Heliyon 10 (2024) e26504

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Investments in basic public infrastructure and their effects on economic growth in a developing country: The case of Cameroon

Cosmas Bernard Meka'a [a], Silvain Raoul Fotso [b,*], Babel Raïssa Guemdjo Kamdem [c]

[a] Faculty of Economics and Management, University of Bertoua, Cameroon
[b] Faculty of Economics and Applied Management, University of Douala, Cameroon
[c] Higher School of Economics and Commerce, University of Douala, Cameroon

ARTICLE INFO

Dataset link: https://databank.worldbank.org/source/world-development-indicators

JEL classification:
H54
O47
C13

Keywords:
Stock of public capital
Economic growth
Generalized method of moment
Cameroon

ABSTRACT

The literature review conducted in this study indicates that there is no unanimity regarding the definition of infrastructure and its impact on growth. While some economists argue that focusing on logistical infrastructure, such as transportation, telecommunications, water, and energy, would be beneficial for governments, others emphasise the importance of social infrastructure, such as health and education. Given the diverse range of opinions, further investigation is required, particularly in the context of Cameroon's infrastructure. The objective of this article is to evaluate the impact of investing in fundamental public infrastructure on economic growth in Cameroon. The study compares the elasticities of various infrastructure types on growth and private investment. With data from WDI 2020, a generalized method of moments is utilised, revealing that the energy sector has the highest contribution. In the majority of studies relating to infrastructure; many are those who are limited to overall infrastructures without however specifying them. Furthermore, the particularity of our study is that we are not interested in the stock of infrastructure, but rather in the amount of investment actually allocated. We are therefore trying to jointly see their repercussions on economic growth and the behaviour of private investments, something which had not yet been done in Cameroon to our knowledge. Therefore we find that the impacts of investments actually allocated do not have the same effects on the growth and behaviour of private investments; for example, everything happens as if there is a crowding out effect between the telecommunications sector and the behaviour of private investments. Macroeconomic performance in Cameroon is positively influenced by investment in road and telecommunications infrastructure. A 1% increase in investment in this sector leads to a 0.0536% boost in economic growth and a 0.329% increase in the private sector. Compared to other forms of infrastructure investment, this sector has a strong impact on the country's economic development. A 1% increase in investment in this sector leads to a 0.0536% boost in economic growth and a 0.329% increase in the private sector. These results allow on the one hand to see the infrastructures which contribute the most to economic growth in a country like Cameroon which is still struggling to take off in its development process. But they will also further densify the public-private partnership which is very important for the quantity but also the quality of infrastructure.

* Corresponding author.
E-mail addresses: bmeka'a@yahoo.fr (C.B. Meka'a), srfotso74@gmail.com (S.R. Fotso), guemdjobabel@gmail.com (B.R. Guemdjo Kamdem).

https://doi.org/10.1016/j.heliyon.2024.e26504
Received 18 September 2023; Received in revised form 3 February 2024; Accepted 14 February 2024

Available online 21 February 2024

1. Introduction

The government of Cameroon has prioritized infrastructure development as part of its Growth and Employment Strategy Paper (DSCE). To this end, a comprehensive public investment programme has been launched, which includes several major infrastructure projects such as roads, a deep-water port, freeways, and thermal and hydroelectric power stations. A measurable and qualitative advancement in infrastructure is imperative for attaining sustainable development objectives (WB, 2020). In comparison to other nations in the sub-region, Cameroon's infrastructure measures fall behind (AICD, 2008).

Infrastructure enhancement sustained an incremental growth from 1972 until 1980, but plummeted significantly between 2007 and 2010, plausibly due to the global financial downturn that affected all activity sectors. Infrastructure development in Cameroon has been increasing since 2013. However, despite this progress, the country's infrastructure indicators are lower than many other sub-Saharan African countries, particularly in terms of the road network, air transport, and electricity.

According to the 2013-2014 Competitiveness Index by the World Economic Forum, Cameroon ranks 128th out of 151 countries for infrastructure quality. Closing Cameroon's infrastructure gap is crucial in achieving its development objective. From 2000 onwards, the average annual growth rate has remained at a mere 3.6% (AICD, 2008), which is significantly lower than the 5.5% target set by the DSCE between 2010 and 2020. In addition to the requirement of bridging this gap, there is a further need to address. Look at the evolution of infrastructure in Cameroon from 1970 to 2020, plotted in Fig. 1.

Dominguez-Torres and Foster [1] have estimated that Cameroon could gain 3.3 growth points if it improved the quality of its infrastructure to match that of neighbouring middle-income countries in the sub-region. The greatest part of this potential growth would be derived from rectifying infrastructure challenges in the energy sector via the reduction of production costs and improvement of national access rates. In transport, improved road conditions and a reduction of transport costs would be beneficial.

