Effects of Capital Flows on Industrialization in Sub-Saharan Africa: Does Corruption Matter?

PRAO Yao Séraphin[1], Bakayoko Mamadou[2]

[1]Associate Professor at Alassane Ouattara University, LAMPE- Laboratory of Economic Policies' Analysis and Modeling, Bouaké, Ivory Coast.
Praoseraph@gmail.com

[2]Teacher-researcher at Institut National Polytechnique Félix Houphouët-Boigny, LADEG- Laboratoire de Droit, Economie et Gestion, Yamoussoukro, Ivory Coast.
mamadou.bakayoko@inphb.ci

Abstract

This article empirically analyzes the direct and indirect effects of capital flows on industrialization through corruption during the period 2010-2021 in 39 sub-Saharan African countries. The data comes from the World Bank's 2022 development indicators database. The econometric results, after applying the GMM estimator in the Blundell and Bond (1998) system, can be generalized as follows. First, capital flows have ambiguous effects on industrialization in sub-Saharan Africa. Indeed, foreign direct investment promotes industrialization, while official development assistance has the opposite effect. Second, controlling corruption increases industrialization in sub-Saharan Africa. Unexpectedly, the results reveal that controlling corruption reduces the positive effect of foreign direct investment on industrialization and accentuates the negative effect of official development assistance. This indicates that there is a minimum threshold of corruption control beyond which foreign direct investment becomes detrimental to industrialization in sub-Saharan Africa.

Keywords: *Capital flows, Corruption, Industrialization, GMM, Sub-Saharan Africa,*

JEL Classification: E23; F21; F41; O25

1. INTRODUCTION

The African economy remains largely unindustrialized, with Africa exporting raw materials with very little added value while importing manufactured goods with high added value. Industrial development in African countries is an essential prerequisite for sustained and inclusive growth. Industry increases productivity by introducing new equipment and techniques. It thus improves labor efficiency and creates new jobs. Linking industrialization to national economies would help African countries achieve high growth rates, diversify their economies, and reduce their vulnerability to external shocks. This would contribute substantially to poverty eradication through job and wealth creation.

Despite these benefits, there has been a real deindustrialization of Africa in general, but more visibly in sub-Saharan Africa. In 1980, the industrial sector accounted for 37.96% of GDP; in 2015, it accounted for 26.5% (Nkoa, 2016). There are many causes for this deindustrialization. These include, among others, the lack of energy, transport, and telecommunications infrastructure (Rodrik, 2016; Rowthorn and Ramaswamy, 1997); low levels of human capital; agricultural policies ill-suited to a growing industry; low productive diversification; corruption issues; and dysfunctional credit markets (Boillot and Lemoine, 1992).

Lacking sufficient national resources to finance their industries, most African countries have adopted attractive investment codes to attract private investors. The main objective of these codes is to attract foreign private capital flows to domestic economies to finance investments and thus build an industrial base capable of driving economic growth. These capital flows remain one of the main sources of financing for industrialization outside the traditional financial system (UNIDO, 2018). They mainly consist of foreign direct investment, migrant remittances, multilateral and bilateral debt flows, and official development assistance.

Foreign direct investment (FDI) is now considered an important catalyst for productivity through the dissemination of knowledge and technology in developing countries. In addition, it contributes significantly to economic growth in terms of

investment, job creation, and trade. Thus, the establishment of an appropriate economy and, more specifically, an institutional governance environment capable of attracting FDI has become a major concern for developing countries. To this end, Makki and Somwaru (2004) point out that FDI inflows are considered an effective means of transferring technology, knowledge, and know-how from investor countries to developing countries.

Official development assistance (ODA) is another important source of financing for African economies. Indeed, the continent receives ODA estimated at tens of millions of US dollars each year (UNIDO, 2018). Unlike FDI, which can be invested in both the private and public sectors, ODA is generally directed toward the public sector to finance infrastructure, social projects, and often to fill budget deficits. In general, the rules governing the accounting of aid ensure that donors record certain expenditures made in their own economies as aid to poor countries. This tends to distort the scope and level of such aid as presented in official reports. This problem could become more acute in the coming years, as the financing of certain companies in donor countries is likely to be considered as aid. This involves indirectly financing their own economies under the guise of ODA by subsidizing some of their companies under the ODA label. From this perspective, aid cannot have a real impact on the economies of the countries that receive it. It would therefore be illusory to rely on this aid to finance industries in sub-Saharan Africa.

Since the emergence of New Institutional Economics (NIE) in the 1970s, theoretical and empirical analyses have agreed on the role of institutional quality in economic growth and the attractiveness of capital flows. These analyses show that good governance in general, and the fight against corruption in particular, are important factors in attracting capital flows. Paradoxically, the experience of East Asian countries shows that these countries, which are among the most corrupt in the world today, are popular destinations for foreign investors. This contradicts the idea that corruption discourages FDI and ODA and revives the debate on corruption and its impact on the attractiveness of capital flows in developing countries in general, and those of sub-Saharan Africa in particular.

