Banking System Vulnerability and Domestic Investment in Sub-Saharan Africa

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Abstract: The objective of this study is to identify the indicators of banking system vulnerability that most delay domestic investment in Sub-Saharan Africa between 2002 and 2016. To do so, we use secondary data. Specifically, data from the World Development Indicator (WDI 2017), the World wide Governance Indicator (WGI 2017) and the International Monetary Fund IMF. Using a dynamic panel, a generalized method of moments (GMM) estimation shows that indicators related to the stability of the banking system, notably the credit/deposit ratio and the credit-to-GDP gap, are the ones that slow down domestic investment the most in sub-Saharan Africa.

Keywords: Vulnerability, Banking system, Domestic investment. Sub-Saharan Africa.

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1. INTRODUCTION

The dependence of most Sub-Saharan African economies on foreign capital and commodity exports is a reality that makes them particularly vulnerable to shocks, both general and financial (Naudé, 2009). A number of studies on the analysis of this vulnerability in African countries have attempted not only to define the concept, but also to propose indicators that could help to better define it. Thus, it emerges from this work that vulnerability can be defined as the risk for a country of being durably affected by exogenous and unforeseen factors (Guillaumont, 2007). It is in fact the product of three distinct elements: the magnitude of the factors generally identified as shocks, the country's exposure to these shocks, and the country's low resilience or capacity to cope with them. Applied to the banking system, it indicates the level of sensitivity of a banking system as a whole, to a negative shock such as a financial crisis (Gibson et al, 2018). While the economic literature identifies several indicators of banking system vulnerability, the most common ones proposed by the International Monetary Fund (IMF) are: solvency, the quality of assets and off-balance sheet positions, bank profitability and liquidity, the quality of credit expansion, and external and domestic debt.

However, following the global financial crisis of 2007, the financial systems of SSA economies have shown resilience. Indeed, despite substantial pressures from the global crisis, the monetary, financial, and foreign exchange markets of SSA countries have continued to follow their usual course. This relative stability has been attributed to several factors including: limited, albeit growing, integration with global financial markets, minimal exposure to complex financial instruments, fairly high bank liquidity, moderate dependence on foreign financing, or low institutional leverage (UNCTAD[1], 2016).

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[1] United Nations Conference on Trade and Development.

However, it is clear that investment policies in these countries have become increasingly complex and uncertain (UNCTAD, 2016). This reflects low investment at both the public and private levels in this part of the African continent. This is sufficient evidence of the low growth rates recorded there. As an illustration, according to an IMF report (2015), domestic investment (i.e., public and private) in Sub-Saharan Africa has evolved very slowly. Indeed, the level of private investment in 2002 was 6.80% and in 2013 8.15% while having experienced a slight decline between 2004 and 2005. As for public investment over the period from 2002 to 2013, it has evolved, but only slightly. In 2002 it was 9.64% and in 2013 it rose to 13.04%. That is an increase of 3.43% in eleven years. More explicitly, it is noted that public investment has experienced a slight increase than private investment.

However, since the financial system is at the center of the financing process, particularly through its function of mobilizing savings, allocating resources and managing risks, it is possible to establish a link with investment. Levine (1997) shows that there is a positive link between the development of the financial system and an improvement in the quality of investment. However, for Guillaumont and Kangni (2006), a poorly oriented financial system can be a source of fragility for the latter, which can negatively affect investment. It is therefore interesting to examine the indicators of vulnerability of the banking system that can influence domestic investment in sub-Saharan Africa. This analysis is therefore in line with the empirical work on the determinants of investment in Sub-Saharan Africa. It therefore aims to **identify and analyze the indicators of banking system vulnerability that slow down domestic investment in Sub-Saharan Africa**. To do so, it makes sense to examine the theoretical explanations that underpin this study and present some stylized facts (2), before conducting an empirical analysis of the determinants of domestic investment in Sub-Saharan Africa (3) and finally discussing the results (4).

2. REVIEW OF THE LITERATURE

The purpose of this literature review is to present the main arguments on the effects that indicators of financial vulnerability can have on domestic investment. A review of the literature shows that two main groups of theories are very often used to assess the influence of the banking system on investment. While the first group questions or refutes any influence of the banking system on investment, the second group, which we also use to establish this link in this analysis, highlights the strong influence of this sector on investment.

One of the major contributions of economic research in the Keynesian tradition has been the break with the traditional dichotomy between the financial system and real economic activity. Walras' theory, based on the assumption of perfect foresight of markets and agents, suggests that financial factors have no role in the firm. In other words, this theory states that the structure of a financial system is irrelevant for investment decisions (Modigliani and Miller, 1958). Numerous theoretical models from the mid-1980s, notably Jorgenson's neoclassical investment model, the gas pedal model, and Tobin's q-model, support this view. More specifically, these models do not take liquidity into account when making investment decisions. For example, according to Tobin's q model, the market valuation of a firm is a sufficient indicator of investment opportunities. This argument is used to explain how investment decisions can be made without intervention by the financial system. For Kuh, (1963), the investment model leaves no room for liquidity variables, as long as the expected profitability is fully exploited through production.

