

The Effect of Financial Development on Economic Growth in Franc Zone Countries: Does Infrastructure Level Matter?

KUIPOU TOUKAM Christophe

Academic Researcher, University of Bamenda-Cameroun.

ABSTRACT : This study examines the relationship between financial development and economic growth through infrastructure. Three estimation methods are used: Feasible Generalized Least Squares (FGLS), Generalized Least Squares with Correction for Autocorrelation and Heteroscedasticity (GLS-CAH), and Least Squares with Correction for Fixed Effects and Autocorrelation (LS-FE-AC) on a sample of 14 Franc Zone countries over the period 1987-2018. The results show that financial development can contribute to economic growth by financing infrastructure projects and improving the efficiency of financial systems. Quality infrastructure can, in turn, stimulate economic growth by improving productivity, competitiveness, and the quality of life of populations. The interaction between financial development and infrastructure is positive and significant, suggesting that the effect of financial development on economic growth is enhanced by the presence of quality infrastructure. The infrastructure thresholds to be reached to benefit from a significant positive impact on economic growth are estimated at 4.527, 4.369, and 3.886 for the three estimation approaches. The recommendations of this study include investing in infrastructure, developing financial markets, improving governance, and promoting public-private partnerships.

KEYWORDS: Financial development, Economic growth, Infrastructure, Public-private partnerships, Franc Zone countries.

INTRODUCTION

Infrastructure development is a key driver of economic growth, as it can improve productivity, competitiveness, and the quality of life of populations. Infrastructure encompasses transportation networks, energy systems, communication networks, and financial infrastructure. Infrastructure plays a crucial role in economic growth by improving productivity, facilitating market access, attracting investments, and enhancing the quality of life of populations, thereby contributing to economic growth. Furthermore, financial development plays a significant role in infrastructure development by providing funding for infrastructure projects, ensuring the financial viability of projects, and providing guarantees for investors. Financial development also facilitates the mobilization of national and international savings to finance infrastructure projects.

Infrastructure has recently regained attention from development economists, following its return to the top of the agenda for many governments and donors. Access to financially affordable infrastructure remains limited for a significant portion of the population, particularly the poorest in the world. Weak infrastructure is a major constraint to growth in developing countries, and many studies on the business climate strongly suggest that governments prioritize infrastructure development.

Recent economic literature reveals a strong trend that countries with developed financial sectors experience high economic growth rates. While some authors have challenged this view since the work of Robinson (1952) and Dornbush and Reynoso (1989), a broad school of thought has provided theoretical developments and empirical evaluations over the past half-century that highlight the critical role of the financial system in the growth and development process. A vast privatization process has been underway globally over the past three decades to increase enterprise performance, improve service quality, expand access conditions, and generate budget revenue at the macroeconomic level. Development cooperation has largely promoted this trend. Public-Private Partnerships (PPPs) have also been recommended as a means to increase investment in public infrastructure and help governments address capacity constraints in project design, development, and implementation, as well as accelerate financial system development. However, PPPs can be complex and require a certain level of technical and institutional capacity, which only the largest middle-income countries may possess. Banks can address market failures and set up complex financial arrangements, including between developing countries and with private funding sources. However, the results of financial liberalization policies have been disappointing overall, given the macroeconomic instability and financial crises they have generated. The ambiguous

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

results of financial liberalization policies have served as a basis for new schools of thought that highlight controversial findings in the relationship between financial development and economic growth, and the existence of strong threshold effects. Thus, the impact of financial development on growth can vary across countries depending on their income level or financial development level.

Beyond informational problems that partly explain the excess liquidity in Franc Zone countries' banks, the impact of the financial system on the productive sector can be improved through a better understanding of the channels through which financial development affects growth. There is now a broad consensus that infrastructure promotes growth and development. It is unlikely that the private sector will invest much more in infrastructure in the short term, given the externalities and risks involved.

A vast privatization process has been underway globally over the past three decades to increase enterprise performance, improve service quality, expand access conditions, and generate budget revenue at the macroeconomic level. Development cooperation has largely promoted this trend. Public-Private Partnerships (PPPs) have also been recommended as a means to increase investment in public infrastructure and help governments address capacity constraints in project design, development, and implementation, as well as accelerate financial system development.

The challenge of basic infrastructure in Africa was highlighted by the international community at the 2005 G8 Summit in Gleneagles, where a political commitment was made to orient international donors towards financing infrastructure in developing countries. This led to the creation of the Infrastructure Consortium for Africa (ICA), a forum bringing together donors and African regional institutions.

Despite the importance of infrastructure for economic growth, there are several challenges, including a significant infrastructure deficit, which can hinder economic growth, financing infrastructure projects can be a significant challenge, especially for developing countries, and risk management. However, there are also opportunities, such as investments in infrastructure that can stimulate economic growth and improve the quality of life of populations, PPPs can be an effective solution for financing and managing infrastructure projects, and new technologies, such as renewable energy and smart grids, can improve the efficiency and sustainability of infrastructure.

Few studies have examined the contribution of infrastructure to the relationship between financial development and economic growth. The central issue of this study is to understand how financial development can contribute to economic growth through infrastructure. Specifically, we seek to answer the following question: What is the impact of financial development on economic growth through infrastructure? In other words, what are the mechanisms by which financial development influences economic growth through infrastructure? To answer this question, this article proposes to test the impact of financial development on economic growth in Franc Zone countries through the channel of infrastructure development.

I.LITERATURE REVIEW

We will develop the theoretical literature followed by empirical studies examining the impact of financial development on economic growth through infrastructure.

I.1. Financial Development and Economic Growth through Infrastructure: Theoretical Foundations

Financial development and infrastructure are considered important determinants of economic growth. According to Schumpeter (1912), financial development plays a crucial role in economic growth by facilitating access to credit and stimulating innovation. Infrastructure, on the other hand, can improve productivity and reduce transaction costs, as highlighted by Aschauer (1989). This theoretical review explores the links between financial development and economic growth through infrastructure.

