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Physical Infrastructures and Attractiveness of Private Capital in Sub-Saharan African (SSA) Countries

By Elie NGONGAN[†]

Abstract. Physical infrastructures are a set of interconnected structural elements whose function is to participate in attracting capital flows in order for the economy to function efficiently. They transfer capital flows that are able to ensure growth and stability. They also constitute a major challenge for growth and development. We have attempted in this paper to study the influence of physical infrastructures and financial development on foreign direct investments (FDIs) in the context of Sub-Saharan African (SSA) countries by combining two theoretical approaches (the Paradox of Lucas and the external-internal factors), and by integrating the correlation between the components of capital flows. Our regressions show the importance of non-linear effects in the explanation of the determinants of private capital. This analysis also emphasizes the more important role physical infrastructures play in attracting FDIs despite perverse effects.

Keywords. Physical Infrastructures – Financial Development – Foreign Direct Investments (FDI) – Sub-Saharan Africa

JEL.

1. Introduction

From the point of view of neo-classical theory, in the presence of free competition on the market for capital, and taking account of the decreasing yields of capital, capital should go from countries that have more capital towards those that have less capital at their disposal. This transfer thus makes it possible to balance the marginal yields of capital. From the point of view of reality, this theoretical prediction is not observed. According to [Lucas \(1990\)](#), The movements of capital from rich countries to poor ones represent but quite a small share of the net transfers of savings (« paradox of Lucas »). Mainly, movements or flows of capital remain focused among industrialized countries or intermediate income countries. The physical infrastructure is a set of interconnected structural elements whose function is to participate in attracting capital flows in order for the economy to function efficiently. It makes it possible to transfer capital flows that are capable of ensuring growth and stability. For that purpose, physical infrastructures represent a major challenge for growth and development. Since 2005, a large number of studies on the determinants of capital flows have been published.

These studies rely on an approach that consists in evaluating the effect of external determinants and internal determinants (capable of being influenced by this economy). [Calvo et al. \(1996\)](#), [Kim \(2000\)](#), [Ferrucci et al. \(2004\)](#) Seetanah and [Khadaroo \(2007\)](#) and [Kinda \(2008\)](#) show the importance of external factors in the determination of capital movements. Similarly, several studies agree about the

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dominant role of internal factors in explaining the inflows of private capital (notably, [Root et al. \(1979\)](#), [Gastanga et al. \(1998\)](#), [Asiedu \(2002, 2006\)](#), [Teulon \(2014\)](#)). The recent literature goes by the explanation of the « paradox of Lucas » in the study of the determinants of private capital.

In the same filiation as Lucas, these different studies distinguish the determinants of capital inflows by insisting on the economic fundamentals that can affect the structure of production (notably, institution, bank credit, education etc.), and in a situation of imperfection in capital markets. [Alfaro et al \(2003, 2005\)](#) find through a cross-section study on developing countries, that the « paradox of Lucas » is explained by the quality of education, inflation, institutions, the credit allocated by the banking sector. According to [Reinhart et al. \(2004\)](#) and revisited by [Kinda \(2008\)](#), the pretexts (arguments, allegations) of the existence of a « Paradox of Lucas » are linked to political risk and the imperfections of credit markets.

One question emerges from all this development. Due to the importance of private capital in development financing, why is it that a lower amount of capital is directed towards Sub-Saharan Africa where their marginal yields are higher?

One may envisage several methods of response to this question. A possible method would consist of spotting the potential determinants of FDI's that are the most tested in empirical studies ([Bénassy et al. \(2001; 2007\)](#), [Dupuch et al \(2001\)](#) and Peter [Nunnenkamp \(2002\)](#)). As interesting as it may be, this approach presents some limits. It concentrates on two types of determinants relative to macroeconomic stability such as apprehended by certain fundamentals of the economy of reception (home economics) (Growth and the stability of growth, the business climate, political stability, the country's risk, the sustainability of the public debt, inflation etc.). It is for this reason that we may choose an approach which makes it possible to study the determinants of private capital integrating the variables of market imperfections and the variables of economic fundamentals which are internal to Sub-Saharan African (SSA) economies. They consider as foreign private capital, the net inflows of foreign direct investments (FDI's), and portfolio and debt investments. This study is in line with this perspective.