However, several theoretical works will oppose this neoclassical theory by emphasizing the primordial role of the financial system in investment decision-making. It is in this perspective that Brunnermeir (2009) and Scheiter and Vishny (2010), based on the theory of the demand and supply of credit by the financial system, will highlight the effects of credit on investment. They find that a shock to the supply of credit to firms leads to a reduction in capital spending, which is treated as investment. This theory of the demand and supply of credit is added to that of financial liberalization, which shows that the liberalization of interest rates applied within financial institutions facilitates access to banking services and therefore promotes investment. Based on the theory of financial liberalization, Mishkin (1997) and Caprio and Klingebiel (1997) demonstrate the importance of the banking sector in developing countries and the serious effects of banking imbalances on these economies. They argue that the vulnerability of the banking system can adversely affect economies to the

extent that the banking system cannot perform its traditional role of screening out bad risks and mitigating adverse selection in investment projects.

Other theoretical models highlight the influence of a vulnerable financial system on investment through the role played by domestic credit markets in transmitting external shocks to the domestic economy. In this perspective, the work of Arellano and Mendoza (2002) and Mendoza and Smith (2006) emphasizes the importance of introducing credit and collateral constraints into models analyzing small open economies in order to account for the empirical regularities associated with sudden stops, including investment collapses. Mendoza (2006a, b) reveals the importance of leverage ratios and collateral constraints in amplifying investment responses following sudden stops. Collateral constraints refer to the situation of a financial system that is highly leveraged, such that a shock will cause firms to respond negatively, making assets hard to meet marginal needs, resulting in investment collapses.

Gopinath's (2004) analysis stems from another problem caused by financial intermediation, which is information asymmetry. In the banking system, information asymmetry is a situation in which the bank does not have complete knowledge of its client's project when it wants to grant a loan, so the two do not have the same level of information. Thus, Gopinath shows that in an economy where investors do not have adequate information about the returns associated with investment projects, they conduct costly searches to evaluate different projects. These search frictions generate an asymmetric response in capital flows, with a gradual inflow and gradual creation of projects in response to positive shocks and a large outflow of capital, and a sudden outflow following a sudden destruction of the project in response to negative shocks.

Other theoretical works explain how financial frictions affect investment decisions. Starting from the theory of the credit multiplier, this work seeks to identify the impact of frictions in the financial system on corporate investment. Based on the "monotonicity" hypothesis, Fazzari et al (1998) argue that the sensitivity of investment to internal funds should increase with the difference between the costs of internal and external funds. This highlights the impact of credit frictions on investment. Following the same line of thought, Bernanke and Gertler (1989) and Kiyotaki and Moore (1997) show that credit market imperfections can amplify the effect of macroeconomic shocks. In other words, financial vulnerability can arise from moral hazard or from the costly state of verification. With credit imperfections, the decline in net worth at the same time will reduce the borrower's ability to invest in physical and operating capital, which will lead to a decline in future output.

En insérant cette analyse dans le deuxième groupe de travaux théoriques, nous postulons que la vulnérabilité du secteur financier devrait influencer l'investissement dans les pays d'Afrique subsaharienne.

By including this analysis in the second group of theoretical works, we postulate that financial sector vulnerability should influence investment in SSA countries. This assumption is the basis for the objective of this study as stated above.

3. METHODOLOGY

This section is devoted to the presentation of the method adopted in this analysis. These methodological elements relate essentially to the choice of the model and its specification, the description of the study variables and finally the sampling.

3.1. Choice of model and specification

Drawing on the work of Ndikumana (2000), who highlights the relationship between financial variables and domestic investment, we opt for a dynamic panel model in this analysis. The advantage of such a model lies in the fact that it takes into account unobservable characteristics specific to individuals and/or the periods studied over time. This model can be specified as follows:

$$\ln(InvPUB)_{i,t} = \beta\ln(InvPUB)_{i,t-1} + \delta vul_{i,t} + \Gamma'X_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (1)$$
$$\ln(InvPRIV)_{i,t} = \beta\ln(InvPRIV)_{i,t-1} + \delta vul_{i,t} + \Gamma'Y_{i,t} + \mu_i + \varepsilon_{i,t} \qquad (2)$$

Where $InvPUB$ and $InvPRIV$ represent public and private investment, respectively. vul represents the vector of banking system vulnerability indicators. $X_{i,t}$ and $Y_{i,t}$ is the vector of other determinants of domestic

investment. η_i et μ_i are the specific fixed or random effects of country i. $\varepsilon_{i,t}$ the error term. *t= 1,2,3……T et i=1,2,3……N* epresenting years and countries respectively. Specifically we have:

$$\ln(InvPUB)_{i,t} + \beta\ln(InvPUB)_{i,t-1} + \delta_1\ln(rcre/dep)_{i,t} + \delta_2 z - score_{i,t} + \delta_3\ln(creGDP)_{i,t}$$
$$+ \Gamma'_1\ln(real\ GDP)_{i,t} + \Gamma'_2\ln(domstcsave)_{i,t} + \Gamma'_3\ln(natress)_{i,t} + \Gamma'_4\ln(extdebt)_{i,t}$$
$$+ \Gamma'_5 Ir\acute{e}el_{i,t} + \Gamma'_6\log(educprim)_{i,t} + \Gamma'_7 corruption_{i,t} + \Gamma'_8 regulation_{i,t} + \Gamma'_9 polstab_{i,t}$$
$$+ \Gamma'_{10}\ln(InvPRIV)_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (3)$$

$$\ln(InvPRIV)_{i,t} + \beta\ln(InvPRIV)_{i,t-1} + \delta_1\ln(rcre/dep)_{i,t} + \delta_2 z - score_{i,t} + \delta_3\ln(creGDP)_{i,t}$$
$$+ \Gamma'_1\ln(real\ GDP)_{i,t} + \Gamma'_2\ln(domstcsave)_{i,t} + \Gamma'_3\ln(natress)_{i,t} + \Gamma'_4\ln(extdebt)_{i,t}$$
$$+ \Gamma'_5\ln(exchrate)_{i,t} + \Gamma'_6\log(educprim)_{i,t} + \Gamma'_7 corruption_{i,t} + \Gamma'_8 polstab_{i,t}$$
$$+ \Gamma'_9 electricity_{i,t} + \Gamma'_{10} inflation_{i,t} + \eta_i + \varepsilon_{i,t} \qquad (4)$$

