

**INCREASING PRIVATE CAPITAL FLOWS TO DEVELOPING COUNTRIES:
THE ROLE OF PHYSICAL AND FINANCIAL INFRASTRUCTURE IN 58
COUNTRIES, 1970-2003**
KINDA, Tidiane*

Abstract

Combining the classical “push-pull factors” and the “Lucas paradox” theoretical approaches, and taking into account the relationship between components of capital flows-through Three Stage Least Square (3SLS) estimations-, this paper shows that physical infrastructure and financial development positively affect Foreign Direct Investment (FDI) and portfolio investment in developing countries. The analysis highlights the importance of non-linearity effects when assessing the role of financial development for portfolio investment inflows. Lax monetary policy and excessive credit provision could weaken the financial system and significantly reduce portfolio investment flows in long-run. The results also show that for Sub-Saharan African countries, better physical infrastructure tends to attract more FDI.

Keywords: Foreign Direct Investment, Portfolio Investment, Physical Infrastructure, Financial Development, Three Stage Least Squares.

JEL codes: F21, O11, C23.

1. Introduction

During the last two decades, the international economy has been largely marked by financial crises. The national and international economic environment contributed to these episodes of economic stagnation, but the destination and composition of private capital flows were also particularly important.

According to the neoclassical economic theory -assuming free capital markets and diminishing returns-, capital should flow from capital abundant countries (developed countries) to capital scarce countries (developing countries) leading to the equalization of marginal returns to capital. In reality, this theoretical prediction is not observed, leading to an important paradox in international macroeconomics: the “Lucas paradox”. Private capital flows are important in financing development, especially in the context of insufficient and unstable aid, which makes it crucial to understand why the neoclassical theory is not observed. Why does capital not flow to developing countries where their marginal return is higher? Answering this question requires the study of the determinants of private capital flows. For foreign private capital, we consider net flows of FDI, portfolio investments and debts.

Following the Asian crisis, a number of studies on the determinants of private capital flows emerged. These studies were generally based on an approach that distinguishes between external determinants (exogenous to the economy receiving

* Tidiane Kinda, International Monetary Fund, Washington D.C. USA. E-mail: tkinda@imf.org
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capital, or “push factors”) and internal determinants (under the recipient economy’s control, or “pull factors”). Many authors showed the importance of the external factors (international interest rate and international growth rate) in determining private capital flows (Calvo et al., 1996; Fernandez-Arias, 1996; Montiel and Reinhart, 1999; Kim, 2000; Ying and Kim, 2001; Ferrucci et al., 2004). A greater number of studies revealed the dominant role of internal factors (macroeconomic conditions of the recipient country) in the explanation of private capital inflows (Root and Ahmed, 1979; Schneider and Frey, 1985; Fernandez-Aria, 1996; Ahn et al., 1998; Gastanga et al., 1998; Asiedu, 2002). More recent studies use the “Lucas paradox” to explain the determinants of private capital flows. Following Lucas, these studies differentiate the determinants of capital flows into economic fundamentals with the ability to affect the production structure (education, institutions, and so forth) and capital market imperfections (mainly informational asymmetry). Alfaro et al. (2006a, 2006b), through a cross-sectional study, find that the “Lucas paradox” is explained by the quality of institutions, education, inflation and financial development. According to Reinhart and Rogoff (2004), the “Lucas paradox” exists because of political risk and credit market imperfections. Recent studies also illustrated the importance of business environment for private capital flows (Martin and Rose-Innes, 2004; Asiedu, 2006; Naudé and Krugell, 2007; Bénassy-Quéré et al. 2007; IMF, 2008; IMF, 2007).

All of these studies lead to different conclusions about the factors which significantly influence private capital inflows to a country. Another crucial element to attracting FDI is building industrial capacity. This includes developing infrastructure and human capital; strengthening institutional capabilities and economic openness; and promoting sound macroeconomic policies (low inflation, strong and sustainable economic growth). The purpose of this study is to extend the “Lucas paradox” approach (which considers only the economic fundamentals¹ and capital market imperfections), by integrating external factors from the traditional approach (“push-pull factors”). Emphasis will be given to physical infrastructure and financial development which have received insufficient attention in the literature (especially for financial development) given the importance of their contribution to private capital attractiveness. Contrary to past studies, this paper, for the first time, takes into account the relationship between different components of private capital and non-linearity effects of physical infrastructure and financial development.

The rest of the paper is organised in two main sections: the first section analyses the relation between private capital flows, physical infrastructure and financial development. The second part of the study is devoted to an empirical estimation of the determinants of private capital flows followed by robustness checks. The last part concludes.

