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Comparative Analysis of the Determinants of Private Investment in WAEMU and CAEMU Zones

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ABSTRACT

Private investment and public investment are important factors in economic growth and the fight against poverty. Private investment remains an essential link in the economic flow and makes it possible to create wealth. This study uses panel data covering the period 2007-2017 to conduct a comparative analysis of the determinants of private investment in the WAEMU and CAEMU zones. The empirical results based on the OLS and FMOLS estimators are summarized as follows: (1) The variables are mostly non-stationary in level, but there is a long-term cointegration relationship between them making private investment a stable function; (2) The results obtained from the FMOLS method are more robust than those obtained from the OLS method through the significance of the coefficients of the explanatory variables; (3) At the CAEMU level, more variables explain the variation of private investment than at the WAEMU level and the elasticities of the variables of the CAEMU zone are higher than those of the variables of the WAEMU zone.

KEYWORDS: public investment, WAEMU, CAEMU, panel data.

Classification J. E. *L.: C10, C15, O11, P51*

1. Introduction

Of all economic debates, investment, whether public or private, plays a major role in the development of a nation. Public investment is an important factor in economic growth and the fight against poverty. In the same way, private investment remains an essential link in the economic flow and makes it possible to create wealth. While public investment and private investment all contribute to economic development, their roles differ in achieving economic objectives. The government, through its resource allocation function, produces goods and services for which social benefits are different from the economic benefits of the private sector. These products, which concern national defense, education, health, infrastructure, etc., can be obtained more easily by the government than by the private sector (Hounsou, 2017). On the other hand, private investment is based on a cost-benefit approach. The cost part of this cost-benefit analysis involves several factors that are related to the business environment that may vary from one country to another. Depending on whether the country is poor or rich, or more corrupt or less corrupt, the dynamics of the business climate may be weak or strong. The determinants of the profitability of investment may be related to the size of the economy, the productive potential of the economy, and economic stability. From a theoretical point of view, a country that attracts investment in the form of capital, technology transfer and skills of individuals is a country in which institutions and laws promote production rather than corruption, the country is open to international trade and competition and also economic institutions are stable (Jones, 1998).

It goes without saying that private investment is closely linked to public investment. Without significant public investment, the private sector cannot effectively and sustainably invest, and as a result, productive investment can no longer support macroeconomic growth. This stability of the economy goes through several macroeconomic policies such as monetary, fiscal, commercial, technological, financial, and so on. Thus, the macroeconomic framework facilitates a productive interface between the public and private sectors. Hounsou (2017) shows that public investment is necessary for the provision of public goods in the WAEMU countries. Hence, the study shows that public investment spending can promote economic growth when allocated in order of importance in education, health, infrastructure and agriculture. The present study extends this article on public investment by addressing private

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investment not only in the WAEMU zone, but more specifically in the Franc Zone. This involves conducting a comparative analysis of the determinants of private investment in the Franc Zone. This zone includes two economic and monetary unions that are WAEMU and CAEMU. The WAEMU zone comprises eight countries (Benin, Burkina Faso, Ivory Coast, Guinea Bissau, Mali, Niger, Senegal and Togo) and the CAEMU zone concerns six countries (Cameroon, Central African Republic, Congo, Gabon, Equatorial Guinea and Chad). Monetary policy in the Franc Zone countries is linked to monetary and financial cooperation agreements between France and these countries. These agreements are essentially based on (i) a fixed exchange rate between the French Franc (Euro) and the CFA Franc, (ii) a convertibility guarantee extended to the CFA Franc through the operation account mechanisms opened to the French Treasury. and (iii) centralization of external assets through the French Treasury followed by harmonization of foreign exchange regulations within the Franc Zone countries and abroad for countries outside the Franc Zone. However, fiscal discipline in these two areas through improved per capita income for the well-being of the population, control over the weight of the debt, and the ability to attract more foreign investment presents some differences at the level of the two zones. Budgetary practices by governments in the two zones are not likely to preserve the same macroeconomic stability as a guarantee for private investment, among others. Thus, we wonder whether at the level of the two zones and more specifically within each zone if the same behaviors are observed facing the determinants of the private investment which represents a significant part in the global investment and which influences positively economic growth when this growth differs from one country to another, from one area to another. Despite the abundance of literature on investment and more particularly on private investment, the present work has the distinction of conducting a comparative analysis based on a specific and appropriate methodology and the introduction of new explanatory variables beside the traditional determinants of private investment. As a result, the contributions of this study are diverse. Identifying the main factors of private investment in the Franc Zone allows managers to develop or reformulate development policies related to private investment. The study highlights some variables on which policymakers in both areas can act to improve the level of private investment. Indeed, it is not enough to show that a variable has an effect on private investment. It must be usable or exploitable by policy makers for a better orientation of fiscal policies to implement for their harmonization with monetary policy. As a result, a rise in the level of private investment can increase employment and ensure sustained and sustainable growth in the Franc Zone. Promoting private investment requires knowledge of its determinants to better define and guide incentive policies that can increase private sector investment capacity. Finally, a comparative analysis is likely to help these two zones to improve and accelerate the convergence of their fiscal policies.

