

# Infrastructure Spending, Political Instability and Economic Growth

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**How to cite this paper:** Lonzo Lubu, G., Musonda Kalusambo, J. C., Tondi Kikola, C., & Ambroise, J. E. (2023). Infrastructure Spending, Political Instability and Economic Growth. *iBusiness*, 15, 119-139.  
<https://doi.org/10.4236/ib.2023.152009>

**Received:** February 21, 2023

**Accepted:** May 14, 2023

**Published:** May 17, 2023

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## Abstract

This study intends to examine the effects of political unrest and government infrastructure spending on economic growth in the Democratic Republic of the Congo between 1980 and 2020. This is being done to assess the relationship between public infrastructure and economic growth in the DRC as well as the impact that political instability has on that relationship. According to the findings of an econometric regression that employed estimation techniques ranging from the most basic to the most reliable, such as the ordinary least squares (OLS) method, fully modified least squares (FMOLS, Philips Hansen), canonical cointegration regression (CCR, Park), and vector error correction model (VECM), a positive relationship between infrastructure spending and long-term economic growth has been found at the ground level. It also seems that political unrest has an impact on infrastructure spending, which has an impact on economic growth both directly and indirectly.

## Keywords

Infrastructure Spending, Political Instability, Economic Growth and the VECM Model, The Democratic Republic of Congo

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## 1. Introduction

The resurgence of growth theories in the 1980s also rekindled academic curiosity on establishing and comprehending the relationships between government spending and economic growth. Due to the government's expanded involvement in economic operations through its numerous ministries, departments, and organ-

izations, public sector spending has increased during the previous few decades (Jawed, 2018).

Following the discussions on balanced growth that development theorists started in the 1940s and 1950s, the analysis of the productive role of infrastructures was brought up quite early (Rosenstein-Rodan, 1943; Hirschman, 1958).

The discussions, however, were swiftly overshadowed as thought shifted to short-term concerns and the conflict between the multiplier effect and the crowding-out impact of public spending from the 1960s onward. In fact, for more than 30 years, the long-term productive role of public infrastructure investment has been hidden and it has instead been viewed more as a demand-stimulating factor from a Keynesian translation perspective.

In recent years, there has been a significant change in how infrastructure is viewed as a driver of growth. The dispute pitted endogenous growth theorists against neoclassical analysis, which finds that infrastructure spending only has a small impact on economic development and that its impacts only materialize after the transition to long-term equilibrium. Barro (1990), Romer (1986) who contend that investment in public infrastructure contributes to growth with rising long-term rewards (Kane, 2011).

Public infrastructure spending is becoming more frequently viewed as a contributing factor to increased productivity and private investment (Véganzonès & Cerdi, 2000). As a result, it promotes growth by enhancing the economy's supply side. This shift in direction is mostly attributable to the work of Aschauer (1989a), who highlighted the importance of public capital in slowing American output beginning in the 1970s by estimating a production function extended to it (Aschauer, 1989b). The fundamental physical and psychological structures required for a civilization to function are referred to as infrastructures throughout this literature. The term "physical infrastructure" refers to the material resources that support the production and distribution of both urban and rural basic services as well as the operation of the economy. These mostly include telecommunications, power, and transportation infrastructure (ports, airports, highways, and trains) (Jacquet & Charnoz, 2003).

But the issues raised by the discussion of infrastructure's contribution to growth are crucial for both economic policy and development economics. Poor countries' gaping infrastructure deficiency threatens their ability to launch their economies. For instance, in Africa, and more especially in the DRC, the adult illiteracy rate ranges from 20% to 60%, with significantly higher rates for the female population. Less than 10% of Congolese people also have access to electricity (World Bank, 2017).

The DRC just spent USD 448.85 million on its infrastructure, which, while representing 1% of GDP, is significantly less than the investments necessary to have a significant impact over the next ten years (CBC, 2019).

According to the literature, infrastructures should be placed in an institutional context that supports their economic development in order for them to completely and efficiently contribute to economic growth (Zergawu et al., 2020).

Such a perspective is predicated on the idea that the standard of institutions and forms of government determines how effective any economic program would be (Rodrick & Di Tella, 2020).

Some analyses back up the fundamental function of institutions. Infrastructure development that is sponsored by public-private partnerships, private developers, and lenders is more likely to succeed when the institutional conditions are favorable, such as political stability, government efficiency, high-quality regulations, the rule of law, and the suppression of corruption (Lo et al., 2020).

This factor is crucial, especially in developing nations where the lack of adequate institutional framework and low-quality institutions can severely limit the ability of the private sector to act as a provider of public goods and services, despite the fact that public goods and services are crucial for the growth of the economy (Hammami et al., 2006).

The 71% poverty rate, blatant illiteracy, and food insecurity of the Congolese people in 2017 necessitate structural reforms on the side of the Congolese government, both political and economic, that allow for economic growth and development. From a political perspective, the reforms can have to do with how elections are run, how well government is run, or how decentralization is implemented.

What are the effects of the relationship between political instability and infrastructure spending on economic growth in the Democratic Republic of the Congo?

This study aims to examine the effects of infrastructure spending and political unrest on economic development in the Democratic Republic of the Congo. The rest of this essay is structured as follows: The examination of the theoretical and empirical literature on the relationship between public investment and economic growth is covered in Section 2. The methodology is described in Section 3 along with the data that was used. The results, their interpretations, and discussions of the results are presented in Section 3.

## 2. Literature Review

Numerous studies have examined the effects of public expenditure policies on growth in total production. The theoretical and empirical literature on the relationship between infrastructure spending and economic growth is reviewed in this point.

### 1) Theoretical literature on the link between infrastructure spending and economic growth

Recent growth models that take into consideration public spending demonstrate its full significance, however economists disagree on whether it is effective (Stiglitz, 2007). It has consequently been the focus of numerous studies.

The many model typologies and theoretical stances on the relationship between infrastructure and growth are highlighted in this point. We examine both historical and contemporary versions of the Big Push, exogenous and endogenous growth, diffusion of technical development, investment, extended produc-

tion function, and dual approach, in particular.

**a) Problem of economic take-off**

The Big Push theory, developed by [Rosenstein-Rodan \(1943\)](#), makes industrialization the catalyst for economic growth. This hypothesis necessitates the existence of a sufficiently sizable domestic market because it is dependent on the existence of increasing returns to scale in industry.

A more recent reformulation of the Big Push idea is put forth by [Murphy & Owen \(1989\)](#). Based on the Rosenstein-Rodan guiding principles, the authors create three models that are distinct from one another by the type of externality. Only the final argument emphasizes the usefulness of infrastructures.

Although it lowers the production costs of businesses under this model, infrastructure is a fixed expenditure that can only be financed if there are enough of them. Investment raises demand from other businesses and lowers the cost of constructing infrastructure, which is the externality at work. The returns to scale of the sector using contemporary infrastructure are rising while those of the conventional industry are staying the same.

