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Public investment in local road infrastructure and economic growth in Benin: A dynamic analysis

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Abstract

This study examines the effect of local public investment on economic growth in Benin, with particular emphasis on the role of local road transport infrastructure. From a theoretical perspective, the analysis is grounded in Barro's (1990) endogenous growth model, which incorporates the externalities of public infrastructure spending through a production function combining private and public capital. Empirically, vector autoregressive (VAR) models are employed to assess the impact of public investment in local road infrastructure on economic growth using data covering the period 1993–2023. The results indicate that the contribution of public expenditure excluding local road infrastructure investment to economic growth is greater than that of public investment in local road infrastructure. Nevertheless, local road infrastructure investment has a positive and significant effect on economic growth in the long run. In turn, higher economic growth increases government tax revenues, thereby enhancing the government's capacity to invest in local road infrastructure. Consequently, improving the business climate through the development of local infrastructure appears to be a key driver of economic growth.

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1.Introduction

Benin is experiencing an average annual growth rate of 6.30% over the period 2022-2023 (World Bank, 2024). To accelerate growth with a view to significantly improving the population's standard of living, the Government of Benin has initiated several reforms, including a major increase in investment, which would rise from 26.4% of GDP in 2018 to 33.2% of GDP for the period 2022-2025 (MEF, 2024). These investment levels will make it possible to achieve at least an average growth rate of 7.1% over the period 2025-2027. Investments benefiting grassroots communities are primarily focused on the construction and maintenance of existing basic infrastructure, particularly inter-municipal transport infrastructure and to serve local markets and the transport of tropical products, particularly cotton. The objective is to improve the business climate at the grassroots level and to instill another local dynamic.

Infrastructure can then be defined as collective goods that are the basis of productive activity. This definition refers to two notions: collective good and production factor. This notion, developed by Samuelson (1954) and Musgrave (1959), is based on the criteria of "non-rivalry" and "non-exclusion" of public goods in the sense that their use by one agent does not reduce the quantity available to other agents. The non-exclusion characterizing public goods means that all agents can benefit from them given their intrinsic nature, escaping market mechanisms, which justifies, to some extent, state intervention in both the supply process and in regulation.

Investment in infrastructure is an economic policy that resurfaces in times of economic crisis and/or low growth (Mohamed Bayoudh , 2012). In accordance with Keynesian logic, on the one hand, it is expected that this type of investment must have an expansionary effect on aggregate demand; public spending for the benefit of grassroots communities can exert a significant influence on the fundamental variables of economies, particularly on consumption and investment. On the other hand, investment in road transport infrastructure can, in the long term, improve the structures of the economy and stimulate foreign investment.

To provide explanations for the problem of economic growth, several authors have sought to highlight the role of the accumulation of production factors, in particular the labor factor and the capital factor (Harrod 1939, Domar 1949 [1], Solow 1956 [2]). Their contribution to economic theory is certainly fundamental, but remains insufficient to explain certain characteristics linked to the functioning of the economic sphere. Solow (1956) attributes the origin of economic growth to invested technical capital (machines, equipment). He notes that when capital per capita increases, production increases but not proportionally. A time will come when production per capita will increase less quickly, growth per capita will cease. He thus evokes the principle of diminishing returns which he describes as a regular state. The Solow model with technical progress (exogenous factor) announces the convergence of economies. This is one of the limitations that encourages further research into economic growth and its explanation, to the extent that divergence or at least non-convergence seems to be validated by the observation of the non-development of certain countries.

From the mid-1980s, theoretical approaches to economic growth underwent a profound renewal. This is the success of endogenous growth theories, whose strength is that they predict the possibility of maintaining or worsening gaps between regions (Willian Roy, 2024). Undoubtedly, the founding model of endogenous growth theories is that proposed by Romer

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[1] Harrod (1939), Domar (1949) is the first formalized model of economic growth. It aims to extend Keynes's general theory over the long term, respectively in their article "An Essay in Dynamics Theory" published in the Economic Journal and "Expansion and Employment " published in the American Economic Review

[2] Solow (1956), his theory of exogenous economic growth, known as the "Solow paradox". His work focuses on the long-term growth process and the hypothesis of convergence of economies.

(1986). The latter makes the link between growth and the accumulation of knowledge and technical skills. Investment is placed at the heart of the growth dynamic, because it allows the acquisition of new production techniques, increases productivity and emits positive externalities that benefit other firms. The second model, developed by Lucas (1988) is based on the notion of human capital, which in turn generates positive externalities that prevent the decline of production factors, thus leading the economy towards self-sustained growth. Romer's model (1990) developed following this work considers that technical progress comes from research and development activity supported by economic actors.