Major transit routes to neighbouring countries facilitate the inter-regional exchange of goods, which characterises economic integration [2]. Several theoretical and empirical studies confirm a positive correlation between public investment and growth [3,4]. Infrastructure, whether physical or social, pertains to intermediate goods that enhance trade.

Improving the productivity of other production inputs is often considered a crucial factor in economic growth, productivity and well-being. Improving the productivity of other production inputs is often considered a crucial factor in economic growth, productivity and well-being. Therefore, investment in public infrastructure can have a significant impact on economic growth and productivity. Theoretically, public investment in infrastructure is transformed into a stock of public capital, which is not only a direct input into the total production function but also stimulates the productivity of private capital through a complementarity effect as predicted in endogenous growth models [5]. Indeed, Barro's premise is that spending on infrastructure, such as motorways, railways and telecommunications networks, improves the productive activity of private companies. Public spending has two opposing effects, according to Barro. Effects of public capital on private capital productivity can lead to a reduction in its marginal productivity over time. Additionally, taxation can have a depressive effect on productivity by reducing private returns through income deprivation.

In the model developed by the latter, endogenous growth occurs, where public spending on infrastructure results in increased income. The growth in income contributes to an expansion of the tax base, which allows for an increase in public spending. This, in turn, facilitates the accumulation of capital. Starting in the 1980 there was a significant transformation in the theoretical aspects of growth with the success of endogenous growth theories. During steady-state growth, the ratio of public spending to income remains consistent at 45% and equals the tax rate. One notable feature of these models is their ability to anticipate the potential for a gap, or a widening of a pre-existing one, between regions or countries. Alongside the ongoing "exogenous versus endogenous" debate, the emergence of new growth theories in the 1990s resulted in a proliferation of empirical studies exploring the impact of public infrastructure on national growth. Adding to the pioneering work of Ratner [6] on the productive aspects of infrastructure, this interdisciplinary field of research has continued to make significant contributions. Aschauer's work [7] highlighted the positive impact of public capital on corporate output and productivity. Munnel [8] has since confirmed this proposition, but it still faces criticism, primarily of a methodological nature. Infrastructure. Given these critiques, it is necessary to analyse the connection between public infrastructure investment and economic growth further. Achieving balanced economic growth requires consideration of additional factors, including favourable conditions for private sector development. However, this cannot be attainable without the implementation of adequate public spending policies, which are necessary to stimulate private sector investment. Specifically, we aim to compare the actual and non-potential effects of public infrastructure capital on sector investment efficiency. We will focus on the empirical effects of public infrastructure capital on economic growth and private investment behaviour in Cameroon's investment sector.

Notice that, popularisation of Internet service. Modern infrastructure development contributes significantly to economic growth and tourism activities [9]. In their work [10], the authors show that information & communication technology plays a significant role in sustainability. This can be illustrated by the use of social media to overcome the COVID-19 pandemic that the globe has passed through and which is not yet totally jubilated.

This study aims to evaluate the impact of public investment in basic infrastructure on growth and private investment behaviour. The impact of government spending on road, energy, and telecommunications infrastructure on economic growth is analysed in this study. It further investigates the effects on the private sector. Technical abbreviations are explained upon their first use, and the style adheres to standard academic conventions. The article is structured into four sections: a literature review, a description of the methodology used, the data analysed, and the results and conclusions. The article is structured into four sections: a literature review, a description of the methodology used, the data analysed, and the results and conclusions.

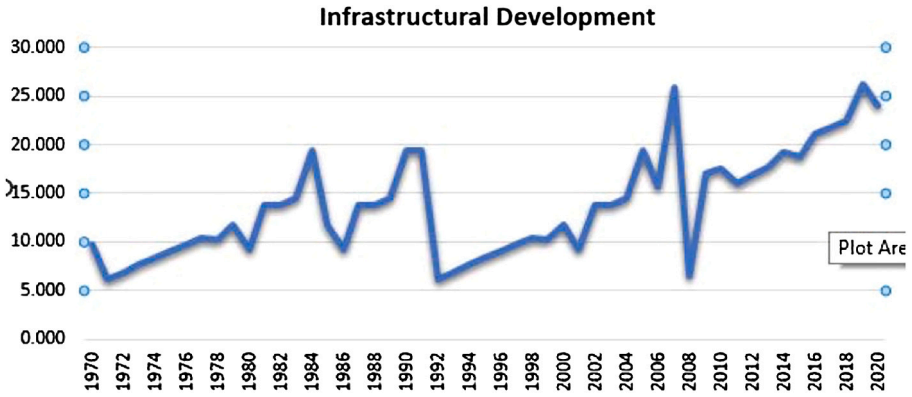

Fig. 1. Evolution of infrastructure in Cameroon development from 1970 to 2020.