The objective of this paper is to extend (to deepen, to light up, to explore, analyze) the « paradox of Lucas » approach which is only concerned about the economic fundamentals and the imperfections of capital markets by taking into account the external factors that are integrated in the traditional approach.

The interest of this study is double: First, a particular attention should be given physical infrastructures and to financial development (whose contribution to the attraction of private capital which is important, has not sufficiently been exhausted (above all for financial development in SSA countries). Next, as [Kinda \(2008\)](#), to take account of the relationship between the different movements of private capital and the non linear effects of physical infrastructures, in addition to financial development in the study of the determinants of private capital flows. .

The first part of our paper analyzes the relationship between the inflows of private capital, physical infrastructures and financial development in SSA countries, and the second part of the study deals with the estimation of the empirical model and the robustness of our results.

2. Physical Infrastructures and Financial, and Private Capital

In fact, the determinants of the infrastructures of the economic environment have been recognized for a long time as significant elements which have an

influence on the productivity of economies. The physical infrastructure plays a significant role in productivity, but a debate continues concerning the importance of its impact on the attraction of private capital as indicated in several studies such as those of: [Maleck \(2014\)](#), [Calderon and Serven \(2004\)](#), [Garcia-Milà et al. \(1996\)](#), [Gramlich \(1994\)](#), [Aschauer \(1989\)](#). In effect, globalization and the rise in trade flows have increased the demand for physical infrastructures for countries at all levels of development. According to [Kinda \(2008\)](#), a greater availability of infrastructures increases the yield of private investments by reducing transaction costs and bringing together enterprises, their clients and their suppliers, thus making it possible for enterprises to increase their potential markets, and hence their profits opportunities. The importance of infrastructures in attracting foreign private capital have however been highlighted, and researches were mainly focused on the level of the role of infrastructures on the inflows of FDIs. [Loree et al. \(1995\)](#) show through a cross-sectional study over the period 1977-83, that countries that are endowed with quite developed infrastructures receive more FDI from North American countries. [Kumar \(2002\)](#) finds from a sample of 66 countries over the period 1992-95 that the development of infrastructures measured by a composite index has a positive and significant impact on the attractivity of FDIs. [Asiedu \(2002\)](#) with the help of panel data estimation has observed that countries that have modernized their infrastructure are «rewarded» for their efforts by a recovery of their investment. Subsequent studies of the author ([Asiedu \(2006\)](#) and [Asiedu and Gyimah-Brempong \(2007\)](#)) and [Escribano et al \(2005\)](#) have observed the positive impact of on FDI. [Kandiero and Chitiga \(2003\)](#) who studied 52 African countries also confirmed these results. [Ngowi \(2001\)](#) used a sample of African countries and [Jenkins et al \(2002\)](#) a sample of 14 southern African countries obtained similar results. If most of the studies establish the importance of infrastructure for FDI, others do not validate this hypothesis. This is the case of [Quazi \(2007\)](#) who does not observe any significant positive relationship between infrastructure and FDI in Asia. Generally speaking, investments in infrastructure may also be undertaken by the private sector ([Kinda, 2008](#)). [Ramanmurti et al \(2004\)](#) show that FDIs intended for financing infrastructures represent a third of the inflows of capital in developing countries since a decade.

Financial development means that financial instruments, the markets and financial intermediaries reduce, without necessarily eliminating them, the costs of obtaining and of executing contracts, the costs of transactions and to ensure the monitoring of investments and the mobilization of net savings ([Levine, 2005](#)). According to [Kinda \(2008\)](#) following [Levine \(1997\)](#), financial development may lead to a rise in private investment through a better accessibility of enterprises to financing. A developed financial sector favours trade between local or foreign firms, their suppliers and their clients. To the extent that the attractivity of portfolio investments requires the existence of a stock exchange, the inflows of these flows in a country assumes that the latter has a financial sector that is quite developed. Financial development in itself generally implies the entry of new banks or of new actors in the local market with acquisitions of a stake in capital in the form of FDI or portfolio investments. Several studies on financial development and investments according to [Levine \(1997\)](#) do not generally make a distinction between foreign investments and domestic investments. They only focus on foreign private capital and its different components. The objective of this study is to see the extent to which financial development affects the inflows of foreign private capital, thus contributing to extend a literature that is not yet abundant on this subject. In effect, to our knowledge, only five studies have more or less linked financial development to the inflows of private capital, more precisely the FDIs. [Hausmann et al \(2000\)](#) show that countries which have the least developed capital markets, have more