Based on data from the World Bank (2022), foreign direct investment and official development assistance (as a percentage of GDP) in sub-Saharan Africa declined between 2011 and 2016. Foreign direct investment fell from 5.53% to 3.39%, and official development assistance from 6.92% to 6.39%. Over the same period, the corruption control indicator and industrial value added also declined, falling from -0.65 to -0.71 and from 25.21 to 22.87%, respectively. Over this period, one might assume that the combined decline in capital flows and corruption control is detrimental to industrialization in sub-Saharan Africa. However, looking at the same variables between 2018 and 2021, we see that capital flows have been on an upward trend. Specifically, foreign direct investment rose from 3.63% to 4.15% and official development assistance from 5.92% to 8.13%. The corruption control index remained stable on average over this period. On the other hand, industrial value added continued its downward trend, falling from 25.11% to 23.29%. Based on these latest observations, one might reconsider and think that the increase in capital flows is not conducive to industrialization.

Therefore, the fundamental question we ask in this research is: What is the relationship between capital flows, corruption, and industrialization in sub-Saharan Africa? Several questions arise from this central concern that can help to clarify the main issue: (i) What is the influence of capital flows on industrialization in sub-Saharan Africa? (ii) Does corruption influence industrialization in sub-Saharan Africa? (iii) What is the role of corruption in the relationship between capital flows and industrialization in sub-Saharan Africa?

The main objective of this study is to examine the relationship between capital flows, corruption, and industrialization in sub-Saharan Africa. This general objective is broken down into three specific objectives, namely: (i) to examine the effect of capital flows on industrialization in sub-Saharan Africa; (ii) to analyze the effect of corruption on industrialization in sub-Saharan Africa; and (iii) to determine the role of corruption in the relationship between capital flows and industrialization in sub-Saharan Africa.

We start from the general assumption that the effect of capital flows on industrialization in sub-Saharan

Africa depends on the level of corruption in the region. We associate the following hypotheses with our specific objectives: (i) capital flows have a positive influence on industrialization in sub-Saharan Africa; (ii) corruption has negative effects on industrialization in sub-Saharan Africa; and (iii) corruption reduces the effect of capital flows on industrialization in sub-Saharan Africa.

This study is both interesting and important. Indeed, the impact of corruption on foreign direct investment and official development assistance has attracted the attention of several authors in the economic literature (Masoud, 2014; Asiedu, 2006; Yasin, 2005; Voyer and Beamish, 2004). However, most studies do not take into account the potential effects of this relationship on industrialization. This study aims to fill the gap in the literature by linking capital flows, corruption, and industrialization in sub-Saharan Africa. Methodologically, the study relies on dynamic panel models with the GMM estimator developed by Blundell and Bond (1998). The GMM estimator is ideal for conditions where the number of periods (T) is small and the cross-sections (N) are large. This is perfectly suited to this study, as the data cover the period 2010-2021 with a sample of 39 sub-Saharan African countries. The advantage of estimation with GMMs lies in the fact that the dependent variable is persistent (dynamic); the explanatory variables are not entirely exogenous, there is heteroscedasticity, and there is an individual fixed effect that is invariant over time.

The rest of the article is organized as follows. Section 2 reviews the literature on the relationship between capital flows, corruption, and industrialization. Section 3 presents stylized facts on the link between capital flows, corruption, and industrialization in sub-Saharan Africa. Section 4 describes the modeling approach. Section 5 presents the empirical results and discusses their implications. The final section summarizes the main conclusions.

2. REVIEW OF THE LITERATURE

There are a number of theoretical and empirical arguments relating to the analysis of the link between capital flows, corruption, and industrialization. This chapter, divided into two sections, first reviews the theoretical literature on the subject and then reviews the empirical literature.

2.1. Review of theoretical literature on the relationship between capital flows, corruption and industrialization

The objective of this section is to show the theoretical relationship between capital flows, corruption, and industrialization. It is structured in two points. The first point presents the theoretical relationships between capital flows and industrialization. The second point discusses the role of governance, particularly corruption, in the relationship between capital flows and industrialization.

With regard to the theoretical relationship between capital flows and industrialization, economic literature highlights the link between capital accumulation and industrialization through the inflow of foreign capital in the form of foreign direct investment (FDI) or official development assistance (ODA).

Based on a theoretical model, Markusen and Venables (1999) suggest that the entry of multinationals has a dual effect: a competitiveness effect and a spillover effect. The competitiveness effect explains the competition between multinational firms and domestic companies in the production of substitutable goods that can be consumed in the domestic market or exported. The larger the market, the more multinational firms can reduce the productivity of local companies. The spillover effect argues that the intensity of multinational firms' use of local inputs depends on the substitutability of the goods produced by local companies. Thus, multinational firms that use more local inputs than domestic companies reduce the latter's level of intermediate goods production.