2. Literature review

The correlation between infrastructure and economic growth has received significant attention [7], which displayed a favourable link between the two. Aschauer argues that the accumulation of public capital is a crucial determinant of growth and conversely, the reduction in public capital is the key reason for the deceleration in productivity witnessed in the United States. The 2009 OECD study, which evaluated how infrastructure investments in energy, water, transport, and telecommunications networks affect production, indicates a tangible impact. Likewise, [11] examined how infrastructure affects global competitiveness and economic growth. His research showed that national competitiveness is primarily determined by institutional development and seven additional factors, including infrastructure.

Infrastructure is mainly determined by the quality of roads, rail infrastructure, air transport and electricity supply. In their 2015 study [12], Normaz and Mahyideen assessed the impact of tangible and intangible infrastructure on export and import trade volume in the Asian region, alongside various economic growth indicators. The study reveals that enhanced transportation infrastructure, including road density network, air transport, railroads, ports and logistics, drives trade flows sharpeningly by 85%. Furthermore, Information and Communications Technology (ICT) infrastructure also positively impacts trade, as the number of telephone lines, cell phones, broadband access, internet users and secure internet servers influence both exporters and importers in Asia. Sherkulovich [13] investigated the correlation between infrastructure and economic growth and concluded that investing in public infrastructure has a significant positive effect on production and long-term growth. Similarly, [14] studied the relationship between public infrastructure and economic growth in Turkey from 1980 to 2013, by using the Cobb Douglas production function estimation approach. Public physical and social infrastructure. According to Kpemoua [15], who utilized annual data from 1980-2014 to evaluate the relationship between transport infrastructure and economic growth in Togo, there is a positive long-term correlation between transport infrastructure and economic growth, and a causal relationship from infrastructure to economic growth. Meanwhile, Yılmaz and Cetin [16] on the other hand studied the impact of infrastructure on growth in developing countries using a set of instrumental variables including 29 developing countries between 1990 and 2014 to estimate dynamic panel data. Their results affirm that infrastructure has a positive and significant impact on growth. Babatunde [17] examined the link between public expenditure on infrastructure and economic growth in Nigeria. His study reveals that spending on transport, education, and health infrastructure has a considerable effect on economic growth.

The work [18] investigated the relationship between transport infrastructure and economic growth in EU countries from 2000 to 2014 utilizing panel data methods. Their findings indicate that transport infrastructure components have noteworthy impacts even when institutional and other factors are taken into account. The results of the path analysis validate the alternative hypothesis.hypothesis, which highlights a long-term unidirectional causal relationship between economic growth, transport infrastructure, and public services. A recent study [19] investigated the joint impact of infrastructure capitale and institutional quality on economic growth, utilizing a large panel dataset covering countries between 1980 and 2015. The study shows that interaction terms between infrastructure capital and institutional quality have a significant impact on economic growth. A high level of institutional quality and capital has a noteworthy effect on economic growth according to recent research. Diandy and Seck [20] investigated the role of physical infrastructure in economic growth across 14 West African countries, finding that physical infrastructures have an overall positive but weak impact on economic growth. Meanwhile, El Khider et al. [35] examined the effect of transport infrastructure on economic growth in Morocco, discovering a positive impact from transport infrastructures. Infrastructure projects have positive impacts on economic growth, both in the short and long term. However, in contrast to the earlier cited studies that demonstrate beneficial outcomes of infrastructure on economic growth, additional research has revealed insignificant effects in their analyses. The works [21–23] were unable to detect any significant impact of infrastructure on growth while studying its effects. Additionally, [16] produced a dataset on the subject.

Between 1950 and 1995, physical infrastructure stocks including roads, paved roads, railway lines, electricity generating capacity, telephones, and telephone lines were examined across 152 economies. The analysis contained descriptions from an annual database

of built physical infrastructure. Results indicate that telephones and paved roads played a substantial role in economic growth, whereas other types of infrastructure had no significant impact.

Devarajan et al. [24] found a negative relationship between infrastructure spending and economic growth across 43 countries. They attribute this result to excessive infrastructure spending. Canning and Pedroni [25] and Barro [5] also argue that there is a point where infrastructure spending maximises growth, beyond which, the cost of diverting resources from other productive uses outweighs the gains from infrastructure investments. Sanchez-Robles [26] identifies a decrease in the occurrence of infrastructure when public capital is used as a proxy, but an increase is found when using physical indicators. The author employs the infrastructure index derived from three sectors: transport, telecommunications, and energy, and conducts a principal component analysis (PCA) for constructing an index. The literature review indicates that research on the correlation between infrastructure and economic growth is inconclusive. Various studies have produced divergent results. Certain studies utilize public capital and expenditure as indicators of infrastructure, while others utilize a physical infrastructure index. This study will assess the impact of investments in road, energy, and telecommunications infrastructure on economic growth. The impact of their externalities on private investment is an issue that has not been empirically and simultaneously addressed in the literature.