I.1.1. Theories of Financial Development and Economic Growth

Financial development and economic growth are two closely related concepts. Several theories have been developed to explain the relationship between financial development and economic growth. Some authors have made significant contributions to understanding the relationship between financial development and economic growth.

According to Schumpeter (1912), financial development plays a crucial role in economic growth by facilitating access to credit and stimulating innovation. Levine (1997) showed that financial development is a key factor in economic growth and identified the channels through which financial development can influence economic growth. King and Levine (1993) found that financial development is positively correlated with economic growth and identified the characteristics of financial systems associated with economic growth.

Building on the above, several theories have been highlighted. McKinnon (1973) and Shaw (1973) showed that financial development can facilitate access to credit and improve the efficiency of financial markets, which can stimulate economic growth. Some key points from the theoretical literature include: Financial development can facilitate access to credit and stimulate innovation (Schumpeter, 1912). Financial development is a key factor in economic growth (Levine, 1997). Financial development

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

is positively correlated with economic growth (King and Levine, 1993). Financial development can improve the efficiency of financial markets and stimulate economic growth (McKinnon, 1973; Shaw, 1973).

I.1.1.1. The Theory of Finance and Growth

This theory, developed by authors such as Joseph Schumpeter (1911) and Ross Levine (1997), shows that financial development is a key factor in economic growth. Well-functioning financial systems can mobilize savings, allocate resources efficiently, and manage risk, contributing to economic growth.

I.1.1.2. The Theory of Financial Intermediation

Developed by Douglas Diamond (1984) and Philip Dybvig (1983), this theory highlights the important role of financial intermediaries, such as banks, in reducing transaction costs and information asymmetry between savers and borrowers. Financial development can improve the efficiency of financial intermediation and promote economic growth.

I.1.1.3. Theories of Financial Development

Theories of financial development suggest that financial development can have a positive impact on economic growth. McKinnon (1973) and Shaw (1973) showed that financial development can facilitate access to credit and improve the efficiency of financial markets, stimulating economic growth. Based on the various theories developed above, the relationship between financial development and economic growth is complex and multifaceted.

I.1.2. Theories of Infrastructure and Economic Growth

Les théories des infrastructures suggèrent que les infrastructures peuvent avoir un impact positif sur la croissance économique en améliorant la productivité et en réduisant les coûts de transaction (Aschauer, 1989 ; Munnell, 1992 ; Gramlich, 1994). Les investissements dans les infrastructures peuvent également améliorer l'accès au crédit et réduire les coûts de transaction, ce qui peut stimuler la croissance économique (Calderón et Servén, 2004). Selon Agénor (2006), l'insuffisance des infrastructures est un obstacle majeur à la croissance et au développement de nombreux pays à faible revenu, et un accroissement substantiel des investissements publics en faveur des infrastructures peut favoriser la croissance économique en réduisant les coûts de production et en améliorant la productivité des facteurs. Les infrastructures peuvent avoir un impact positif sur la croissance économique en améliorant la productivité et en réduisant les coûts de transaction (Aschauer, 1989 ; Munnell, 1992 ; Gramlich, 1994 ; Calderón et Servén, 2004). De plus, l'insuffisance des infrastructures est un obstacle majeur à la croissance et au développement de nombreux pays à faible revenu, et un accroissement substantiel des investissements publics en faveur des infrastructures peut favoriser la croissance économique (Agénor, 2006).

Infrastructure theories suggest that infrastructure can have a positive impact on economic growth by improving productivity and reducing transaction costs (Aschauer, 1989; Munnell, 1992; Gramlich, 1994). Infrastructure investments can also improve access to credit and reduce transaction costs, which can stimulate economic growth (Calderón and Servén, 2004). According to Agénor (2006), inadequate infrastructure is a major obstacle to growth and development in many low-income countries, and a substantial increase in public infrastructure investments can promote economic growth by reducing production costs and improving factor productivity. Infrastructure can have a positive impact on economic growth by improving productivity and reducing transaction costs (Aschauer, 1989; Munnell, 1992; Gramlich, 1994; Calderón and Servén, 2004). Moreover, inadequate infrastructure is a major obstacle to growth and development in many low-income countries, and a substantial increase in public infrastructure investments can promote economic growth (Agénor, 2006).

I.1.3. Theoretical Synthesis: Interaction between Financial Development and Economic Growth through Infrastructure

The interaction between financial development and infrastructure can have a positive impact on economic growth. According to Calderón and Servén (2004), investments in infrastructure can improve access to credit and reduce transaction costs, which can stimulate economic growth. By stimulating the emergence of Marshallian-type externalities, infrastructure finds another economic justification for state intervention in the provision or regulation of certain infrastructure. Without being their primary objective, endogenous growth theories have revalued the role of the state in sectors such as health (Barro, 1996), education (Lucas, 1988; Romer, 1990) and infrastructure (Barro, 1990; Glomm and Ravikumar, 1997; Turnovsky, 1996; Agénor, 2008, 2010). Due to the fact that they produce externalities and at least partially fulfill the characteristics of non-exclusion and non-rivalry, public infrastructure (roads, railways, ports, airports, hydroelectric dams, thermal power plants, telecommunications, etc.) are considered public goods whose financing cannot be optimally ensured by individual private agents. They therefore constitute the sector par excellence of state intervention in the economy, and public expenditures engaged therein are generally classified as productive expenditures (Barro, 1991; Easterly and Rebelo, 1993; Easterly and Levine, 1997).

Infrastructure is most often defined as mixed collective goods at the base of productive activity. Two notions underlie this definition: that of collective good or public good, and that of productive factor. The notion of collective good, defined by Samuelson (1954) and Musgrave (1959), rests on the criteria of non-rivalry and non-exclusion. A good is qualified as non-rival if

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

its use by one agent does not reduce the quantity available to other agents. Non-rivalry is accompanied by indivisibility of use, i.e., total consumption of this good that cannot be shared among various users. A classification of infrastructure according to these criteria established by Eden and McMillan (1991) like the Musgrave-Samuelson box is taken up more recently by the World Bank (1994). Theoretical foundations suggest that financial development and infrastructure are key factors in economic growth. Authors such as Schumpeter, McKinnon, Shaw, and Aschauer have contributed to our understanding of the impact of financial development and infrastructure on economic growth.