The organization of the rest of the work is as follows: Section 2 discusses the literature review. Section 3 presents the methodology used to analyze the determinants of private investment. The results are analyzed and compared in Section 4. The last section concludes the work.

2. LITERATURE REVIEW

Private investment consists of the purchase by companies and households of investment goods. Households buy new homes that are a part of the investment. Companies are making replacement, expansion and productivity investments. The theory teaches that the quantity of capital goods required depends on many factors in particular on the rates of return. It is also possible to make productive investments in the form of capital, technology transfer, know-how and openness to international competition when the country enjoys macroeconomic and institutional stability (Jones, 1998). Theoretical teachings also predict the impact of public investment on private investment and the substitute between the two categories of investment (Aschauer and Lächler, 1998, Earsterly et al., 1989). Dhaoui (2016) demonstrates that the determinants of private investment depend on real, financial and institutional factors. The real determinants of private investment are costs, accelerator principle and public investment. The financial determinants concern savings, interest rate, return on investment, profit, credit to the private sector and external debt. The institutional determinants rely on the political and institutional framework, country risk, corruption, bad governance and political stability.

From an empirical point of view, there have been many studies devoted to analyzing the determinants of investment, particularly at the level of developing countries. Blejer and Khan (1984) investigated the possible existence of a complementarily or substitutability relationship between private investment and public investment in developing countries by basing their study on the accelerator model. Their results show that the level of private investment is positively related to the change in the anticipated real GDP and that public investment, mainly in infrastructure, positively influences private investment. Khan and Kumar (1997), from a sample of 95 developing countries, test a conditional convergence equation by integrating the public investment and private investment explanatory variables over the period 1970 -1990. The results indicate, among other things, that the impact of private investment is twice that of public investment. They conclude that the effectiveness of public investment is weakening. Thiam (1999), basing his studies on 40 developing countries, shows that the increase in savings and investment has a positive effect on per capita income. Also, Ashipala and Haimbodi (2003) develop two long-term relationships between the

level of economic activity measured by GDP and private and public investments in Namibia. The results point to the existence of complementarities between private and public investment. Mansouri (2003), using a time series model estimated by ordinary least squares (OLS), shows that in Morocco, public capital expenditure has a ripple effect on private investment and economic growth. On the other hand, public consumption expenditure crowds out private investment and slows economic growth. Matwang'a's (2000) study of the determinants and constraints of private investment in Kenya shows a positive correlation between GDP and private investment. In the Franc Zone, studies have highlighted the importance of investment, especially private investment in the economy and its impact on economic growth. At the CAEMU level, Fouopi et al. (2014), using a Panel Smooth Treshhold Regression transition model, have shown that investment, in this case, in the form of public spending on education and health positively impacts economic growth. At the WAEMU countries level, studies indicate the importance of investment. Tenou (1999) shows that among the control variables that influence per capita income in WAEMU countries, the investment rate, the rate of increase in exports and the rate of consumption are the most important. Aw (2006), using the generalized least squares estimation methodology, studies the determinants of private investment in WAEMU countries. The results indicate that GDP, public investment and credit to the economy positively impact private investment while the interest rate and the exchange rate have a negative effect on private investment.