3. Methodology and data

3.1. Methodology

This study is inspired by the growth models of Mankiw, Romer & Weil [27]. The distinctive feature of these models is that they show the stock of public capital in the production process, and consequently highlight an explicit link between government policy and long-term economic growth within an endogenous growth framework. We adopt a similar approach to study the analysis of the impact of basic public infrastructure investment on economic growth and private investment behaviour The general empirical model is given by the following equation:

$$\ln gdp_t = \beta_0 + \beta_1 \ln invr_t + \beta_2 \ln invg_t + \beta_3 \ln n_t + \phi_t.$$

Note that the $invg_t$ variable is made up of investments in road, energy and telecommunications infrastructures. The model itself is therefore written as follows:

$$\ln gdp_t = \beta_0 + \beta_1 \ln invp_t + \beta_2 \ln invg_{1t} + \beta_3 \ln invg_{2t} + \beta_4 \ln invg_{3t} + \beta_5 \ln n_t + \phi_t, \tag{1a}$$

where $\ln gdp$ is the logarithm of gdp, $\ln invp$ is the logarithm of gross fixed capital formation in the private sector. $\ln invg_1$, $\ln invg_2$, $\ln invg_3$ represent respectively the logarithm of public investment in road, energy and telecommunications infrastructure. $\ln n$ represents the logarithm of the growth rate of the working population. ϕ_t is the error term.

Bearing in mind that private investment in Eq. (1a) is an endogenous variable, we can also define an investment equation. Kamgnia & Touna Mama [28] have defined an investment function for Cameroon, where the dependent variable (private investment) depends on real GDP, credit to the private sector, public investment, the exchange rate, the budget deficit and external debt. However, this analysis does not distinguish between sectors (transport, energy, telecommunications). Drawing on the work [28], we define an investment function as specified in the following equation:

$$invr = \delta_0 + \delta_1 \ln gdp(-1) + \delta_2 cred + \delta_3 invg + \delta_4 det + \delta_5 txch + \tau_t, \tag{1b}$$

where cred represents credit to the private sector as a percentage of GDP, $txch$ represents the real exchange rate quoted at the uncertain, det represents foreign debt as a percentage of national income.

3.2. The data

The data used in this study come from the National Institute of Statistics, the Ministries of Public Works and Water and Energy, and the Ministry of Posts and Telecommunications. For public spending on road, energy and telecom infrastructures, we have used the investments actually consumed by these ministries over the periods 1983-2020. Given that data for roads are not available, we have considered those of the Ministry of Public Works, since according to the National Road Fund, roads alone account for almost 80% of the budget allocated to this department. Data on GDP growth rates, gross fixed capital formation (GFCF) in the private sector, labour force growth rates, credit granted to the private sector, external debt and real exchange rates are taken from the world development indicator (2020).

Private capital: the decision to invest in private capital is a growth factor for both the neoclassical school and Keynesian theory. What's more, according to recent endogenous growth models [29], private capital investment is likely to generate externalities. Indeed, a company's investment enables it to increase not only its own production, but also that of other companies, thanks to the technological externalities it generates. Empirical studies of African economies [30,31] cited by Nubukpo, have shown a positive relationship between private capital investment and GDP growth.

Population: In a study based on a panel of American states, [32] recommend using the number of hours worked, in particular to control for effects linked to heterogeneity in legal working hours. Other authors, such as Everaert and Canning, use the total working-age population or the total workforce in the country's various sectors to define this variable. However, in the absence of

such data in Cameroon, we will use the labour force as a proxy for the level of employment. This is easy to understand, insofar as the labour force is made up of people who fall within the definition of the economically active population.

Infrastructure: This concerns public investment in infrastructure, including roads, electricity and telecommunications. Numerous studies have shown that they make a substantial and often greater contribution than investments in other forms of equipment, and for the purposes of this study they are considered to be public goods, whose main characteristics are non-excludability and non-rivalry.

External indebtedness: Faugere and Voisin [33] emphasize that external indebtedness can be encouraged if, and only if, it allows the inflow of foreign currency needed to service the debt, brings in foreign capital to compensate for insufficient domestic savings, helps maintain activity both in the borrowing country and in the countries supplying the goods and services, and provides an opportunity for banks to expand their business.

The real exchange rate: this is calculated by taking into account the purchasing power ratio of two currencies. It is a measure of a country's price competitiveness.

Credit to the private sector: this is an essential element in a country's development to lift it out of poverty. Although the problem of excess liquidity is a matter of debate in African countries, there has been an upward trend in credit granted to the private sector since the trough observed in 1990-1998.