According to Rodriguez-Clare (1996), FDI influences industrialization through a direct mechanism marked by the volume of jobs created in the industrial sector and the manufacturing value added to GDP. Two conditions are essential to explain this phenomenon. First, the goods produced by multinational firms are complex because they use a large volume of highly diversified local inputs. Second, the industrial workforce improves in terms of the quality of the products manufactured by multinational firms. For OECD countries, FDI inflows between 1970 and 2009 not only increased industrial employment but also improved

manufacturing value added (Kang and Lee, 2011). Makki and Somwaru (2004) point out that FDI inflows are considered an effective means of transferring technology, knowledge, and know-how from investor countries to developing countries.

Similarly, Søreide (2001) explored two groups of externalities through which FDI can promote industrialization, namely technology transfer and industrial restructuring. Technology transfer occurs when domestic firms in the FDI recipient country adopt foreign technology applied by a multinational corporation. The adoption of imported technology has proven to be a sine qua non condition for industrialization. Despite a certain degree of patent and copyright protection, domestic companies in the host economy that adopt foreign technology benefit from the innovative investments made by foreign companies, as the cost of these research investments is avoided. In addition, technology transfers can increase the efficiency of local companies and thus their profitability. However, this depends on the absorption capacity of domestic companies. The second channel, industrial restructuring, occurs when existing competition is affected by the establishment of a multinational subsidiary. The production of a wider range of specialized inputs can generate a positive externality for other producers of final goods. This concept is called "upstream linkages." However, "downstream linkages" can be achieved if more complex goods are produced locally at competitive costs. This ultimately leads to industrial development.

The indirect impacts of FDI on industrialization stem from the transfer of technology that emerges from the entry of multinational companies into the manufacturing industry. Fundamentally, technology transfer has the potential to increase a company's productivity and profitability. Indeed, according to various studies, the phenomenon of technology transfer in the host economy can occur with the entry of FDI into the manufacturing sector. The occurrence of this phenomenon would have an impact on the productivity of local companies in this sector and other related sectors, thus potentially influencing the industrialization process. We consider these types of effects to be "indirect impacts on industrialization." Another channel through which FDI influences industrialization is human capital. According to Cleeve et al. (2015),

human capital is not only a significant factor in attracting FDI to Africa, but also improves long-term growth by increasing the absorption capacity of local companies (Adams and Opoku, 2015). The role of human capital as a catalyst for FDI in host countries is first justified by Borensztein et al. (1998), who show, regardless of preconceptions, that the impact of FDI on growth depends on the level of human capital development.

With regard to the role of governance in the relationship between capital flows and industrialization, following North (1990), high-quality institutions could reduce transaction costs and investment risks, thereby ensuring greater efficiency of foreign capital through private sector participation in an economy.

Similarly, theoretical models explaining industrialization suggest that FDI inflows are less likely to contribute directly to a country's industrialization unless the country is attractive. Indeed, to increase a country's attractiveness to the "best" foreign investors for industrialization, the government should improve the business environment by removing institutional bottlenecks, ensuring political stability, providing infrastructure, and training a skilled workforce (Murphy et al., 1989; Markusen and Venables, 1999).

In the same vein, the literature indicates that the political environment has a substantial influence on capital flows because it is linked to damage and loss of assets (Chauvet and Collier, 2004; Davies, 2012). In the presence of political instability and violence, investors are very likely to transfer their capital to economic environments associated with lower levels of investment risk. Furthermore, if investors believe that national political institutions (e.g., competitive elections and executive accountability) are not conducive to economic performance, they are very likely to transfer their investments to other countries where political institutions are more stable and credible. Busse and Hefeker (2007) argue that factors such as government stability, internal and external conflicts, ethnic tensions, democratic accountability, public order, and bureaucracy are crucial determinants of FDI inflows to developing countries.

However, Abotsi (2016) shows that in a country with a high level of institutional quality, corruption

promotes FDI inflows, while the opposite is observed in a context of low institutional quality. As a result, the author identifies a tolerable threshold of corruption that is likely to attract foreign investors to a country with a high level of institutional quality.

2.2. Empirical contributions

Ravi (2015) conducted a study of the effect of corruption on FDI inflows in China and India. The results of this study showed that corruption had a positive effect on FDI inflows in China and a negative effect in India. Taking the analysis further, he discovered a factor that determines the behavior of FDI in the face of corruption. This factor is the level of arbitrariness in each country. In China, corruption is not associated with arbitrariness, whereas in India, investors have no guarantee of getting what they want, even after paying bribes. According to him, it is therefore the nature of corruption, and not its extent or level, that influences FDI flows in a country.

Using a single source country, Voyer and Beamish (2004) use cross-sectional regressions to study the effects of corruption levels on Japanese FDI in 59 host countries (developed and emerging). They find that Japanese FDI is negatively related to corruption levels, especially in emerging countries. Furthermore, their results show that in emerging countries where a comprehensive legal system is underdeveloped or does not exist to effectively reduce illegal activities, corruption serves to reduce Japanese FDI inflows.