Finally, Barro (1990) and Barro and Sala-I-Martin (1992, 2020) give a central place to public infrastructure in their endogenous model, the latter being considered as the engine of long-term growth. These new theories, which mark a break with the neoclassical vision, equate economic growth with a self-sustaining process through the accumulation of four main factors: physical capital, technology, human capital and public infrastructure capital. This last factor includes all investments made by the State /community in the field of networks for the benefit of grassroots communities. In our study, we were interested in public infrastructure capital, particularly road transport at the local level.

Recent empirical studies largely confirm that public investment in infrastructure supports economic growth, although the observed effects vary according to the type of infrastructure, institutional quality, and national context. For example, Barro and Sala-i-Martin (1992;2020), using data from several African countries, find an overall positive effect of public investment on growth, while highlighting variations linked to institutional quality. Calderón and Servén (2014:2020) emphasize the importance of road, energy, and digital infrastructure for productivity, but their analyses remain primarily macroeconomic, with limited focus on local and rural infrastructure. Fosu (2021) confirms that public capital has a significant impact on growth in Sub-Saharan Africa, while noting strong heterogeneity across countries and sectors. At the national level, studies specific to Benin, such as those by TBS/INSTaD (2023), indicate that local and intercommunal roads positively contribute to growth, particularly in rural areas, although the methodologies used are limited for analyzing dynamic effects. Finally, recent reports by the OECD and the African Union (2025) highlight the crucial role of rural roads for economic inclusion and agricultural development, while emphasizing the scarcity of detailed empirical studies at the local level.

Indeed, the local road network has undergone profound changes for more than two decades with the advent of the Communes and is undergoing a transformation thanks to massive investments in the rehabilitation and construction of new roads, improving the rate of paved roads from 39% to 55% over the period 2000 to 2024 (TBS/ INSTaD 2024). However, many dirt roads, particularly in rural areas, are in poor condition and impassable during the rainy season, requiring maintenance work. According to data collected from the Social Dashboard of the National Institute of Statistics and Demography (TBS/ INSTaD), efforts are regularly made to rehabilitate strategic axes and rural roads in order to open up agricultural areas and facilitate transport.

These observations highlight an empirical gap: very few studies focus on local and rural infrastructure, even though it plays a crucial role in economic development and social inclusion. Our study aims to fill this gap by specifically analyzing the impact of public investment in local road transport infrastructure on economic growth in Benin over a long period (1993–2023). It employs a five-variable VAR model, which allows capturing dynamic interactions and the bidirectional causality between public investment, GDP, total public expenditure, private investment, and the active population.

Thus, this study contributes to the literature by providing novel empirical insights on local infrastructure and offering lessons that may be generalizable to other developing countries facing similar challenges.

For these reasons and many others, the implementation of infrastructure at the local level for the benefit of grassroots communities attracts our attention. The concern of this study is to verify whether public investment programs in infrastructure, more precisely those in road transport for the benefit of grassroots communities, have an effect on economic growth in Benin? More specifically, what is the share of public spending allocated to road transport infrastructure at the local level to boost economic growth in Benin; is there an impact of public investment in local road infrastructure on economic growth during the period 1993 and 2023 in Benin.

Addressing this concern leads us to formulate the hypotheses that: public spending allocated to road transport infrastructure for growth at the local level is greater than other spending; public investment in road infrastructure at the local level for the benefit of grassroots communities contributes to improving Benin's economic growth.

On the theoretical level, the interest of this subject lies in the role of production factors, particularly infrastructure, in economic growth (Solow Model), but theoretical foundations studied within the framework of endogenous growth models have given rise to numerous empirical evaluations whose results are not unanimous, given the diversity of econometric methods used, the indicators retained and the geographical areas studied. It is therefore important to position Benin in this literature where very few developments have been carried out, particularly through this modeling.

The purpose of this article is to analyze the effect of public investment in local infrastructure, more specifically road transport, on economic growth in Benin, using more sophisticated econometric techniques.

The remainder of the paper is structured as follows. In the first section, we review the methodological approach and data presentation. The results and their interpretations are presented in the second section. Finally, the last section concludes and offers some policy recommendations.

2. Research methodology

To analyze the causality between public capital and economic growth, economists often use autoregressive models. Sims (1980) is arguably the first user of these models. He used vector autoregressive (VAR) models to model the joint behavior of a group of variables for forecasting purposes.

The approach adopted in this study falls within the framework of endogenous growth models and is based on a Cobb–Douglas production function, as presented in the literature review, defined by:

$$y(t) = A\,k(t)^{1-\alpha}\,g(t)^{\alpha} \quad (1)$$

where $y(t)$is per capita income at time t; $k(t)$is the per capita private capital stock at time t; $g(t)$represents total government expenditure at time t; $A$is the marginal productivity of capital, capturing technological progress; and $\alpha$and $1-\alpha$are the output elasticities with respect to public investment and private capital stock, respectively.