important FDI inflows. On the other hand, Jenkins et al (2002) using a sample of 81 foreign firms based in countries of southern Africa, show that South Africa attracts relatively more FDIs than the other countries of that region because of the development of its financial system. Montiel (2006), through a theoretical analysis, affirms that Africa is unable to attract foreign private capital to finance the different sectors with potential high yields, because of the low level of development of its financial system. Kinda (2008) also finds in the context of developing countries and particularly in African countries, that financial development influences the flows of foreign portfolio capital. He also finds non-linearity in the analysis of the determinants of private capital. OCDE (2002) shows that after the diminution at the height of the great recession, the FDIs in the firms and portfolio investments attracted by the high returns on capital, re-established themselves progressively in Africa, and the FDIs are ahead of the official monetary transfers.

3. Methodology

In the light of the preceding literature on the relationship between physical infrastructures, financial development and private capital, our econometric model relies on the specification of the explicative approach of the « Paradox of Lucas », of the market imperfections variables and of the variables of economic fundamentals. This is firstly concerned with data sources and with the estimation of the econometric model, and then with the results and the robustness of our results.

2.1. Data Sources and Estimation of the Econometric Model

Both steps are considered, the first data and then estimating the econometric equation.

2.1.1 Data Sources

The data that we use in this study cover the period 1980 -2009 (subdivided into sub-periods of 5 years¹), and they are used to carry out regressions for 25 Sub-Saharan African (SSA) countries². Since our analysis concerns private capital and its different components, the capital movements' variable may therefore be foreign direct investments (FDIs), portfolio investments, the debts (mainly bank and trade credits) and private capital, all of which are the sum of the private capital types mentioned (indicated) previously. In addition, for the econometric study we shall only retain FDIs and portfolio investments for several reasons. Just after the debt crisis of the 1990s, according to Alfaro et al (2003, 2005), the figures of the debts integrate a large number of estimation errors. However, the main reason is the lack of tested data on the debt between private agents exclusively. The debts that we consider are those issued by private economic agents (notably foreign banks), but who may be contacted by private economic agents as well as by governments. Contrary to FDIs and portfolio investments, these different debts therefore are not the image (the portrait) of market mechanisms.

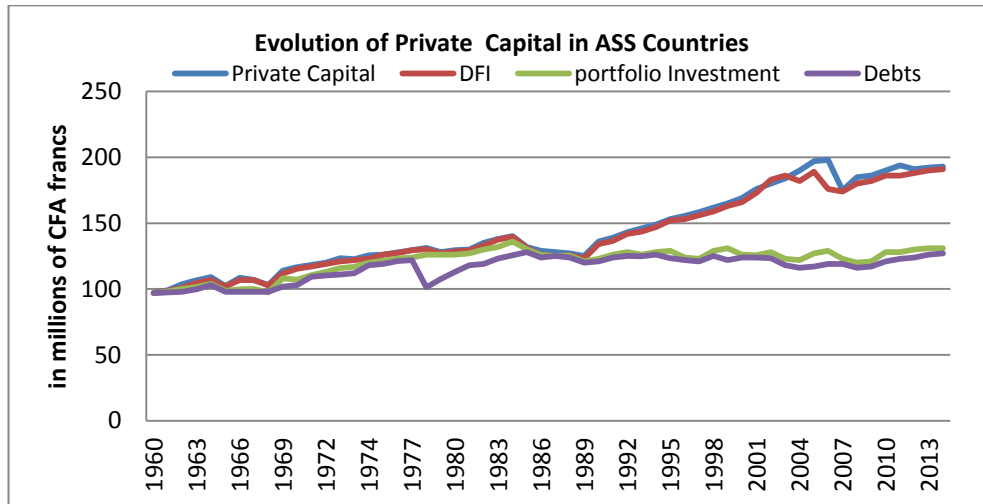
Since the 1960s, SSA countries have been witnessing several events of massive private capital inflows. The first of such events is associated with the price of oil (petroleum) and the strong increase of the prices of basic products, followed by the debt crisis. The second of such events appeared during the second half of the 1980s, and it gave rise to the repercussions of the effects of two main financial