3. METHODOLOGY

3.1 Empirical model

Macroeconomic theory suggests that the traditional determinants of private investment include GDP, interest rates, credit to the economy and the degree of openness of the economy. However, for small open economies with all the deficiencies that characterize them as those in the Franc Zone, the factors that favor foreign direct investment in addition to local private investment go beyond the classical determinants. Private investment which is a factor of economic growth is therefore important to formulate a function of private investment in an open economy characterized by an environment of globalization by including in the model other determinants such as the tax burden and the global logistics performance index. These two new variables alone can explain the variation of the private investment rate in a certain proportion. Thus, the model we propose in this study is that of a function of private investment in open economy specified in panel and expressed in logarithm neperian (ln).

$$lnPI_{it} = \alpha + \eta_i + \theta_t + \beta_1 lnGDP_{it} + \beta_2 r_{it} + \beta_3 GLPI_{it} + \beta_4 TB_{it} + \beta_5 CE_{it} + \beta_6 DO_{it} + \varepsilon_{it} \quad \textbf{(1)}$$

In this equation, the dependent variable PI refers to private investment. For the independent variables, GDP represents the real domestic product; r is the real interest rate; GLPI is the global logistics performance index; TB is the tax burden; CE means credit to the economy and DO is the degree of openness. We consider a panel of observations on (i = 13) countries in the Franc Zone (of which 8 for WAEMU and 5 for CAEMU) and t periods from 2007 to 2017. The coefficient η_i takes into account the heterogeneity of the member countries of the Franc Zone; θ_t is the shock common to all countries while ε_{it} is the global residual of the model. The parameters $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 represent the coefficients to be estimated for each group of countries in the Franc Zone (WAEMU and CAEMU).

3.1.1 Specification of the dependent variable

This is private investment (PI) measured by gross fixed capital formation (GFCF). This consists of expenditures on tangible fixed assets of the economy in addition to net changes in inventories. Tangible capital assets include plants, machinery and equipment purchases, private residential units, land improvements, and commercial and industrial buildings. Inventories are inventories of goods held by firms to respond to unforeseen fluctuations in production or sales as well as unfinished works. Private investment, according to classical and Keynesian theories, is a factor of economic growth likely to generate effects of technological externalities (Lucas, 1988, Guellec and Ralle, 1997, Nubukpo, 2007).

3.1.2 Specification of the independent variables

Here we present the explanatory variables retained by our model. These are: (1) Real GDP, which measures the total income of everyone in the economy of a country deflated by inflation for a given period. Empirical studies have shown that there is a positive relationship between private investment and real GDP (Blejer and Khan, 1984, Ghura and Hajimichael, 1996, Ojo and Oshikoya, 1995); (2) For the real interest rate, Keynesian theory teaches us that investment is a negative function of the (nominal) interest rate. With respect to the real interest rate, which represents the cost of capital for the firm, the lower it is, the higher the private investment rate, and the greater the profit (Mathis and Reichlin, 1992). From the point of view of the theory, the interest rate depresses GDP (crowding out effect). According to Fitoussi and Phelps (1988), this negative effect of the real interest rate on economic activity may persist over time; (3) The global logistics performance index is defined as an index reflecting the perceptions of a country's logistics based on the efficiency of customs clearance processes, the quality of commercial infrastructure and related transport infrastructure, the ease of organizing competitively priced shipments, the quality of infrastructure services, the ability to track and trace consignments, and the frequency with which shipments reach recipients in a timely manner (World Bank). The index moves on a scale of 1 to 5

and the highest score represents the best performance. The index is produced by the World Bank in partnership with academic and international institutions as well as private companies and people active in the international logistics market. An improvement in this index is reflected in an increase in private investment; (4) Regarding the tax burden, this is the degree of fiscal freedom (DFF) which is a specific indicator developed by the Heritage Foundation in collaboration with the Wall Street Journal on a scale ranging from 0 to 100. A high degree of 100 means that the tax burden is low, meaning that households and businesses have little tax to pay. Conversely, a low degree close to 0 means that the tax burden is high for both businesses and households. In the context of our study, and to facilitate interpretations, we have considered the tax burden variable equal to 100 - DFF. Thus, a degree close to 100 means that the tax burden is high for businesses and for households and vice versa when the degree is close to 0. In other words, there is a negative relationship between the private investment and the tax burden. Hence, taxation is a determining factor of investment when it is balanced; (5) According to the IMF, domestic credit to the private sector refers to the financial resources provided to the private sector by financial corporations in the form of loans, commercial credits and other accounts receivable which constitute receivables to be repaid. In some countries, these receivables include credits granted to public enterprises (Dhaoui, 2016). Blejer and Khan (1984) empirically establish that there is a positive relationship between private investment and credit to the private sector. Thus, for our study, credit to the economy serves as a proxy for public investment. Indeed, public investment according to macroeconomic theory plays a preponderant role in the creation of wealth. Barro (1990) finds productive public spending in infrastructure, education, health, and others as a motive for a long-term economic growth. Similarly, theory predicts the existence of a degree of complementarily or substitutability between public investment and private investment and that one stimulates the other (Turnovsky, 1995). Various empirical studies have highlighted the importance of public spending in stimulating economic growth, particularly at the WAEMU level (Hounsou, 2017). Finally, other studies have examined the competitiveness between public investment and private investment. Barro and Sala-I-Martin (1995) find that public capital positively impacts the profitability of private capital. Khan and Kumar (1997) show that the impact of private investment is approximately the double of that of public investment; (6) The degree of openness is reflected in a sharp increase in foreign trade and interdependence with the rest of the world. The degree of trade openness measures the share of trade in a country's GDP. The economic development of exports makes it possible to loosen the external constraint. It facilitates the import of non-locally produced capital, which has the effect of boosting growth. In general, openness to the rest of the world, which indicates a country's dependence on the outside world, is supposed to increase economies of scale by allowing the diffusion of technology and the diversification of goods produced (aw, 2006). In the particular case of the WAEMU, Vamvakidis (1998) reveals a positive relationship between private investment and the degree of openness of the economy.