2. Physical infrastructure and private capital flows

A greater availability of infrastructure increases the output of private investment by reducing transactions costs and enabling firms to get closer to their customers and suppliers, making it possible for the firms to increase their potential markets and thus their opportunities for profit. Well-developed telecommunications infrastructure, for

¹ The economic fundamentals include industrial capacity main determinants.

example, can help firms to access financial resources through financial markets. Firms that do not have access to modern telecommunication services, reliable provision of electricity, or developed road systems invest less and have less productive investments (regardless of whether they are local or foreign). When the provision of well-functioning infrastructure fails, firms are sometimes forced to pay the costs of providing infrastructure themselves, such as electricity through power generating units, in order to continue their activities. This type of provision is generally more costly than traditional infrastructure provision.

The determinants of FDI may vary according to their type. FDI in manufacturing, services or in oil, gas and mineral extraction may have different determinants. Moreover, variables such as infrastructure, education or inflation may have different effects depending on the destination of FDI.

In previous studies, the importance of physical infrastructure in determining the attractiveness of foreign private capital essentially focused on FDI. Loree and Guisinger (1995) find that countries with developed infrastructure (measured by a multidimensional index of infrastructure) receive more FDI from United States. Wheeler and Mody (1992) and Mody and Srinivasan (1998) find similar results. Kumar (2002), with a sample of 66 countries over 1982-1994, finds that the development of infrastructure, measured by a composite index, has a positive effect on FDI inflows. Ngowi (2001), Asiedu (2002) using a sample of African countries, and Jenkins and Thomas (2002), using a sample of Southern African countries, obtain similar results. Infrastructure may also be provided by the private sector. Ramamurti and Doh (2004) find that FDI dedicated to infrastructure financing accounted for one third of capital inflows to developing countries in the beginning of the 1990s.

3. Financial development and private capital flows

Financial development may increase private investments due to firms' better access to financing.² In addition to the informational asymmetry supported by the local entrepreneurs, the distance between foreign investors and local markets generally increases this already existing information asymmetry. Foreign investors know neither the opportunities nor the risks of the local market as well as local investors do. Financial intermediaries can provide information about local market risks which provides credibility to potential profit in the country thereby stimulating the entry of new investors, in particular foreign investors, in the local market. A developed financial sector also facilitates interactions between foreign and local firms and their suppliers and clients. Since portfolio investments generally require the pre-existence of a stock market, these inflows require a developed financial sector. Financial development itself can imply the entry of new banks or new actors in the local market with acquisitions in the form of FDI or portfolio investments. The importance of financial development for FDI could be reduced with the entry of multinational banks which tend to follow their corporate clients.

As mentioned by Levine (1997), studies on financial development and investments generally do not distinguish domestic investments from foreign investments. Focusing only on foreign capital, this study enriches the scarce literature on this topic. To

² See Levine (1997, 2003) for a review of the theoretical and empirical literature.

the best of our knowledge, only three studies deal with the effect of financial development on private capital flows, precisely FDI. Hausmann and Fernandez-Arias (2000) find that the countries with the least developed capital markets tend to have more FDI inflows as alternative financing for the firms. However, using a sample of 81 foreign firms based in Southern African countries, Jenkins and Thomas (2002) show that South Africa attracts relatively more FDI than other African countries because of its developed financial system. Montiel (2006), in a theoretical analysis, argues that financial underdevelopment mainly explains why Africa does not attract enough private foreign capital.

4. Empirical analysis

4.1. Data and variables

The data cover the period 1970-2003 (subdivided into five periods of five years) and we retain for the regressions 58 developing countries.³ The variables for private capital flows are FDI, portfolio investments, debts, and private capital which is defined as an aggregate of the three types of private capital.

Figure 1: Private capital flows in developing countries

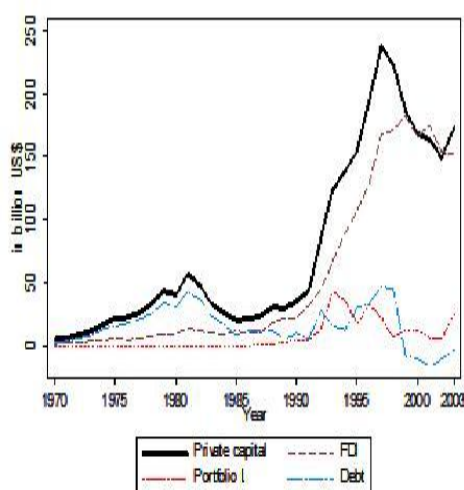
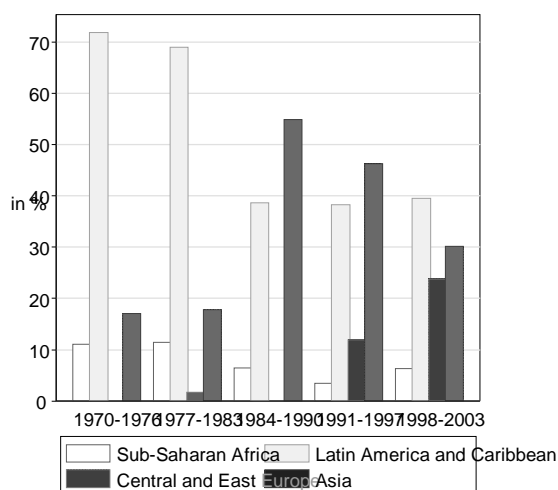