4. Econometric estimation techniques

4.1. Problem and conditions for identifying variables in a simultaneous equation model

Let us consider a model with g structure equations linking g endogenous variables y_t and k exogenous variables x_t. We want to know under what conditions the parameters of an equation are identifiable, i.e. under what conditions the estimators of the parameters of this equation can be deduced from the estimators of the parameters of the reduced equations. Identification conditions are determined equation by equation. The model is under-identified if one equation of the model is under-identifiable, i.e. if there are fewer equations than parameters to be identified in the structural form, the system is impossible to solve.

- The model is correctly identified if all the equations are correctly identifiable.
- The model is over-identified if the model equations are over-identifiable.

If the model is sub-identical, it will be impossible to estimate its parameters and it will have to be re-specified. Let:

- g be the number of endogenous variables in the model, or the number of equations in the model. In our case, this is equal to 2 (gdp and $Invr$);
- k the number of exogenous variables in the model. In our model it is 11 ($(invg_{1t}, invg_{2t}, invg_{3t}) \times 2, n_t, gdp(-1), cred, det, txch$);
- g' the number of endogenous variables in an equation. In our model g' is 2 (gdp and $Invr$);
- k' is the number of exogenous variables in an equation;
- k' is 4 in our model ($invg_{1t}, invg_{2t}, invg_{3t}, n_t$).

To determine the nature of the model, simply perform the following calculation: $(g - g') + (k - k')$.

- If $(g - g') + (k - k') < g - 1$ then the model is under-identified;
- If $(g - g') + (k - k') = g - 1$ then the model is just identified;
- If $(g - g') + (k - k') > g - 1$ then the model is over-identified.

In the structure of our model, $(g - g') + (k - k') = (2 - 2) + (11 - 4) = 7$ and $7 > (2 - 1)$, which means that our model is over-identified. Our estimates will therefore focus on an over-identified simultaneous equation model.

5. Estimation method

Estimation of system (1) by ordinary least squares poses a problem of variable endogeneity. Indeed, one of the conditions for OLS estimation is that all explanatory variables are exogenous, i.e. uncorrelated with the error term. If this condition is violated, OLS estimators are biased and no longer convergent. To overcome this problem, it is advisable to use the instrumental variable method, which involves finding a variable that is highly correlated with the endogeneity source variable, but uncorrelated with the error term. Only the growth rate of the working population was considered as a purely exogenous variable. Foreign aid as a percentage of national income was used as an instrument of public investment, and for the other variables, lagged values were used as instruments. One of the conditions for using the instrumental variables method is that the number of instruments should be at least equal to the number of endogenous variables in each equation [34]. Strictly speaking, exogenous variables can be used as instruments in their own right. In the context of simultaneous equation models, there are three main methods for using instruments. The System Double Least Squares (STSLS) method is the system version of double least squares applied to a single equation. This method is appropriate when some of the explanatory variables are correlated with the error term, and there is no problem of heteroscedasticity or correlation between the residuals.

The triple least squares method is the double least squares version of SUR (Seemingly Unrelated Regression) models. SUR models are multivariate regressions that take into account heteroskedasticity and contemporaneous correlation of errors between equations. This technique is therefore appropriate when the explanatory variables are correlated with the error term and there is both heteroscedasticity and autocorrelation between the contemporaneous errors of the equations.

The generalized method of moments yields robust estimators, since it does not require information on the exact distribution of the errors. The method is therefore robust even when heteroscedasticity and autocorrelation are of unknown form. Most estimators are considered a special case of the generalized method of moments. This method therefore appears to be the most appropriate for the use of instrumental variables, and has been chosen for our estimations.

6. Results and discussion

To obtain results on the effect of various basic public infrastructure investments on growth and private investment in Cameroon, we carried out a one-step estimation with level and log variables, replacing the invg variable by $invg_1, invg_2, invg_3$ in each equation. These variables represent investment in road, energy and telecommunications infrastructure respectively. The results are detailed in Table 1. Remember that the coefficients associated with these variables are elasticities. Public investment in the road sector has a positive but insignificant impact on per capita GDP growth. The same result is obtained for investment in telecommunications infrastructure. The impact of investment in energy infrastructure on per capita GDP growth is positive and significant for a threshold of 5%.

As for the growth rate of the working population, its impact on per capita GDP growth is significant, but with a contrary relationship. There is a positive and highly significant effect of gross fixed capital formation on per capita GDP growth.

In the private investment equation, the impact of investment in basic public infrastructure proves to be more beneficial. Investment in road and energy infrastructure has a positive and significant effect on private sector development. In the telecommunications sector, there is no effect, and the sign of the coefficient is negative. The value of GDP delayed by one period has a positive and significant effect on private investment. There is a strong correlation between foreign aid and the development of the private sector, as well as that of the exchange rate. However, although credit granted to the sector is strongly correlated with private investment, the coefficient is in the opposite direction.