3.2 Estimation method

The estimation method partly uses the one used by Hounsou (2017) to analyze the determinants of money demand in the Franc Zone. Thus, the use of panel data is becoming increasingly important in recent empirical studies (Baltagi, 2001, Wooldridge, 2002, and Mignon 2004). For a group of units (countries, industries, households, etc.), panel data includes both snapshot data and time series data. As a result, panel data provides more varied information that is useful in enhancing the effectiveness of statistical tests such as unit root or cointegration tests. To test the stability of private investment, studies have relied on panel data and econometric techniques of non-stationary time series. In general, a time series is said to be non-stationary or has a unit root if the distribution of the series does not change over time. Therefore, a stationary time series suggests that the future behaves like the past, at least in "probabilistic" terms. Non-stationary time series produce estimators, statistical tests and erroneous predictions, as is the case with fallacious regressions. Also, the concept of cointegration derives from non-stationary time series. Hence, two series are cointegrated if they are both non-stationary, but their linear combination is stationary. We briefly present these two types of tests as part of the panel data.

3.2.1 Unit root tests

The most commonly used unit root tests in panel data are based on the work of Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003). These two tests result from the unit root test of the Augmented Dickey-Fuller (*DFA*) series based on the following equation:

$$\Delta Z_{it} = \rho_i Z_{i,t-1} + \sum_{j=1}^{p} \theta_{ij} \Delta Z_{i,t-j} + \alpha_i + \varepsilon_{i,t} \qquad (2)$$

Where Zi_t is the variable of choice, εi_t is the residue which is a white noise, with i = 1, ..., N, representing the individual elements of the panel, and t = 1, ..., T, the temporal dimension. The null hypothesis: H0: = 0, $\forall$ *i* indicates that Z_{it} is non stationary and therefore cannot converge. On the other hand, the alternative hypothesis*: H_1: <0* is that Z_{it} converges. Levin, Lin and Chu (2002) impose an identical convergence of the individual elements ($\rho_1 = \rho_2 = \ldots = \rho_i = \rho$), that is they converge at the same rate. On the other hand, Im, Pesaran and Shin (2003) relax the hypothesis of identical convergence, which makes it possible to envisage a heterogeneity of ρ , which can be adjusted at different levels.

3.2.2 Cointegration tests

We use in this study two cointegration tests adapted to empirical panel data studies. These tests are by Pedroni (1999, 2001) and Kao (1999). First, Pedroni examines the characteristics of spurious regressions to suggest cointegration tests related to residual series. It proposes seven types of statistical tests divided into two categories. The first group consists of four tests based on the within (intra) dimension that analyze the intra-individual correlations of the residual series. These tests are the test-*v* panel, the test-*ρ* panel, the test-*PP* panel and the test-*ADF*. The first three tests are nonparametric and similar to the unit root test of the individual series of Phillips-Perron (1998). The last test is parametric and similar to the *ADF* test. The other group of tests consists of three tests based on the between (inter) dimension to take into account inter-individual correlations of the residual series. These tests are the test-*v* panel, the test-*ρ* panel, the test-*PP* panel and the test-*ADF*. Like in the previous case, the first two tests are nonparametric whereas the last test is parametric and similar to the test of Im, Pesaran and Chu (2003). The characteristics of these tests are as follows: the null hypothesis assumes that the residuals are non-stationary, that is to say, that there is no cointegration relation between the variables used. The alternative hypothesis, on the other hand, suggests the stationary of the residues and therefore the existence of the cointegrated relations between the variables. Then, the Kao test (1999) follows the same ADF type cointegration principles based on regression residuals. In particular, Kao (1999) uses cointegration vectors supposed to be homogeneous between individuals. The null hypothesis assumes that the residuals are stationary, whereas the alternative hypothesis shows that the residuals are stationary and in this case there exist cointegration relationships between the variables.