Figure 2: Distribution of private capital between developing countries



For the econometric analysis, we will only retain FDI and portfolio investments as variables of capital inflows for several reasons. After the debt crisis, data on debts suffer from significant measurement errors (Alfaro et al., 2006a, 2006b). The principal reason is the lack of data on debts existing exclusively between private agents (debt data

³ Central and Eastern European Countries (CEEC) are not taken into account in the regressions since the majority of these countries was created after 1990 whereas one of our objectives is to evaluate a differentiated effect before and after the 1990's financial crises.

used here are issued by private economic agents but can be contracted by private or public sector)⁴.

Since 1970, developing countries have seen two episodes of massive surge in capital flows. The first one is associated with the oil price boom of the 1970s followed by a crisis of national debt. The second surge in capital inflows occurred in the second half of the 1980s. This second episode gave way to two main financial crises: the Mexican crisis of 1994 and the Asian crisis of 1997.

Beyond the evolution of private capital flows, their repartition is largely unequal, showing a great marginalisation of Sub-Saharan Africa.

4.2. Estimations

The analysis of the effects of physical infrastructure and financial development on private capital inflows is based on the following equation. It includes capital market imperfections and economic fundamental variables to explain the “Lucas paradox” and variables specific to capital exporters’ countries in accordance with the “push-pull factors” approach:

$$Ci_{jt} = \lambda_j + \beta Inf_{jt} + \delta Fin_{jt} + \phi X_{jt} + \lambda_t + \varepsilon_{jt} \quad (1)$$

Ci_{jt} , is a type i of private capital flow received by the country j in year t . Inf_{jt} is the variable of physical infrastructure and Fin_{jt} the variable of financial development. X_{jt} is the matrix of the control variables. The country and time fixed effects are respectively λ_j and λ_t while ε_{jt} is the error term. Because our sample is only made up of developing countries, the time fixed effects capture external factors (“push factors”). Capital market imperfections, which can be approximated by the distance between countries, reflecting informational asymmetry (Coval and Moskowitz, 1999, 2001), are taken into account in the country fixed effects.

The two equations of capital inflows could be estimated with standard fixed effect method. However this would suppose that the amount of the FDI received by a country is independent of the amount of portfolio investments received by this country (in other words, error terms of the two equations are not correlated). This rather restrictive assumption is not verified since a high number of identical variables explain the two components of capital flows. Thus, it is important to consider the correlation of error terms which can affect the significance of the coefficients. The empirical model for estimation will be a system of equations as follows:

$$\begin{cases} FDI_{jt} = \lambda_j + \beta_1 Inf_{jt} + \delta_1 Fin_{jt} + \phi_1 X_{jt} + \lambda_t + \varepsilon_{jt} \\ PORT_{jt} = \lambda_j + \beta_2 Inf_{jt} + \delta_2 Fin_{jt} + \phi_2 X_{jt} + \lambda_t + \varepsilon_{jt} \end{cases} \quad (2)$$

FDI_{jt} and $PORT_{jt}$ represent net inflows of FDI and portfolio investments in country j in year t , respectively. The definition of the other explanatory variables remains identical to those given in equation 1. The use of Seemingly Unrelated Regression (SUR) would be more efficient than the standard fixed effect model (Arellano, 1987) since SUR takes into

⁴ We checked the specificity of debt compared to FDI and portfolio investments by adding to our system of two equations an equation of debt. The results (available upon request) show that physical and financial infrastructure does not increase debt inflows.

account the correlation between the errors terms. It is very likely that private capital flows received by a country affect its financial and physical infrastructure development. This potential reverse causality, as explained in the theoretical section, can be a source of endogeneity. In order to solve this problem, which is confirmed by the Nakamura-Nakamura test, we define three instruments: the lagged value of physical infrastructure variable, the lagged value of financial development variable, and the regulation of credit market as financial development variable instrument.⁵ Instruments diagnostic with first-stage regressions statistics (partial R^2 , Shea partial R^2 , partial F-test, Cragg-Donald Statistics) reject the hypothesis of weak instruments.

