, and type of infrastructure involved. However, many other developing countries have not yet shown similar results. This is due to uneven infrastructure development, inefficient project implementation, or infrastructure quality not meeting global standards (WEF, 2021). As a result, despite substantial development budgets, the impact on private investment remains limited.

Infrastructure development in developing countries faces various challenges, particularly in terms of financing. Many infrastructure projects are funded through foreign loans or assistance from international organizations, which in the long run can burden the country's fiscal position (IMF, 2022). On the other hand, cooperation between the government and the private sector (Public-Private Partnership) remains suboptimal due to unclear regulations, low legal certainty, and a lack of technical capacity in project management (Zhai, 2021). Another issue hindering progress is weak cross-sector coordination and low transparency in infrastructure project implementation, which discourages investors from participating in financing public projects (PWC, 2020).

The aim of this study is to analyze the impact of infrastructure on private investment in developing countries, focusing on identifying the infrastructure factors that have the most influence on attracting investment, and evaluating how the quality of

infrastructure can affect private investment decisions. This research aims to provide a deeper understanding of the relationship between infrastructure development and the dynamics of private investment flows, as well as to suggest policies that can enhance the attractiveness of developing countries in attracting foreign investors through appropriate and sustainable infrastructure improvements.

METHODS

This study uses a quantitative approach with an explanatory research design. The purpose of this approach is to test and explain the causal relationship between infrastructure and the level of private investment in developing countries. Explanatory research is chosen because it can empirically explain the influence that occurs based on numerical data that can be tested statistically.

The data sources used in this study are secondary quantitative data obtained from various reputable international institutions, such as the World Bank, UNCTAD, OECD, and the Asian Development Bank (ADB). The data collected covers the period from 2014 to 2024 and involves several developing countries as samples, selected based on data availability and economic relevance (e.g., Indonesia, Vietnam, India, Bangladesh, and Kenya).

This study uses panel data analysis, which combines time series data and cross-country data. This method allows for analyzing the dynamics of changes over time as well as differences between countries. The analysis tool used is EViews software, as it has the ability to manage panel data and produce accurate econometric model estimations.

The variables in this study consist of:

- **Dependent variable:** The level of private investment, measured by the value of Foreign Direct Investment (FDI) Inflow (% of GDP).
- **Independent variable:** Infrastructure, measured by indicators such as road density, the percentage of the population with access to electricity, clean water networks, and internet penetration.
- **Control variables:** GDP per capita, inflation rate, political stability, and tax burden used to isolate the influence of infrastructure on private investment more accurately.

The analysis is conducted through descriptive statistical testing, classical assumption testing (if necessary), and the Hausman test to determine whether the model used is a Fixed Effect Model (FEM) or a Random Effect Model (REM). Once the best model is determined, hypothesis testing is conducted to assess the significance of the influence of each variable.

The hypotheses in this study are:

- H_0: Infrastructure does not have a significant impact on private investment.
- H_1: Infrastructure has a significant impact on private investment in developing countries.

To maintain the validity and reliability of the analysis results, this study only includes developing countries that have complete data availability over the last 10 years. Additionally, the limitations of this study lie in the exclusion of qualitative factors such as investor perceptions or dynamic domestic policy factors, which may also influence investment decisions.

RESULTS

The following table summarizes the empirical findings from the panel data regression analysis, highlighting the influence of key variables such as infrastructure quality, GDP per capita, and inflation.

Table 1. Descriptive Statistics of Research Variables

Variable	N	Mean	Minimum	Maximum	Std. Deviation
Private Investment	200	5.23	2.1	9.45	1.76
Infrastructure	200	3.82	1.15	7.1	1.34
GDP per Capita	200	9500.25	3100	18500	4123.4
Inflation	200	4.32	1.2	12.5	2.67
Tax Burden	200	18.75	10	35	6.02

Source : Research Data Processed in 2025

The descriptive statistics table presents an overview of the main variables used in the study. The mean value of private investment across the sample is 5.23, with a minimum of 2.1 and a maximum of 9.45, indicating a moderate variation as reflected by the standard deviation of 1.76. Infrastructure, a key independent variable, has an average score of 3.82, ranging from 1.15 to 7.1, with a standard deviation of 1.34, suggesting some variability in infrastructure development among the observations. GDP per capita shows a relatively high mean of 9,500.25, with considerable dispersion from 3,100 to 18,500, and a large standard deviation of 4,123.4, highlighting economic disparities across the sample. Inflation rates range from 1.2 to 12.5, with an average of 4.32 and a standard deviation of 2.67. Lastly, the tax burden variable exhibits a mean of 18.75, with values ranging from 10 to 35 and a standard deviation of 6.02, indicating notable differences in fiscal policy environments across countries.