In general, the modeling of such equations can lead to endogeneity problems. Moreover, the specification of a model under a dynamic panel requires that the dependent variable lagged by at least one period be introduced among the explanatory variables. The presence of this variable in the right-hand side of the equations automatically leads to an endogeneity bias. Consequently, the use of traditional estimation methods, in particular OLS, is no longer adequate since it gives biased and non-convergent estimators due to the correlation between the lagged endogenous variable and the error term, when the residuals are autoregressive. Hence the need to use more efficient estimation methods, in this case the generalized method of moments (GMM) developed by Holtz-Eakin et al. (1988) and Arellano and Bond (1991). To this end, Arellano and Bond (1991) propose to transform the reference equations (1) and (2) into first differences, thus eliminating the country-specific effect.

$$\Delta InvPUB_{i,t} = \beta\Delta InvPUB_{i,t-1} + \delta\Delta vul_{i,t} + \Gamma'\Delta X_{i,t} + \Delta\varepsilon_{i,t} \qquad (5)$$
$$\Delta InvPRIV_{i,t} = \beta\Delta InvPRIV_{i,t-1} + \delta\Delta vul_{i,t} + \Gamma'\Delta Y_{i,t} + \Delta\varepsilon_{i,t} \qquad (6)$$

However, the passage of these reference equations in first difference raises a new problem since the lagged dependent variable is by construction correlated with the error term. To solve this problem, the authors make two assumptions, namely that the error terms are not autocorrelated and that the explanatory variables are weakly exogenous (the explanatory variables are uncorrelated with the future realizations of the error terms). Arellano and Bond (1991) therefore propose the following moment conditions:

$$E[InvPUB_{i,t-s}(\varepsilon_t - \varepsilon_{i,t-s})] = 0 \qquad for\ s \geq 2, t = 3, …T \qquad (7)$$
$$E[InvPRIV_{i,t-s}(\varepsilon_t - \varepsilon_{i,t-s})] = 0 \qquad for\ s \geq 2, t = 3, …T \qquad (8)$$
$$E[vul_{i,t-s}(\varepsilon_t - \varepsilon_{i,t-s})] = 0 \qquad for\ s \geq 2, t = 2, …T \qquad (9)$$
$$E[X_{i,t-s}(\varepsilon_t - \varepsilon_{i,t-s})] = 0 \qquad for\ s \geq 2, t = 2, …T \qquad (10)$$
$$E[Y_{i,t-s}(\varepsilon_t - \varepsilon_{i,t-s})] = 0 \qquad for\ s \geq 2, t = 2, …T \qquad (11)$$

These different conditions underline the absence of correlation between the lagged explanatory variables and the lagged endogenous variables with the variations of the error term. Consequently, they allow the use of level lagged variables as instruments to estimate equations (5) and (6). However, this method, while providing more accurate results than the usual techniques, has some limitations, as the use of level lagged variables as instruments is not always adequate. Indeed, Blundell and Bond (1998) have shown that, in small samples, the coefficients can be seriously biased if the level explanatory variables are highly correlated. Therefore, the preferred approach in this analysis is the GMM estimator in Arellano-Bover (1995)/Blundell-Bond (1998) systems. It consists in combining for each period the first difference equation with the level equation. In the first difference equation, the variables are then instrumented by their level values delayed by at least one period. In contrast, in the level equation, the variables are instrumented by their first differences (Guillaumont and Kangni, 2006).

To test the robustness of our model, we perform two tests. The first test is the Sargan/Hansen identification test, which allows us to test the validity of the lagged variables as instruments. It is conclusive if we fail to reject the null hypothesis at the 10% threshold. We prefer the Hansen test to the Sargan test because it is robust and corrects for heteroscedasticity in the residuals. The second is the Arellano and Bond second-order autocorrelation test. It is conclusive if the null hypothesis (absence of autocorrelation of the error terms in first difference of order 2) cannot be rejected at the 10% threshold.

3.2. Description of Study Variables

Table 1 below provides a description of the variables in this study. These are mainly indicators of vulnerability of the banking system, other determinants of domestic investment and governance variables according to the Kaufmann, Kraay and Mastruzzi approach.