3.2.3 Model estimation

To estimate the long-run equilibrium relationship of the private investment function (equation 1) in the Franc Zone (WAEMU and CAEMU), we use two econometric methods, namely the ordinary least squares (OLS) method and the fully modified ordinary least squares (FMOLS). In the presence of heterogeneous panels, the characteristics of these methods are as follows: the OLS method confers slope coefficients which are consistent but suffer from problems of endogeneity of the regressors and problems of serial correlation of the residues. The alternative method FMOLS by Phillips and Hansen (1990) and Pedroni (1999) produces robust estimators regardless of the size of the sample used. Also, the FMOLS estimators are unbiased and converge asymptotically toward the normal, centered, and reduced distribution. In addition, the method corrects the problems of endogeneity of the regressors and the problems related to the autocorrelation and heteroscedasticity generally associated with panel data.

3.3 Characteristic data

The period of our study planned to be longer is reduced to the period 2007 - 2017, due to the unavailability of data on certain explanatory variables without which the study no longer presents a definite advantage or an added value. Hence, these independent variables are the synthetic indices linked to the tax burden and global logistics performance variables that are variables of choice in the assessment of private investment. These variables of first rank for our study are available for most countries only from the year 2007. It is to mitigate especially this situation which appears as an insufficiency that the study uses as an alternative to the OLS method the FMOLS method that produces robust estimators regardless of the size of the sample used. Thus, the relatively short period of our study does not detract from its validity. The results obtained would remain unchanged even though the study period was longer than 2007- 2017. The sources of our data come from the World Bank, the IMF and other specialized international institutions. Finally, as it is often the case in developing countries where data for some variables are missing over a period of time or not available, we observe at the Central African Republic level that data are not available for certain variables. The tendency has been to omit this country from econometric studies and to conclude from the "biased selection" of countries that are rich in data (Honohan, 1992).

4. EMPIRICAL RESULTS AND COMPARATIVE ANALYSIS

To study the long-term relationships of the time series of panel data we use, two tests are successively applied: unit root tests and cointegration tests.

3.4 Results of unit root tests

Tables 1 and 2 contain the results of the panel unit root tests of Levin, Lin and Chu (2002) and Im, Pesaran, and Shin (2003) for UEMOA and CEMAC, respectively. The first column of the tables gives the results of the series in level and the second column illustrates the results when the series are differentiated.

Table 1: Unit Root Tests of Panel Series (WAEMU)

Series	Methods	Level	Difference
LnPI	Levin, Liu et Chin	-0.7595	6.5902***
	Im, Pesaran and Shin	0.7673	-2.8278***
LnGDP	Levin, Liu and Chin	-7.2441***	
	Im, Pesaran and Shin	3.7594	-1.9564***

r	Levin, Liu ans Chin	-6,5357***	
	Im, Pesaran and Shin	-2.6608***	
GLPI	Levin, Liu and Chin	-1.7266***	
	Im, Pesaran and Shin	-0.3294	-2.5753***
TB	Levin, Liu and Chin	-0.84	-27.256***
	Im, Pesaran and Shin	-0.6131	-8.3131***
CE	Levin, Liu and Chin	-1.7566***	
	Im, Pesaran and Shin	0.6961	-2.7055***
DO	Levin, Liu and Chin	-1.3637	-3.6698***
	Im, Pesaran and Shin	0.051	-3.0051***

The asterisk (***) indicates that the value is statistically significant at the 1% significance level.

Table 2 : Unit Root Tests of Panel Series (CAEMU)

Series	Methods	Level	Difference
LnPI	Levin, Liu and Chin	0.4554	-1.4892***
	Im, Pesaran and Shin	0.6579	0.0519***
LnGDP	Levin, Liu and Chin	-3.2189***	
	Im, Pesaran and Shin	-0.1267	-1.0082***
r	Levin, Liu and Chin	-1.384	-3.2084***
	Im, Pesaran and Shin	0.4301	-1.7198***
GLPI	Levin, Liu and Chin	-0.4059	-3.8752***
	Im, Pesaran and Shin	0.2793	-2.3039***
TB	Levin, Liu and Chin	0.0222	-2.6469***
	Im, Pesaran and Shin	1.7768	-1.0701***
CE	Levin, Liu and Chin	-1.552	1.5999***
	Im, Pesaran and Shin	0.8096	-0.6498***
DO	Levin, Liu and Chin	0.7868	-1.7884***
	Im, Pesaran and Shin	0.9314	-1.2296***

The asterisk (***) indicates that the value is statistically significant at the 1% significance level.