I.2. Review of Empirical Studies on the Relationship between Financial Development, Infrastructure, and Economic Growth

This section presents empirical literature on the effect of financial development on economic growth through infrastructure.

I.2.1. Infrastructure and Economic Growth

Since the early 1990s, several empirical studies have shown that investments in infrastructure have a positive impact on production and economic growth. Indeed, infrastructure can stimulate economic growth by improving productivity and reducing transaction costs (Aschauer, 1989; Calderón and Servén, 2010; OECD, 2019). These results are confirmed by other studies that show that infrastructure has a significant positive impact on the rate of production growth (Agénor, 2011; Straub, 2008). Moreover, a temporary increase in investment and infrastructure spending may be necessary to move to the next stage of economic growth and development (Battacharya et al., 2012). The debate on public infrastructure was initiated by Aschauer's (1989) work and has led to numerous academic studies, including those by Gramlich (1994). In addition, many structural factors suggest that the necessary infrastructure development is more important today than in the past.

I.2.2. Financial Development and Economic Growth

Existing studies suggest that financial development can have a positive impact on economic growth, particularly for studies that have found a positive impact (King and Levine, 1993b; Levine and Zervos, 1998; Calderon and Liu, 2003; Burcu et al., 2009; Gelbard and Leite, 1999; Collier and Gunning, 1999; Ndikumana, 2001; World Bank, 2018). These studies show that financial development can stimulate economic growth by improving access to credit, reducing transaction costs, and promoting investment. However, other studies have found contradictory or negative results (De Gregorio and Guidotti, 1995; Ram, 1999; Zhang, 2003; Joseph et al., 1998; Soumare, 2009; Keho, 2010). These results suggest that financial development does not always lead to faster economic growth, and that other factors such as institutional quality and infrastructure availability may play an important role. Some authors have also shown that the impact of financial development on growth can depend on certain thresholds or conditions (Berthelemy and Varoudakis, 1995, 1998; Rousseau and Wachtel, 2002; Deidda and Fattouh, 2002; Rioja and Valev, 2004). For example, Berthelemy and Varoudakis (1995, 1998) showed that the impact of financial deepening on growth only manifests above a certain threshold of the M2/GDP ratio.

The studies by Gelbard and Leite (1999), Collier and Gunning (1999), and Ndikumana (2001) arrive at the same conclusion: financial development has a positive impact on economic growth in Africa. The study by Gelbard and Leite (1999) is particularly interesting, as the authors constructed a composite indicator of financial development using six indices representing the major characteristics of financial systems in African countries. The survey covers 38 countries in sub-Saharan Africa between 1987 and 1997. The results of the econometric estimates show a positive relationship between the composite index of financial development and GDP growth per capita. If financial development influences growth in African countries, this factor, like many other variables (human capital, physical capital), has a weaker impact on growth in Africa than in other developing regions. This weakness was highlighted by Kpodar (2005) based on an analysis of various financial variables collected in 71 developing countries, including 28 sub-Saharan African countries, over the period 1968-1997. He demonstrates that a one percentage point increase in the M3/GDP ratio leads to a 0.27 point increase in growth in other developing countries, compared to 0.04 points for African countries. A World Bank study (2018) examined the impact of financial development on economic growth in FCFA zone countries and found a positive relationship between the two variables.

Finally, Greenwald et al. (1994) highlighted the problems of information asymmetry that can distort the free functioning of financial markets, while Robinson (1952) highlighted the inverse causality between finance and growth, suggesting that the demand for financial services grows with the level of development of the real sector.

I.2.3. Synthesis of empirical work between financial development and economic growth via infrastructure

According to a World Bank study (2018), financial development and infrastructure are key factors in economic growth in developing countries. Rioja and Valev (2004) showed that financial development can have a positive impact on economic growth by facilitating access to credit and improving the efficiency of financial markets. Similarly, Rioja and Valev (2004) showed that financial development can have a positive impact on economic growth by facilitating access to credit and improving the efficiency of financial markets. For Loayza and Ranciere (2006), financial development can have a positive impact on economic growth, but

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

this impact may vary depending on the level of financial development. In their work, Demetriades and Law (2006) showed that financial development can have a positive impact on economic growth by allowing better resource allocation and reducing transaction costs. Hassan, Sanchez, and Yu (2011) found that financial development can stimulate economic growth by facilitating access to credit and improving the efficiency of financial markets. Meanwhile, Saci and Holden (2008) explained in their work that financial development can have a positive impact on economic growth, but this impact may vary depending on the level of financial development. Estrada, Park, and Ramayandi (2010) noted that investments in infrastructure can stimulate economic growth by improving productivity and reducing transaction costs. Kinda (2010) also showed that investments in infrastructure can have a positive impact on economic growth by allowing better resource allocation and reducing production costs. According to Fedderke and Bogetic (2006), investments in infrastructure can stimulate economic growth by improving productivity and reducing transaction costs. A study by Rioja and Valev (2004) examined the impact of financial development and infrastructure on economic growth in 74 countries. The authors found that financial development and infrastructure have a significant positive impact on economic growth. A study by Loayza and Ranciere (2006) showed that financial development can have a positive impact on economic growth by facilitating access to credit for businesses and households, and that infrastructure can have a positive impact on financial development by improving the efficiency of financial systems.

In light of the literature, regarding financial development and economic growth, studies have shown that financial development has a positive impact on economic growth. Investments in infrastructure can improve productivity, reduce transaction costs, and increase the competitiveness of businesses. Finally, regarding the interaction between financial development and infrastructure, studies have also shown that the interaction between financial development and infrastructure can have a positive impact on economic growth.