The results of the normality test are shown in Table 2. From this table, we can see that the errors do follow a normal distribution, as we find that in both models, for a threshold of 5%, the Jarque-Bera statistic is greater than 5% ($0.3939 > 0.05$ and $0.9863 > 0.05$). The estimates were therefore carried out without risk.

Analysis of these results shows that only the effects of investment in energy infrastructure are felt on per capita GDP growth. A 5% increase in the construction of new energy infrastructures leads to a 0.0536% increase in per capita GDP growth. As far as investment in road and telecommunications infrastructure is concerned, the fact that the impact is positive but not significant means that, despite major efforts on the part of the government, investment in these sectors is insufficient to achieve the expected results in terms of per capita GDP growth. In line with empirical studies of African economies [30,31], we also find a positive relationship between private capital investment and GDP growth. Indeed, a 5% increase in private capital investment leads to a 0.579% increase in per capita GDP growth in Cameroon.

The effects of investment in basic public infrastructure on per capita GDP growth are not identical for private investment in Cameroon. In fact, a 5% increase in public investment in roads and energy leads to an increase of 0.051% and 0.32% respectively in private investment. The impact of road and energy infrastructure on private investment behaviour is therefore positive and significant. There is a positive externalities and complementarity between infrastructure investment (roads, energy) and private investment. The sign of public investment in telecommunications, on the other hand, is negative and not even significant. This means that public investment in the Telecom sector is crowding out private investment. This result confirms Ongono's [36] analysis that public investment in this sector is not a public good. The R^2 in both models is close to 1 (between 0.840 and 0.869), demonstrating that the model is globally significant. The elasticity of growth for the different types of infrastructure is positive; investment in roads, energy and telecommunications therefore has a positive effect on growth in Cameroon. For example, when investment in roads increases by 1%, GDP grows by 0.0014%. This rate of increase is 0.0536% and 0.00608% respectively for investments in energy and telecommunications, which means that investments in roads, energy and telecommunications have a positive impact on the growth of the Cameroon economy. These growth rates are 0.051%, 0.329% and -0.036% respectively in the private investment equation. This shows that except for telecommunications, a 1% increase in public investment in road and energy infrastructure will be highly beneficial to the development of the private sector. There is therefore a greater advantage to be gained from investing in energy than in the other infrastructure categories, due to its higher rate of growth than the other two types of infrastructure. This result for the study period can be explained by the major projects undertaken in the energy sector in recent years, notably the construction of the Kribi gas-fired power station. The low elasticity of telecommunications is explained by the situation of CAMTEL and NTIC. CAMTEL remains the sole fixed-line operator in Cameroon. There is still a very high demand for telephone connections, especially in rural areas, and the cost of Internet access is very high, despite the liberalization of the mobile telephony sector. All in all, the growth of the NICT sector and its application still come up against obstacles such as inadequate telecommunications infrastructures, high service costs, insufficient qualified human resources, inadequate electricity coverage throughout the country, and insufficient computer equipment. All this justifies the low impact of telecommunications investment on growth and private investment behaviour in Cameroon over our study period.

Table 1
Estimation results.

Variables explicatives	Variables expliquées	
	Pibh	Invr
Invp	0 ,579** (13 ,143) [0 ,000]	
Invg1	0,0014 (0,039) [0,9690]	0,051** (2,0583) [0,0453]
Invg2	0,0536** (4,219) [0,0001]	0,32** (14,2306) [0,000]
Invg3	0,00608 (0,9863) [0,3291]	-0,036 (0,836) [0,4070]
N	-1,888** (19,815) [0,000]	
gdp(-1)		1,6579** (3,415) [0,0013]
CP		-0,346** (2,229) [0,0307]
Txch		0,5509* (1,8845) [0,0658]
Dext		0,199** (2,0464) [0,0464]
Constante	25,660** (39,066) [0 ,000]	-9,942* (1,181) [0,2434]
R-square	0,840	0,869
Adjusted R-quared	0,807	0,828

Table 2
Error normality test.