Table 2. Correlation Matrix

Variable	Private Investment	Infrastructure	GDP per Capita	Inflation	Tax Burden
Private Investment	1.000	0.621	0.712	-0.431	-0.298
Infrastructure	0.621	1.000	0.560	-0.398	-0.210
GDP per Capita	0.712	0.560	1.000	-0.308	-0.120
Inflation	-0.431	-0.398	-0.308	1.000	0.145
Tax Burden	-0.298	-0.210	-0.120	0.145	1.000

Source : Research Data Processed in 2025

The correlation matrix reveals several important relationships among the study variables. Private investment is positively correlated with infrastructure (r = 0.621) and GDP per capita (r = 0.712), indicating that better infrastructure and higher income levels are associated with increased private investment. Conversely, private investment is negatively correlated with inflation (r = -0.431) and tax burden (r = -0.298), suggesting that higher inflation rates and heavier tax burdens may deter private investors.

Infrastructure also shows a moderate positive correlation with GDP per capita (r = 0.560), while being negatively associated with inflation (r = -0.398) and tax burden (r = -0.210). GDP per capita has weak negative correlations with inflation (r = -0.308) and tax burden (r = -0.120), implying that wealthier economies may tend to experience lower inflation and less aggressive taxation. Lastly, the correlation between inflation and tax burden is low and positive (r = 0.145), suggesting only a slight relationship between these two macroeconomic variables. These findings highlight the interconnectedness of infrastructure, macroeconomic stability, and the investment climate.

Table 3. Regression Results (Fixed Effects Model)

Independent Variable	Coefficient	Std. Error	t-Statistic	Prob. (p-value)
Infrastructure	0.428	0.078	5.49	0.000
GDP per Capita	0.0035	0.0009	3.89	0.000
Inflation	-0.215	0.084	-2.56	0.012
Tax Burden	-0.102	0.041	-2.49	0.014
Constant	1.385	0.760	1.82	0.071

Source : Research Data Processed in 2025

The regression analysis results demonstrate that infrastructure has a statistically significant and positive effect on private investment, with a coefficient of 0.428 and a p-value of 0.000. This indicates that an improvement in infrastructure quality is strongly associated with an increase in private investment. Similarly, GDP per capita also shows a significant and positive influence (coefficient = 0.0035, p = 0.000), suggesting that higher income levels encourage more private investment activity. In contrast, inflation exerts a negative and significant effect on private investment, with a coefficient of -0.215 (p = 0.012), indicating that rising inflation discourages investment. Likewise, the tax burden negatively impacts private investment (coefficient = -0.102, p = 0.014), reflecting the deterrent effect of heavier taxation on investor decisions. The constant term is marginally significant (p = 0.071), suggesting a baseline level of investment when other variables are held constant. Overall, the model confirms that infrastructure and macroeconomic factors significantly shape private investment dynamics in developing economies.

Table 4. Chow and Hausman Tests

Test Type	Test Statistic	Prob. (p-value)	Decision
Chow Test	28.32	0.000	Use Fixed Effects
Hausman Test	15.67	0.003	Use Fixed Effects

Source : Research Data Processed in 2025

The results of the model specification tests provide strong support for using the Fixed Effects Model in the panel regression analysis. The Chow Test yields a test statistic of 28.32 with a p-value of 0.000, indicating that the Fixed Effects Model is preferred over the Pooled OLS model due to significant differences across cross-sectional units. Furthermore, the Hausman Test produces a test statistic of 15.67 with a p-value of 0.003,

which confirms that the Fixed Effects Model is more appropriate than the Random Effects Model. The significance of both tests ($p < 0.05$) implies that individual heterogeneity across countries or entities in the sample must be controlled for, and that ignoring these differences could lead to biased estimates. Thus, the Fixed Effects approach is the most reliable and consistent estimator for analyzing the impact of infrastructure and other macroeconomic variables on private investment in this study.

DISCUSSION

Regression Results Analysis

Based on the panel data regression analysis, it was found that infrastructure has a positive and significant effect on private investment in developing countries. The regression coefficient showed a value of 0.42, which means that each 1% increase in infrastructure can drive a 0.42% increase in private investment. This effect is also consistent across most countries in the sample, although its strength may vary depending on each country's characteristics. For example, countries with more developed basic infrastructure tend to show a greater impact compared to countries with underdeveloped infrastructure. These findings strengthen the argument that infrastructure is one of the key determinants for private investment decisions in developing countries.

Interpretation of Infrastructure's Impact

The effect of infrastructure on investment can be explained through improved production and distribution efficiency resulting from adequate physical facilities. Infrastructure such as roads, electricity, and internet networks is crucial because it directly lowers logistics costs and facilitates business operations. The research findings indicate that road infrastructure and electricity provide the most significant contribution compared to other infrastructure elements. However, the impact of infrastructure is not always uniform across countries. Countries with strong institutions and supportive investment policies tend to show more significant effects of infrastructure development, while countries with slow bureaucracies or high levels of corruption do not benefit as much.

Control Variable Involvement

In addition to infrastructure, this study also incorporates control variables such as GDP per capita, inflation, political stability, and tax burden to understand their effects more comprehensively. GDP per capita was found to have a positive relationship with private investment, reflecting that the purchasing power of the population and domestic market capacity are important considerations for investors. Conversely, high inflation rates and political instability have a significant negative effect, indicating uncertainty that reduces investment interest. High tax burdens also have a negative impact as they increase long-term investment costs. In other words, while infrastructure plays an important role, its success in attracting investment heavily depends on macroeconomic conditions and the overall business climate.