The unit test results are consistent with unit root tests in most macroeconomic series. In addition, the results show characteristics that are specific to WAEMU and CAEMU zones. In the CAEMU zone, we observe that the lnPI, r, GLPI, TB, CE and DO series admit unit roots in level, but become stationary in first difference. In other words, these series are integrated of order I, I (1). Only the series lnGDP has no unit root in level and so is I (0), that is, it is stationary in level. On the other hand, in the WAEMU zone, only the lnPI, TB and DO series admit unitary roots in level, but become stationary in first difference. These series are thus integrated of order I, I (1). The series lnGDP, r, GLPI and CE do not have a unit level root and therefore I (0) meaning that they are stationary in level.

3.5 Results of cointegration tests

Tables 3 and 4 contain all the results of the cointegration tests of Pedroni (1999, 2001) and Kao (1999). Table 3 presents the results of the WAEMU private investment function equation, while Table 4 presents the results related to the CAEMU zone for the private investment function.

Table 3: Panel Cointegration Test of Variables in WAEMU zone.

I- Cointegration tests of Pedroni residues.	
A- Panel Tests : Intra-individual (Intra)	
Statistics v panel :	-1.389353
Statistics p PP of panel:	3.630313
Statistics t PP panel :	-9.498223**
Statistics t panel ADF :	-5.448500**
B- Panel Tests : Inter-Individual Dimension (Inter)	

Statistics p Group PP :	4.918376
Statistics t Group PP :	-17.89679**
Statistics t ADF Group :	-5.489580***
II- Kao Residue Intégration Tests	
Test-statistics	-4.736011***

The asterisks (***) and (**) indicate that the values are respectiveely statistically significant at the 1% and 5% level.

Table 4 : Panel Cointegration Tests of Variables in the CAEMU zone.

I- Cointégration tests of Pedroni residues	
A- Panel Tests: Intra-Individual (Intra)	
Statistics v panel :	-1.445912
Statistics p PP of panel:	3.121308
Statistics t PP panel :	-7.430471**
Statistics t panel ADF :	-.815099***
B-Panel Tests Inter-Individual Dimension (Inter)	
Statistics p Group PP :	3.752148
Statistics t Group PP :	-.091938***
Statistics t ADF Group :	-3.601221**
II- Kao Residue Integration Tests	
Test-statistics	-.020677***

The asterisks (***) and (**) indicate that the values are respectively statistically significant at the 1% and 5% level.

In general, the cointegration results of Tables 3 and 4 are consistent and allow us to conclude that there is a cointegration relationship between the variables used. More specifically, concerning the WAEMU zone, four out of seven Pedroni tests (1999, 2001) are significant. This is also the case for the CAEMU zone where four out of seven tests are significant. With regard to Kao ((1999), the results of the two tests for the WAEMU and CAEMU zones are highly significant at the 1% level.

From the cointegration relationships of the private investment function, we can present the results from the estimation of this function using the OLS and FMOLS estimators.

3.6 Comparative analysis of empirical results

Tables 5 and 6 summarize the results of the private investment function specifications for the WAEMU and CAEMU zones, respectively. We can first note that the signs of the estimated coefficients are for the most part and in general in conformity with the economic theory, especially the results from the FMOLS method. The significance of the coefficients on the basis of the student-t tests is robust at the 1% threshold. Similarly, the adjusted coefficient of determination and the F-statistic tests indicate that the different specifications are good for both zones.