¹ The sub-periods are the following: 1980-84, 1985-89; 1990-94; 1995-99; 2000-2004; 2005-2009.

² Countries of the Franc Zone (except for Burkina Faso, Madagascar, Gabon, Chad, Equatorial Guinea, Guinea Bissau in addition to Ghana, Burundi, Botswana, Kenya, Malawi, Mauritius, Rwanda, Sierra Leone, Tanzania, Uganda, Zambia, Zimbabwe, Algeria, Egypt, and Tunisia).

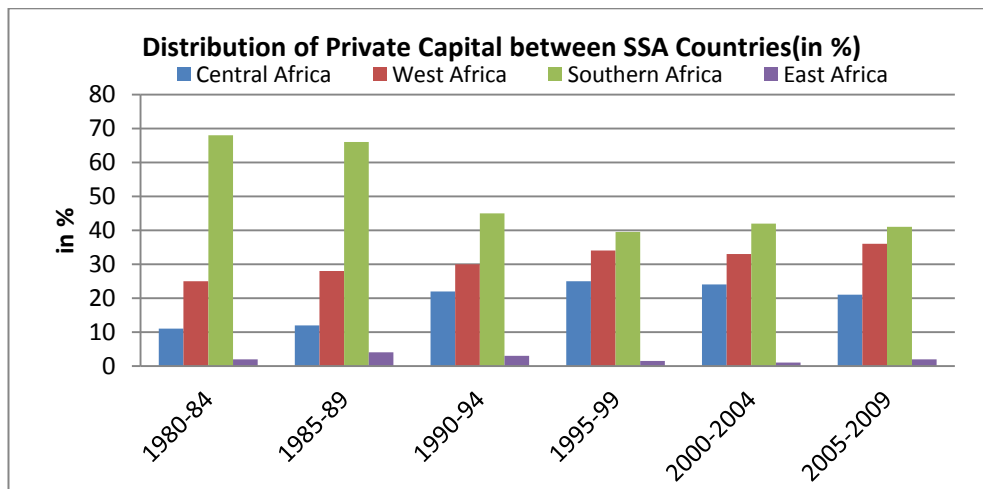
crises: the Mexican crisis of 1994 and the Asian crisis of 1997. The third crisis is the financial crisis of the year 2008.

Beyond the evolution over time of the movements of private capital in SSA countries, the distribution of this capital between SSA countries is opportune and very important.



GRAPH 1: Evolution of Private Capital in SSA Countries

Sources: Our calculations from syntheses of Global Development Finance (2000-2014) and the statistical data of the National Institutes (NIs) (1968-2013).



GRAPH 2: Distribution of Private Capital between SSA Countries

Sources: Our calculations from syntheses of Global Development Finance (2000-2014) and the statistical data of the National Institutes (NIs) (1968-2013).