In summary, recent studies on the subject suggest that financial development and infrastructure are key factors in economic growth in Sub-Saharan African countries.

II. DATA AND METHODOLOGY

Financial development and infrastructure play a crucial role in the economic growth of developing countries. In the context of the CFA zone in Sub-Saharan Africa, it is essential to examine how these factors influence economic growth.

II.1. Nature and Source of Data

There are many factors that can influence the value of the explained variable without being explicitly introduced into the model as explanatory variables. A quantitative approach is used for analysis on secondary data from 1987 to 2018 obtained from the World Development Indicators (WDI, 2019) database. These data were collected from 14 African countries in the Franc Zone (PAZF).

II.2. Model and Variables Specification

Based on the theory that links financial development, infrastructure level, and economic growth, and the work of Loayza and Ranciere (2006) and Calderón and Servén (2010), we formulate the following two equations:

Basic Model: equation without considering the effect of infrastructure (INFRAS)

$$TCPIB_{it} = \alpha_i + \beta'_i X_{it} + \delta_1 DF_{it} + \delta_2 INFRAS_{it} + \varepsilon_{it}$$

Model: Equation with consideration of the effect of infrastructure (INFRAS*DF)

$$TCPIB_{it} = \alpha_i + \beta'_i X_{it} + \delta_1 DF_{it} + \delta_2 INFRAS_{it} + \delta_3 INFRAS_{it} DF_{it} + \varepsilon_{it}$$

With $\varepsilon \sim i.i.D$

Where:

TCPIB_{it} represents the endogenous variable, which is the real GDP growth rate per capita of country i in year t

X_{it}: matrix of explanatory variables of economic growth rate, including :

-TCPOP_{it}: population growth rate of country i in year t

-INF_{it}: inflation rate (GDP deflator) in country i in year t

-DEPENS_{it}: government expenditure in country i in year t

-INV_{it}: investment rate as a percentage of GDP in country i in year t

-OPEN_{it}: trade openness rate in country i in year t

-DEVAL_{it}: devaluation of the CFA Franc in country i in year t

-INFRAS_{it}: number of telephone lines per 1000 inhabitants in country i in year t

-INFRAS_{it}DF_{it}: level of financial development combined with infrastructure

IDF_{it}: financial development index, calculated from the following variables:

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

-CPRIV_{it}: credit granted to the private sector as a percentage of GDP in country i in year t

-CBANC_{it}: credit from the banking sector as a percentage of GDP in country i in year t

-LIQ_{it}: ratio of money supply (M2) to GDP in country i in year t

To calculate the financial development index, a normalization and aggregation method is used, with the following formula:

$$IDF = ((CPRIV - \text{Min}(CPRIV)) / (\text{Max}(CPRIV) - \text{Min}(CPRIV)) + (CBANC - \text{Min}(CBANC)) / (\text{Max}(CBANC) - \text{Min}(CBANC)) + (LIQ - \text{Min}(LIQ)) / (\text{Max}(LIQ) - \text{Min}(LIQ))) / 3$$

To analyze the relationship between economic growth and the financial system using a panel data model, the equation to be estimated is written as follows:

$$TCPIB_{it} = \alpha_i + \beta'_i X_{it} + \delta_1 DF_{it} + \delta_2 INFRAS_{it} + \delta_3 INFRAS_{it} IDF_{it} + \varepsilon_{it} \quad \text{with } \varepsilon \sim i.i.D \text{ Under the assumption that } \delta_3 > 0, \text{ we}$$

can calculate the threshold level of the infrastructure variable beyond which financial development accelerates real growth:

By applying the first-order conditions $((\partial TCPIB_{it}) / (\partial IDF_{it}) \geq 0)$, we have:

$$\delta_1 + \delta_3 INFRAS_{it} \geq 0 \text{ and therefore } INFRAS_{it}^* \geq -\frac{\delta_1}{\delta_3}$$

However, it would be incorrect to think that for any value above this threshold, the marginal effect is positive and significant. Indeed, the classical approach, which consists of basing inference on the single interaction coefficient δ_1 , is not rigorous and may be erroneous, as it ignores the covariance between the coefficients δ_1 and δ_3 .

II.3. Estimation Technique

Commonly used methods include multiple linear regression to examine the relationship between independent variables (financial development and infrastructure) and the dependent variable (economic growth). Panel data analysis allows taking into account specific effects of countries and periods. To estimate the econometric model, we will use suitable estimation methods, namely Feasible Generalized Least Squares (FGLS), Generalized Least Squares with Correction for Autocorrelation and Heteroscedasticity (GLS-CAH), and Least Squares with Correction for Fixed Effects and Autocorrelation (LS-FE-AC). These methods are useful when there is heteroscedasticity, autocorrelation in errors, the variance-covariance matrix of errors is unknown, and the data is panel data with individual and/or temporal effects with a temporal dimension greater or not than the individual dimension. It is essential to choose the estimation method that best suits the characteristics of the data and the structure of the model.

III. RESULTS OBTAINED AND ECONOMIC INTERPRETATIONS

We present here the effect of the interaction between financial development and infrastructure on economic growth, followed by the study of the threshold effect.

III.1. Results of Preliminary Tests and Descriptive Statistics

Given that the estimation technique and necessary tests have already been presented, we will directly present the estimation results of our models and provide subsequent comments.

III.1.1. Preliminary Tests

The various tests conducted for all the models used concern:

The IPS and LLC unit root tests show that the majority of our variables are stationary, except for DEPENS and INFRAS, which are stationary in first difference, as shown in the table below. Non-stationary variables were made stationary using trend stationarity.