**b) The production function's primary approach and the neoclassical growth model**

Big Push models adhere to a static comparative approach, hence they are not strictly speaking growth models. They assume that industrialization is superior in terms of the well-being of every collective while moving even further away from the hypothesis that its neoclassical generates scale constants. Since we do not count that model as the antecedent, neo-classical models of managing growth and the function of infrastructures are, on the other hand, fairly uncommon. Arrow, who was unaware of development ([Arrow & Kutz, 1970](#)).

The subject of the production function's returns to scale is then brought up by the entry of public capital. The Neoclassical analysis assumes that all factors will have constant returns. We will see that only private elements that grant public capital a state of externality unique to pure public goods make it conceivable to have constant returns. In order to disclose self-sustaining endogenous growth rather than exogenous growth as in the neoclassical model, the new model growth companies will play on this possibility from methods as well as on the yield of accumulative variables.

For its part, the model developed by [Arrow and Kutz \(1970\)](#) enables a broader understanding of the productive role of infrastructures in a model of growth. The authors codify the behavior of public and private capital accumulation using a model of Solow type growth ([Solow, 1957](#)) that includes public capital.

**c) New growth model**

Public capital did not emerge in the core of economic dynamics prior to the rebirth of growth theories, along with Arrow's neoclassical growth model ([Arrow & Kutz, 1970](#)). [Barro \(1990\)](#) created the first endogenous growth model in which public money serves as the development engine.

This now explains the long-term growth trajectory of economies, whereas in the neoclassical model, public capital is merely involved in determining the level

of equilibrium income.

In this approach, the infrastructures are in fact the driving force behind the economy's unrestricted growth. Any rise in private investment immediately results in an increase in public investment since the Republic believes that so much funding is provided by a tax on capital and labor, which causes the marginal productivity of private capital to drop.

## **2) Theoretical research on the link between infrastructure investment and economic expansion**

Since the early 1990s, the empirical debate on the productive nature of infrastructure has taken center stage in the literature on economics. Beyond [Ratner's \(1983\)](#) groundbreaking work, [Aschauer's \(1989b, 1990, 1991\)](#) work was what first sparked quantitative research in this area.

The focus of this research is on finding the dynamics of growth at work and the mechanisms through which the productive role of infrastructures is transmitted. We specifically make distinctions:

- The dual approach, or estimating the cost function of businesses;
- The primal approach, or the direct estimation of the extended production function;
- Examining the effects of infrastructures' spatial diffusion on transient dynamics or the conditional convergence approach.

### **a) Primal approach or the extended production function**

Therefore, including them into the manufacturing function is the basic approach's guiding premise. Numerous empirical studies have focused on this strategy in the years since Aschauer's study, particularly those looking to explain why American production began to decline in the 1970s.

The elasticity of production to capital found by the author is 39%. He comes to the conclusion that public capital makes a significant productive contribution and that it can, in some circumstances, be better than private capital. As a result, the author claims that the decline in public investment shown since the middle of the 1970s is the primary cause of the productivity slowdown seen over the same time period.

However, depending on the country and the study periods, the infrastructure aggregate taken into consideration, the functional form of the production function, and the estimation methodologies, the econometric estimates of these extended production functions produce very different results.

[Munnell \(1990\)](#) finds an elasticity of between 31% and 39% using the same data as Aschauer and varying the type of returns to scale. The author verifies Aschauer's findings but goes further by demonstrating that the absence of public capital stock in the production function is what causes the productivity decline of the conventionally accepted private factors. The author finds that after accounting for the externalities related to public capital, the decline in average worker productivity for the years 1969-1987 falls from 1.4% to 0.3%.

[Finn \(1993\)](#) goes beyond the parameters of the partial equilibrium approach used by the two writers, pointing out the high level of elasticities in Aschauer

and Munnell. Within the framework of a structural stochastic dynamic general equilibrium model, it suggests an estimate of the productive contribution of public capital. She contends that the reason Aschauer's estimations are so high is because the definition of public capital includes non-productive elements (such as museums and jails). According to the author, only the stock of capital owned by public enterprises and the stock of transportation infrastructure, such as roads and motorways, can directly influence the productivity of private firms.

The generalized least squares method was used to estimate the general equilibrium model that allowed the process of capital accumulation to be characterized (through tax levies). According to the author, public capital contributes positively and significantly to growth, but at a very low rate of 22% of GDP growth.

Coe and Moghadam (1993) extend the production function to trade openness and the stock of capital in R&D, two factors that are thought to be growth-impelling factors in another study on the slowdown in productivity gains in France. The authors discover that the public and private capital variables' elasticity is 53% in this five-variable model (public capital, private capital, employment, trade openness, and R & D stock), which was evaluated using a VAR technique. They also draw the conclusion that investment in R & D and economic openness have favorable benefits on growth.

Sturm and De Hann (1995), using Aschauer's model and the estimation performed on first difference data discover that, at the given thresholds, the elasticity of production to capital is positive but insignificant under the assumption of free returns. This conclusion demonstrates that the results of Aschauer on differentiated data were not robust.

The level estimates provided significant values for the production's elasticity to public capital. This shows, in the opinion of economists, the potential existence of a bias caused by the non-stationarity of the series under consideration, which results in the phenomenon of false regression. For this reason, the authors initially suggested co-integration or non-stationarity tests.

By using the Johansen test, Flores de Frutos & Méndez (1998) on Spanish data (1964-89) discover a relationship of co-integration between the product and the set of variables. They achieve a 21% elasticity of the product to the public capital within the confines of an error correction model. However, they acknowledge that accounting for this elasticity alone only captures the immediate benefits of public infrastructure on productivity.

The authors suggest a study using the VAR framework's reaction function to shocks, and they demonstrate that a temporary rise of 1% in the growth rate of the public capital stock implies long-term increases in output of 2.8%, employment of 0.3%, and private capital stock of 3.1%.

Zakane & Sami (2008) Granger causality tests are used on Algerian data (1970-2003) for examining the relationship between infrastructure spending and economic growth. A VAR model is taken into consideration. According to the findings, public investments have no long-term effects on economic growth but are

beneficial in the near term.

#### **b) The conditional convergence technique or transient dynamics**

Comparative to studies based on the basic method of the extended production function, empirical research on the importance of infrastructure as a growth factor utilizing the conditional convergence approach is far less common.

The majority of empirical research that have employed this methodology have been cross-sectional on a more or less significant sample of nations. However, some people employ panel data econometrics. It should be emphasized that this work takes developing countries into account more due to its international component than the extended production function approach does. Some employ disaggregated infrastructure indicators, however these are less common. Numerous studies have demonstrated the beneficial effect of public investment on growth.