The empirical analysis relies on a Vector Autoregressive (VAR) model, which allows examining the dynamic interactions among economic variables and conducting shock simulations. The methodological approach follows several steps.

First, Principal Component Analysis (PCA) is employed for exploratory purposes to identify the most relevant variables that are strongly correlated with Gross Domestic Product (GDP). This method reduces the dimensionality of the dataset, limits redundancy among variables, and better captures existing relationships, while being appropriate for continuous data.

Second, stationarity tests are applied to determine the integration order of the time series and assess potential cointegration. For this purpose, the Augmented Dickey-Fuller (ADF) test is implemented through a sequential procedure that accounts for the possible presence of a constant and/or trend. This step distinguishes stationary series from those requiring differencing. When the variables are integrated of the same order, the Johansen cointegration test is performed. The optimal lag length is first determined using the Akaike and Schwarz information criteria to identify the number of long-term relationships among the variables.

The VAR model is estimated using Ordinary Least Squares (OLS). The analysis of results is based on impulse response functions and forecast error variance decomposition, which allow evaluating the effects of economic shocks. Model validity is assessed through diagnostic tests for autocorrelation, heteroskedasticity, and residual distribution.

In order to analyze shocks between variables, several economists have used a VAR to carry out their economic identifications and interpretations (Shapiro and Watson 1988; Blanchard and Quah 1989). VARs allow time series to be modeled in a multivariate approach by taking into account the existing interactions between macroeconomic variables and by carrying out an analysis of shocks on the variables using the impulse response function [3]. In other words, VAR models offer the possibility of making simulations, and therefore of anticipating the effects of an economic policy.

A VAR model is defined as the autoregressive vector representation of a random variable Yt of dimension (K,1):

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + E_t (2)$$

$$Y_t = \begin{bmatrix} y_{1,t} \\ y_{2,t} \\ \ldots \\ y_{k,t} \end{bmatrix} ; A_p = \begin{bmatrix} a_{11,p} & a_{2,p} & \cdots & a_{1k,p} \\ a_{21,p} & a_{22,p} & \cdots & a_{2k,p} \\ \ldots & \ldots & \ldots & \ldots \\ a_{k1,p} & a_{k2,p} & \cdots & a_{kk,p} \end{bmatrix} ; \; A_0 = \begin{bmatrix} a_1 \\ a_2 \\ \ldots \\ a_k \end{bmatrix} ; \; E_t = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \ldots \\ \varepsilon_k \end{bmatrix}$$

The vector Yt includes k stationary variables [4], the vector A $_0$ and the matrix Ap group the parameters to be estimated from the model. Indeed, on the right side of the equation we only have lagged variables. The ordinary least squares estimation method gives satisfactory results as long as we pay attention to the problem of autocorrelation between the explanatory variables. Each of the equations can be estimated independently of the others in the VAR model.

Let two series $X_t$and Y_t. If they are stationary, we then estimate the VAR model in level which can be written:

$$y_t = a x_t + b + \varepsilon_t (3)$$

[3] This function allows you to simulate shocks on the model variables in order to study the behavior of each of them.

4One of the major questions in the study of time series is whether they follow a stationary process . This refers to whether the structure of the assumed underlying process changes over time. If the structure remains the same, the process is said to be stationary.

In the case where the two series are not stationary in level, but after first differentiation, the estimate of the VAR model is written:

$$\Delta y_t = \Delta x_t a + b + \vartheta_t (4)$$

Furthermore, the use of time series in this type of model requires a certain number of precautions regarding their stationarity and possible cointegration. The Dickey-Fuller (1979) and Augmented Dickey-Fuller (1981) unit root tests allow us to address the problem of stationarity and to define the order of integration of the variables. The Augmented Dickey-Fuller test takes into account the fact that the errors may be correlated. To test for the existence of cointegration, the Engel and Granger (1987) tests are generally used in the case of two variables, or the Johansen (1988) test in the case of several variables to determine the number of cointegrating relationships.

One of the first steps in implementing an autoregressive model is choosing the number of lags using information criteria. The three criteria traditionally used are the Akaike , Hannan -Quinn, and Schwarz criteria. The optimal lag is the one that minimizes one of these information criteria. Generally speaking, a VAR model provides information on how the past of a group of variables influences their present, and to what extent shocks on one variable propagate to the rest of the system, which allows us to characterize a particular economic phenomenon. From a mathematical point of view, a vector autoregressive model with k variables has k equations, in other words, one for each variable. The regressors are the lagged values of the kth-order equation system, i.e., the k series studied. The estimation technique for each equation is generally ordinary least squares (OLS).