2.1.2 Estimations of the Econometric Model

The analysis of the effects of physical infrastructures and of financial development on private capital inflows is based on an equation that integrates (like the approach of the explanation of the «paradox of Lucas») the market imperfections variables and the economic fundamentals variables which are internal to the economies of SSA countries. Exogenous variables peculiar to developed countries (from which capital leaves) and which are therefore external to SSA countries, are also integrated in accordance with the «external-internal factors» approach. This equation is written as follows:

$$FCP_{ijt} = \delta_j + \beta INFRA_{jt} + \theta DF_{jt} + \psi X_{jt} + \delta_t + \varepsilon_{jt} \quad (1)$$

Where, FCP_{ijt} , is a type i flow of private capital received by country j during year t . $INFRA_{jt}$ is considered as the infrastructure variable and DF_{jt} as the financial development variable. X_{jt} is the matrix of the set of the control variables of our econometric model which may affect the inflows of private capital. The country and temporal fixed effects are represented respectively by δ_j and δ_t , while ε_{jt} is the error term. The growth rates or the interest rates of developed countries (donors) represent the shocks common to the set of SSA countries at a given moment, and they are therefore captured by temporal fixed effects. The market imperfections of the markets for capital which can be approximated by the distance between countries representing the informational asymmetry (Coval et al (2001), Portes al (2005), Kinda (2008)) are taken into account by the country fixed effects. The estimation of our equations can be carried out buy the standard fixed effects. This assumes that the amount of FDIs received by a country is independent of the portfolio investments received by this country. This means that we suppose that the error terms of our different equations are uncorrelated. This has to do with a hypothesis that is quite restrictive and not verified since a large number of identical variables explain both our different components of capital flows. It is therefore necessary to take into account these correlations of the error terms of our different equations which can make the significance of our coefficients to vary. In this approach our econometric model to be estimated is a system of equations which can be written as follows:

$$\begin{aligned} IDE_{jt} &= \delta_j + \beta INFRA_{jt} + \theta_1 DF_{jt} + \psi_1 X_{jt} + \delta_t + \varepsilon_{jt} \\ PORTF_{jt} &= \delta_j + \beta_2 INFRA_{jt} + \theta_2 DF_{jt} + \psi X_{jt} + \delta_t + \varepsilon_{jt} \end{aligned} \quad (2)$$

Where IDE_{jt} and $PORTF_{jt}$ are respectively the net inflows of FDIs and portfolio investments in country j during year t . It is possible that the private capital received by a country have an influence on the financial development and the development of the infrastructures of that country. This inverse causality may be a source of endogeneity. In order to resolve this endogeneity problem of the variables of interest which is confirmed by the Nakamura-Nakamura test, we define three instruments (like Kinda (2008)) which are the values lagged one period of our variables of infrastructures and of financial development, as well as of the regulation of the credit market as instrument of financial development. This variable of credit market regulation indicates the constraints or incentives put in place by the governments of SSA countries to control the interest rates on the deposits and on bank loans.

Because of this, we use the triple ordinary least squares (3SLS), which like the double ordinary least squares (2SLS) make it possible deal with the problem of endogeneity, but also take account of the correlation between the error terms of our different equations like the method of apparently independent regressions (SUR). Under the hypothesis of a good specialization of the different equations, The 3SLS are more efficient insofar as they take account of the correlation of the error terms of the different equations. In spite of the fact that the results obtained by using the 2SLS do not differ significantly, a test of Hausmann confirms the preference for the estimates obtained by using the 3SLS.

2.2. Results and interpretations

To avoid the problems of eventual collinearities between our infrastructure variables, we first consider a physical and financial infrastructures index obtained by using a principal components analysis (PCA).

Table 1: Physical and Financial Infrastructures and FDIs

Dependent variables					
	Private capital	FDIs	Portfolio Inv.	FDI	Portfolio Investment
Explanatory Variables	DMC	TMC	TMC		
Infrastructures ¹	0.567 (2.11)**	0.339 (1.94)*	0.182 (1.98)*		
Telephones				0.041 (2.44)**	-0.007 (1.52)
M3/GDP				-0.009 (0.61)	0.015 (2.46)
Control	-1.203 (1.80)*	-0.909 (1.89)*	-0.332 (1.33)	-0.783 (1.91)**	-0.382 (1.68)*
Growth	0.331 (4.11)***	0.188 (5.09)***	0.058 (2.39)**	0.111 (3.16)***	0.042 (2.36)**
Inflation	-0.0003 (0.52)	-0.002 (1.66)	0.0004 (1.51)	-0.002 (2.99)***	0.0004 (1.58)
Openness	-1.588 (1.38)	-0.888 (0.93)	-0.671 (1.42)	1.302 (1.59)	-0.623 (1.61)
Schooling	-0.402 (0.54)	-0.601 (1.12)	0.200 (0.91)	-0.955 (1.79)	0.303 (1.62)
Political Stability	-0.002 (0.200)	0.021 (1.04)	-0.018 (3.49)***	0.009 (0.78)	-0.015 (2.98)***
Crisis	-0.810 (2.63)***		-0.125 (1.19)		-0.094 (1.21)
R^2	0.71	0.75	0.27	0.72	0.20
Stat. of Sargan (surplus)	0.33 (0.61)	0.11 (0.23)	0.36 (0.43)	1.88 (0.84)	0.24 (0.45)
Observations	140	140	140	197	197
Countries	25	25	25	32	32