[Kocherlatoka and Yi \(1996\)](#) compare the production function to a co-integration relationship and test the long-term non-neutrality hypothesis of public investments. The authors demonstrate that the ratio to the product of public capital has long-term consequences and that the relevant elasticity is equal to 6.5% using American data from 1925 to 1988.

[Lau and Sin \(1997\)](#) found an elasticity of 11% for public capital and 43% for private capital in a different study using the same data and time period, but acknowledging a co-integration relationship between the product and the factors of production.

[Greene and Villanueva \(1991\)](#) examined how state investment affected the private sector. on a group of 23 developing nations from 1982 to 1987. The end result is that public investment has a favorable impact on private investment, proving the complementarity of the two investment kinds. Both public and private investment are considered explanatory variables for private investment in this study.

#### **c) Factor cost and demand functions are estimated using a dual function technical**

The now numerous studies that use the dual strategy do so in a variety of ways. They cover aggregate, sectoral, and regional data even though the majority of them use a translog-type production function. The predicted cost functions tend to be long-term, while they can occasionally be short-term with fixed private capital.

Developing countries are rarely affected by them once more, most likely due to an even more glaring data shortage than in the case of the other approaches (factor pricing data in particular). Additionally demonstrating the robustness of this method, which is less reliant on the quality of the infrastructure indicator, the infrastructure indicators are typically aggregate indicators of public capital that are occasionally reduced to the core of infrastructure.

These studies, which primarily employ American data, include [Keeler and Ying's \(1988\)](#) study on the benefits of expenditures in road infrastructure made as part of federal support on the expenses of road transportation. They find that



capital investment in road infrastructure greatly increased the productivity of the trucking business using data for nine regions between 1950 and 1973. Truck cost savings alone cover roughly one-third of the construction expenses of the road network that benefited from federal aid between 1950 and 1973, making the advantages of road investments very large.

Bangqiao (2001) also presents the study carried out by Morrison and Schwartz (1996). These investigate how infrastructure affects the performance of the manufacturing sector at the state level using a variable cost function. Roads, water systems, and sewers are all included in the study's estimate of public capital. Using annual data on prices and quantities of outputs and inputs in the manufacturing sectors of the 48 states from 1970 to 1987, the estimate is made by region. The findings indicate that, in most places, a \$1 investment in infrastructure saves around \$0.16 in costs over the course of a year.

#### **d) Infrastructure specific diffusion effects evaluation**

The effects of spatial diffusion of growth represent another transmission channel of the role of infrastructures which has been little subject to quantitative validation.

Another transmission channel for the function of infrastructures, the effects of spatial diffusion of growth, have not received much quantitative confirmation.

Despite being easily misinterpreted in this way, the basic model of Chua (1993), which implements the spread of spatial externalities through the physical and human resources of surrounding countries (regions), nonetheless produces some novel findings. On many samples of nations, Chua, H. validates his model in terms of both conditional convergence and equilibrium equations. The fact that these diffusion effects significantly lessen the relevance of the dummy variables for Africa, Asia, and Latin America is also an intriguing outcome of these calculations. This circumstance amply demonstrates the existence of regional dynamics—which have been neglected and little understood till now—in the development and convergence of nations.

This spatial scattering phenomenon was approached indirectly once again by Nagaraj et al. (2021) on the Indian states. The function of infrastructures as a cause of disparities in the economic performance of States is validated by the authors on the basis of panel data using a conditional convergence scheme. However, they also draw attention to the impact of growth diffusion between nearby States.

However, because this growth is dependent on the quality of each State's infrastructure, this result enables us to demonstrate, via transitivity, the significance of this equipment in the spatial dissemination of growth.

Holtz-Eakin and Schwartz (1995) concentrated on more clearly demonstrating how infrastructures provide spatial externalities. As it relates to interstate roads and significant roads within American states, the indicator evaluated here is fairly precise, in contrast to practically all empirical research that touch on the relationship between infrastructure and growth. Since roads are the primary form of transportation in the United States, their productive impact



should be substantial despite being modest in comparison to other forms of infrastructure.

### 3. Specification, Estimation and Interpretations of Results

#### 3.1. Model Specification

The model is inspired by the work of Lo et al. (2020) of the theoretical framework of Mankiw et al. (1992). In our work, we have included additional factors in addition to the dependent variable (GDP per capita). These are the explanatory factors in more detail. Other control variables are also important for the investigation. The following dynamic growth equation results from this:

$$LGDP_t = \gamma LGD_{t-1} + \sum_j \beta_j X_t + \varepsilon_t \quad (1)$$

with and  $\gamma = e^{-\lambda}$   $\lambda$ : representing the speed of convergence;  $LGDP_t$  is the logarithm of GDP per capita;  $LGDP_{t-1}$  represents the lagged endogenous variable.  $\lambda$  The latter enables consideration of the model's dynamic component.  $X_t$  is the group of factors (control factors) that enable a nation to remain in a stable state (production, investment, socio-demographic traits, etc.).

As part of our work, we include the numerous metrics for measuring public infrastructure in the growth equation. The equations that need to be estimated with the control variables required for the analysis are as follows:

$$LGDP_t = \gamma LGDP_{t-1} + \beta_1 LINFRA_t + \beta_2 LPUBSP_t + \beta_3 LGFC_t + \beta_4 LIGA_t + \beta_5 LOPEN_t + \beta_6 LINF_t + \beta_7 LDEVF_t + \varepsilon_t \quad (2)$$

We add our dummy variable of political instability, which is roughly represented by changes in government (cf. Table 1), to this equation. We also presumptively assume that political instability multiplicatively affects economic growth through its combined impact on public infrastructure. In order to account for the relationship between infrastructure and political instability, a multiplicative term will be used.

This results in the multiplicative formulation of our model being estimated as follows:

$$LGDP_t = \gamma LGDP_{t-1} + \beta_1 LInfra_t + \lambda_1 Inst_t + \lambda_2 Infra * Inst_t + \beta_2 LPUBSP_t + \beta_3 LGFC_t + \beta_4 LIGA_t + \beta_5 LOPEN_t + \beta_6 LINF_t + \beta_7 LDEVF_t + \varepsilon_t \quad (3)$$

Political unrest is thought to have a multiplicative effect on infrastructure growth when it interacts with public infrastructure. As a result, the following marginal effect is produced:

$$\frac{\partial y}{\partial LInfra} = \beta_1 + \lambda_2 Inst_t$$

With  $y = LGDP_t$

This equation shows that the effect of physical infrastructure on real GDP per capita depends on institutional quality. In this case, three cases can arise, namely:

- Whether  $\beta_1$  and  $\lambda_2$  are all positive (respectively negative), then the variable *Infra* has a positive (respectively negative) effect on  $y$  and  $Inst_t$  favorably affects (respectively, aggravates) this positive impact.
- Whether  $\beta_1 > 0$  and  $\lambda_2 < 0$ , then  $Infra_t$  has a positive effect on  $y$ , but  $Inst_t$  reduces this positive impact;
- Whether  $\beta_1 < 0$  and  $\lambda_2 > 0$ , then  $Infra_t$  has a negative effect on  $y$ , but  $Inst_t$  mitigate this negative impact.