With regard to African countries, Gui-diby and Renard (2015) used data from 49 countries over the period 1980-2009 to study the relationship between FDI inflows and the industrialization process in Africa. Their results showed that while other control variables, such as market size, financial situation, and international trade, were important, the impact of FDI on industrialization was not significant. This study concludes that the role of FDI in the transformation program currently under discussion in Africa must be carefully analyzed in order to maximize the impact of these capital inflows.

More recently, Nnadozie et al. (2021) sought to analyze the dynamic relationship between foreign direct investment (FDI) and industrialization in Nigeria for the period 1981–2015. The results show that FDI has no significant effect on industrialization in Nigeria, either in the short or long term. Similarly, the empirical results reveal that trade significantly hinders industrialization in Nigeria, both in the short and long term. According to the authors, these empirical results are not surprising given that FDI flows in Nigeria have been largely oriented toward resource extraction, i.e., mainly toward the oil sector, with a concomitant negative impact on non-oil sectors, particularly manufacturing.

Furthermore, Njangang et al. (2018) studied the relationship between Chinese foreign direct investment and industrialization for 41 African countries over the period 2003-2015. Based on the generalized method of moments (GMM) approach, the empirical results show that Chinese foreign direct investment did not significantly influence the industrialization process of African countries.

Similarly, Efobi et al. (2019) assess how remittances, directly and indirectly, affect industrialization, using a panel of 49 African countries for the period 1980 to 2014. The indirect impact is assessed through financial development channels. The authors conclude that for certain initial levels of industrialization, remittances can stimulate industrialization through the financial development mechanism.

With regard to North Africa, Amara and Thabet (2012) find that FDI had a negative effect on manufacturing value added in Tunisia over the period 1998–2004. In the same vein, Bouoiyour and Toufik (2007) examine the impact of FDI on factor productivity in the Moroccan manufacturing industry over the period 1987-1996. The results indicate that human capital growth and trade openness, together with FDI, have a positive and significant impact on industrial sector productivity. In contrast, the results obtained by Jekki (2000) did not reveal any positive impact of FDI on manufacturing value added growth in Morocco over the period 1983-1986.

3. DATA AND STYLIZED FACTS

The data comes from the World Bank's 2022 development indicators database. The study covers 39 countries in sub-Saharan Africa, observed between 2010 and 2021.

Figure 1 shows the evolution of industrialization in sub-Saharan African countries over the period 2010-

2021. We observe that industrial value added has evolved erratically in Sub-Saharan African countries. Notably, industrial value added in the region has experienced a downward trend, falling from 25.5% to 22.9% between 2011 and 2016. This decline can be attributed to socio-political instability and a lack of political vision in Sub-Saharan African countries. This downward trend could also be explained by a shortage of suitable skills, low productivity, heavy dependence on imports for intermediate consumption, an energy deficit, and poor infrastructure quality.