Notes: Statistics between parentheses are the Zs. All the regressions integrate country and temporal fixed effects.

* Significant at 10%, ** significant at 5%; *** significant at 1%.

1 An infrastructure index obtained by the analytical method of principal components. These results are normalized. The physical infrastructures variables for the indexes are the proportion of phone subscribers, the consumption of electricity per head, and the variables of financial development are the M3/PIB ration and bank deposits.

The assessment (judgement) of the instruments realized from the different statistics of the first stage equation (notably the partial R^2 , the Shea partial R^2 , the partial F-test and the statistic of de Cragg-Donald) reject the hypothesis of a weakness in our instruments (see Annex 1). But the Sargan over determination test also does not cast doubt the validity of the instruments. The macroeconomic instability of SSA countries (inflation, banking crises, etc.) as well as the control of capital has a negative influence foreign private capital. A favorable economic situation marked by a high rate of economic growth has a positive influence on the movements of private capital towards SSA countries. Schooling also has a negative effect on the FDIs and a positive effect on portfolio investments. This result may be explained by the fact that certain SSA countries with a low schooling rate attract FDIs in the direction of the exploitation of natural resources (notably mining), which is not exactly for portfolio investments. Political instability, which is determined the length of the period African heads of state stay in power, have a negative influence on the inflows of portfolio investments. This is observed in

most SSA countries, where leaders a longer stay in power (sometimes under autocratic regimes), which is not necessarily the sign of a stable social climate during the exercise of their power. Since portfolio investments are short-term movements, they are more sensitive to socio-political troubles and do not necessarily lead to regime changes.

As concerns both of our variable of interest (notably, physical infrastructures financial development), the physical and financial infrastructure index has a positive and significant impact on private capital, as well as on each type of capital (FDI of portfolio investments). Physical infrastructures exclusively affect the inflows of FDIs, and financial infrastructures only affect the inflows of portfolio investments. All other things remaining the same, a rise of 10 percentage points for those who are on fixed or mobile phone increases FDI inflows by a percentage point of 0.4 point. This result conveys, as [Kinda \(2008\)](#) noted, the existence of a minimal condition in order to guarantee the prosperity of investments, and hence to attract the FDIs. The implementation of a large number economic activities (notably, industrial) requires the existence of the means of communications (roads, railway tracks, telephones, etc.) to permit or to facilitate access to inputs, but also access to different markets, and hence to reduce the costs of production, of transaction and of training. The presence of these infrastructures therefore creates an environment favourable to investments, notably those originating from foreign countries.

Portfolio investments, with their quite volatile character are relatively of a small amount in SSA countries. Among both of the variables of interest in our study, only financial development has a positive and significant impact on the inflows of portfolio investments in SSA countries. An increase of 10 percentage points in the money supply (M3/GDP) leads to a rise of 15 percentage points in the inflows of portfolio investments. The inflow of portfolio investments into a country requires a level of financial development that is quite high, insofar as this type of capital movement is negotiated on the security markets. According to [Kinda \(2008\)](#) a better financial development with quite developed financial markets should, through the detour of quality information reduce the potential risk incurred by investors on this market. Can we say, as far as SSA countries are concerned, that these results are quite powerful and robust?