From an econometric point of view, a VAR model is an extension of the univariate autoregressive model to a vector of time series variables (Stock and Watson 2012). In the case where the number of lags p is identical for each equation, the system of equations formed by the variables studied is called a vector autoregression model of order p in which it is possible to test hypotheses imposing constraints on several equations. The equations of the VAR model are naturally characterized by a number of parameters proportional to the size of the autoregressive vector, which can in certain cases give a high number of parameters to estimate and therefore alter the quality of the estimation. To avoid this problem, we generally try to analyze the economic problem we wish to model before any econometric approach from the point of view of economic theory and empirical studies dealing with similar issues. This intuitive approach makes it possible to retain a small number of variables, and to ensure that they are potentially linked to justify their joint modeling. Otherwise, introducing one or more unrelated variables into a VAR model introduces estimation bias into the model.

In short, VAR modeling offers the possibility of analyzing the dynamics of evolution and adjustment between the variables of a model. In our research, the interest of these models is to be able to measure the effectiveness of public policies in terms of local road transport infrastructure and their impact on economic growth in Benin. The empirical analysis is carried out using Eviews and SPAD. The data cover the period 1993-2023.

This work was done by disaggregating public capital into two categories: public expenditure on local road infrastructure (DPIRL) and other public expenditure (DPN). The DPN variable was used to isolate the specific effect of local road investments on economic growth, while controlling for the impact of other types of public spending (such as current expenditures, health, education, or social transfers) on GDP. By explicitly separating local road investment from other public expenditures, the model allows for a more precise estimation of the dynamic relationship between local road infrastructure and economic growth, thereby strengthening the methodological robustness of the study.The PCA allowed us to select the variables that could explain economic growth. Thus, we retained for the analysis of this study the following variables: Public expenditure allocated to local road infrastructure (DPIRL); other public expenditure (DPN); Private capital stock (Kpriv); and Total active employed population (Ppactiv). As for the stationarity test, we were able to eliminate the components (trends) likely to influence the results of the modeling. Furthermore, the definition, measurement, unit, and source of the variables are as follows:

Table 1 : Definition, Measurement, and Data Sources

Variable	Definition	Unit of Measurement	Source
DPIRL	Public expenditure on local road infrastructure	Billion FCFA	Ministry of Economy and Finance (MEF, 2024), Social Dashboard (TBS-INStaD)
DPN	Other public expenditure	Billion FCFA	MEF (2024), TBS-INStaD
Kpriv	Private investment	Billion FCFA	MEF
Ppactiv	Active population	Number of persons	TBS-INStaD
GDP	Real gross domestic product	Billion constant FCFA	TBS-INStaD

Source: Author, 2025

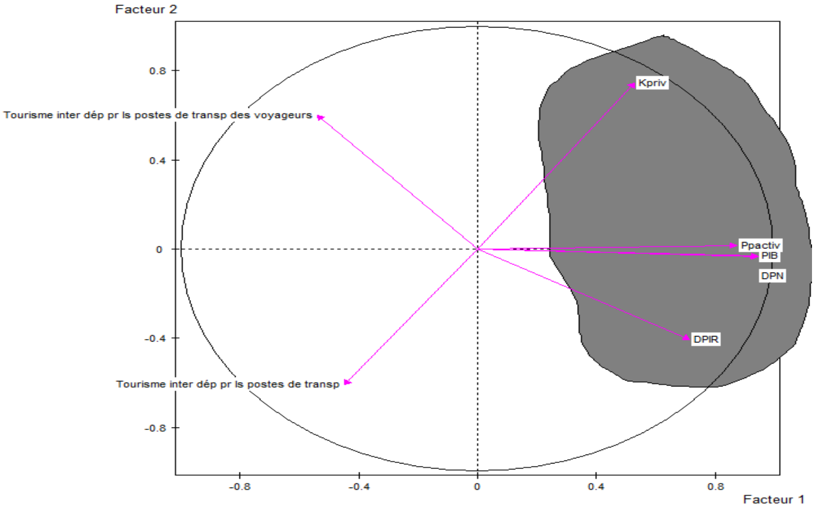
3- Results of the estimates

3.1 Estimation of the VAR model

3.1.1. Principal component analysis (PCA)

The representation of the cloud of variables under SPAD shows that the Public expenditure allocated to road infrastructure at the local level (DPIRL) ; the Private capital stock (Kpriv); and the Total active employed population (Ppactiv) other public expenditure (DPN) are those which are closest to the GDP.