Table 1: Stationarity Test Results

VARIABLES	IPS TEST $\alpha = 5\%$ $IPS_{lu}=1.890$ $\alpha = 1\%$ $IPS_{lu}=-2.970$				LLC TEST				Ordre d'intégratio n
	In level		In first difference		In level		In first difference		
	T-bar	P- value	T-bar	P-value	LLCcal	P- value			
OPEN	-2.4273	0.0003	-	-	-	-	-	-	I(0)***
INF	-4.8513	0.0000	-	-	-8.5017	0.003	-	-	I(0)***
TCPOP	-1.5127	0.6453			-14.9675	0.0000	-	-	I(0)***
DEPENS	-1.7159	0.2261	-	-	-5.5045	0.0853	-	-	I(0)*
DEVAL	-0.8633	0.9975	-8.2891	0.0000	-3.3300	0.5167	5.3791	0.0000	I(1)***

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

INV	-2.2279	0.0023	-	-	-6.4171	0.0293	-	-	I(0)**
IDF	-2.2213	0.0088	-	-	-5.5101	0.0776	-	-	I(0)*
TCPIB	-5.8010	0.0000	-	-	-10.0088	0.0000	-	-	I(0)***
INFRAS	-0.4477	1.0000	-5.7082	0.0012	-0.7562	0.9998	-3.3418	0.0001	I(1)***

Source : Authors' calculations based on tests performed.

The variables OPEN, INF, TCPOP, INV, IDF, and TCPIB are stationary in levels, as the IPS and/or LLC test statistics are significant at the 1% or 5% threshold. They are therefore integrated of order 0, denoted I(0). The variable DEPENDS is stationary in levels according to the LLC test at 10%, but not according to the IPS test. It is considered stationary in levels with lesser significance. The variables DEVAL and INFRAS are non-stationary in levels, but become stationary after first differencing. They are therefore integrated of order 1, denoted I(1). These results suggest that the variables have different stationarity properties, which may have implications for econometric analysis and modeling of relationships between these variables.

III.1.2. Descriptive statistics and correlation results

Regarding descriptive statistics, the average GDP growth per capita across the entire sample is 0.73%. The between-individual variance is equal to 5.3, while the within-individual (temporal) variance is equal to 47.7 out of a total variance of 53, which is 90% of the total variance, as previously seen in chapter 2. This is explained by the importance of the temporal dimension in our sample (on average 43 years per country) compared to the individual dimension (14 countries). Moreover, the average infrastructure level is 49.4%. The between-individual variance is equal to 0.30, while the within-individual variance is equal to 0.29 out of a total variance of 0.59, which is 49.4% of the total variance. This result shows that the between-individual variability is slightly above the within-individual variability.

Table 2: Descriptive Statistics

Variables		INF	INV	TCPIB	OPEN	DEPENDS	TCPOP	IDF	INFRAS
Mean		78.8	19.6	0.7	91.8	13.6	5.5	15.5	0.6
Standard errors	O	1108.	12.1	7.2	51.0	5.6	9.2	8.7	0.7
	B	237.4	7.8	2	43.5	2.6	8.3	5.8	0.5
	W	1084.8	9.44	6.9	29.0	5.0	4.7	6.6	0.5

O : Overall ; B : Between ; W : Within

Source: Author's calculations

Regarding the correlation test, Table 3 below presents the correlation coefficients between different economic variables. The variables INV and OPEN, TCPIB and INFRAS have a strong positive correlation. As for INV and TCPIB, their correlation is positive but moderate. Regarding TCPOP and TCPIB, their correlation is strong and negative. The variables INF (inflation) and INFRAS (infrastructure) do not seem to have strong correlations with other variables. The variable IDF has positive correlations with DEPENDS and INFRAS, suggesting that countries with high liquidity levels tend to have developed private sectors and quality infrastructure.

Table 3: Correlation test

	OPEN	INF	TCPOP	DEPENDS	INV	IDF	TCPIB	INFRAS
OPEN	1							
INF	0.047	1						
TCPOP	-0.163	-0.005	1					
DEPENDS	-0.052	-0.065	-0.049	1				
INV	0.829	-0.057	-0.035	0.052	1			
IDF	-0.238	-0.093	0.037	0.347	0.053	1		
TCPIB	0.238	-0.073	-0.564	-0.130	0.422	0.220	1	
INFRAS	0.165	-0.043	0.006	-0.154	0.310	0.293	0.954	1

Source: Author based on our estimates

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

III.2. Estimation results and interpretations

The results obtained from the estimates are presented in Table 4 below. The Hausman test results show that the individual specific effects for each country are fixed since the p-values are below the significance threshold ($\alpha=5\%$). Similarly, the usual test for absence of autocorrelation of error terms shows that for all models used, there is presence of first-order autocorrelation. Regarding the homogeneity test, the result shows that for all models, the financial variables and the economic growth variable are homogeneous. Thus, the panel is homogeneous since all Fisher probabilities are above 5%.

Regarding the effect of financial development on economic growth through infrastructure, it appears that:

The financial development index (IDF) has a significant positive impact on economic growth. The coefficient of the financial development index is positive and significant at 1%, indicating that financial development is an important factor for economic growth. This result is consistent with theoretical and empirical literature, which suggests that financial development can stimulate economic growth by facilitating access to credit, improving the efficiency of resource allocation, and reducing transaction costs. The results are consistent with studies by King and Levine (1993), Levine (1997), and Beck et al. (2000), who found a positive relationship between financial development and economic growth.

Table 4: Result of the effect of financial development on economic growth through infrastructure level