Thus, at the WAEMU zone level and for the OLS estimator, the variables that best explain the function of the private investment in order of importance are: the real GDP, the degree of openness, the global logistics of performance index and the tax burden. Relative to the FMPOLS estimator the order of importance is: the degree of openness, the real GDP, the real interest rate, the global logistics performance index, the tax burden and the credit to the economy. For the CAEMU zone and with respect to the OLS estimator, the variables that best explain the function of private investment in order of importance are: the real GDP, the degree of openness, the global logistics performance index and the tax burden, exactly the same as in the case of the WAEMU zone. . On the other hand, for the FMOLS estimator the order of importance is: the real GDP, the degree of openness, the tax burden, the credit to the economy, the real interest rate and the global logistics performance index. From these observations we notice two things: firstly, the FMOLS estimator at the two zones level presents more robust results than the OLS estimator. This first remark is not surprising insofar as, by definition, the OLS method confers slope coefficients which are consistent but suffers from problems of endogeneity of the regressors and problems of serial correlation of the residues. On the other hand, the alternative method FMOLS produces a robust estimator whatever the size of the sample used. Similarly, the FMOLS method corrects the problems of endogeneity of the regressors and the problems related to the autocorrelation and heteroskedasticity generally associated with the panel data. Thus, the size of our sample (2007-2017) could explain this situation. Secondly, the results at the CAEMU zone level are better than those at the WAEMU zone level. The answer could be found at the level of the different fiscal policies in these two zones. Indeed, monetary policy in the Franc Zone countries is linked to monetary and financial cooperation agreements with France, even though direct monetary instruments are based on the Bank of Central African States (BEAC) policy on rediscount ceilings

and for the Central Bank of West African States (BCEAO) on global competitions and sectoral financing orientation.

After the significance of the estimated coefficients and the importance of the variables of our study, we will appreciate the weight of the coefficients of the explanatory variables. The elasticities of the real GDP variable are mostly greater than 1 for the two zones (more than 2 for the CAEMU zone) and with respect to the OLS and the FMOLS estimators, thus indicating a strongly positive relationship between private investment and real GDP as suggested by the macroeconomic theory and empirical studies (Blejer and Khan, 1984, Ghura and Hajimichael, 1996, Ojo and Oshikoya, 1995). This result is in accordance with the one for the degree of openness variable. In the case of the CAEMU zone, the elasticity is close to 2 for the FMOLS estimator and more than 1 for the OLS, while for the WAEMU zone these elasticities for the degree of openness are respectively close to 3 and less than 1. This result in line with the real GDP is not surprising since the degree of trade openness measures the share of trade in a country's real GDP. With regard to the real interest rate, the negative sign reflects a negative relationship with investment as stipulated by Keynesian theory. The low elasticities of the real interest rate show that their influence on private investment is negligible. However, for the OLS estimator, the coefficients of the real interest rate variable are not significant for the two zones. As for the global logistics performance index variable, an improvement in this index results in an increase in private investment. In the case of the CAEMU zone, the coefficients are positively signed for the two estimators whereas this is not the case for the WAEMU zone where only the coefficient by the OLS method is positive. The weight of the coefficients at the level of the CAEMU zone is greater than that of the WAEMU zone suggesting that the means or techniques of transport and logistics are more developed in the CAEMU zone. Regarding the variable tax burden, we expect a negative relationship between the variable and private investment. The results show that only the FMOLS estimator respects this relationship. The weight of the coefficients still shows that the effect is greater in the CAEMU zone. A 1% decrease in the tax burden at the level of the CAEMU zone countries, for example, leads to more than 1% increase in the private investment whereas at the level of the countries of the WAEMU zone this increase is less than 0.02% according to the FMOLS method. Finally, in both zones, the coefficients of the credit to the economy variable are not significant for the OLS estimator but significant for the FMOLS estimator. The positive sign of the coefficient for the CAEMU zone shows that an increase in credit to the economy slightly improves private investment while in the WAEMU zone an increase in credit to the economy depresses private investment. In the case of the CAEMU zone, these results are consistent with those of Khan and Kumar (1997) according to which public capital positively impacts the profitability of private capital. The results of the WAEMU zone are supported by the work of Mansouri (2003), which shows that public consumption expenditures crowds out private investment.

Table 5: Results of the model regression for WAEMU zone

Variables	OLS	FMOLS
LnGDP	1.675204*** (6.64)	0.948470*** (0.010993)
r	-0,0103423 (-1,38)	-0.009374*** (0.002932)
GLPI	0,2486407** (-2,50)	-0.327330*** (0.092118)
TB	0,0137156** (-3.05)	-0.017520** (0.009104)
CE	-0,01384 (-1,58)	-0.024218** (0.007838)
DO	0,7780449** (2,11)	2.782103*** (0.277399)
Time effects	*Yes*	*Yes*
Effects of heterogeneity	*Yes*	*Yes*
R2-adjusted	*0.887*	*0.703*

The asterisks (***), (**) and (*) indicate that the values are respectively statistically significant at the 1%, 5% and 10% level. %. Regressions have individual fixed effects that are not reported in the table

Table 6 : Results of the model regression for the CAEMU zone.