Figure 1: Principal component analysis under SPAD (representation of the cloud of variables)



Source: Author, 2025

Furthermore, the same analysis shows that axis 1 (component 1) holds 57.72% of the information on the variables. We can therefore decide on axis 1, by using the representation of each variable on said axis. Unlike the other variables, the variables International Tourism Expenditure for transport items (TIT) (-01967) and International Tourism Expenditure for Passenger Transport Positions (TITV) (-0.2279) are further from the variable of interest. We can therefore remove them from our discriminant function. The objective of this step is to determine the best correlations with GDP (variable of interest). We will therefore essentially retain in the framework of the econometric study the following five (05) variables: Real GDP (GDP), Public Expenditure Allocated to Local Road Infrastructure (DPIRL); Other Public Expenditure (DPN); Private Capital Stock (Kpriv); and Total Active Employed Population (Ppactiv).

3.1.2. Study of stationarity of variables

We therefore carried out the Augmented Dickey-Fuller (ADF) test on the five (05) series corresponding to the selected variables. The Dickey-Fuller test reveals that all the variables are stationary in First Difference (Table 2). Being integrated of the same order, there is therefore a risk of cointegration. To avoid biased regressions, it is necessary to carry out the Johansen cointegration test.

Table 2: The Augmented Dickey-Fuller Test

Variables	Statistics (ADF Tests)	T-statistics	Probability	Model	Order of integration
GDP	-5.0855	-2.9719	0.0003	2	1st difference
DPIRL	-6.2684	-1.9529	0.0000	1	1st Difference
DPN	-5.1457	-2.9715	0.0003	2	1st Difference
Ppactiv	-5.1575	-1.9529	0.0000	1	1st difference
Kpriv	-4.2344	-1.9529	0.0001	1	1st difference

Source: Author, 2025

3.1.3. Johansen cointegration test

The cointegration test shows on the one hand that with the Scharwz criterion there is 0 cointegration relationship following the Trace test and 0 relationship following the Maximum Likelihood test (Max- Eig), which allows us to retain a VAR model; On the other hand that with the Akaïke criterion there is a cointegration relationship following the Trace test (and 0 relationship following the Maximum Likelihood test). In the case of a cointegration relationship according to the Trace test, the model to retain is an ECM (Error Correction Model), but the estimation of the ECM shows that there is no restoring force to equilibrium (the coefficient of the delayed residual of order [1] should be negative and significantly different from zero, which is not the case), which allowed us to eliminate the ECM, to retain the VAR.

3.1.4. Estimation of the VAR model by the OLS method

The restricted model 1 is specified as follows:

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + E_t (4)$$

With : $Y_t = \begin{bmatrix} \textbf{PIB} \\ \textbf{DPIR} \\ \textbf{DPN} \\ \textbf{Ppactiv} \\ \textbf{Kpriv} \end{bmatrix}_t$; $A_p = \begin{bmatrix} a_{11,p} & a_{12,p} & a_{13,p} & a_{14,p} & a_{15,p} \\ a_{21,p} & a_{22,p} & a_{23,p} & a_{24,p} & a_{25,p} \\ a_{31,p} & a_{32,p} & a_{33,p} & a_{34,p} & a_{35,p} \\ a_{41,p} & a_{42,p} & a_{43,p} & a_{44,p} & a_{45,p} \\ a_{51,p} & a_{52,p} & a_{53,p} & a_{54,p} & a_{55,p} \end{bmatrix}$; $A_0 = \begin{bmatrix} a_1^0 \\ a_2^0 \\ a_3^0 \\ a_4^0 \\ a_5^0 \end{bmatrix}$; $E_t = \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix}$

3.1.4.1. Optimal order and estimation

Here we will essentially use three (03) criteria to determine the optimal number of delays, namely the Akaïke , Schwarz and Log-likelihood criteria. The order of our model will be the one that minimizes the information criterion. The choice of the optimal order here is easy in the sense that the three criteria follow the same chronology (table 3). The smallest value associated with each criterion is obtained at order 1. Thus the optimal number of delays is 1.

Table 3: Calculation of information criteria

INFORMATION CRITERIA	VAR(1)	VAR(2)	VAR(3)
Log likelihood	264,8206*	274,1213	293,1546
Akaike information criterion	-16.19452*	-15.65152	-15.78923
Schwarz criterion	-14.78008*	-13.03469	-11.94971

Source: Author, 2025

Note: * (smallest value) Indicates the optimal delay order according to the criterion

We can therefore estimate the VAR model (1) on the five (05) variables. The results of this estimation are summarized in the following table 4.