Tableau 1 : Description des variables d'étude

Variable	Definition	Source
Credit to GDP gap	Measures the size of the credit cycle; that is, the deviations of credit from the normal range of historical experience.	GFD 2016
z-score	Measures the solvency of the banking sector.	GFD 2016
Credit to deposit ratio	Measures the stability of funding for the banking sector.	GFD 2016
Private investment	Expressed as a percentage of GDP (*InvPriv*).	FMI
Public investment	Expressed as a percentage of GDP (*InvPub*).	FMI
Gross savings	Measured by gross national income less total consumption plus transfers.	WDI 2017
Gross fixed capital formation	Which is the measure of domestic investment as a percentage of GDP.	WDI 2017
External debt	Measured by the debt to GDP ratio.	WDI 2017
Trade balance	Corresponds to exports of goods and services minus imports of goods and services (current account).	WDI 2017
Domestic savings	Gross national income minus consumption plus net transfers.	WDI 2017
Exchange rates	Indicates the likely transition indicator from the quiet state to the shock vulnerable state.	WDI 2017
GDP	The measure is constant GDP (the sum of gross value added by all resident producers in the economy, plus taxes on products and subsidies not included in the value of the product) and current GDP (which is GDP at purchaser prices).	WDI 2017
Interest rate	Measured by the real interest rate and the lending rate.	WDI 2017
Trade opening	Measured by the sum of exports and imports of goods and services relative to GDP.	WDI 2017
Natural resources	Measured by total natural resource rents which are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents and forestry rents.	WDI 2017
Infrastructure	Measured by the rate of access to electricity.	WDI 2017
Financial development	It highlights the role of financial intermediaries in financing the productive sector, particularly the private sector. It is measured by the ratio of credit to the private sector to GDP (Devfin).	WDI 2017
Quality of the regulation	Measures the ability of governments to develop and implement sound policies and regulations that support private sector development. This indicator takes values between -2.5 and +2.5.	WGI 2017
Control of corruption	Measures the degree to which public authority is used for personal gain. This indicator takes values between -2.5 and +2.5.	WGI 2017

Political stability	Measures the perceived likelihood of destabilization or overthrow of the government through non-constitutional means. Values range from -2.5 to +2.5.	WGI 2017

Source: Based on WDI 2017, WGI 2017, FMI, and GFD 2016.

3.3. Sample

The data used in this study are secondary data. Specifically, they are the World Development Indicator (WDI 2017) and the World wide Governance Indicator (WGI 2017) for the indicators of macroeconomic variables and those of governance. And for domestic investment (public and private), the data come from the International Monetary Fund IMF database (ICSD 2015). For our variables of interest, the data were provided by the Global Financial Development (GFD 2016). Our scope of study includes all countries in Sub-Saharan Africa over the period 2002-2016. However, given the lack of data on some countries, they were removed from the sample. These are Somalia, Sudan, Eritrea, South Sudan, Seychelles, and Liberia.

4. RESULTS

4.1. Descriptive Statistics

Generally speaking, the volume of investment in Sub-Saharan Africa did not really increase over the years 2002-2013. However, we observe countries where the evolution of private and public domestic investment has deviated considerably from the average trend. Thus, we will distinguish the ten countries with the highest and ten countries with the lowest rates of domestic investment in each type. Comparing the different groups of countries, we observe that in the first group[2] private investment averages 20.83% and in the second group[3] 4.22%. The standard deviation is 5.88% in the first group and 1.73% in the second group, reflecting the different levels of private investment within each group. To illustrate this, in the first group, the gap observed is about 18.22% between Cape Verde (34.25%) and Guinea (16.03%), yet in the second group, the gap between Burundi (6.43%) and Lesotho (0.84%) is only 5.58%. Public investment in the top ten countries[4] was 11.86% compared to 3.50% in the bottom ten[5]. As in the case of private investment, there is a large gap between public investments in the top ten countries. The illustration here is that Cape Verde (15.63%) has an investment rate of more than 5.87% than the Republic of Congo (10.27%). Conversely, in the second group, Guinea-Bissau (4.37%) has a higher rate of 1.92% than Nigeria (2.45%). Thus, to better understand inter- and intra-group disparities, we first analyze the influence of financial factors on the slowdown of private and public domestic investment in Sub-Saharan Africa; these are the interest rate and gross domestic savings. Next, we will capture the effect of indicators of banking system vulnerability on private and public domestic investment in SSA.

4.1.1. Influence of financial factors: interest rate and gross savings

Gross domestic savings and the interest rate are financial determinants that allow a bank to see how it can extend credit to a third party. In other words, the level of private investment in a country can be justified by the quality of the banking sector. It is therefore observed that in countries with a high rate of private investment, the savings rate is high and the interest rate is accessible to investors. Specifically, in the case of the first country in the ranking, the average savings rate over the period from 2002 to 2013 indicates that a high average savings rate of 36.65% gives an average private domestic investment of 34.26% while the ninth country on the list, has a relatively low savings rate of 7.47% and so follows its private investment rate of 16.19%. However, there are countries where the average savings rate is high at 53.99% and the average private investment rate does not follow its course at 24.12%; this is the case of Botswana.

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[2] Cape Verde, Mauritania, Botswana, Gabon, Namibia, Senegal, Zambia, Mauritius, South Africa, Guinea.
[3] Burundi, Ethiopia, Nigeria, Côte d'Ivoire, Guinea-Bissau, Central African Republic, Cameroon, Angola, Zimbabwe, Lesotho.
[4] Cape Verde, Zimbabwe, Swaziland, Cameroon, Malawi, Ethiopia, Angola, Republic of Congo, Gambia.
[5] Guinea-Bissau, Madagascar, Togo, Burundi, Sierra Leone, Chad, Uganda, South Africa, Central African Republic, Nigeria.