Table 1: First-stage equation

	FDI		Portfolio I.	
<i>Excluded Instruments</i>	Telephone	M3/GDP	Telephone	M3/GDP
Telephone_1	2.010	-0.133	2.010	-0.136
	(26.81)***	(0.72)	(26.72)***	(0.73)
M3/GDP_1	-0.015	0.549	-0.015	0.548
	(0.60)	(9.12)***	(0.61)	(9.08)***
Regulation	-0.041	0.841	-0.041	0.839
	(0.21)	(1.76)*	(0.21)	(1.75)*
<i>Weak instruments diagnostics</i>				
<i>Shea Partial R²</i>	0.83	0.33	0.83	0.33
<i>Partial R²</i>	0.83	0.33	0.83	0.33
<i>Partial F</i>	268.19	27.72	266.41	27.49
<i>p-values</i>	0.00	0.00	0.00	0.00
<i>Cragg-Donald F stat.</i>	27.66		27.42	
Stock and Yogo Critical values				
<i>10%</i>	13.43		13.43	
<i>15%</i>	8.18		8.18	
<i>20%</i>	6.40		6.40	
* significant at 10%; ** significant at 5%; *** significant at 1%				

For the estimations, we use three stage least squares (3SLS) which, like two stage least squares (2SLS), deals with the endogeneity problem but also takes into consideration the correlation between the errors terms of the equations like SUR method. Under the null assumption of good specification of all equations in the model, 3SLS is more efficient since it deals with the correlation of different equations' error terms. However, when at least one equation in the system is misspecified, this misspecification extends to all systems by the correlation of error terms, leading to biased and less consistent coefficients. In this case, the 2SLS estimator, although less efficient, is preferable since there is no correlation in error terms and it is consistent, even in the case of the misspecification of one equation in the system. Although results obtained by the 2SLS do not differ significantly, a Hausmann test confirms the preference for 3SLS.

⁵ This credit market regulation variable indicates governments' constraints or incentives in term of control of interest rates on deposits and bank loans. An instrument for financial development, commonly used in the literature is the legal origin. This instrument cannot be used in our case since it is already included in the country fixed effects.

4.3. Results

We first consider an index of physical and financial infrastructure obtained with principal components analysis which avoids colinearity problems between infrastructure variables. A second method of aggregation used is the standardisation of variables. This method is similar to principal component analysis but it gives an equivalent weight to each variable in the calculation of the index. We retain as physical infrastructure variables the proportion of subscribers of fixed and mobile phone service in the population and electric consumption per capita. The variables measuring financial development in the indexes are the ratio M3/GDP, the credit to private sector, and the deposits in financial institutions. In accordance with the theoretical and empirical literature, we control for some variables. Appendix 1 gives the list, definitions and sources of the variables used. The following table gives the results of estimations with aggregated indexes.

Table 2: Estimation with physical and financial infrastructure index

	<i>Dependent Variables</i>					
	Private capital	FDI	Portfolio I.	Private capital	FDI	Portfolio I.
<i>Explanatory variables</i>	<i>2SLS</i>	<i>3SLS</i>	<i>3SLS</i>	<i>2SLS</i>	<i>3SLS</i>	<i>3SLS</i>
Infrastructure¹	0.541	0.331	0.189			
	(2.56)**	(1.87)*	(2.04)**			
Infrastructure²				0.283	0.205	0.070
				(2.88)***	(2.48)**	(1.62)
Control	-1.289	-1.050	-0.127	-1.222	-0.982	-0.128
	(2.38)**	(2.31)**	(0.53)	(2.28)**	(2.18)**	(0.54)
Growth	0.193	0.167	0.056	0.189	0.171	0.048
	(3.73)***	(3.93)***	(2.46)**	(3.84)***	(4.24)***	(2.23)**
Inflation	-0.000	-0.001	0.000	-0.001	-0.001	0.000
	(0.80)	(2.18)**	(1.72)*	(1.02)	(2.29)**	(1.44)
Openness	-0.716	-0.390	-0.584	-0.695	-0.578	-0.395
	(0.69)	(0.45)	(1.28)	(0.72)	(0.71)	(0.92)
Education	-0.004	-0.004	0.001	-0.002	-0.002	0.001
	(0.33)	(0.36)	(0.21)	(0.18)	(0.22)	(0.28)
Property	-0.041	-0.061	0.010	-0.035	-0.063	0.017
	(0.41)	(0.73)	(0.24)	(0.36)	(0.75)	(0.38)
Natural resources	-0.103	-0.084	0.013	-0.098	-0.079	0.013
	(0.71)	(0.69)	(0.20)	(0.68)	(0.65)	(0.20)
Crisis	-0.708		-0.152	-0.705		-0.148
	(3.21)***		(1.58)	(3.25)***		(1.57)
R²	0.69	0.74	0.22	0.70	0.75	0.24
Sargan Stat.	0.01	0.28	0.53	0.02	0.06	0.49
<i>(p-value)</i>	(0.95)	(0.40)	(0.53)	(0.89)	(0.19)	(0.52)
Observations	197	197	197	197	197	197
Countries	45	45	45	45	45	45

z statistics in parentheses. All regressions include time and country fixed effects.* significant at 10%; ** significant at 5%; *** significant at 1%.