2.2.1. Robustness of the Results

From an empirical point of view, several variables are likely to be used to characterize the available infrastructures in SSA countries or the financial development of these countries. The results may well be influenced by the choice of these different variables. Because of this, we estimate the set of equations again, this time by considering as physical infrastructures variable electrical consumption per head, and as financial development variable, the credits granted by the banks to the private sector (in % of GDP)³. The results obtained are attested (confirmed or consolidated) with the use of these variables of alternative interests.

The variable of protection of property rights integrate certain aspects of the socio-political climate which are not considered by the variable of political instability. Portfolio investments being short-term flows, a large variability of the exchange rate may be the cause of uncertainty in the profitability of these

³ The choice of these variables is explained by the availability of figures in the set of countries considered in our study over a long period. This has to do with variables of alternative interests.

investments. However, the integration of the variables of protection of the property rights and of the variability of the exchange rate does not affect the main results⁴.

Up to now, we have tested in the case of these SSA countries but the linear relationship. And yet, physical infrastructures have proved congestion effects. For instance, a rise in credit or in the money supply may be the sign of a financial development, but very high amounts of credit or a money supply that is high may also indicate a poor management of monetary policy or be the warning sign of a crisis in the banking system. The main results in the case of SSA countries are attested with the effects of physical and financial infrastructures which are more important in the attraction of FDIs and portfolio investments⁵. The Ramsey-Reset test confirms here the non-linearities suspected at the level of our variables of physical and financial infrastructures. In addition, we observe that the integration of the non-linearity reveals a positive effect of the physical infrastructures on the inflows portfolio investments with the existence of significant threshold effects at the level of physical and financial infrastructures in the attractiveness of portfolio investments. However, although it is insignificant, financial development has a positive impact of the inflows of FDIs, and the positive effect of physical infrastructures also presents a significant threshold effect. These results thus highlight the dimension of non-linearity in the analysis of the determinants of private capital, insofar as the coefficients of the infrastructures variables change in terms of sign, size and significance (See Annex 2).

The flows of private capital and, in particular, the FDIs in the direction of SSA countries, have initiated an exponential rise during the period 1990 -94. This period is marked by the great reforms of the liberalization of the current account and of the capital account which were undertaken by these countries in the context of the Washington consensus in order to attract more private capital. A temporal Chow test carried out before and after 1990-94 makes possible to say that there is no differentiated effect of the reforms on the determinants of private capital. Available data does not permit us to test other periods of potential breakdowns or even to carry out the Andrews-Quandt test which could make it possible for us to determine a break down period. Although the choice of this period is theoretically justified, it is also imposed to us by the available data. The analysis of the inflows of capital in SSA countries also shows a net marginalization of these countries. This Chow test somehow confirms specificity for SSA countries. Our results display a net specificity. Physical infrastructures alone positively and significantly affect the inflows of FDIs in the different countries.

Thus, this physical infrastructures effect is relatively more important compared with Latin American countries in the attractiveness of FDIs. A rise of 10 percentage points in the number phone subscribers increases by a 0.59 percentage point the FDIs in SSA countries, while the same rise increases the FDIs by only a 0.2 percentage point in Latin American countries (Annex 3). These results are explained by the fact that SSA countries have physical and financial infrastructures that are not very developed, and which practically do not also attract portfolio investments. The same results corroborate those of [Kinda \(2008\)](#), according to which a rise of 10 percentage points in the number of phone subscribers increases by a 0.52 percentage point the FDIs in SSA countries, with an increase of only a 0.3 percentage point in the other developing countries. This author finds that over the period 1970-2003, only 2% of the population of SSA countries were phone subscribers, while this figure rises to 12 % for Latin American countries. Since

⁴ The results available are not integrated here in this text, but they may be available on a simple request.

⁵ The coefficients have very large sizes.

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2005, the advent of mobile telephony has practically exploded, and this figure has been multiplied by four. A simple simulation shows that if SSA countries maintain the same level of physical infrastructures development as that of the year 2008, this could lead to a rise of about 9.7 percentage points in their FDIs. This simulation provides a general idea of the importance of infrastructures in the attractiveness of FDIs in SSA countries in spite of pervert effects.