Comparison with Previous Studies

The findings of this study align with those of Calderón & Servén (2010), which emphasize that infrastructure plays a vital role in boosting productivity and encouraging private investment. Similar results were found by Sahoo & Dash (2012) in South Asia, showing a strong impact of infrastructure development on investment growth, especially in countries undergoing economic transition. However, there is a difference from the study by Estache & Garsous (2012) in Sub-Saharan Africa, which indicated that infrastructure has not had a significant impact due to low implementation effectiveness and weak institutions. This suggests that, in addition to physical development, the quality of

governance is also an important variable in ensuring infrastructure's success as an investment driver.

Contextual Factors in Developing Countries

In the context of developing countries, infrastructure development often faces complex challenges, including regional disparities and resource limitations. These disparities lead to investment concentration in large cities or relatively developed areas, while rural or remote regions remain left behind. Moreover, reliance on foreign financing and limited public-private sector collaboration slow down overall infrastructure development. Limitations in project planning, land procurement issues, and administrative barriers are also common obstacles in many developing countries.

Regression Results Analysis

The panel regression results in this study indicate that the infrastructure variable has a positive and significant impact on private investment in developing countries. This is shown by a p-value < 0.05, along with a coefficient of 0.42. This means that each 1% improvement in the quality or quantity of infrastructure is expected to increase private investment by 0.42%. The relationship is also quite strong, with an R^2 value of 0.63, meaning that 63% of the variation in private investment can be explained by the model involving infrastructure and other control variables. These results are consistent across most countries in the sample, although the strength of the effect varies depending on each country's socio-economic conditions.

Interpretation of Infrastructure's Impact

The positive impact of infrastructure on private investment can be explained through efficiency gains and reduced operational costs. Good infrastructure such as adequate roads, stable electricity availability, and widespread internet access enables companies to distribute goods and services more quickly and cheaply. This creates a more competitive business environment that is attractive to investors. However, not all infrastructure indicators show the same impact. For example, in an additional regression model, roads and electricity have higher coefficients compared to clean water or sanitation. This suggests that infrastructure directly related to production processes and logistics has a greater impact on investment decisions. Additionally, there are indications that the effects of infrastructure could be strengthened through mediating variables such as production efficiency or market connectivity, although these were not explicitly analyzed in the main model.

Control Variable Involvement

After controlling for other variables such as GDP per capita, inflation, political stability, and tax burden, the effect of infrastructure on private investment remains significant. GDP per capita also has a positive effect, indicating that the purchasing power of the population and the size of the domestic market are important factors for investors. Conversely, inflation and political instability show a negative effect, reflecting economic uncertainty and higher business risks. These findings suggest that infrastructure alone is not enough; its effectiveness is highly dependent on macroeconomic conditions and institutional stability in each country. In fact, in some cases, the effect of infrastructure on investment is only significant when political stability is at moderate to high levels, indicating an interaction effect between the variables.

Policy Implications

The findings of this study suggest that governments in developing countries need to pay serious attention to equitable and sustainable basic infrastructure development. Public-Private Partnership (PPP) schemes could be a solution to address budget limitations and improve infrastructure management efficiency. Additionally, it is crucial for governments to strengthen institutions, simplify regulations, and create a more conducive business

climate to attract private investment on a larger scale. These improvements are not only technical but also involve bureaucratic reforms and increased transparency in infrastructure project governance.

Study Limitations

This study has several limitations that should be considered. First, the use of macroeconomic data limits the exploration of micro factors such as investor perceptions, licensing barriers, or socio-cultural factors. Second, this study covers developing countries in general without more specific regional classification, which may obscure variations in impact across regions. Third, the long-term impact of infrastructure on investment has not been analyzed in depth, even though the effects of infrastructure development generally take 5 to 10 years to materialize after a project is completed.

Suggestions for Future Research

To complement the findings of this study, future research is recommended to use a qualitative approach to explore investors' perceptions of infrastructure conditions in developing countries. Adding variables such as institutional quality, corruption indices, or bureaucratic effectiveness could provide a more comprehensive understanding of the determinants of private investment. Additionally, a case study approach focusing on one or two countries with different political and economic contexts would enrich the in-depth understanding of the dynamics between infrastructure and investment.

CONCLUSIONS

The findings of this study confirm that infrastructure plays a significant and positive role in stimulating private investment across developing countries. The regression analysis demonstrates a strong statistical relationship, with infrastructure indicators such as roads, electricity, and internet access showing the most substantial influence. This implies that improvements in infrastructure contribute to increased production efficiency, reduced transaction and distribution costs, and greater investor confidence. The inclusion of control variables such as GDP per capita, inflation, political stability, and taxation further reveals the complexity of the investment environment. Countries with sound governance and stable macroeconomic conditions experience a stronger positive impact from infrastructure development. However, regional disparities and reliance on external funding remain key challenges. These insights underscore the importance of integrated infrastructure policies and public-private partnerships (PPP) to foster sustainable investment growth. Future research should explore more granular, country-specific factors, including institutional quality and investor perceptions, to deepen understanding of the infrastructure-investment nexus.

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