1 Infrastructure index by principal component analysis. 2 Infrastructure index by standardization

Before interpreting the results obtained with the infrastructure index, let us separately estimate the equations with individual infrastructure variables in order to address criticisms generally made to aggregate indicators that cannot distinguish the partial contribution of each variable. The following table gives the results of estimation considering a proxy for physical infrastructure (the proportion of fixed and mobile phone subscribers) and another one for financial development (M3/GDP) separately.

Table 3: Estimation (3SLS) with differentiation of physical and financial infrastructure

<i>Explanatory Variables</i>	<i>Dependent Variables</i>	
	FDI	Portfolio I.
Telephone	0.031 (2.53)**	-0.006 (0.92)
M3/GDP	-0.016 (1.06)	0.017 (2.10)**
Control	-1.080 (2.65)***	-0.083 (0.40)
Growth	0.084 (2.29)**	0.048 (2.52)**
Inflation	-0.002 (3.73)***	0.000 (1.87)*
Openness	1.286 (1.65)*	-0.532 (1.32)
Education	-0.003 (0.34)	0.001 (0.22)
Property	-0.008 (0.11)	0.009 (0.23)
Natural resources	-0.079 (0.94)	0.015 (0.35)
Crisis		-0.128 (1.55)
R²	0.88	0.19
Sargan Stat.	0.14	0.29
<i>(p-value)</i>	(0.29)	(0.41)
Observations	239	239
Countries	58	58

z statistics in parentheses. All regressions include time and country fixed effects.
 * significant at 10%; ** significant at 5%; *** significant at 1%

Beside the instruments diagnostic tests which reject the hypothesis of weak instruments, the Sargan overidentification test does not reject the validity of the instruments. With the index of infrastructure compared to physical and financial infrastructure variables taken separately, the results do not differ significantly for the control variables. Thus, macroeconomic instability characterised by a high inflation or a banking crisis negatively affects inflows of FDI and portfolio investments in developing countries respectively. Inflation positively affects portfolio investment in developing countries. This result could illustrate the fact that Latin American countries which attract an important part of portfolio investment in the sample are countries that exhibit a higher inflation rate -especially during the Mexican crisis of 1994. Capital controls⁶ have a

⁶ The measure of capital control is the average of proxies of government restrictions which affect capital mobility (capital account restrictions, current account restrictions, presence of multiple exchange rates and repatriation requirements for export proceeds). There is a structural break in capital account data series in 1996 when the IMF started to report more details on capital account -permitting a measure of capital account restriction intensity- instead of the dichotomous variable. That makes the data before and after 1996 not entirely comparable. Quinn (1997) and Mody and Murshid (2005) have also constructed single data series using the IMF publications. Chinn (2004) finds also that Quinn index explain 71 percent of the four variables we used to construct our index before 1996. As Mody and Murshid (2005), a robustness check using a truncated sample (before 1996) does not change our results.

negative effect on private capital inflows and a good economic situation characterised by a high growth rate positively influences capital flows to developing countries. Countries with higher trade openness also receive more FDI.⁷

Concerning our two variables of interest the index of physical and financial infrastructure, obtained either by the principal component analysis or by the standardisation method, positively and significantly affects private capital flows and each of its components (FDI or portfolio investments). Physical and financial infrastructure have a stronger impact on FDI than on portfolio investments, but this result gives no indication of the respective importance of physical or financial infrastructure in the attractiveness of FDI or portfolio investments. Table 3 deals with this question by underlining the fact that physical infrastructure only affects FDI inflows while financial infrastructure only has a significant effect on portfolio investments. Indeed, a rise of 10 percentage points in the number of fixed and mobile phone subscribers increases FDI inflows by 0.31 percentage point. This result illustrates the existence of a minimal condition in order to guarantee prosperity of investments and thus attract FDI. The implementation of a great number of economic activities (especially industrial ones) requires a minimum of communication infrastructure (telephones, roads, so forth) allowing or facilitating the access to raw and intermediate materials but also access to markets which reduces production costs. The government usually provides financing for infrastructure, given that a firm can hardly support the cost by itself. Hence the existence of infrastructure creates a favourable environment for investments, particularly foreign investments.

Portfolio investments are more volatile, and are relatively scarce in developing countries. Of the two infrastructure variables, only financial development significantly and positively affects portfolio investment flows to developing countries. A rise of 10 percentage points in the liquidity liabilities (M3/GDP) leads to a rise of 0.17 percentage point of portfolio investments. Inflows of portfolio investments require a high level of financial development since this type of capital flow is, most frequently, negotiated in stock markets. Well-developed financial markets improve information circulation, which reduces the potential risk taken by investors on this market and also transaction cost.