Graph 1: Relationship between private investment and domestic savings in the 1st group
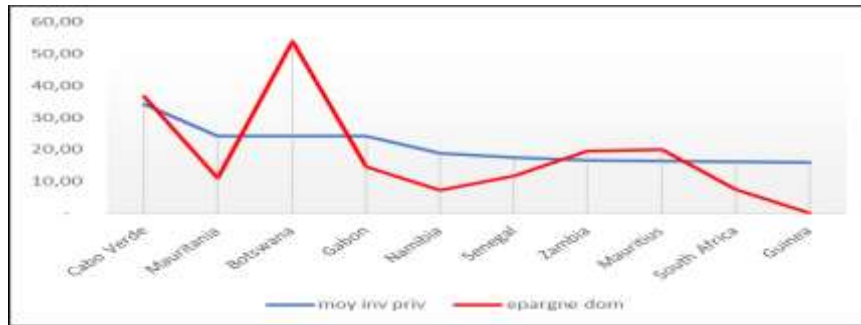
Source: Based on World Bank data (WDI, 2017).

As for the interest rate, it has a different interpretation from domestic savings. In fact, the lower the interest rate, the more interested investors are in making their investment at a lower cost. In general, the average interest rate in this group of countries is 3.65% for an average private investment of 20.83% over the whole period. In one particular case, we note that Cape Verde, first on the list, was able to achieve an average private investment rate of 34.26% for an interest rate of 7.39%. While Zambia comes sixth with a higher average interest rate than the others, i.e. 9.50%, at an average private investment rate of 16.58%. An exceptional case in this group is Senegal which has the lowest average interest rate, but its investment remained at 17.42%.

Graph 2: Relationship between private investment and interest rates in the first group
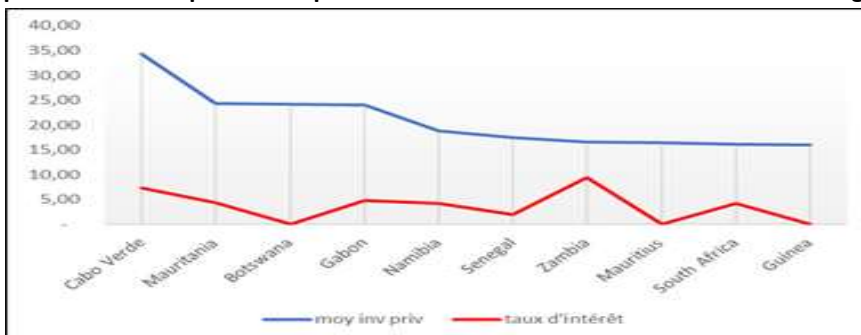
Source: Based on World Bank data (WDI, 2017).

The last ten investors here refer to countries with low domestic investment rates in our sample and over our study period. In general, the average private domestic investment rate in this group is 4.22 percent, which is much lower than that observed in the first group, 20.83 percent. In particular, it is found that the differences in private investment between the different groups in some years are not as great. This is highlighted in the years 2003, 2004 and 2005 where the gap varies between 0.81% and 1.23%.

Graph 3: Comparison of private domestic investment between the two groups
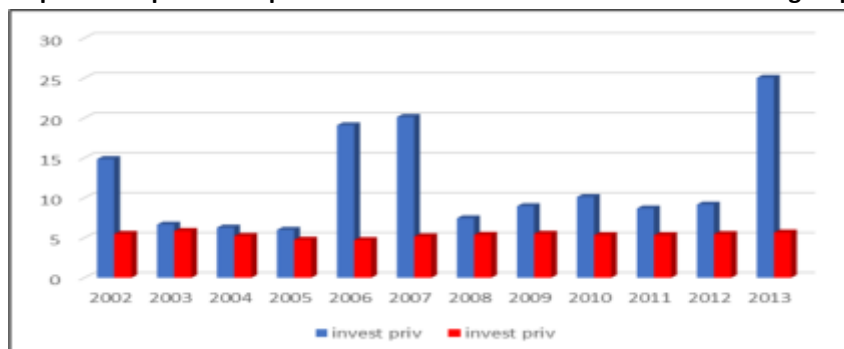
Source: Based on World Bank data (WDI, 2017).

As for the link between domestic savings and domestic investment in this group, we can justify that their investments are at such a low level because it is low and negative for some countries. We have countries such as Guinea-Bissau, which has a domestic savings rate of -2.23% with a domestic public investment rate of 4.38%, Burundi, which has a domestic savings rate of -4.99% against a public investment rate of 3.93%, and Chad, which has a domestic savings rate of -2.04% against a public investment rate of 3.40%. The same phenomenon is repeated in private investment. But here, it is countries like Angola (-2.23%), Zimbabwe (-15.66%) and Lesotho (-6.82%) that reproduce the phenomenon.

In this group of countries, it is observed that the average interest rate is 18.73% for private investment which is also at an average rate of 4.22%. By making a comparative study with that observed in the group of countries with high investment rates, we note that there is a gap of 15.08% on the interest rate. This justifies the classification of these countries as low. The key illustration here is Lesotho, which has an average private investment rate of 0.85% corresponding to an average interest rate of 139.50%. In contrast, Angola has a relatively low interest rate of 1.26 percent, but private investment hovers around 3.37 percent over the period. If we look at public investments, we see the same thing. Interest rates are high and do not facilitate investment in these countries.