Component	Skewness	Kurtossis	Jarque-Bera
1	0,42586 (0,906) 0,3410	3,874 (0,9567) 0,3280	1,8633 2=df 0,3939
2	-0,070983 (0,025) 0,8739	2,9569 (0,0023) 0,9616	0,027 2=df 0,9863

7. Conclusion

Our main objective was to evaluate the impact of public investment in basic infrastructure on economic growth. Specifically, we aimed to determine the extent to which public spending on basic infrastructure affected both growth and private investment. We employed estimates derived from a simultaneous equation model, which comprised a growth equation and an investment equation with logarithmic and level variables. This model consisted of separate equations and was designed to identify causal connections between variables. To guide our investigation, we began with the hypothesis that public expenditure on fundamental infrastructure has a positive and significant impact on economic growth and influences private investment behaviour positively through externalities. Essentially, adequate investment in fundamental public infrastructure, combined with effective management practices, enhances the effectiveness of private investment, which in turn leads to the creation of national wealth. Using an endogenous growth model as specified by Romer and Mankiw and based on a Cobb-Douglass production function, we applied the generalized method of moments to examine this effect. Following a one-step estimation of our simultaneous equation model during the period of 1983-2020, we

determined that the elasticity rates of investing in fundamental public infrastructure are greater in the investment equation than in the growth equation, albeit all of the rates are Positive outcomes are evident in the growth equation, whereas the private investment equation highlights a negative impact of public investment on private investment behaviour in Cameroon. The characterisation of public goods assigned to telecommunications infrastructure in this category, as described by economists, remains a highly debatable issue. Indeed, a 5% increase in private capital investment leads to an increase of 0.579% in GDP per capita growth in Cameroon. The effects of investments in basic public infrastructure on GDP per capita growth are not identical to the behaviour of private investment. A 5% increase in the amount of public road and energy investments leads to an increase of 0.051% and 0.32% respectively in the amount of private investments. On the other hand, the sign of public investment in telecommunications is negative and is not even significant. This means that public investment in the telecommunications sector therefore crowds out private investment. However, a limitation of this work is that we would have liked the existing stock of infrastructure and see their effects on economic growth.

As a limitation of this work, we would have liked to work with the value of the infrastructure stock. However, it was difficult to access this data. Also, that we carried out the analyses jointly, perhaps by taking the infrastructures separately, the effects could be different.

Today, Cameroon wants to be more and more present in international trade and this could be achieved through the development of these infrastructures with border countries. It would therefore be important to question the impact of this economic policy on the well-being of households. To achieve its double-digit growth rate, the Cameroon government must prioritize the development of the private sector. This goal could be accomplished through maintaining various infrastructures post-depreciation, as high-quality infrastructure, particularly in quantity, has a substantial impact on growth through private sector development. However, the government could derive greater benefits from increasing public-private partnerships.

Funding

This article has no funding affiliation to declare.

CRediT authorship contribution statement

Cosmas Bernard Meka'a: Supervision, Methodology, Formal analysis, Data curation, Conceptualization. **Silvain Raoul Fotso:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Babel Raïssa Guemdjo Kamdem:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that support the findings of this study are publicly available from the World Bank World Development Indicators (WDI) 2020 https://databank.worldbank.org/source/world-development-indicators.

References

[1] Carolina Dominguez-Torres, Vivien Foster, Infrastructure du Cameroun: une perspective continentale, 2011.
[2] Flora Bellone, Marie-Antoinette Maupertuis, Nouvelle économie géographique et dynamique de l'innovation: une relecture des configurations centre-périphérie, Rég. Dév. 11 (2000) 1–29.
[3] Donald Djatcho Siefu, Infrastructures de transport routier: Facteur de croissance economique et des echanges en zone CEMAC-cas du Cameroun, du Congo et de la RCA, de 1995 a 2017, Rev. Fr. Econ. Gest. 3 (6) (2022).
[4] Traoré Souaïbou Samba Lamine, Traoré Modibo, Infrastructures et croissance économique: cas du Mali, Int. J. Account. Finance Audit. Manag. Econ. 3 (2–2) (2022) 118–138.
[5] Robert J. Barro, Government spending in a simple model of endogeneous growth, J. Polit. Econ. 98 (5, Part 2) (1990) S103–S125.
[6] Jonathan B. Ratner, Government capital and the production function for us private output, Econ. Lett. 13 (2–3) (1983) 213–217.
[7] David Alan Aschauer, Is public expenditure productive?, J. Monet. Econ. 23 (2) (1989) 177–200.
[8] Alicia H. Munnell, et al., Why has productivity growth declined? Productivity and public investment, N. Engl. Econ. Rev. (Jan 1990) 3–22.
[9] Shiying Wang, Jaffar Abbas, Khalid Ibrahim Al-Sulati, Syed Ale Raza Shah, The impact of economic corridor and tourism on local community's quality of life under one belt one road context, Eval. Rev. 48 (2) (2023) 312–345.
[10] Daniel Balsalobre-Lorente, Jaffar Abbas, Chang He, Ladislav Pilař, Syed Ale Raza Shah, Tourism, urbanization and natural resources rents matter for environmental sustainability: the leading role of AI and ICT on sustainable development goals in the digital era, Resour. Policy 82 (2023) 103445.
[11] Tatyana Palei, Assessing the impact of infrastructure on economic growth and global competitiveness, Proc. Econ. Finance 23 (2015) 168–175.
[12] I. Normaz Wana, M. Jamilah Mohd, N.W. Ismail, J.M. Mahyideen, The impact of infrastructure on trade and economic growth in selected economies in Asia, Asian Development Bank Institute Working Paper (553), 2015.
[13] S.S. Sherkulovich, Infrastructure and economic growth, Int. J. Econ. Commer. Res. 5 (1) (2015).
[14] Tuncay Serdaroğlu, The Relationship Between Public Infrastructure and Economic Growth in Turkey, Kalkınma Bakanlığı Ekonomi Çalışma Tebliğleri Serisi, vol. 2016/02, 2016, pp. 1–20.