Figure 1. Evolution of industrial value added in sub-Saharan Africa (% of GDP), 2010 to 2021
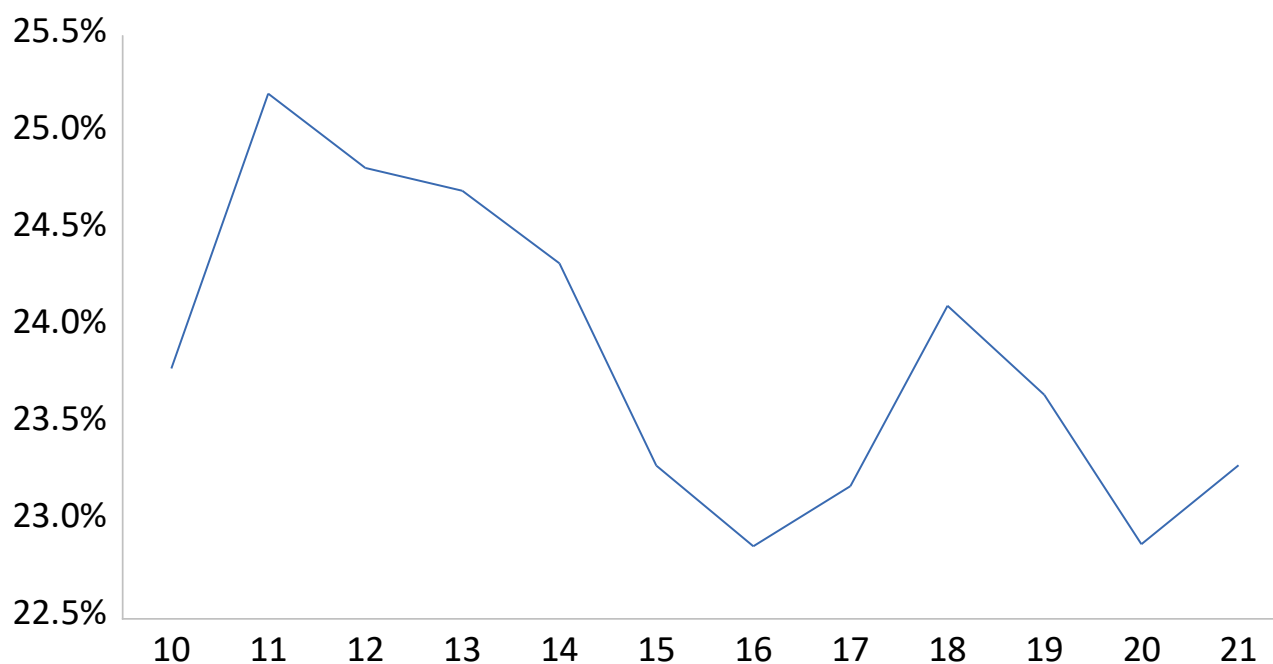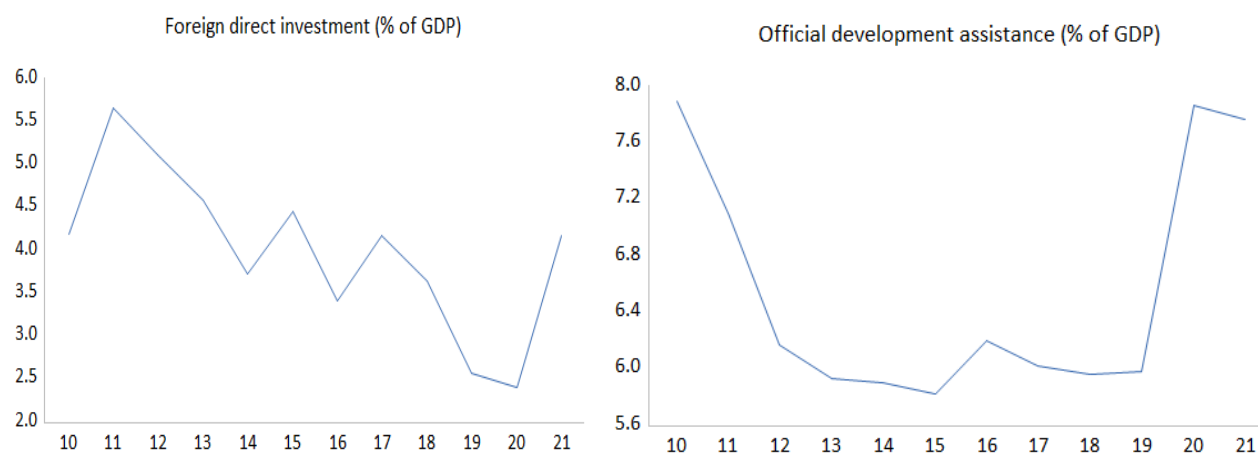

Source: Authors, based on WDI data (2022).

Figure 2 shows the evolution of capital flows in sub-Saharan African countries over the period 2010-2021. We note that the share of capital flows in GDP is very low, less than 8%, for both foreign direct investment and official development assistance. Foreign direct investment is on a downward trend, although we can see a 2% increase between 2020 and 2021.

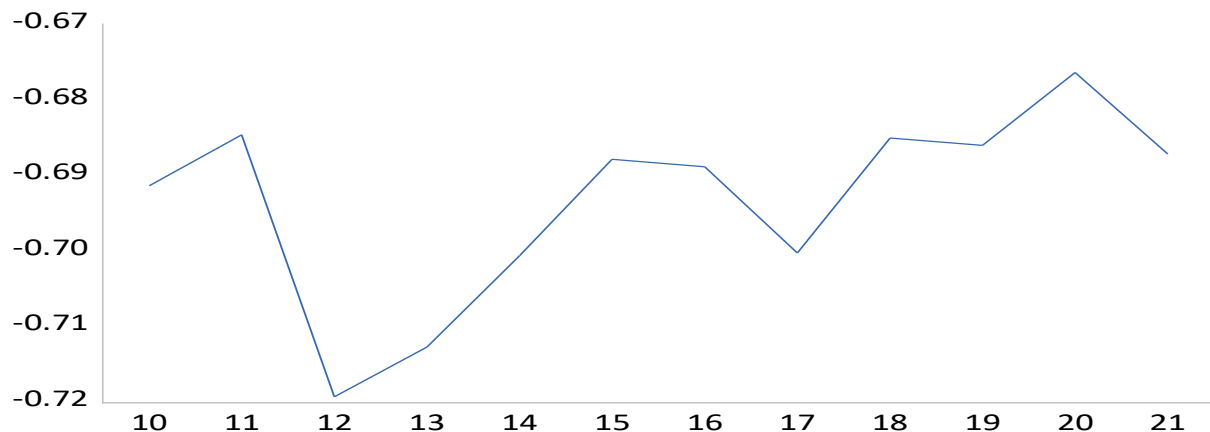**Figure 2.** Evolution of capital flows in sub-Saharan Africa, 2010 to 2021

Source: Authors, based on WDI data (2022).

Figure 3 shows the level of corruption control in Sub-Saharan African countries over the period 2010-2021. The corruption index reflects perceptions of the extent to which public power is exercised for private gain, including small and large forms of corruption, as well as the "capture" of the state by elites and private interests. This index ranges from -2.5 (poor governance performance) to 2.5 (strong governance performance). With an average score well below zero, Sub-Saharan Africa shows no significant improvement in controlling corruption over the period 2010-2021. The progress made by a handful of countries is overshadowed by the decline or stagnation of others.