### 3.2. Selection of Variables (Table 1)

#### 3.2.1. Explained Variable

Gross domestic product per capita (GDP) (World Bank CD-ROM, WDI, 2020) is a measure of economic performance.

#### 3.2.2. Explanatory Variables

The following explanatory variables are used in the model: gross domestic product per capita with a one-year lag (GDP-1), public infrastructure (INFRA), public spending (DPUB), gross fixed capital formation (GFCF), commercial opening (OPEN\_COM), share of agriculture in value added, economic inflation (IGA), liquidity ratio (DEVF), and political instability (INST).

##### a) Public infrastructure

All government capital expenditures are roughly equivalent to the public infrastructure designated by (INFRA). This indicator captures an economy's internal public investment effort. We anticipate a favorable relationship between public infrastructure and GDP per person (Nzingoula, 2015).

##### b) Public expenses

Public expenditures, which are covered by fiscal policy, include both current and capital State expenditures. The weight of empirical evidence is shifting in support of the validity of the short-term impacts of fiscal stimulus (Creel et al., 2011). An increase in these causes investments to rise, which, in turn, induces an increase in employment. The predicted sign is good since public spending has a favorable impact on growth.

##### c) Gross fixed capital formation

Gross fixed capital formation (GFCF) is often measured by private investment. The expenses incurred by each business owner individually cover it. Growth is directly impacted. A rise in private investment results in an increase in employment, which boosts growth. We predict a negative correlation between per-capita GDP and gross fixed capital formation.

##### d) Commercial opening

The sum of exports and imports expressed as a percentage of GDP is used to calculate the economic or trade openness mentioned (OPEN). This variable serves as a gauge for international trade volume. A high trade volume denotes the import and export of numerous items. Trade openness can affect growth in two different ways. On the one hand, a poor economy's initial endowment can result in a lack of specialization, which would be detrimental to growth

**Table 1.** Studies of expected signs.

Exogenous and instrumental variables	Ratings	Expected signs
Regression with LGDP as endogenous variable		
Gross Domestic Product shifted by one year	<b>GDP(-1)</b>	+
Public Infrastructure	<b>INFRA</b>	+
Public expenses	<b>PUBSPEND</b>	+
Gross Capital Formation	<b>GFCF</b>	+
Commercial opening	<b>OPEN</b>	+/-
Share of Agriculture in value added	<b>IGA</b>	+
Economic inflation	<b>TINF</b>	-
Liquidity Ratio	<b>DEVF</b>	+
Political instability	<b>INST</b>	-

Source: Authors.

(Krugman, 1987; Young, 1991); On the other hand, through technological advancement and the transfer of technology, openness can enable an increase in the pace of capital accumulation (Romer, 1986).

#### **e) Agriculture's contribution to value added**

The proportion of agriculture in the added value (IGA) as determined by the further processing of agricultural output. 61.2% of Congolese people live in rural areas, making up a sizable portion of the population (survey 1-2-3, NIS, 2012).

The growth in agricultural potential will cause the available unemployed rural labor force to become more active. The proportion of agriculture in the agricultural value added and the gross domestic product per person are positively correlated.

#### **f) Economic inflation**

The GDP deflator is a rough approximation of economic inflation labeled (INFL). We think that inflation must have negative impacts on the improvement of per capita income in the DRC through the deterioration of the population's purchasing power, despite the debate about the theoretical implications of inflation on growth.

#### **g) Liquidity ratio**

The ratio of the M2 monetary aggregate to GDP captures the recognized liquidity ratio (DEVF). Financial growth encourages a higher mobilization of funds that may be used for investment, which plays a good and beneficial function (Campos & Karanasos, 2008). On growth and investment, a favorable sign is anticipated.

#### **h) Political instability**

A qualitative variable called "political instability noted" (INST) measures the impact of political instability. Changes in government will be used to gauge political instability. For economic activity and the flow of funds for development, a peaceful atmosphere is essential. It boosts capital accumulation and investor

confidence. We anticipate a negative correlation between political unrest and economic growth (Barro, 1991; Alesina et al., 2003; Bakaboukila & Hakizimana, 2021).

## 4. Presentation and Interpretation of the Results and Discussion of Results

### 4.1. Estimation of the Model and Interpretation of the Results

This point presents the results from the different estimation methods. Furthermore, it is important to remember that we have used different estimation methods, in particular the method of Ordinary Least Squares (OLS), fully modified least squares (FMOLS), canonical cointegration regression (CCR), and vector error correction model (VCEM). From the modeling results (Equations (3))<sup>1</sup>.

By passing by the methods of Ordinary Least Squares (OLS) (Table 2), fully modified least squares (FMOLS, Hansen, 1990), canonical cointegration regression (CCR, Park, 1992), and vector error correction model (VCEM), we estimated our Equation (3) in order to obtain robust results corrected for endogeneity bias. We were able to achieve really pleasant and productive results thanks to this activity.

#### 4.1.1. Estimation Results

World Development Indicators (WDI, 2020), the World Bank, and several papers from the Central Bank of Congo provided the data for the estimates. Additionally, *INST*, our dummy variable for political instability (measured by changes in government; see Table 1).

#### 4.1.2. Results Interpretation

These results, which were estimated for the years 1980-2019, warrant a number of observations. Our vector error correction model indicated two periods for us to consider when calculating the estimates: the long term and the short term.

The variables public infrastructure (INFRA) (Table 3), public expenditure (DPUB), gross fixed capital formation (GFCF), trade openness (OPEN), inflation (INFL), the liquidity ratio (DEVF), the share of agriculture in value added (AGR), and political instability (INST) are the main long-term determinants of the growth of the Congolese economy (GDP).

According to Equation 1's findings, public infrastructure (INFRA), public spending (PUBSPEND), trade openness (OPEN), inflation (INFL), the liquidity ratio (DEVF), and the proportion of agriculture in value added (IGA) all have a favorable impact on economic growth in the DRC. As a matter of fact, a 1% change in public infrastructure causes an increase in economic growth of about 0.05%. This can be explained by the fact that the Congolese economy is extrovert and monopolistic, with mining making up the majority of its industries. Since this industry hasn't been negatively impacted by political unrest, looting, or

<sup>1</sup>The values in parentheses correspond to the values of the STUDENT test. In addition, for each case, the R<sup>2</sup> value obtained indicates the relevant quality of the fit.