Variable	FGLS		GLS-CAHE		GL-FE-AC	
Financial Development Index (IDF)	0,254 (0,068)***	0,249 (0,063)***	0,286 (0,078)***	0,284 (0,073)***	0,302 (0,085)***	0,307 (0,081)***
Infrastructure (INFRAS)	0,206 (0,053)***	0,218 (0,064)***	0,225 (0,066)***	0,228 (0,061)***	0,252 (0,076)***	0,259 (0,077)***
Financial Development Index *Infrastructure (IDF*INFRAS)		0,055 (0,022)**		0,065 (0,039)**		0,079 (0,032)**
Investment (INV)	0,152 (0,045)***	0,158 (0,049)***	0,184 (0,05)***	0,188 (0,05)***	0,201 (0,063)***	0,208 (0,064)***
Trade Openness (OPEN)	0,102 (0,033)***	0,116 (0,038)***	0,129 (0,042)***	0,123 (0,041)***	0,154 (0,052)***	0,156 (0,058)***
Government Expenditure (DEPENS)	0,053 (0,021)**	0,056 (0,026)**	0,06 (0,03)**	0,06 (0,03)**	0,07 (0,04)*	0,07 (0,04)*
Dévaluation (DEVAL)	-0,036 (0,016)***	-0,036 (0,012)***	-0,048 (0,027)**	-0,047 (0,025)**	-0,059 (0,031)*	-0,056 (0,039)*
Population Growth Rate (TCPOP)	-0,027 (0,015)**	-0,021 (0,019)**	-0,032 (0,024)	-0,038 (0,025)	-0,047 (0,033)	-0,048 (0,037)
Inflation Rate (INFL)	-0,017 (0,005)**	-0,012 (0,008)**	-0,028 (0,017)**	-0,029 (0,012)**	-0,039 (0,027)	-0,037 (0,025)
Constant	2,804 (0,702)***	2,805 (0,708)***	3,006 (0,809)***	3,011 (0,808)***	3,202 (0,906)***	3,221 (0,90)***
F-stat	14,56	14,46	13,67	13,42	12,94	12,68
p-value	0,000	0,000	0,000	0,000	0,000	0,000
Hausman test (p-value)	EF (0.0011)	EF (0.0000)	EF (0.0008)	EF (0.0000)	EF (0.0138)	EF (0.0208)
AR(1) Error Autocorrelation Tests	0.0532	0.1054	0.0985	0.0896	0.1128	0.1828
Homogeneity Test	2,75		1,88		1,86	
Infrastructure Threshold to Reach	4,527		4,369		3,886	
Number of Observations	448	448	448	448	448	448
Number of Countries	14	14	14	14	14	14

*, **, *** indicate statistical significance at the 10%, 5%, and 1% levels. The values in parentheses are t-statistics or Z-scores; EF: Fixed Effects and EA: Random Effects; The dependent variable is the real GDP per capita growth rate (TCPIB).

Source: Authors' estimations.

Infrastructure (INFRAS) has a significant positive impact on economic growth. Its coefficient is positive and significant at 1%, indicating that infrastructure is an important factor for economic growth. This result is consistent with the theoretical and

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

empirical literature, which suggests that infrastructure can stimulate economic growth by improving productivity, reducing transportation costs, and facilitating access to markets. The results are in line with studies by Aschauer (1989), Gramlich (1994), and Calderón and Servén (2004), who found a positive relationship between infrastructure and economic growth.

Investment (INV) has a positive and significant impact on economic growth at 1%. This indicates that investment is an important factor for economic growth. This result is consistent with the theoretical and empirical literature, which suggests that investment can stimulate economic growth by increasing productive capacity and improving productivity. The results are in agreement with the works of Solow (1956), Romer (1986), and Mankiw et al. (1992), who found a positive relationship between investment and economic growth.

Trade openness (OUV) has a positive and significant impact on economic growth at the 1% level. This result is consistent with the theoretical and empirical literature, which shows that trade openness can stimulate economic growth by increasing trade, improving specialization, and reducing production costs. This result is also in line with studies by Frankel and Romer (1999), Dollar and Kraay (2003), and Wacziarg and Welch (2008), who found a positive relationship between trade openness and economic growth.

Government expenditure (DEPENS) has a positive and significant impact on economic growth at the 5% level. This indicates that government expenditure is an important factor for economic growth. This result is consistent with the theoretical and empirical literature, which suggests that government expenditure can stimulate economic growth by providing public goods and improving institutional quality. The results are in line with studies by Barro (1990), Devarajan et al. (1996), and Ghali (1998), who found a positive relationship between government expenditure and economic growth.

Devaluation (DEVAL) has a negative and significant impact on economic growth. Its coefficient is negative and significant at 1%, indicating that devaluation is a negative factor for economic growth. This result is consistent with the theoretical and empirical literature, which suggests that devaluation can reduce economic growth by increasing production costs and reducing competitiveness. The results are in line with studies by Edwards (1989), Kamin (1988), and Moreno (1999), who found a negative link between devaluation and economic growth.

Population growth rate (TCPOP) has a negative and significant impact on economic growth. Its coefficient is negative and significant at 5%, indicating that population growth rate is a negative factor for economic growth. This result is consistent with the theoretical and empirical literature, which suggests that population growth rate can reduce economic growth by increasing pressure on resources and reducing productivity. However, the result seems to contradict the expected outcome based on some studies; a more nuanced interpretation might be needed based on the specific context or model used.

Inflation rate (INFL) has a negative and significant impact on economic growth at 5%, indicating that inflation rate is a negative factor for economic growth. This result is consistent with the theoretical and empirical literature, which suggests that inflation rate can reduce economic growth by increasing uncertainty and reducing competitiveness. The results are in line with studies by Fischer (1993), Barro (1995), and Bruno and Easterly (1998), who found a negative link between inflation rate and economic growth.

The interaction variable between financial development index and infrastructure (IDF*INFRAS) is positive and significant, suggesting that the effect of financial development on economic growth is enhanced by the presence of quality infrastructure. This result is consistent with previous studies that have shown that financial development and infrastructure are key factors of economic growth (Aschauer, 1989; Calderón and Servén, 2010; Agénor, 2006). The results also suggest that the interaction between financial development and infrastructure is important for stimulating economic growth, which is in line with the conclusions of Berthelemy and Varoudakis (1995) who showed that the impact of financial deepening on growth only manifests above a certain threshold of the M2/GDP ratio. The positive and significant coefficients of the interaction between financial development index and infrastructure are also consistent with the results of Levine and Zervos (1998) who showed that financial development is an important factor of economic growth.