Conclusion

We have attempted in this paper to show that physical infrastructures exclusively affect FDIs inflows and financial development has an influence on portfolio investments in the context of SSA countries, by combining two theoretical approaches, namely the Paradox of Lucas and external-internal factors. The results of our regressions illustrate the fact that the integration of the thresholds effects of infrastructures that are significant makes it possible to establish that physical infrastructures and financial development positively and significantly affect the FDIs as well as portfolio investments, despite the fact that financial development is insignificant as far as FDIs are concerned. These results convey the importance of non linear effects in the explanation of the determinants of private capital. This analysis also emphasizes the more important role played by physical infrastructures in the attractiveness of FDIs.

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Appendixes

Appendix 1: First stage equation of instrumentation

	IDE		INV. Portfolio	
	Telephone	M3/PIB	Telephone	M3/PIB
Instruments				
Telephone_1	1.998 (25.55)***	0.013 (0.09)	1.996 (25.49)	0.006 (0.04)
M3/PIB_1	0.012 (0.51)	0.571 (9.48)***	0.012 (0.50)	0.569 (9.46)
Regulation	0.036 (0.17)	0.692 (1.31)	0.034 (0.15)	0.654 (1.29)
Weak t of instruments				
Partial R^2 (Shea)	0.80	0.31	0.79	0.31
Partial R^2 1	0.80	0.31	0.80	0.31
Partial F	226.51	25.41	224.23	25.35
Surplus	0.00	0.00	0.00	0.00
Cragg-Donald F Stat.	27.2		27.18	
Critical values of Stock-Yogo				
10%	12.34		12.34	
15%	7.16		7.16	
20%	5.68		5.69	

Notes: *significant at 10%, ** significant at 5%; *** significant at 1%

Appendix 2: Integration of the non-linearity

Explanatory variables	IDE	Inv. Portfolios
Telephone_1	1.172 (2.08)**	0.095 (2.46)
M3/PIB_1	0.043 (0.87)	0.068 (2.98)***
Telephone^2	-0.003 (0.17)*	-0.002 (2.59)
M3/PIB^2	0.000 (1.2)	-0.002 (4.01)***
R^2	0.75	0.23
Stat. of Sargan	1.62	4.90
(Surpluses)	(0.78)	(0.98)
Observation	162	162
Countries	25	25

Notes: Statistics between parentheses are the Zs z. Each of these regressions integrates the country and temporal fixed effects, as well as the control variables such as in Table 1 above. * Significant at 10%; ** significant at 5%; *** significant at 1%. Telephone^2 and M3/PIB^2 represent the variables Telephone and M3/PIB squared.

Appendix 3: 3SLS Estimation for the Sample of SSA Countries

Explanatory variables	IDE	Inv. Portfolios	IDE	Inv. Portfolios
Telephone	0.021 (2.15)**	-0.014 (1.88)	0.059 (2.30)**	-0.005 (0.46)
M3/PIB	-0.016 (0.73)	0.015 (2.22)**	-0.068 (1.47)	0.005 (0.16)
R^2	0.73	0.24	0.84	0.51
Stat. of Sargan (Surpluses)	0.52 (0.51)	1.98 (0.85)	0.50 (0.52)	0.02 (0.11)
Observation	162	162	56	56
Countries	25	25	17	17

Notes: The statistics between parentheses are the Zs. Each of these regressions integrates the country and temporal fixed effects as well as the control variables such as in Table 1 above. * Significant at 10%; ** significant at 5%; *** significant at 1%. Telephone² and M3/PIB² represent the variables Telephone and M3/PIB squared.

Appendix 4: Sample of Countries for Estimation

Sub-Saharan African (SSA) Countries
South Africa – Algeria- Benin- Botswana – Burundi- Cameroon - CAR – Congo Ivory Coast- Egypt- Ghana- Kenya- Malawi – Mali- Mauritius- Niger – Rwanda- Senegal - Sierra Leone- Tanzania- Togo - Tunisia - Uganda - Zambia - Zimbabwe



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