**Table 2.** Summary of estimation results.

Estimation methods		Regression 1	Regression 2	Regression 3	Regression 4
Endogenous Variable	Exogenous Variables	OLS	FMOLS	CCR	VCEM
LGDPH	C	1.09 (1.43)	1.23*** (3.11)	2.01** (2.91)	-5.91*** (-14.8)
	LGDP (-1)	0.82*** (3.88)	0.84* ** (7.52)	0.69** (3.58)	NA
	LINFRA	0.003 (0.38)	0.007 (1 - 19)	0.01 (1 - 37)	0.05*** (3.61)
	INST^LINFRA				-0.08*** (-7.27)
	LPUBSPEND	-0.008 (-0.09)	-0.03 (-0.56)	-0.03 (-0.30)	0.08** (2.06)
	LGFCF	0.03* (1.61)	0.03*** (3.01)	0.04** (2.42)	-0.03*** (-18.88)
	LOPEN	-0.06 (-1.33)	-0.06** (-2.87)	-0.09** (-2.38)	0.24*** (8.04)
	LINFL	0.07 (0.97)	0,07* (1.83)	0.05 (0.85)	0.3*** (6.15)
	LDEVF	-0.009 (-1.29)	-0,009** (-2.58)	-0.01** (-2.26)	0.03*** (12.63)
	LIGA	-0.11 (-1.41)	-0,14*** (-3.14)	-0.21** (-2.92)	0.63*** (10.85)
	INST	0.02 (1.31)	0.02** (2.73)	-0.02** (2.05)	-0.58*** (-6.1)
	DLGDP (-1)	0.24 (1.06)	0.26** (2.17)	-0.03 (-0.11)	0.98*** (8.15)
	DLNFRA	-0.01* (-1.89)	-0.02*** (-3.77)	0.02 (1.07)	-0.003 (-0.46)
	DINST^LINFRA				-0.004 (-0.78)
	DLPUBSPEND	0.22** (2.31)	0.23*** (4.78)	0.23 (1.41)	-0.18*** (-3.37)
	DLGFCF	-0.006 (-0.55)	-0.006 (-1.03)	-0.06** (-2.62)	-0.03*** (-2.61)
	DLOPEN	0.11** (2.36)	0.12*** (4.85)	0.16** (2.92)	0.07*** (2.67)

## Continued

	DLINFL	0.13	0.14**	0.08	-0.12**
		(1.47)	(2.97)	(0.61)	(-2.37)
	DLDEVF	-0.006	-0.006**	-0.01	0.005*
LGDPH		(-1.14)	(2.18)	(1 - 59)	(1.75)
	DLIGA	0.09	0.11**	0.34***	0.14***
		(1.36)	(3.05)	(3.10)	(3.77)
	DINST	-0.01	-0.01**	-0.05***	0.02
		(-1.22)	(2.71)	(3.54)	(0.44)
	R2 Ajusté	0.99	0.99	0.90	0.85
	Obs	38	37	37	37
	Fisher/Chi2	464.75			22.88

Source: Author based on study data using Eviews software. Legend: \*denote significance at the 10 percent level; \*\*denote significance at the 5 percent level; \*\*\*denote significance at the 1 percent level(...): The values in parentheses correspond to the values of the STUDENT test.

**Table 3.** Results of the estimation of the long-term equation.

Equation (1) End. Var	LGDPH (-1)	LINFRA	INST^LINFRA	LPUBSPEND	LGFCF	LOPEN	LINFL	LDEVF	LAGR	INST	Const
GDPH	NA	0.05***	-0.08***	0.08**	-0.03***	0.24***	0.3***	0.03***	0.63***	-0.58***	-5.91***
		(3.61)	(-7.27)	(2.06)	(-18.88)	(8.04)	(6.15)	(12.63)	(10.85)	(-6.1)	(-14.8)
	R-squared = 85.18		RMSE = 0.075		Chi <sup>2</sup> = 22.88						
	Obs = 37		Parameters = 9		P_Chi <sup>2</sup> = 0.000						

Source: Authors.

aggression wars, it has attracted a lot of profitable public and private investment in recent years.

Then, a change of 1% in trade openness (OPEN) results in an improvement in GDP of about 0.24 percentage points. As a result, trade openness (OPEN) is a factor in the DRC's economic growth.

It should be noted that the Congolese economy is extroverted; it owes much of its development to the mining industry, which accounts for 70% of GDP on its own (CBC, 2018) and exports all of its output, serving as a source of foreign exchange through exports and customs revenue.

Additionally, any change of 1% in public expenditure (PUBSPEND) results in an improvement in economic growth of about 0.08%, showing a situation similar to that of Keynes.

Similar to this, any change of 1% in the rate of inflation results in an improvement of around 0.3% in long-term economic growth. This can be explained by the fact that production and growth have always benefited from a little rise. Other economists contend that inflation enhances the efficiency of labor

markets, which promotes growth. They see modest growth as the economic life's grease.

Economic growth (GDP) is positively impacted by the liquidity ratio (DEVF). Therefore, a 1% change in the liquidity ratio (DEVF) results in a 0.03 percent gain in economic growth. Long-term, the financial development represented by the variable (DEVF) encourages higher mobilization of funds that can be devoted to investment.

Finally, a change of 1% in the percentage of agriculture improves economic growth by about 0.63%. Because 61.2% of Congolese live in rural areas, a significant portion of the population (survey 1-2-3, NIS, 2012).

On the other hand, political unrest (INST) has a detrimental effect on the DRC's economy. Therefore, a change of 1% in political unrest causes a 0.58 percentage point decline in GDP, or economic growth. In fact, the country's institutions have been set up with a bad governance mechanism that encourages corruption and disregard for the law. This prevents the growth of the country's economic system. The dynamics of growth in the DRC are negatively and statistically significantly impacted by the interaction variable  $INST \wedge LINFRA$ ). Accordingly, this finding implies that while political instability tends to reduce the favorable effects of public infrastructure on GDP.

In the end, political instability has a detrimental impact on economic growth via the channel of public infrastructure due to its negative and statistically significant effects on it as well as its positive and substantial impact on growth.

Growth in the DRC is impacted by political instability in two different ways: directly, as indicated in Equation (1), and indirectly, through its effects on the state of public infrastructure both now and in the future. An rise of one point in political unpredictability over the same time period has the following overall effects on economic growth:  $\frac{\partial y}{\partial Inst} = \lambda_1 + \lambda_2 Infra_t = -0.66$  It is composed of  $-0.58$  (direct effect) and  $-0.08$  (indirect effect due to the decline in public infrastructure).

It was discovered that (Table 4) the following factors affect the DRC's GDP in the short term: growth in year  $t - 1$  (GDP(-1)), public spending (PUBSPEND), gross fixed capital formation (GFCF), inflation (INFL), economic openness (OPEN), and the proportion of agricultural in added value (IGA). Political unrest (INST), public infrastructure (INFRA), and the interaction variable, however, had no appreciable impact on short-term economic growth.