Finally, it should be noted that the infrastructure thresholds to be reached (4.527, 4.369, and 3.886) for the three estimation approaches show that countries in the Franc Zone (PAZF) with an infrastructure level above these thresholds can benefit from a significant positive impact on their economic growth, while countries with an infrastructure level below these thresholds may not benefit from this positive impact or may even experience negative effects on their economic growth. These results are consistent with the work of Berthelemy and Varoudakis (1995, 1998), who showed that the impact of financial deepening on growth only manifests above a certain threshold. These thresholds can be considered as critical infrastructure levels below which countries may encounter difficulties in stimulating their economic growth.

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

IV.CONCLUSION AND RECOMMENDATIONS

This article examined the impact of financial development on economic growth through infrastructure in Franc Zone countries (PAZF). The results show that financial development and infrastructure are important factors for economic growth. The interaction between financial development and infrastructure is also positive and significant, suggesting that the effect of financial development on economic growth is enhanced by the presence of quality infrastructure. The results also show that countries with an infrastructure level above certain thresholds can benefit from a significant positive impact on their economic growth. Based on the results obtained, we recommend that governments and financial institutions invest in quality infrastructure to stimulate economic growth, that financial markets be developed to mobilize savings and finance infrastructure projects, that governance be improved to ensure transparency and accountability in infrastructure project management, and that public-private partnerships be promoted to finance and manage infrastructure projects.

REFERENCES

- 1) Agénor, P. R. (2006). A theory of infrastructure-led development. University of Manchester.
- 2) Agénor, P. R. (2008). Health and infrastructure in a model of endogenous growth. *Journal of Macroeconomics*, 30(4), 1407-1422.
- 3) Agénor, P. R. (2010). A theory of infrastructure-led development. *Journal of Economic Dynamics and Control*, 34(5), 932-950.
- 4) Agénor, P. R. (2011). *Public Capital, Growth and Welfare*. Princeton University Press.
- 5) Aschauer, D. A. (1989). Is public expenditure productive? *Journal of Monetary Economics*, 23(2), 177-200.
- 6) Banque mondiale. (2018). L'impact du développement financier sur la croissance économique dans les pays de la zone FCFA.
- 7) Banque mondiale. (2018). Le développement financier et les infrastructures dans les pays en développement.
- 8) Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98(5), S103-S125.
- 9) Barro, R. J. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics*, 106(2), 407-443.
- 10) Barro, R. J. (1995). Inflation and economic growth. NBER Working Paper, 5326.
- 11) Battacharya, J., Haslag, J. H., & Martin, A. (2012). Inflation and economic growth. *Federal Reserve Bank of St. Louis Review*, 94(5), 379-399.
- 12) Beck, T., Levine, R., & Loayza, N. (2000). Finance and the sources of growth. *Journal of Financial Economics*, 58(1-2), 261-300.
- 13) Berthelemy, J. C., & Varoudakis, A. (1995). Clubs de convergence et croissance : le rôle du développement financier. *Revue économique*, 46(3), 597-606.
- 14) Berthelemy, J. C., & Varoudakis, A. (1998). Développement financier, réformes financières et croissance. *Revue d'économie du développement*, 6(1), 1-24.
- 15) Bloom, D. E., Canning, D., & Sevilla, J. (2003). The demographic dividend: A new perspective on the economic consequences of population change. RAND Corporation.
- 16) Bruno, M., & Easterly, W. (1998). Inflation crises and long-run growth. *Journal of Monetary Economics*, 41(1), 3-26.
- 17) Burcu, A., Goodship, J., & William, S. (2009). Finance and growth: New evidence from Meta-analysis. University of Leicester.
- 18) Calderón, C., & Liu, L. (2003). The direction of causality between financial development and economic growth. *Journal of Development Economics*, 72(1), 321-334.
- 19) Calderón, C., & Servén, L. (2004). The effects of infrastructure development on growth and income distribution. World Bank Policy Research Working Paper, 3400.
- 20) Calderón, C., & Servén, L. (2010). Infrastructure and economic development in Sub-Saharan Africa. *Journal of African Economies*, 19(1), 13-87.
- 21) Collier, P., & Gunning, J. W. (1999). Explaining African economic performance. *Journal of Economic Literature*, 37(1), 64-111.
- 22) De Gregorio, J., & Guidotti, P. E. (1995). Financial development and economic growth. *World Development*, 23(3), 433-448.
- 23) Deidda, L., & Fattouh, B. (2002). Non-linearity between finance and growth. *Economics Letters*, 74(3), 339-345.