Graph 4: Evolution of private investment as a function of the interest rate in weak countries
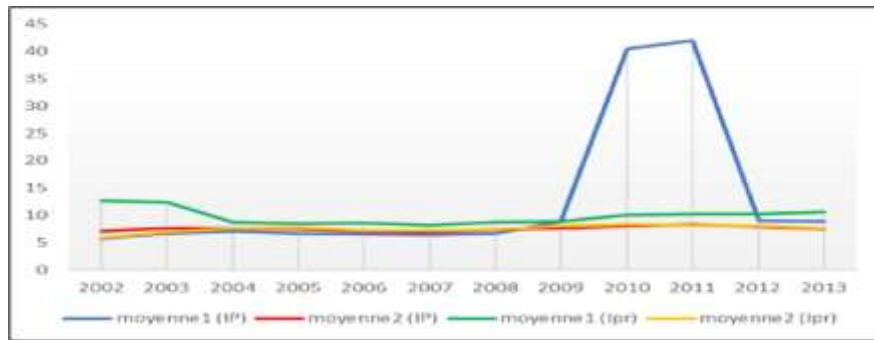

Source: Based on World Bank data (WDI, 2017).

The above analysis shows that financial factors influence domestic investment in Sub-Saharan Africa. In other words, it was observed that domestic savings and the interest rate have a positive or negative influence on private and public investment, depending on the situation. Next, we will look at the evolution of domestic investment in relation to the indicators of vulnerability of the banking system.

4.1.2. Influence of banking system vulnerability indicators

The z-score measures the solvency of the banking sector. The aim here is to see how a non-creditworthy banking system behaves in the face of a slowdown in domestic investment in Sub-Saharan Africa. In the case of private investment, it is observed that in high-income countries the average investment is 20.83% throughout the period for a z-score of 10.84%. In particular, we observe that a high z-score means that the banking system is solvent and can therefore ensure investment, hence Cape Verde is first on the list with an investment rate of 34.26%, well above the average for a z-score of 10.61%. On the other hand, the effect of the z-score on the slowdown of investment is better noted in the case of the last country on the list, Guinea, with a z-score of 5.16%. Following the lead of the last country are Zambia with an average z-score of 2.01% and Senegal with 5.82%, occupying the last positions and with average private investment rates below the group average. As far as public investment is concerned, the phenomenon is similar with the Republic of Congo being among the last on the list with a z-score of 1.96%. A paradox is noted at this level with Zimbabwe which has a relatively low z-score of 2.75%, but the rate of public investment is above average.

Graph 5: Comparative evolution of the z-score between the two groups

Source: Based on World Bank data (GFD, 2017).

Before starting out, investors need to be sure that they will get the funds they need to do so. Thus, the banking system must be solvent to allow them to do so. But the figures described above show that banks in sub-Saharan Africa are not sufficiently solvent, hence the slowdown in investments with average rates of 20.83% and 11.87% for private and public investments respectively. In line with the above, countries with vulnerable banking systems do not have sufficiently high domestic investment. In other words, this group of countries should have lower domestic investment than the first group because their banking system is certainly at a deplorable level. The figures confirm this, with an average private investment rate of 4.22% and public investment of 3.51%. When we look at the case of countries like Nigeria (2.45%), CAR (2.75%), Lesotho (0.85), Zimbabwe (2.95) which have the lowest z-scores, their domestic investments fall. As for the credit/deposit ratio, when it is high the banking system becomes unstable. These countries also score high on this level, hence their domestic investments are at low percentages. For this group of countries, the rate of this indicator credit/deposit ratio is 78.90% for public investments and 65.25% for private investments, thus justifying the decline in investments.

A general observation is that in countries with a stable banking system, domestic investment follows its normal course. In other words, the banking system has a place in domestic investment decisions in Sub-Saharan Africa. However, this descriptive analysis does not allow us to conclude a priori that there is a causal relationship between the vulnerability of the banking system and domestic investment. The following section will help us to better construct this through an econometric approach.

4.2. Results of the econometric analysis

Four regressions were run to meet the objective of this study. The first equation to analyze the influence of banking system vulnerability indicators on public investment in Sub-Saharan Africa is estimated in two ways: the first (model 1), takes into account other macroeconomic variables including private investment, but does not include time dummies. The second (model 2), on the other hand, excludes private investment and takes into account time dummies. In the second equation, which analyzes the influence of indicators of the vulnerability of the banking system on private investment, we used two variables of interest, crossed some governance variables and made the variables of interest more significant (model A).

Table 2: Estimation results

Variable	Public investment		Private investment	
	Model 1	Model 2	model A	model B
Credit/GDP (Log)	0,313*	0,164		
	(0,173)	(0,193)		
Real GDP lagged (Log)	-0,00483	0,115		
	(0,328)	(0,207)		
Quality of regulation	-0,329	-0,169		
	(0,337)	(0,259)		
Private investment (Log)	0,0511	-		