Figure 3. Evolution of the Corruption Control Index in Sub-Saharan Africa, 2010 to 2021


Source: Authors, based on data from WGI (2022).

Figure 4 shows the joint evolution of industrialization and capital flows in sub-Saharan Africa between 2010 and 2021. Overall, we find that industrial value added has a positive correlation with foreign direct investment, while its correlation with official development assistance appears to be negative. These correlations indicate that foreign direct investment is conducive to industrialization in sub-Saharan Africa, unlike official development assistance.

Figure 4. Joint evolution of industrialization and capital flows in sub-Saharan Africa, 2010 to 2021
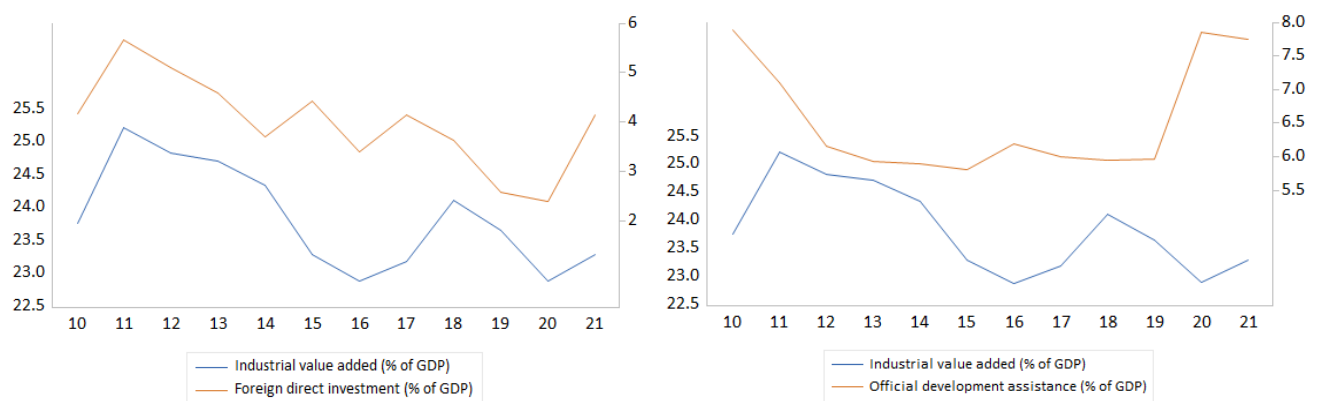
Source: Authors, based on WDI data (2022).

To better assess the direct and indirect effects of capital flows on industrialization through corruption, we have devoted the following section to econometric analysis.

4. METHODOLOGICAL APPROACH

This section presents our model used to estimate the relationship between capital flows, corruption, and industrialization.

4.1. The Model Specification

We estimate a dynamic model based on a cylindrical panel comprising 39 sub-Saharan African countries, observed between 2010 and 2021. The data comes from the World Bank's 2022 development indicators database. The model is:

$$Ind_{i,t} = \alpha_i + \eta_t + \mu \cdot Ind_{i,t-1} + \Omega^m \cdot X_{i,t}^m + \beta \cdot FC_{i,t} + \delta \cdot CCORR_{i,t} + \varepsilon_{i,t}$$

(1)

where $Ind_{i,t}$ represents the industrial value added of country i at time t. We include the lagged value of $Ind_{i,t}$ to control for autoregressive trends. This lagged endogenous variable describes the dynamic aspect of our model and provides information on the persistence of the industrialization process from one year to the next. The vector X^m is a vector of control variables containing m elements, while FC and CCOR represent our variables of interest,

respectively capital flows and corruption control. μ, Ω^m, β and δ are the model coefficients. The parameter α_i is the country-specific effect for country i. The fixed temporal effects η_t capture the unobservable characteristics of periods that are invariant across countries, such as a crisis affecting all countries simultaneously (e.g., the COVID-19 crisis), and $\varepsilon_{i,j,t}$ are the error terms assumed to be independent and identically distributed.

We distinguish between two types of capital flows: foreign direct investment (FDI) and official development assistance (ODA). FDI refers to the total international investments through which entities resident in one economy acquire or have acquired a lasting interest in an entity resident in an economy other than that of the investor. ODA includes grants and concessional loans budgeted and transferred from developed countries to developing countries.

Table 1. Description of model variables

Variables	Description
Ind	Industrial added value
IDE	Foreign direct investment
APD	Official development assistance
CCOR	Control of corruption
URB	Urbanization rate
OUV	Commercial opening rate
Tax	Tax charges
TCPIBH	GDP per capita growth rate
INFL	Inflation rate

Source: Authors, based on literature review.