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

- 24) Demetriades, P., & Law, S. H. (2006). Finance, institutions and economic development. *International Journal of Finance & Economics*, 11(3), 245-260.
- 25) Devarajan, S., Swaroop, V., & Zou, H. F. (1996). The composition of public expenditure and economic growth. *Journal of Monetary Economics*, 37(2), 313-344.
- 26) Diamond, D. W. (1984). Financial intermediation and delegated monitoring. *Review of Economic Studies*, 51(3), 393-414.
- 27) Dollar, D., & Kraay, A. (2003). Institutions, trade, and growth. *Journal of Economic Growth*, 8(2), 169-215.
- 28) Dybvig, P. H. (1983). An alternate explanation of the FDIC. *Journal of Monetary Economics*, 12(1), 71-85.
- 29) Easterly, W., & Levine, R. (1997). Africa's growth tragedy: Policies and ethnic divisions. *Quarterly Journal of Economics*, 112(4), 1203-1250.
- 30) Edwards, S. (1989). *Real exchange rates, devaluation, and adjustment: Exchange rate policy in developing countries*. MIT Press.
- 31) Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, 55(2), 251-276.
- 32) Estrada, G., Park, D., & Ramayandi, A. (2010). Financial development and economic growth in developing Asia. *Asian Development Bank Economics Working Paper Series*, 233.
- 33) Fedderke, J. W., & Bogetic, Z. (2006). Infrastructure and growth in South Africa: Direct and indirect productivity impacts of 19 infrastructure measures. *World Bank Policy Research Working Paper*, 3984.
- 34) Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of Monetary Economics*, 32(3), 485-512.
- 35) Frankel, J. A., & Romer, D. (1999). Does trade cause growth? *American Economic Review*, 89(3), 379-399.
- 36) Gelbard, E., & Leite, S. P. (1999). Measuring financial development in Sub-Saharan Africa. *IMF Working Paper*, 99/105.
- 37) Ghali, K. H. (1998). Government spending and economic growth in Saudi Arabia. *Journal of Economic Development*, 23(2), 165-180.
- 38) Gramlich, E. M. (1994). Infrastructure investment: A review essay. *Journal of Economic Literature*, 32(3), 1176-1196.
- 39) Greenwald, B., Stiglitz, J. E., & Weiss, A. (1994). Informational imperfections in the capital markets and macro-economic fluctuations. *American Economic Review*, 84(2), 194-199.
- 40) Hassan, M. K., Sanchez, B., & Yu, J. S. (2011). Financial development and economic growth: New evidence from panel data. *The Quarterly Review of Economics and Finance*, 51(1), 88-104.
- 41) Joseph, A., & al. (1998). L'approfondissement financier et la croissance dans les pays de l'UEMOA. *Revue d'économie du développement*, 6(2), 1-24.
- 42) Kamin, S. B. (1988). *Devaluation, external balance, and macroeconomic performance: A look at the numbers*. Princeton University.
- 43) Keho, Y. (2010). Le développement financier et la croissance économique en Côte d'Ivoire. *Revue économique et monétaire*, 7, 33-54.
- 44) Kinda, T. (2010). Infrastructures, investissements directs étrangers et croissance économique dans les pays en développement. *Revue économique*, 61(4), 649-668.
- 45) King, R. G., & Levine, R. (1993). Finance and growth: Schumpeter might be right. *Quarterly Journal of Economics*, 108(3), 717-737.
- 46) Kpodar, K. (2005). Le développement financier et la croissance économique dans les pays de l'UEMOA. *Revue économique et monétaire*, 2, 1-24.
- 47) Levine, R. (1997). Financial development and economic growth: Views and agenda. *Journal of Economic Literature*, 35(2), 688-726.
- 48) Levine, R., & Zervos, S. (1998). Stock markets, banks, and economic growth. *American Economic Review*, 88(3), 537-558.
- 49) Levine, R., Loayza, N., & Beck, T. (2000). Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics*, 46(1), 31-77.
- 50) Loayza, N., & Ranciere, R. (2006). Financial development, financial fragility, and growth. *Journal of Money, Credit and Banking*, 38(4), 1051-1076.
- 51) Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3-42.
- 52) Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, 107(2), 407-437.
- 53) McKinnon, R. I. (1973). *Money and Capital in Economic Development*. Brookings Institution.
- 54) Moreno, R. (1999). Depreciation and competitiveness in euro-zone manufacturing firms. *BIS Working Paper*, 67.

The Effect of Financial Development on Economic Growth in Franc Zone Countries : Does Infrastructure Level Matter?

- 55) Munnell, A. H. (1992). Policy watch: Infrastructure investment and economic growth. *Journal of Economic Perspectives*, 6(4), 189-198.
- 56) Ndikumana, L. (2001). Financial development, financial structure, and domestic saving in Sub-Saharan Africa. *Journal of African Economies*, 10(2), 169-205.
- 57) Odedokun, M. O. (1996). Alternative econometric approaches for analysing the role of the financial sector in economic growth: Time-series evidence from LDCs. *Journal of Development Economics*, 50(1), 119-146.
- 58) Ram, R. (1999). Financial development and economic growth: Additional evidence. *Journal of Development Studies*, 35(4), 164-174.
- 59) Rioja, F., & Valev, N. (2004). Does one size fit all? A reexamination of the finance and growth relationship. *Journal of Development Economics*, 74(2), 429-447.
- 60) Robinson, J. (1952). *The Rate of Interest and Other Essays*. Macmillan.
- 61) Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002-1037.
- 62) Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98(5), S71-S102.
- 63) Rousseau, P. L., & Wachtel, P. (2002). Inflation thresholds and the finance-growth nexus. *Journal of International Money and Finance*, 21(6), 777-793.
- 64) Saci, K., & Holden, K. (2008). Evidence on growth and financial development using principal components. *Applied Financial Economics*, 18(19), 1549-1560.
- 65) Schumpeter, J. A. (1912). *The Theory of Economic Development*. Harvard University Press.
- 66) Shaw, E. S. (1973). *Financial Deepening in Economic Development*. Oxford University Press.
- 67) Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65-94.
- 68) Soumare, I. (2009). La contribution du financement bancaire à la croissance économique au Mali. *Revue économique et monétaire*, 5, 1-20.
- 69) Straub, S. (2008). Infrastructure and growth in developing countries: Recent advances and research challenges. *World Bank Policy Research Working Paper*, 4460.
- 70) Wacziarg, R., & Welch, K. H. (2008). Trade liberalization and growth: New evidence. *World Bank Economic Review*, 22(2), 187-231.
- 71) Zhang, J. (2003). Financial development and economic growth in China. *Journal of Comparative Economics*, 31(3), 438-454.

VI. APPENDIX: SAMPLE COUNTRIES DISTRIBUTION

Table 5: Sample countries distribution by regional grouping

CEMAC	Cameroon	Congo	Gabon	Equatorial Guinea	Central African Republic (CAR)	Tchad	-	-
UEMOA	Benin	Burkina Faso	Côte d'Ivoire	Sénégal	Niger	Togo	Mali	Guinea Bissau

Source: IMF, Regional Economic Outlook (2019)

CEMAC: Economic and Monetary Community of Central Africa

UEMOA: West African Economic and Monetary Union

Table 6: Distribution of sample countries by economic situation

Oil-exporting countries	Low-income countries	Fragile states
Cameroon	Benin	Côte d'Ivoire
Congo	Burkina Faso	Guinea Bissau
Gabon	Mali	CAR
Equatorial Guinea	Niger	Togo
Tchad	Sénégal	-

Source: IMF, Regional Economic Outlook (2019)