	(0,162)			
Delayed public investment (Log)	0,516***	0,585***	0,163	0,187
	(0,154)	(0,173)	(0,124)	(0,132)
Credit to deposit ratio (Log)	0,128	-0,0841	-0,842**	-0,716*
	(0,302)	(0,259)	(0,397)	(0,403)
Z-score	0,0333*	0,0338**	0,0707	0,00602
	(0,0189)	(0,0155)	(0,189)	(0,173)
Gross domestic savings	-0,0288	-0,00253	0,0739	0,120
	(0,0916)	(0,0771)	(0,123)	(0,0859)
Natural resources	0,205*** (0,0647)	0,157***	0,170*	0,147*
		(0,0435)	(0,0923)	(0,0860)
School enrollment (Log)	0,203	-0,0765	1,052*	1,011*
	(0,313)	(0,459)	(0,579)	(0,562)
Real interest rate	-0,00224 (0,00352)	-0,00524	-0,009**	-0,008**
		(0,00556)	(0,0046)	(0,004)
Control of corruption	0,0822	0,0316	-0,382	-
	(0,235)	(0,234)	(0,452)	
Political stability	0,261**	0,321**	0,477	-
	(0,109)	(0,121)	(0,345)	
External debt (Log)	0,0191	0,0663*	0,0114	0,0223
	(0,0330)	(0,0384)	(0,0745)	(0,0627)
Financial development			0,799**	0,717**
			(0,362)	(0,287)
Access to electricity			-0,0126	-0,0084
			(0,00914)	(0,0083)
Political stability * corruption			0,484	0,322
			(0,430)	(0,352)
Real GDP (Log)			0,110	0,0523
			(0,434)	(0,421)
Trade openness (Log)			0,310	0,280
			(0,519)	(0,358)
Inflation			-0,00297	-0,0026
			(0,0018)	(0,0017)
Observations	201	201	201	201
Number of countries	29	29	29	29
Fisher (p-value)	0,000	0,000	0,000	0,000
Hansen test (p-value)	(15,73) 0,942	(12,20) 0,909	(15,75) 0,618	(15,39) 0,496
AR (1) (p-value)	(-1,93) 0,053	(-1,90) 0,058	(-2,19) 0,029	(-1,92) 0,055
AR (2) (p-value)	(0,49) 0,623	(0,39) 0,693	(-0,94) 0,348	(-1,07) 0,285

Sources: Based on WDI 2017, WGI 2017, IMF, GFD 2016. Note: Values in parentheses are standard deviation adjusted for heteroskedasticity, *** significant at 1%; ** significant at 5%; * significant at 10%.

In model B, we did not cross any, but obtained a less significant variable of interest than in the first model. Table 2 below presents the different results of these estimations. The Fischer test allows us to conclude that our four estimates are globally and strongly significant: the p-value associated with this statistic (prob>

F=0.0000) is lower than the 1% threshold for the four estimates. In addition, the Hansen test, whose p-value is higher than the 10% threshold for all models, does not allow us to reject the null hypothesis and thus the validity of our instruments.

Finally, the AR (2) test is also satisfactory, as the p-value above the 10% threshold does not allow us to reject the null hypothesis of the absence of second-order auto-correlation of the four estimates. The results of the analysis are therefore robust, especially since the standard deviations have also been corrected for heteroscedasticity. These different results are consistent with theories on the traditional determinants of domestic investment and on the influence of the vulnerability of the banking system on domestic investment. With respect to the latter, we obtain a negative and significant relationship between the credit/deposit ratio and the two categories of investment. More precisely, it is significant at the 5% threshold with respect to private investment (model A) and 10% in model B. Fohlin (2002) finds a similar result in a study conducted in Germany over the period 1903-1913.

This can be justified by the fact that a company that depends on bank financing will feel influenced in its decision to invest when the bank has liquidity constraints. In such cases, investments are made in the short term, hence the rapid reaction of firms to such constraints imposed by the failing banking system. In the case of Sub-Saharan African countries, banking systems are underdeveloped and vulnerable to a smaller shock, which is directly linked to the decline in investment, given the dependence of firms on bank financing.

5. CONCLUSION AND RECOMMENDATIONS

The issue of investment in Africa remains at the center of many development debates and programs. It is therefore important to show the role that the banking system can play on investment in Africa. The objective of this study was therefore to identify the indicators of banking system vulnerability that most slow down investment in Sub-Saharan Africa. In general, our analysis shows that a vulnerable banking system can lead to a slowdown in domestic investment. Indeed, domestic investment reacts negatively to the credit-to-deposit ratio, the z-score and the credit-to-GDP gap.

The recommendations that emerge from this paper are oriented towards improving banking systems and sources of investment financing. Investment is a topic that is resurfacing nowadays, and especially its link with the quality of the banking system. For countries that are dependent on bank credits to finance investment, it is necessary today to highlight the difficulties that the banking system may encounter (external shocks) and that could have a negative effect on their domestic investment. Thus, our study recommends that African countries better prepare their banking system for possible shocks, as their economies depend on it. More clearly, in economies where private agents play an important role in investment decisions, the allocation of savings by financial firms should be an insurance for them.

The result as obtained from our estimates shows us that through the negative credit-deposit ratio, private investment tends to decline. This indicator, which measures the stability of the banking sector's financing, presents the situation where a vulnerable banking sector slows down private investment. As the banking system is the main source of financing for companies when they want to carry out their projects, we therefore recommend that banks intensify their formal relations with the companies they finance. It is important to remember that the bank creates sufficient credit through the deposits it collects rather than investing in low-risk instruments (government securities, rationing me credit). This indicator allows the bank to ensure that it is creating enough credit, which implies that it must have clear guidelines for screening clients, placing a clear emphasis on social returns rather than profitability in performance evaluations.

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ANNEX

Table A1: Descriptive statistics for macroeconomic variables (2002-2013)

Variable	Obs.	Average	Ecart-type	Minimum	Maximum
Public investment (%GDP)	492	1.17e+09	2.46e+09	6452614	1.76e+10
Private investment (%GDP)	492	2.65e+09	8.59e+09	7188210	7.33e+10
Real GDP	492	2.71e+10	7.12e+10	1.25e+08	4.25e+11
Access to electricity	492	34.81222	26.46197	.01	99.4
Domestic savings	492	4.66e+09	1.47e+10	-2.39e+09	1.54e+11
Trade openness	492	1.48e+10	3.52e+10	0	2.51e+11
Financial development	492	1.28e+10	6.80e+10	0	5.82e+11

Natural resources	492	3.38e+09	9.41e+09	0	7.49e+10
External debt	444	4.66e+08	1.35e+09	78000	1.28e+10
Real interest rate	363	11.98346	44.097	-42.31018	572.9363
Urban population	492	37.53808	15.85098	8.682	86.658
Inflation	486	62.23163	1108.229	-35.83668	24411.03
School enrollment	422	100.3944	20.97376	39.51496	149.3073

Sources: Based on data from the World Bank WDI (2017) and the IMF (2017).