Economic growth (GDP) is positively and statistically significantly influenced by the gross domestic product per capita that is one year behind (GDP-1), trade openness (LDOPEN), the liquidity ratio (DLDEVF), and the percentage of agriculture in value added (DLIGA).

Therefore, any change of 1% in the growth of INFRA (gross domestic product per capita) causes a rise in GDP of 0.98 percent. The commercial opening has a favorable impact of about 0.07% for every change of 1%.



**Table 4.** Results of the estimation of the short-term equation.

Equation 2 End. Var	DLGDPH (-1)	DLNFRA	DINST^LINFRA	DLPUBSP	DLGCF	DLOPEN	DLINFL	DLDEVF	DLIGA	DINST	Const
	0.98***	-0.003	-0.004	-0.18***	-0.03***	0.07***	-0.12**	0.005*	0.14***	0.02	-5.91***
	(8.15)	(-0.46)	(-0.78)	(-3.37)	(-2.61)	(2.67)	(-2.37)	(1.75)	(3.77)	(0.44)	(-14.8)
GDPH	R-squared = 85.18		RMSE = 0.075			Chi2 = 22.88					
	Obs = 37		Parameters = 10			P_Chi2 = 0.000					

Source: Authors.

At the 1% barrier, the liquidity ratio then influences economic growth in a favorable way. It seems that every 1% change in the liquidity ratio causes growth to increase by about 0.005%.

And last, economic growth is harmed by both inflation and public spending (PUBSPEND). As a result, a 1% increase in government spending reduces growth (GDP) by 0.18%. This outcome demonstrates the state's inadequacy in investing in human capital, especially in the areas of education, health, and economic infrastructure, as the state continues to spend far more than it should on political institutions and defenses.

In the end, political instability has a detrimental impact on economic growth via the channel of public infrastructure due to its negative and statistically significant effects on it as well as its positive and substantial impact on growth.

Growth in the DRC is impacted by political instability in two different ways: directly, as illustrated in Equation (1), and indirectly, as a result of its effects on both the present and future state of the public infrastructure. The overall impact of an increase of one point in political unpredictability on economic growth within the same time period is equal to  $dy/dinst = \lambda_1 + \lambda_2 Infra = -0.66$ . It is composed of  $-0.58$  (direct effect) and  $-0.08$  (indirect effect due to the decline in public infrastructure).

## 4.2. Discussion of Results

This finding somewhat supports research on the subject done in the DRC, which showed the limited influence of governmental investments on economic growth (Ntita et al., 2017; Lonzo, 2014; Lonzo & Avom, 2014). The majority of the empirical research done in articulated economies, in particular, has also produced similar outcomes (Aschauer, 1989b; Kocherlotoka & Yi, 1996), have had a long-term, favorable, and significant impact on the expansion of public investment.

Long-term economic growth is negatively and statistically significantly impacted by political instability. These outcomes were also discovered by (Alesina et al., 1996; Collier et al., 2003) cite examples of how civil war reduces national production by impeding economic activity, destroying physical capital and infrastructure, and redirecting funds to unproductive areas like military spending.

Additionally, the interaction variable has a detrimental and statistically significant impact on the growth dynamic, indicating that political unrest may be a

feature in the DRC's growth process that mitigates the impact of infrastructure. This outcome backs up the analyses of [Esfahani and Ramirez \(2003\)](#) and [Zergawu et al. \(2020\)](#) who emphasize the need to take into account the quality of institutions in assessing the effect of infrastructure on growth.

## 5. Conclusion

At the end of this study, entitled "Infrastructure spending, political instability and economic growth in the DRC from 1980 to 2019". It was a question of answering the following central question: "what are the consequences of the interaction between political instability and infrastructure spending on economic growth in the DR Congo?"

The following hypotheses were generated from this basic question: political instability has a negative long-term impact on the relationship between infrastructure investment and economic growth in the DRC, and infrastructure spending has no influence on short-term growth rather than long-term growth. Political unrest has essentially no influence on the short-term link between infrastructure spending and economic growth. It is important to examine how the DR Congo's infrastructure spending affects political instability and economic progress.

The study also used econometric modeling, employing four techniques: vector error correction model (VECM), canonical cointegration regression (CCR), fully modified least squares (FMOLS), and ordinary least squares (OLS). of Johansen to estimate the coefficients in the form of elasticity in order to facilitate their interpretations in terms of sensitivity.

Indeed, after estimation of the model, the results obtained in our study confirm our hypotheses. For the President estimates results, a positive and statistically significant effect of infrastructure spending on long-term economic growth. However, this effect remains weak and tends to erode, which shows that infrastructure spending is not concentrated in the accumulation of capital and the development of the productive capacities of the economy and political instability captured by changing governments has a long-term and statistically significant negative effect on economic growth in the DRC.

The estimates' findings also demonstrate how political instability brought on by a change in government has an impact on infrastructure spending, which has an impact on economic growth both directly and indirectly. These findings helped us to better understand the controversy surrounding the relationship between infrastructure spending, political unrest, and DRC economic growth.

The vector error correction model also shows that the short-term effects of infrastructure spending and political instability on growth are negative and statistically insignificant.

The findings of this study primarily suggest that the DRC must work to simultaneously develop its institutions and public infrastructure in order to support the expansion of its economy: any investment in institutions must be ac-

accompanied by an investment in infrastructure that is proportionate to that investment.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