3.1.4.2. Choice of the VAR and Variable Ordering

The VAR model includes five variables, a choice that balances informational richness with model parsimony, given the length of the time series (1993–2023). The ordering of the variables in the VAR follows an economic and temporal logic: DPIRL (local public investment); DPN (total public expenditure); real GDP; Ppactiv (active population); and Kpriv (private investment). This ordering is crucial for interpreting the impulse response functions (IRFs), which allow analyzing the dynamic propagation of shocks—how a shock to local public investment affects growth and the other variables, and vice versa.

3.1.4.3. Estimation of VAR

The results of the estimation of the first-order autoregressive vector in Table 3 show that the sign of the coefficients is significant (the absolute value of the T-statistic is greater than 1.96) and positive (+0.1093) between the public expenditure allocated to local road infrastructure and the active population. In other words, there is a positive relationship between the current employed active population and the public expenditure allocated to local road infrastructure in the past year. This result is consistent with the findings of Aschauer (1989) and Barro (1990), who emphasize the role of productive public investments particularly in transport infrastructure in stimulating economic activity and employment, as well as with the conclusions of Calderón and Servén (2010) regarding the positive impact of infrastructure on the labor market in developing economies.

Table 4: Estimation of VAR (1)

VAR Estimate		DPIRL	DPN	GDP	Ppactiv	Kpriv
DPIRL(1)	Coefficient	-0.130	-0.043	-0.042	0.109***	-0.024
	Standard deviation	-0.220	-0.051	-0.050	-0.027	-0.027
	T-statistics	[-0.591]	[-0.847]	[-0.848]	[3,997]	[-0.908]
DNB(1)	Coefficient	-3,403	-0.396	-0.330	1,044	0.162
	Standard deviation	-5,194	-1,209	-1,172	-0.645	-0.632
	T-statistics	[-0.655]	[-0.327]	[-0.282]	[1,620]	[0.256]
GDP(1)	Coefficient	3,896	-0.082	-0.114	-0.894	-0.064
	Standard deviation	-5,466	-1,272	-1,234	-0.678	-0.665
	T-statistics	[0.713]	[-0.065]	[-0.092]	[-1,317]	[-0.096]
Ppactiv (1)	Coefficient	0.976	-0.126	-0.083	0.016	0.019
	Standard deviation	-1,268	-0.295	-0.286	-0.157	-0.154
	T-statistics	[0.769]	[-0.427]	[-0.290]	[0.103]	[0.126]
Kpriv (1)	Coefficient	-2,737	0.361	0.279	0.468	0.021
	Standard deviation	-2,892	-0.673	-0.653	-0.359	-0.352
	T-statistics	[-0.947]	[0.536]	[0.427]	[1,305]	[0.061]
Constant	Coefficient	-0.002	0.037***	0.037***	-0.002	-0.002
	Standard deviation	-0.055	-0.013	-0.012	-0.007	-0.007
	T-statistics	[-0.034]	[2,916]	[3,014]	[-0.354]	[-0.353]
R -squared		0.086	0.267	0.246	0.555	0.084
Adj, R- squared		-0.112	0.108	0.082	0.458	-0.115
Sum sq , resids		1,548	0.084	0.079	0.024	0.023
S,E , equation		0.259	0.060	0.059	0.032	0.032
F- statistic		0.436	1,679	1,498	5,740	0.424
Log likelihood		1,345	43,623	44,514	61,860	62,447
Akaike AIC		0.321	-2,595	-2,656	-3,852	-3,893
Schwarz SC		0.604	-2,312	-2,373	-3,570	-3,610
Mean dependent		0.006	0.025	0.026	0.004	0.000
S,D , dependent		0.246	0.064	0.061	0.044	0.030
Determinant resid covariance (dof adj,)		0.000				
Determinant resid covariance		0.000				
Log likelihood		264,821				
Akaike information criterion		-16,195				
Schwarz criterion		-14,780				

Source: Author, 2025

Note: in brackets are the Student statistics associated with the coefficients

*** statistically significant at 1%

3.1.4.4. Model validity test

Table 5 below summarizes the results of these tests on the five equations of the model. Indeed, as regards the normality test of the residuals, the Jarques statistics Bera relating to the errors of the VAR model are respectively equal to 14.63; 2.74; 2.22, 16.06; 129.40 for the variables DPIRL, DPN, GDP, Ppactiv, Kpriv. The values associated with GDP and DPN are less than

5.99 5and the associated probabilities are also greater than 5%. The errors are therefore normally distributed for these two variables; The White heteroscedasticity test reveals that the errors are homoscedastic since the associated probability (0.1797) is greater than the threshold of 5%. Finally, regarding the autocorrelation between the errors, the LM-test reveals that all the residuals are non-autocorrelated. The associated probabilities are all greater than 5%; The representation of the circle of inverses of the roots of the polynomial reveals that they are inside the unit circle, which means that the model is stable.