In examining the relationship between capital flows, corruption, and industrialization, we control for a number of variables at the country level. First, we control for the country's level of urbanization (URB), approximated by the proportion of the population living in urban areas. Furthermore, this could lead to an increase in local demand for manufactured goods as a result of higher employment income and the combined effects of population growth and urbanization, as factory employment is generally associated with work in cities where real wages are higher (Lewis and Maund, 1976; McArthur and Sachs, 2019). As a result, we expect the urban population to have a positive effect on industrialization.

We also add an openness variable (OUV). This variable refers to the result of a process aimed at

reducing barriers to economic trade between nations. Openness is measured by the average trade volume (the sum of exports and imports divided by 2) relative to GDP. Trade openness increases international trade and is a key factor for industrial development in the context of the SSA region. We therefore expect openness to have a positive effect on industrialization.

The third control variable concerns tax burdens, represented by revenues collected from income and profit taxes, social security contributions, taxes levied on goods and services, social security contributions, property taxes, and other taxes. Total tax revenue as a percentage of GDP indicates the share of a country's output that is collected by the government through taxes. Assuming that higher tax burdens discourage economic activity, we assume a

negative sign. We also control for macroeconomic factors. For this last category of variables, we use the per capita GDP growth rate (TCPIBH) and the inflation rate (INFL). The variables in the model are summarized in Table 1.

Table 2. Descriptive statistics of variables

Variable	Obs.	Moyenne	Écart-Type	Min	Max
Ind	468	23.843	12.779	-3.417	78.064
IDE	468	3.975	5.931	-18.917	39.810
APD	468	6.510	6.043	0.002	35.712
CCOR	468	-0.689	0.590	-1.815	1.027
URB	468	40.596	16.615	10.642	90.423
OUV	468	33.581	14.055	0.378	74.944
Tax	468	15.156	9.394	4.098	38.083
INFL	468	9.093	34.250	-20.192	604.945
TCPIBH	468	11.158	4.554	-36.777	19.938

Source: Authors, based on WDI (2022) and WGI (2022) data, 2010 to 2021.

The descriptive statistics for all variables are shown in Table 2. This table calls for a few comments. The average level of industrialization is 23.843%. This value indicates a low level of industrialization in SSA countries. Furthermore, there is some heterogeneity among countries, with a range of 81.481. Furthermore, we note that the share of capital flows in GDP is very low, at 3.975% and 6.510% for foreign direct investment and official development assistance, respectively. With an average score of -0.689, sub-Saharan Africa shows no significant improvement in corruption control over the period 2010-2021. Although corruption control is moderately weak, the high range between the minimum and maximum values reflects a high degree of dispersion in the region. Indeed, the progress made by a few countries is overshadowed by the decline or stagnation of others. The Pearson correlation coefficient matrix is summarized in Table 3.

Table 3. Correlation matrix between the explanatory variables of the model, 2010 to 2021.

	IDE	APD	CCOR	URB	OUV	Tax	TCPIBH	INFL
IDE	1.000							
APD	0.102*	1.000						
CCOR	-0.045	-0.143*	1.000					
URB	0.093*	-0.411*	0.024	1.000				
OUV	0.303*	-0.163*	0.200*	0.261*	1.000			
Tax	0.047	-0.077*	0.097*	0.064	-0.279*	1.000		
TCPIBH	0.025	0.012	0.206*	-0.188*	0.040	0.062	1.000	
INFL	-0.018	-0.028	-0.118*	-0.056	-0.100*	-0.017	-0.132*	1.000

Note: * indicates significance of correlation at the 10% threshold.

Source: Authors, based on WDI (2022) and WGI (2022) data, 2010 to 2021.

This table shows that the correlations between the explanatory variables are weak to moderate. Of all these variables, the pair APD and URB has the highest correlation coefficient (-0.411). However, this correlation is not strong enough to cause multicollinearity issues. According to Kennedy (2008), there is a problem of multicollinearity when the correlation coefficient between two explanatory variables is greater than 0.8. The following section focuses on the results and economic interpretations.

4.2. The GMM estimator according to Blundell and Bond (1998)

Arellano and Bond (1991) developed the standard GMM estimator, also known as first-differenced GMM, in which all variables are transformed by different instrumental variables and introduced at different levels in the regressions. At this level, first-differenced GMM could give rise to imprecise or even biased estimators. To address these shortcomings, Arellano and Bover (1995) and Blundell and Bond (1998) developed system GMMs, which comprise two simultaneous equations, where one equation is lagged from the dependent variable as instruments for the level equation, and the other is lagged from the dependent variables as instruments for the first difference equation. In this study, we will use the system GMMs of Blundell and Bond (1998) to improve the efficiency of the estimator. Thus, we estimate our model with the Arellano-Bover/Blundell-Bond estimator, which uses the system generalized method of moments (S-GMM).