## References

- Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., & Wacziarg, R. (2003). Fractionalization. *Journal of Economic Growth*, 8, 155-194.  
<https://www.nber.org/papers/w9411>  
<https://doi.org/10.1023/A:1024471506938>
- Alesina, A., Ozler, S., Roubini, N., & Swagel, P. (1996). Political Instability and Economic Growth. *Journal of Economic Growth*, 1, 189-211. <https://doi.org/10.1007/BF00138862>
- Arrow, K. J., & Kurz, M. (1970). *Public Investment, the Rate of Return, and Optimal Fiscal Policy*. Johns Hopkins Press.
- Aschauer, D. A. (1989a). Does Public Capital Crowd out Private Capital? *Journal of Monetary Economics*, 24, 171-188. [https://doi.org/10.1016/0304-3932\(89\)90002-0](https://doi.org/10.1016/0304-3932(89)90002-0)
- Aschauer, D. A. (1989b). Is Public Expenditure Productive? *Journal of Monetary Economics*, 23, 177-200. [https://doi.org/10.1016/0304-3932\(89\)90047-0](https://doi.org/10.1016/0304-3932(89)90047-0)
- Aschauer, D. A. (1990). Highway Capacity and Economic Growth. *Economic Perspectives, Federal Reserve Bank of Chicago*, 14, 14-24.
- Aschauer, D. A. (1991). *Infrastructure America's Third Deficit* (pp. 93-45). Challenge, Marsavril. <https://doi.org/10.1080/05775132.1991.11471496>
- Bakaboukila, A. E., & Hakizimana, J. (2021). Effects of Political Instability on Economic Growth in the Republic of Congo. *Modern Economy*, 12, 1896-1912.  
<https://doi.org/10.4236/me.2021.1212099>
- Bangqiao, J. (2001). *Revue des études sur la relation entre les investissements dans l'infrastructure des transports et la croissance économique*. Rapport pour le Comité d'examen de la Loi sur les transports au Canada, Vancouver.  
<http://www.bv.transports.gouv.qc.ca/mono/0774861.pdf>
- Barro, R. J. (1990). Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy*, 98, S103-S125. <https://doi.org/10.1086/261726>
- Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics*, 106, 407-443. <http://piketty.pse.ens.fr/files/Barro91.pdf>  
<https://doi.org/10.2307/2937943>
- Campos, N. F., & Karanasos G. M. (2008). Growth, Volatility and Political Instability: Non-Linear Time-Series Evidence for Argentina, 1896-2000. *Economics Letters*, 100, 135-137. <https://doi.org/10.1016/j.econlet.2007.12.013>
- CBC (2018). *Rapport de politique monétaire*. Kinshasa.  
<https://www.bcc.cd/publications/rapports>
- CBC (2019). *Annual Report*. Kinshasa.  
<https://www.bcc.cd/publications/rapports-annuels/rapport-annuel-2019>
- Chua, H. B. (1993). *Regional Spillover and Economic Growth* (pp. 145-160). Centre Discussion Paper, No. 700, Economic Growth Center, Yale University.
- Coe and Moghadam (1993). Capital and Trade as Engines of Growth in France: An Application of Johansen's Cointegration Methodology. *IMF Working Papers*, 40, 542-566.

- <https://doi.org/10.2139/ssrn.883430>
- Collier, P., Elliot, V. L., Hegre, H., Hoeffler, A., Reynal-Quérol, M., & Sambanis, N. (2003). *Breaking the Conflict Trap: Civil War and Development Policy* (Vol. 41181, No. 4, pp. 1-211). A Copublication of the World Bank and Oxford University Press.  
<https://doi.org/10.1037/e504012013-001>  
[https://books.google.cd/books?hl=fr&lr=&id=3PLqetBxiOEC&oi=fnd&pg=PR5&dq=Collier+et+al.+<math>\(2003\)</math>.+Breaking+the+Conflict+Trap:+Civil+War+and+Develop-ment+Policy.+<math>+https://doi.org/10.1037/e504012013-001</math>&ots=PTX0GW9d4v&sig=mSPgInpKN6fKrl3bgvT8R6gIQk&redir\\_esc=y#v=onepage&q&f=false](https://books.google.cd/books?hl=fr&lr=&id=3PLqetBxiOEC&oi=fnd&pg=PR5&dq=Collier+et+al.+<math>(2003)</math>.+Breaking+the+Conflict+Trap:+Civil+War+and+Develop-ment+Policy.+<math>+https://doi.org/10.1037/e504012013-001</math>&ots=PTX0GW9d4v&sig=mSPgInpKN6fKrl3bgvT8R6gIQk&redir_esc=y#v=onepage&q&f=false)
- Creel, J., Heyer, E., & Plane, M. (2011). Petit précis de politique budgétaire par tous les temps: Les multiplicateurs budgétaires au cours du cycle. *Revue de l'OFCE*, 1, 61-88.  
<https://www.cairn.info/revue-de-l-ofce-2011-1-page-61.htm>  
<https://doi.org/10.3917/reof.116.0061>
- Esfahani, H. S., & Ramírez, M. T. (2003). Institutions, Infrastructure, and Economic Growth. *Journal of Development Economics*, 70, 443-477.  
[https://doi.org/10.1016/S0304-3878\(02\)00105-0](https://doi.org/10.1016/S0304-3878(02)00105-0)
- Finn, M. (1993). Is All Government Capital Productive? *Economic Quarterly, Federal Reserve Bank of Richmond*, 79, 53-80.  
[https://www.richmondfed.org/-/media/richmondfedorg/publications/research/economic\\_quarterly/1993/fall/pdf/finn.pdf](https://www.richmondfed.org/-/media/richmondfedorg/publications/research/economic_quarterly/1993/fall/pdf/finn.pdf)
- Flores de Frutos, R., & Méndez, M. J. (1998). *Testing for Invertibility in Univariate ARIMA Processes* (pp. 1-7). Documentos de Trabajo (ICAE).
- Greene, J., & Villanueva, D. (1991). Private Investment in Developing Countries: An Empirical Analysis. *IMF Staff Papers*, 38, 33-58. <https://doi.org/10.2307/3867034>
- Hammami, M., Ruhashyankiko, J.-F., & Yehoue, E. B. (2006). *Determinants of Public-Private Partnerships in Infrastructure* (Working Paper No. 06/99). International Monetary Fund, Washington DC. <https://doi.org/10.2139/ssrn.902765>
- Hansen, B., & Phillips, P. (1990). Statistical Inference in Instrumental Variables Regression with I(1) Processes. *Review of Economic Studies*, 57, 99-125.  
<https://doi.org/10.2307/2297545>
- Hirschman, A. O. (1958). *The Strategy of Economic Development* (pp. 13, 217). Yale University Press. <https://onlinelibrary.wiley.com/doi/abs/10.2307/1235188>
- Holtz-Eakin, D., & Schwartz, A. E. (1995). Spatial Productivity Spillovers from Public Infrastructure: Evidence from State Highways. *International Tax and Public Finance*, 2, 459-468. <https://doi.org/10.1007/BF00872777>
- Jacquet, P., & Charnoz, O. (2003). *Infrastructure, croissance et réduction de la pauvreté* (p. 6). Forum franco-vietnamien.  
[https://www.academia.edu/1173774/Infrastructure\\_croissance\\_et\\_r%C3%A9duction\\_de\\_la\\_pauvret%C3%A9](https://www.academia.edu/1173774/Infrastructure_croissance_et_r%C3%A9duction_de_la_pauvret%C3%A9)
- Jawad, E. (2018). *Impact des dépenses publiques sur la croissance économique: Approche par le model ARDL* (pp. 638-653). Maroc.  
<https://www.revuecca.com/index.php/home/article/view/210>
- Kane, C. S. (2011). *Physical Infrastructures and Economic Growth in UEMOA*. Economic and Monetary Review No. 9, June.
- Keeler, & Ying, J. S. (1988). Measuring the Benefits of a Large Public Investment: The Case of the U.S. Federal-Aid Highway System. *Journal of Public Economics*, 36, 69-85.  
[https://doi.org/10.1016/0047-2727\(88\)90023-0](https://doi.org/10.1016/0047-2727(88)90023-0)
- Kocherlakota, N. R., & Yi, K. M. (1996). A Simple Time Series Test of Endogenous vs.