Table 5: Summary of validity tests of the estimated VAR model

Equations (Dependent Variable)	Jarque-Bera Normality Test	White's homoscedasticity test	Breush -Godfrey residual autocorrelation test	Stability test
DPIR L	-	+	+	+
DPN	+	+	+	+
GDP	+	+	+	+
Ppactiv	-	+	+	+
Kpriv	-	+	+	+

Source: Author, 2025

Based on the results in Table 5, the model related to economic growth (GDP) is of good quality. Therefore, we can move on to shock analysis, to see the effect of each explanatory variable on the explained variable (GDP). We will focus primarily on shock response functions and forecast error variance decompositions. These two instruments allow us to synthesize the essential information contained in the dynamics of the estimated VAR system. The variance decompositions will indicate the relative importance of each shock in explaining GDP fluctuations. As for the shock reaction functions, they will allow us to highlight the nature of the effects of the different shocks on the variables.

3.1.4.5. Analysis of impulse responses

The following Figures 2 and 3 plot the impulse response functions; the dotted curves represent the confidence interval. We consider that the amplitude of the shock is equal to the standard deviation of the errors and we are interested in the effects of the shock over 10 periods. This horizon represents the time required for the variables to return to their long-term levels. Figure 2 shows that a positive shock of amplitude 0.23 of public spending on local road infrastructure on Benin's economic growth has a negative effect on the latter from the 1st to the 2nd year; before experiencing a positive effect from the 2nd to the 3rd year. From the 3rd year onwards, the effect begins to stabilize and return to its long-term level. Figure 3 shows that a positive shock of amplitude 0.05 of other public spending (omitting local road infrastructure spending) on Benin's economic growth also has a positive impact on the latter from the 1st to the 2nd year. It is cancelled out in the 8th year, where the effect begins to stabilize and return to its equilibrium level.

These results are consistent with the findings of Aschauer (1989), who highlight the existence of delayed effects of public infrastructure investment on economic growth, as well as with Barro (1990), who argue that productive public expenditure can generate varying short-term effects before converging to a long-term growth path. They also align with the conclusions of Calderón and Servén (2010), who emphasize that transport infrastructure has a positive impact on medium- and long-term growth, following an initial adjustment phase, particularly in developing economies.

[5]Jarques limit value Bera

Figure 2 : Response of public spending on road infrastructure to economic growth

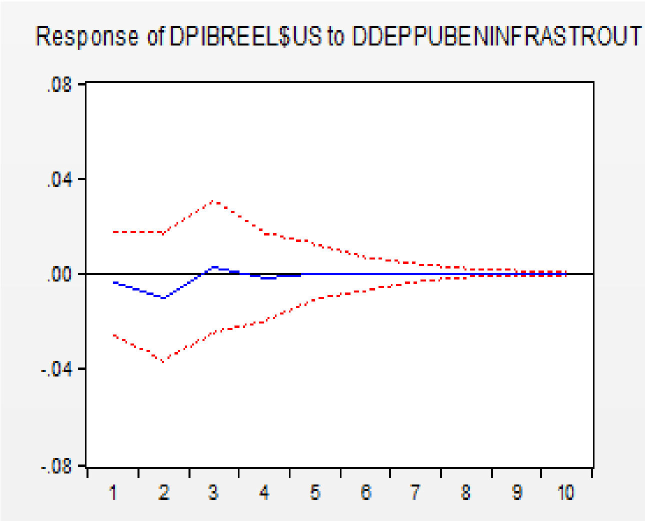
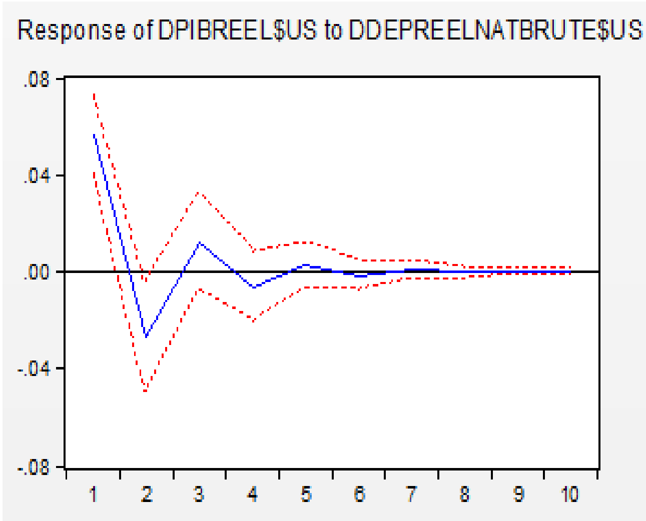