[15] Palakiyèm Kpemoua, Analysis of the link between economic growth and energy consumption in Togo [Analyse du lien entre croissance economique et consommation d'energie au Togo], Technical report, 2016.
[16] Funda Nalbantoglu Yilmaz, Hicran Cetin Gunduz, Career indecision and career anxiety in high school students: an investigation through structural equation modelling, Eurasian J. Educ. Res. 18 (78) (2018) 23–42.
[17] Shakirat Adepeju Babatunde, Government spending on infrastructure and economic growth in Nigeria, Econ. Res. - Ekon. Istraž. 31 (1) (2018) 997–1014.
[18] E. Cigu, D.T. Agheorghiesei, V. Gavriluta, F. Anca, E. Toader, Transport infrastructure development, public performance and long-run economic growth: a case study for the EU-28 countries, Sustainability 11 (1) (2019).
[19] Yitagesu Zewdu Zergawu, Yabibal M. Walle, José-Manuel Giménez-Gómez, The joint impact of infrastructure and institutions on economic growth, J. Inst. Econ. 16 (4) (2020) 481–502.
[20] Idrissa Yaya Diandy, Alioune Badara Seck, Infrastructures physiques et croissance économique en Afrique de l'ouest: le rôle des institutions, Afr. Dev. Rev. 33 (1) (2021) 154–165.
[21] Robert Ford, Pierre Poret, Infrastructure and private-sector productivity, 1991.
[22] Douglas Holtz-Eakin, David Joulfaian, Harvey S. Rosen, Sticking it out: entrepreneurial survival and liquidity constraints, J. Polit. Econ. 102 (1) (1994) 53–75.
[23] Teresa Garcia-Mila, Therese J. McGuire, Robert H. Porter, The effect of public capital in state-level production functions reconsidered, Rev. Econ. Stat. (1996) 177–180.
[24] Shantayanan Devarajan, Vinaya Swaroop, Heng-fu Zou, The composition of public expenditure and economic growth, J. Monet. Econ. 37 (2) (1996) 313–344.
[25] David Canning, Peter Pedroni, Infrastructure, long-run economic growth and causality tests for cointegrated panels, Manch. Sch. 76 (5) (2008) 504–527.
[26] Blanca Sanchez-Robles, Infrastructure investment and growth: some empirical evidence, Contemp. Econ. Policy 16 (1) (1998) 98–108.
[27] N. Gregory Mankiw, David Romer, David N. Weil, A contribution to the empirics of economic growth, Q. J. Econ. 107 (2) (1992) 407–437.
[28] B.D. Kamgnia, Touna Mama, et al., Comportement d'investissement privé au Cameroun: un resserrement de la contrainte financière?, in: Cahiers du SISERA/Secrétariat d'appui institutionnel pour la recherche économique en Afrique; 2002/1, 2001.
[29] Dominique Guellec, Pierre Ralle, Les nouvelles théories de la croissance, Collection Repères, La Découverte, 2003.
[30] Oladeji Ojo, Temitope Oshikoya, Determinants of long-term growth: some African results, J. Afr. Econ. 4 (2) (1995) 163–191.
[31] Dhaneshwar Ghura, Michael T. Hadjimichael, Growth in Sub-Saharan Africa, Staff Pap. 43 (3) (1996) 605–634.
[32] Paul Evans, Georgios Karras, Is government capital productive? Evidence from a panel of seven countries, J. Macroecon. 16 (2) (1994) 271–279.
[33] Jean-Pierre Faugère, Colette Voisin, Le système financier français: crises et mutations, 1994.
[34] John Johnston, John DiNardo, Econometric Methods, 1963.
[35] Abdelkader El Khider, Brahim Elmorchid, Mohammed Amine Margoum, Rajaa Nacaf, Infrastructures de transport et croissance économique: Une analyse économétrique à travers le modèle autorégressif à retards échelonnés ARDL, Int. J. Account. Finance Audit. Manag. Econ. 2 (2) (2021) 57–75.
[36] Ongono Patrice, Investissement en Infrastructures Publiques et Performances Economiques au Cameroun, IDRC, 2012.