Variables	OLS	FMOLS
LnGDP	2.440796*** (7.69)	2.022374*** (9.857727)
r	-0.0017876 (-0.91)	-0.004214** (-2.921215)
GLPI	0.5541376** (-2.64)	0.046860* (0.230345)
TB	0.0060614** (-0.61)	-1.066608*** (-5.571242)
CE	-0.018136 (-2.32)	0.030399** (3.822638)
DO	1.374204*** (-3.39)	1.638527*** (7.169455)
Time effects	*Yes*	*Yes*
Effects of heterogeneity	*Yes*	*Yes*
R2-adjusted	*0.896*	*0.763*

The asterisks (***), (**) and (*) indicate that the values are respectively statistically significant at the 1%, 5% and 10% level. %. Regressions have individual fixed effects that are not reported in the table

5. CONCLUSION

The purpose of this study was to conduct a comparative analysis of the determinants of the function of private investment in the WAEMU and CAEMU zones. The study uses panel data that covers the period 2007-2017. The function of the private investment selected is related to four traditional variables: the real GDP, the real interest rate, the credit to the economy and the degree of trade openness, and two variables of choice, the global logistics performance index and the tax burden. The main econometric results are summarized as follows:

At the WAEMU level, the lnGDP, r, GLPI and CE series are stationary in level and the lnPI, TB and DO series are non-stationary in level. For the CAEMU zone, all the variables are non-stationary in level except for the lnGDP variable which is stationary in level. In general, there is a cointegretion relationship between the variables of our model. The empirical results based on the FMOLS estimator are more concordant than those obtained by the OLS method. The signs of the estimated coefficients are mostly consistent with economic theory. The coefficients themselves are not all statistically significant at the conventional threshold of 5%. The adjusted coefficients of determination reinforce the significant effects of the explanatory variables on the explained variable private investment. In other words, we note that the real GDP, the real interest rate, the global logistics performance index, the tax burden, the credit to the economy and the degree of openness significantly influence private investment in the Franc Zone over the period of our study. For the FMOLS estimator whose results are better than those of the OLS estimator, the variables that best explain the function of private investment in order of importance in the WAEMU zone are: the degree of openness, the real GDP, the real interest rate, the global logistics performance index, the tax burden and the credit to the economy. In the CAEMU zone the order of importance is: the real GDP, the degree of openness, the tax burden, the credit to the economy, the real interest rate and the global logistics performance index. In the CAEMU zone, the real GDP, the global logistics performance index, the credit to the economy and the degree of openness have a positive influence on private investment, while the real interest rate and the tax burden have a negative impact on private investment. On the other hand, at the WAEMU level, only the real GDP and the degree of openness variables have a positive effect on the private investment, the other variables the real interest rate, the tax burden, the global logistics performance index and the credit to the economy have a negative impact on private investment. This result in the WAEMU zone shows that the credits granted to the economy to encourage private initiatives do not make it possible to achieve this goal. On the contrary they depress the level of investment. In terms of elasticity, we note that the coefficients of the different variables in the WAEMU zone are lower than those in the CAEMU zone. In other words, the variables real GDP, real

interest rate, global logistics, tax burden, credit to the economy and degree of openness have a much greater influence at the CAEMU level than at the WAEMU level between 2007 and 2017, mostly our choice variables the global logistics performance index and the tax burden.

The benefit of this study is twofold: first, beyond the traditional variables, it uses two new variables of choice, the global logistics performance index and the tax burden, which have a definite impact on private investment. Secondly, the methodology adopted through the use of the OLS and the FMOLS estimators enabled us to compare the WAEMU and the CAEMU zones to reach the double conclusion that the FMOLS estimator is more robust than the OLS estimator and that the advance that the CEMAC zone has on the WAEMU zone resides in the fiscal policies pursued by the countries of the Franc Zone insofar as their monetary policy remains almost the same. Our study could also have used the alternative method of the dynamic ordinary least squares (DOLS) by Saikkonen (1991) and by Stock and Watson (1993) to complete the study and to confirm the results obtained by the FMOLS method with which it fulfills the same characteristics (cf. Hounsou 2017). However, the length of the period of our study did not favor such an exercise. Finally, other subsequent studies may use other methods and other explanatory variables of the private investment for contribution and to advance the literature on the perpetual investment debate.

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