4.4. Robustness check and African specificity

Alternative explanatory variables

The literature suggests several variables that capture the physical infrastructure or financial development of a country. We considered the percentage of subscribers of fixed and mobile phone service in the population as a proxy for physical infrastructure and liquid liability (M3/GDP) as a proxy of financial development. The results can be influenced by the choice of these variables. To address this, we estimate the system of equations with electric consumption per capita to reflect physical infrastructure and credit

⁷ Education does not affect significantly private capital flows to developing countries. According to the type of FDI (vertical FDI or horizontal FDI), multinational firms will look for unskilled cheap labor or skilled more expensive labor force. Urata and Kawai (2000) find that skilled labor availability discourages Japanese FDI. After a breakdown analysis, the authors show that skilled labor positively affects FDI in developed countries but the effect is not significant for developing countries.

to private sector (in percentage of the GDP) as the financial development variable. The results are robust to the use of these alternative interest variables.

Table 4: Robustness checks (3SLS)

<i>Explanatory Variables</i>	<i>Dependent Variables</i>			
	FDI	Portfolio I.	FDI	Portfolio I.
Electricity	0.002	-0.000		
	(3.86)***	(1.60)		
Credit	0.098	1.644		
	(0.08)	(2.58)***		
Telephone			0.036	-0.007
			(2.80)***	(0.98)
M3/GDP			-0.014	0.016
			(0.93)	(2.04)**
Control	-1.027	-0.259	-0.989	-0.096
	(2.39)**	(1.10)	(2.38)**	(0.45)
Growth	0.138	0.062	0.088	0.048
	(3.45)***	(2.72)***	(2.38)**	(2.46)**
Inflation	-0.001	0.000	-0.002	0.000
	(3.20)***	(2.04)**	(3.67)***	(1.85)*
Openness	-0.160	-0.546	1.169	-0.518
	(0.20)	(1.25)	(1.47)	(1.26)
Education	0.002	-0.001	-0.004	0.001
	(0.17)	(0.10)	(0.45)	(0.25)
Property	-0.052	0.028	-0.014	0.010
	(0.66)	(0.64)	(0.18)	(0.25)
Natural resource	-0.093	0.019	-0.083	0.016
	(0.80)	(0.30)	(1.00)	(0.36)
Crisis		-0.121		-0.127
		(1.28)		(1.54)
Change			-0.336	0.048
			(1.09)	(0.30)
R²	0.77	0.23	0.88	0.19
Sargan Stat.	5.40	6.02	0.24	0.33
<i>(p-value)</i>	0.98	0.98	0.37	0.44
Observations	197	197	239	239
Countries	45	45	58	58
z statistics in parentheses. All regressions include time and country fixed effects. * significant at 10%; ** significant at 5%; *** significant at 1%				

Since portfolio investments are short term flows, high variability in exchange rates could cause uncertainty in the return on these investments. Exchange rate variability may also negatively affect long-term flows such as FDI by increasing uncertainty in returns. Considering the exchange rate variability variable, our main results remain robust (table 4).

Non-linear relationship

Up to this point, we have only tested linear relations whereas the physical infrastructure may have a congestion effect. Even if the number of subscribers to telephone service or electric consumption per capita has a positive effect on capital inflows, it would be possible that this positive effect vanishes above a certain level of telephone subscribers or electric consumption (which could be due to the interaction between infrastructure and other limited factors such as the stock of human capital). Concerning the level of financial infrastructure, a rise in credit or liquid liabilities can be a signal of financial development but an excessive money supply or private credit can also indicate bad management of monetary policy or be the precursory sign of a financial crisis. Table 5 shows the results considering possible threshold effects of infrastructure and financial development⁸.

Table 5: Non linearity check (3SLS)

<i>Explanatory Variables</i>	<i>Dependent Variables</i>	
	FDI	Portfolio I.
Telephone	0.099 (2.04)**	0.029 (1.08)
M3/GDP	0.054 (1.31)	0.069 (3.04)***
Telephone²	-0.001 (1.34)	-0.000 (1.07)
M3/GDP²	-0.001 (2.03)**	-0.001 (3.48)***
Control	-0.641 (1.38)	0.203 (0.79)
Growth	0.078 (2.38)**	0.027 (1.47)
Inflation	-0.001 (1.98)**	0.001 (2.56)**
Openness	1.116 (1.57)	-0.084 (0.22)
Education	-0.001 (0.12)	0.002 (0.51)
Property	-0.006 (0.08)	0.023 (0.59)
Natural resources	-0.065 (0.79)	0.026 (0.60)
Crisis		-0.024 (0.28)
R²	0.89	0.15
Sargan Stat.	0.41	4.85
<i>(p-value)</i>	(0.48)	(0.97)
Observations	239	239
Countries	58	58
z statistics in parentheses. All regressions include time and country fixed effects. * significant at 10%; ** significant at 5%; *** significant at 1% Telephone ² and M3/GDP ² are the squared values of Telephone and M3/GDP		

Our main results are confirmed with a greater effect of physical and financial infrastructure on FDI and portfolio investment inflows. Once we have allowed for non-linearity, our results show significant threshold effects for financial development. This highlights the importance of good management of monetary policy and the negative impact of excessive money supply.