Figure 3 : Response of other public expenditure on economic growth



Source: Author, 2025

3.1.4.6. Analysis of the decomposition of the variance of errors

This analysis complements the one based on impulse response functions. The objective is to calculate the contribution of each of the innovations to the variance of the error. Generally, we write the variance of the forecast error at a horizon h (here h goes from 1 to 10) as a function of the variance of the error attributed to each of the variables. We then calculate the ratio between each of these variances and the total variance to obtain its relative weight in percentage. The results of the variance decomposition (Table 6) reveal that the variance of the forecast error of GDP growth in Benin is due on average to: 4.478% of its own innovations, 2.679% of innovations in public spending on local road infrastructure, 91.646% of innovations in public spending without spending on local road infrastructure, 1.193% of innovations in the stock of private capital, 0.003% of innovations related to the employed labor force.

Table 6: Decomposition of error variance

Period	SE	DPIRL	DPN	GDP	Ppactiv	Kpriv
1	0.2594	0.410	94,334	5,255	0.000	0.000
2	0.2755	2,850	91,418	4,467	0.002	1,262
3	0.2815	2,903	91,415	4,391	0.004	1,287
4	0.2823	2,950	91,332	4,384	0.004	1,330
5	0.2825	2,948	91,329	4,381	0.004	1,338
6	0.2825	2,947	91,327	4,380	0.004	1,341
7	0.2826	2,947	91,327	4,380	0.004	1,342
8	0.2826	2,947	91,327	4,380	0.004	1,343
9	0.2826	2,947	91,327	4,380	0.004	1,343
10	0.2826	2,947	91,327	4,380	0.004	1,343
AVERAGE		2,679	91,646	4,478	0.003	1,193

Source: Author , 2025

The results of this study highlighted the fundamental role of public capital (Local Public Investment) on the growth of the Beninese economy. Based on the results of the VAR model, we can confirm that economic growth is highly sensitive to public capital in Benin. Higher economic growth also provides the government with increased fiscal resources, enabling it to raise its investment in local road infrastructure. In other words, an expanding GDP strengthens the state's capacity to finance infrastructure projects, thereby creating a positive feedback effect between economic growth and local public investment. The variance decomposition analysis shows that "other public expenditure" (DPN) accounts for over 91% of the forecast error variance of GDP, which is highly significant. This result indicates that, during the study period, non-local road infrastructure public spending was a major driver of short- and medium-term GDP fluctuations in Benin. These expenditures include current spending, social transfers, education, and health, which directly contribute to household consumption and the productivity of the active population. This observation highlights that, while investment in local road infrastructure is important for long-term growth, other forms of public spending play a crucial role in short-term economic dynamics. Therefore, for effective economic policy, it is essential to consider the combined effect of infrastructure investments and recurrent public expenditures on economic growth.

However, specifically, the influence of investment in local road infrastructure is 2.95. The effect of investment in local infrastructure is therefore positive in the medium term. Hypothesis 2 is therefore confirmed. As for hypothesis 1, taking into account the total cost estimated at € 2.802,010,000 of local infrastructure reinforcement works (major projects and transport infrastructure modernization programs), we can deduce that hypothesis 1 is invalidated.

Conclusion and recommendations

In this study, we presented the effect of public investment in local road transport infrastructure on economic growth in Benin, by reviewing the definition of infrastructure in terms of collective goods, then we studied the theoretical and empirical formalizations relating to public capital in transport infrastructure and its role in the economic growth process. For this, we used the contributions of endogenous growth theories. From a methodological point of view, our empirical contribution attempts to shed light on the modeling of public capital disaggregated into two categories (public expenditure on local road infrastructure and other public expenditure) in a dynamic econometric approach around vector autoregressive models (VAR). The results found which showed the effect of public investment in local road infrastructure on economic growth are in line with the work based on endogenous growth models with public capital. It also shows that higher economic growth provides the government with increased fiscal resources, enabling it to increase investment in local road infrastructure. However, this research work has limitations related in particular to the reduced number of variables that we introduced in our model. Indeed, this work can be extended to a larger number of economic quantities, notably telecommunications, human capital, or even taking into account in a macroeconomic analysis framework the aspect linked to the financing of public expenditure oriented towards the health sector.

From an economic policy perspective, what is beneficial for Benin is to invest in growth sectors, but in a fairly reasonable proportion, in the local road infrastructure sector which alone between 2003-2023 will account for 80% of road infrastructure expenditure. However, investments in local road transport infrastructure are relevant to the current needs declared by the population; but also to the anticipated needs in relation to integration into the sub-regional and regional economy. This resolution must be a priority for public decision-makers, especially since Benin is a geographically open country and is located on a strategic axis of international trade, particularly with Nigeria and the hinterland countries.

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