- Exogenous Growth Models: An Application to the United States. *The Review of Economics and Statistics*, 78, 126-134. <https://doi.org/10.2307/2109852>
- Krugman, P. R. (1987). Is Free Trade Passe? *Journal of Economic Perspectives*, 1, 131-144. <https://doi.org/10.1257/jep.1.2.131>
- Lau, P. S.-H., & Sin, C.-Y. (1997), Public Infrastructure and Economic Growth: Time-Series Properties and Evidence. *Economic Record*, 73, 125-135. <https://doi.org/10.1111/j.1475-4932.1997.tb00986.x>
- Lo, S. B., Ramde, F., & Diandy, I. Y. (2020). Natural Resources, Financialization and Economic Growth: Empirical Evidence in a Global Sample. *Journal of Applied Business and Economics*, 22. <https://doi.org/10.33423/jabe.v22i8.3274>
- Lonzo, L. G. (2014). *Taille optimale de l'Etat* (20 p.). CEREG/UYII-SOA, MPRA\_paper\_60715, Munich. <https://mpra.ub.uni-muenchen.de/60715/>
- Lonzo, L. G., & Avom, D. (2014). *Les effets non lineaires des dépenses publiques sur la croissance économique en rd congo*. MPRA\_paper\_60716. <https://mpra.ub.uni-muenchen.de/60716/>
- Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics*, 107, 407-427. <https://doi.org/10.2307/2118477>
- Morrison and Schwartz (1996). State Infrastructure and Productive Performance. *American Economic Review*, 86, 1095-1111. <http://links.jstor.org/sici?sici=0002-8282%2819961...O%3B2-M&origin=repec>
- Munnell, A. H. (1990). Why Has Productivity Growth Declined? Productivity and Public Investment. *New England Economic Review, Federal Reserve Bank of Boston*, 2-22.
- Murphy, C. A., & Owen, S. Q. (1989). Development and Validity of the Computer Self-Efficacy Scale. *Educational and Psychological Measurement*, 49, 893-899. <https://doi.org/10.1177/001316448904900412>
- Nagaraj, G., Ciardullo, R., Bowman, W. P., & Gronwall, C. (2021). Stellar, Gas, and Dust Emission of Star-Forming Galaxies out to  $z \sim 2$ . *The Astrophysical Journal*, 913, Article No. 34. <https://doi.org/10.3847/1538-4357/abf1e5>
- NIS (2012). *Enquête 1-2-3 sur l'Emploi et le Secteur Informel 2012*. Kinshasa, ILO. <https://www.ilo.org/surveyLib/index.php/catalog/7795/related-materials>
- Ntita, N. J., Ntita, N. J.-D., & Kazadi, N. F. (2017). *Investissement public et croissance économique en République Démocratique Du Congo*. MPRA\_paper\_92905.pdf, Munich. <https://mpra.ub.uni-muenchen.de/id/eprint/92905>
- Nzingoula, G. C. (2015). *Les déterminants de la croissance économique en zone cemac: Une approche en données de panel*. MPRA\_paper\_67009.pdf, Munich. <https://mpra.ub.uni-muenchen.de/id/eprint/67009>
- Park, J. Y. (1992). Canonical Cointegrating Regressions. *Econometrica, Econometric Society*, 60, 119-143. <https://www.jstor.org/stable/2951679> <https://doi.org/10.2307/2951679>
- Ratner, J. B. (1983). Government Capital and Production Function for U.S Private Output. *Economic Letters*, 13, 213-217. [https://doi.org/10.1016/0165-1765\(83\)90088-5](https://doi.org/10.1016/0165-1765(83)90088-5)
- Rodrik, D., & Di Tella, R. (2020). Labour Market Shocks and the Demand for Trade Protection: Evidence from Online Surveys. *Economic Journal*, 130, 1008-1030. <https://doi.org/10.1093/ej/ueaa006> [https://drodrik.scholar.harvard.edu/sites/scholar.harvard.edu/files/dani-rodrik/files/lab\\_or\\_market\\_shocks\\_and\\_demand\\_for\\_trade\\_protection.pdf](https://drodrik.scholar.harvard.edu/sites/scholar.harvard.edu/files/dani-rodrik/files/lab_or_market_shocks_and_demand_for_trade_protection.pdf)
- Romer, P. (1986). Increasing Returns and Long-Run Growth. *Journal of Political Econo-*

- my, 94, 1002-1037. <https://doi.org/10.1086/261420>
- Rosenstein-Rodan, P. N. (1943). Problems of Industrialization of Eastern and South Eastern Europe. *Economic Journal*, 53, Article ID: 202211. <https://doi.org/10.2307/2226317>
- Solow, R. M. (1957). Technical Change and the Aggregate Production Function. *Revue of Economics and Statistics*, 39, 312-320. <https://doi.org/10.2307/1926047>
- Stiglitz (2007). Rich Countries, Poor People? *New Perspectives Quarterly (NPQ)*, 24, 7-9. <https://doi.org/10.1111/j.1540-5842.2007.00856.x>
- Sturm, J. E., & De Haan, J. (1995). Is Public Expenditure Really Productive? New Evidence for the USA and the Netherlands. *Economic Modelling*, 12, 60-72. [https://doi.org/10.1016/0264-9993\(94\)P4156-A](https://doi.org/10.1016/0264-9993(94)P4156-A)
- Véganzonès, M. A., & Cerdi, C. F. (2000). Infrastructures, Investissement et Croissance: Un bilan de dix années de recherches. *Etudes et Documents du CERDI*, 7, 40 p.
- WDI (2020). *World Development Indicators 2020*. World Bank. <https://datatopics.worldbank.org/world-development-indicators/>
- World Bank (2017). *World Bank Annual Report 2017*. Washington DC. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/143021506909711004/world-bank-annual-report-2017>
- Young, A. (1991). Learning by Doing and the Dynamic Effects of International Trade. *The Quarterly Journal of Economics*, 106, 369-405. <http://hdl.handle.net/10.2307/2937942> <https://doi.org/10.2307/2937942>
- Zakane, A., & Sami, L. (2008). Effet d'un choc budgétaire sur les variables macroéconomiques: approche économétrique par utilisation des modèles VECM appliquée au cas de l'Algérie, Les cahiers du CREAD: Revue du Centre de Recherches en Économie Appliquée pour le Développement. *Alger*, 83-84, 47-68.
- Zergawu, Y., Walle, Y., & Giménez-Gómez, J. (2020). The Joint Impact of Infrastructure and Institutions on Economic Growth. *Journal of Institutional Economics*, 16, 481-502. <https://doi.org/10.1017/S1744137420000016>