⁸ The Ramsey-Reset test confirms the non linearity suspected for the variables of physical and financial infrastructure.

Structural Break and African Specificity

As illustrated in the analysis of capital inflows, private capital inflows, especially FDI to developing countries, have risen exponentially since 1990 with a peak prior to the Asian crisis. Important reforms in the liberalization of current and capital accounts were undertaken by developing countries at the beginning of the 1990s within the framework of the Washington Consensus in order to attract more private capital.

Table 6: Sub-Saharan Africa specificity (3SLS)

	<i>Dependent Variables</i>						
	Total Sample		Restricted Sample¹		Restricted Sample¹		SSA²
	FDI	Portfolio I.	FDI	Portfolio I.	FDI	Portfolio I.	FDI
Telephone	0.031	-0.006	0.030	-0.009	0.099	0.029	0.043
	(2.53)**	(0.92)	(2.36)**	(1.44)	(1.97)**	(1.14)	(2.31)**
M3/GDP	-0.016	0.017	-0.016	0.023	0.053	0.084	-0.030
	(1.06)	(2.10)**	(1.00)	(3.03)***	(1.30)	(3.92)***	(1.35)
Control	-1.080	-0.083	-1.052	-0.097	-0.605	0.239	0.437
	(2.65)***	(0.40)	(2.50)**	(0.49)	(1.26)	(0.97)	(0.74)
Growth	0.084	0.048	0.087	0.057	0.081	0.033	0.078
	(2.29)**	(2.52)**	(2.31)**	(3.13)***	(2.40)**	(1.85)*	(2.20)**
Inflation	-0.002	0.000	-0.002	0.000	-0.001	0.001	0.007
	(3.73)***	(1.87)*	(3.60)***	(2.13)**	(1.93)*	(2.99)***	(1.04)
Openness	1.286	-0.532	1.220	-0.650	1.061	-0.130	2.203
	(1.65)*	(1.32)	(1.52)	(1.71)*	(1.46)	(0.35)	(3.31)***
Education	-0.003	0.001	-0.003	-0.002	-0.001	-0.000	0.013
	(0.34)	(0.22)	(0.33)	(0.45)	(0.09)	(0.01)	(1.62)
Property	-0.008	0.009	-0.009	-0.011	-0.002	0.008	0.188
	(0.11)	(0.23)	(0.11)	(0.30)	(0.02)	(0.20)	(1.93)*
Natural resources	-0.079	0.015	-0.078	0.023	-0.065	0.034	0.046
	(0.94)	(0.35)	(0.91)	(0.56)	(0.77)	(0.81)	(0.68)
Crisis		-0.128		-0.086		0.042	
		(1.55)		(1.09)		(0.49)	
Telephone^2					-0.001	-0.000	
					(1.30)	(1.17)	
M3/GDP^2					-0.001	-0.001	
					(2.02)**	(4.30)***	
R²	0.88	0.19	0.88	0.10	0.89	0.10	0.89
Sargan Stat.	0.14	0.29	0.09	0.34	0.50	6.03	1.24
<i>(p-value)</i>	(0.29)	(0.41)	(0.24)	(0.44)	(0.52)	(0.98)	(0.74)
Observations	239	239	226	226	226	226	70
Countries	58	58	55	55	55	55	22

z statistics in parentheses. All regressions include times and country fixed effects.

* significant at 10%; ** significant at 5%; *** significant at 1%

Telephone^2 and M3/GDP^2 are the squared values of Telephone and M3/GDP

¹ Restricted sample is the total sample without some major developing countries: Brazil, India and South Africa ² SSA indicates Sub-Saharan African countries

A temporal Chow test before and after 1990 enables us to show stability of the coefficients during the two periods. There is no differentiated effect on the determinants of private capital due to the reforms, and no specificity before and after the 1990s crises.⁹ The analysis of private capital inflows to developing countries also shows a marginalisation of Sub-Saharan African countries. Analysis of the Sub-Saharan African sample shows an African specificity which is confirmed by the Chow test. Considering only Sub-Saharan African (SSA) countries, the results show that physical infrastructure positively and significantly affects FDI inflows.¹⁰

A rise of 10 percentage points in the number of subscribers to fixed and mobile phone service increases FDI inflows to SSA countries by 0.43 percentage points. These results may be explained by the fact that most SSA countries have relatively low levels of infrastructure development. On average over the period 1970-2003, only 2 percent of the population in SSA countries were telephone subscribers compared to 5 percent for Asian countries and 12 percent for Latin America countries. A simple simulation shows that if SSA countries were to reach the same level of physical infrastructure development as Asian countries, FDI inflows would increase by 6.5 percentage points. This simulation reveals the importance of physical infrastructure in attracting FDI for SSA countries attractiveness. The estimation for the subsample of SSA countries also highlights the importance of trade openness, economic growth and property rights protection in increasing attractiveness for FDI. It is also important to note that the results are robust to potential influential countries (Brazil, India and South Africa) since these countries attract an important part of FDI and portfolio investments received by developing countries.