Table A2: Vulnerability of the banking system in the 10 countries with the highest public investment rates

Country	Rank	Pub.Inv (%GDP)	Z-score	Credit/deposit ratio	Credit to GDP ratio
Cape Verde	1	15,63	11,50	72,09	49,92
Zimbabwe	2	14,26	2,75	29,63	4,70
Botswana	3	12,25	8,79	62,91	22,34
Swaziland	4	12,24	15,71	88,70	16,80
Cameroon	5	11,76	11,62	68,29	10,19
Malawi	6	11,12	9,72	52,74	7,40
Ethiopia	7	10,81	10,04	32,10	10,10
Angola	8	10,55	12,17	52,37	10,48
RDC	9	10,28	1,96	38,21	4,37
Gambia	10	9,76	7,15	39,35	12,30
Average		**11,87**	**9,14**	**53,64**	**14,86**

Sources: Based on data from the World Bank WDI (2017) and the IMF (2017).

Table A3: Vulnerability of the banking system in the 10 countries with the lowest public investment rates

Country	Rank	Pub.Inv (%GDP)	Z-score	Credit/deposit ratio	Credit to GDP ratio
Guinea-Bissau	1	4,38	2,35	43,97	4,63
Madagascar	2	4,33	5,37	62,61	9,77
Togo	3	4,01	5,07	75,26	19,25
Burundi	4	3,93	11,06	92,67	17,35
Sierra Leone	5	3,59	5,51	37,68	4,29
Chad	6	3,40	12,76	81,64	3,74
Uganda	7	3,21	8,94	66,78	9,30
South Africa	8	3,01	15,80	120,17	68,31
RCA	9	2,75	7,22	121,16	7,63
Nigeria	10	2,45	16,31	87,07	16,40
Average		**3,51**	**9,04**	**78,90**	**16,07**

Sources: Based on data from the World Bank WDI (2017) and the IMF (2017).

Table A4: Vulnerability of the banking system in the 10 countries with the highest private investment rates

Country	Rank	Pub.Inv (%GDP)	Z-score	Credit/deposit ratio	Credit to GDP ratio
Cape Verde	1	34,26	10,61	49,92	49,92285833

Asian Journal of Social Science and Management Technology

| Country	Rank				
Mauritania	2	24,31	21,75	16,33	16,33229167
Botswana	3	24,12	8,11	62,91	22,34311667
Gabon	4	24,12	10,53	66,14	9,551495
Namibia	5	18,87	13,58	109,90	45,30775833
Senegal	6	17,42	5,82	88,12	22,95904167
Zambia	7	16,58	2,01	54,90	8,207996667
Mauritania	8	16,41	16,26	88,04	76,31643333
South Africa	9	16,19	14,58	120,17	68,307525
Guinea	10	16,04	5,16	36,16	4,718209167
Average		**20,83**	**10,84**	**69,26**	**32,40**

Sources: Based on data from the World Bank WDI (2017) and the IMF (2017).

Table A5: Vulnerability of the banking system in the 10 countries with the lowest private investment rates

Country	Rank	Pub.Inv (%GDP)	Z-score	Credit/deposit ratio	Credit to GDP ratio
Burundi	1	6,43	11,06	92,67	17,35
Ethiopia	2	6,22	10,04	32,10	10,10
Nigeria	3	6,19	16,31	87,07	16,40
Ivory Coast	4	4,40	8,74	86,54	14,71
Guinea-Bissau	5	4,23	2,35	43,97	4,63
CAR	6	4,15	7,22	121,16	7,63
Cameroon	7	3,41	11,62	68,29	10,19
Angola	8	3,37	12,17	52,37	10,48
Zimbabwe	9	2,95	2,75	29,63	4,70
Lesotho	10	0,85	7,73	38,75	11,38
Average		**4,22**	**9,00**	**65,26**	**10,76**

Sources: Based on data from the World Bank WDI (2017) and the IMF (2017).

Figure A1: Evolution of private and public investment in Sub-Saharan Africa between 2002 and 2013
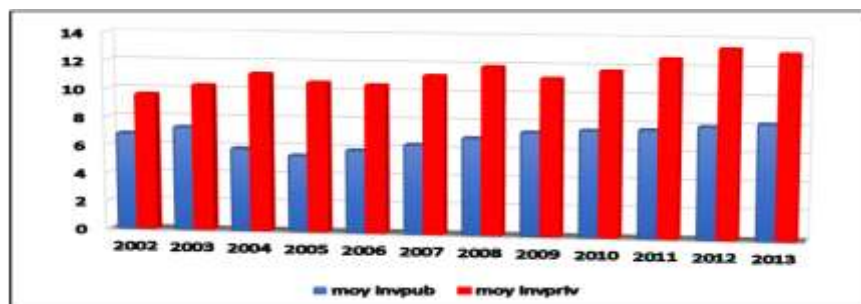
Sources: Based on IMF data (2017).

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