5. Conclusion

Based on two theoretical approaches (Lucas paradox and push-pull factors) and after controlling for interaction between components of capital flows (with 3SLS), this study finds that physical infrastructure only fosters FDI inflows while financial development has a positive effect on portfolio investments. The results highlight the importance of threshold effects -especially for financial development- in analysing foreign private capital determinants. This indicates the importance of sound monetary policy and stronger oversight in the financial system. Indeed, lax monetary policy and excessive credit provision could weaken the financial system and significantly reduces portfolio investment inflows. It is thus important that policies aiming to attract more private capital must also consider the possible unwanted effects such as sudden stops or reversal of short-term capital flows by improving the supervision and the regulation of the financial system.

A study of African specificity underlined the important role of physical infrastructure in attracting FDI inflows. Development of infrastructure should attract

⁹ Data availability does not allow the test of other dates of potential ruptures or an Andrews-Quandt test which would enable to determine the break point. The choice of the break period, although imposed to us by the data is also justified theoretically

¹⁰ Given the low level of portfolio investment in Sub-Saharan African countries and the fact that South Africa is the main destination of these portfolio investments, we consider only FDI for the estimation on SSA countries. The specificity of SSA countries is confirmed with the introduction of a dummy in the full sample. The results obtained for the SSA countries sample are similar after standardization of the coefficients.

more private investments, in particular from abroad. Programs such as the NEPAD (New Partnership for Africa's Development) in Africa aim to find more funds for infrastructure. Our study encourages this type of initiative for a continent which should benefit considerably from the development of its infrastructure by attracting private capital, in particular FDI.

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Appendix 1: List of variables

Variables	Definitions	Sources
FDI	Foreign direct investment, net inflows (% of GDP)	Global Development Finance (2005)
PORTFOLIO I.	Portfolio investment, equity (% of GDP)	
DEBT	Bank and trade-related lending (% of GDP)	
M3/GDP	Liquid liabilities (M3) as % of GDP	Financial Structure Dataset (2006)
Credit	Domestic credit provided by banking sector (% of GDP)	
Deposit	Financial System Deposits (% of GDP)	
Telephone	Fixed line and mobile phone subscribers per 100 inhabitants	World Development Indicators (2005)
Electricity	Electric consumption per capita	
Growth	Economic growth rate	
Inflation	Inflation rate	
Openness	Sum of exports and imports of goods and services as a share of gross domestic product.	
Change	Exchange rate variability (standard deviation)	
Control	Capital control indicator: average of four dummies: Exchange arrangements, payments restrictions on current transactions and on capital transactions, and repatriation requirements for export proceeds	Milesi Ferretti (1970-1997) and Annual Report on Exchange Arrangement and Exchange Restrictions (1998-2003)
Crisis	Financial crisis dummy	Caprio and Klingebel (2003)
Education	Gross primary enrollment rate	UNESCO Statistics (2004)
Natural resources	Log of oil, gas, metal and mineral rents	World Bank (2002)
Regulation	Credit market regulation	Fraser Institute (2005)
Property	Property right Protection	

Appendix 2: Sample for estimation

Sub-Saharan Africa	Latin America and Caribbean	Asia
Benin	Argentina	Algeria*
Botswana	Barbados	Bangladesh
Burundi	Bolivia	Egypt*
Cameroon	Brazil	India
Central African Republic	Chile	Indonesia
Chad	Colombia	Iran
Congo, Rep.	Costa Rica	Jordan
Cote d'Ivoire	Dominican Republic	Malaysia
Ghana	Ecuador	Oman
Kenya	El Salvador	Pakistan
Madagascar	Guatemala	Papua New Guinea
Niger	Honduras	Philippines
Nigeria	Jamaica	Sri Lanka
Rwanda	Mexico	Syrian Arab Republic
Senegal	Nicaragua	Thailand
Sierra Leone	Peru	Turkey
South Africa	Trinidad and Tobago	Tunisia*
Tanzania	Venezuela	Vietnam
Togo		
Uganda		
Zambia		
Zimbabwe		

*Three North African countries are considered in the group of Asian countries because of their similarity to Middle East countries more than to Sub-Sahara African countries.

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