Thus, the two-stage GMM system is ideal for conditions where the number of periods (T) is small and the cross sections (N) are large; the dependent variable is persistent (dynamic) and the explanatory variables are not exogenous, i.e., they may be correlated with the error term. Furthermore, there is heteroscedasticity, time-invariant individual fixed effects, and autocorrelation within individuals, which are more common in banking data. In addition, Blundell and Bond (1998) present the GMM estimator in a system that combines first difference equations with level equations in which the variables are instrumented by their first differences, which appears to be more effective than the one proposed by Arellano and Bond (1991). It should be noted that GMM estimators require the coefficients to be homogeneous, with the exception of the constant, which is assumed to capture specific effects. To this end, Blundell and Bond (1998) propose a system GMM procedure that uses moment conditions based on level equations with the usual orthogonal conditions of the Arellano and Bond (1991) type, which, on the other hand, consider a direct maximum likelihood estimation based on different data under the assumed normality for idiosyncratic errors.

5. RESULTS AND DISCUSSION

Dans la suite du travail, nous présentons les résultats de l'estimation de la relation entre les flux de capitaux, la corruption et l'industrialisation en utilisant l'estimateur GMM en système de Blundell et Bond (1998). La cohérence de l'estimateur GMM dépend de la validité des instruments. Pour aborder cette question, nous considérons deux tests de spécification. Le premier est le test de Sargan de sur-identification des restrictions, qui teste la validité globale des instruments. Le second test examine l'hypothèse selon laquelle le terme d'erreur $\varepsilon_{i,t}$ n'est pas corrélé en série. Le tableau 4 présente les résultats des régressions. Le test de Sargan ne fournit aucune preuve de mauvaise spécification, tandis que les tests de corrélation sérielle indiquent une autocorrélation de premier ordre – mais pas de second ordre – des résidus, ce qui est conforme aux hypothèses qui sous-tendent la sélection des instruments.

5.1. Result of the effect of capital flows on industrialization

In Table 4, the variable Ind_{t-1} represents the country's level of industrialization during the previous year. As expected, the coefficient of the variable Ind_{t-1} is significant and positive at the 1% threshold, proving the dynamic nature of the model specification. This finding means that the level of industrialization in the previous year increases that of the current year.

Table 4. Result of the effect of capital flows on industrialization

Ind	IDE	APD
Ind_{t-1}	0.762*** (0.011)	0.677*** (0.015)
Urbanization	0.100*** (0.032)	0.100*** (0.016)
Commercial opening rate	0.062*** (0.015)	0.099*** (0.016)
Tax charges	-0.054***	0.014***

	(0.019)	(0.023)
GDP per capita growth rate	0.197***	0.211***
	(0.015)	(0.025)
Inflation rate	0.010***	0.012***
	(5.1×10^{-4})	(0.001)
Control of corruption	0.826*	1.275**
	(0.489)	(0.632)
Foreign direct investment	0.144***	
	(0.011)	
Official development assistance		-0.122***
		(0.032)
Const.	3.392	0.524
	(2.456)	(1.613)
Observations	429	429
Number of countries	39	72
Test de Sargan-Hansen p-value	1.000	1.000
Arelanno-Bond AR[1] p-value	0.030	0.021
Arelanno-Bond AR[2] p-value	0.198	0.261

Note: The numbers in parentheses are standard errors. ***(** and *) indicates the significance of the coefficient at a confidence level of 99% (95% and 90%).

Source: Authors, based on estimation results. Data from World Bank databases (2022).

With regard to the effect of capital flows, the left-hand side of Table 4 shows that foreign direct investment contributes significantly to increased industrialization. The positive effect of FDI on industrialization could be explained by the transfer of technology undertaken by multinationals, which benefits local firms. The technology brought in by foreign firms contributes to increased productivity among local businesses. This effect is reinforced by positive externalities based on the entry of foreign firms. Thus, structural, institutional, and cyclical changes accompany the contribution of foreign firms. Technology transfer can take place through the acquisition of knowledge or through labor mobility (Glass and Saggi, 2002). It makes it possible to differentiate between substitutable goods and promotes conditions for job creation. When local companies diversify and accumulate technology, they produce competitive goods and increase the ratio of private investment to GDP. This result contradicts those of Nkoa (2016), who finds a positive relationship between FDI and industrialization. On the other hand, official development assistance has the opposite effect, leading to weaker industrialization (right-hand side of Table 4). This result could be explained by the fact that official assistance is ineffective when recipient countries are not free to use the aid in sectors of activity that could promote industrialization. Indeed, the fact that aid is conditional on donor countries prevents recipient countries from using it in productive sectors. Our results contradict those of Murphy et al. (1989), who found that countries with low levels of corruption receive more official development assistance.

Furthermore, controlling corruption has a significant and positive influence on industrialization. Indeed, controlling corruption strengthens the institutional framework by ensuring better democracy and greater respect for human rights. Better protection of property rights stimulates foreign investment by not only ensuring transaction security (Javed, 2015), but also by increasing the productivity of physical capital. Similarly, the freedom to invest created by controlling corruption increases employment opportunities, productivity, and physical capital. This result contradicts that of Effioma and Uche (2022), who show that in the long term, controlling corruption reduces industrialization. In SSA, controlling corruption can effectively serve as a lubricant for certain underdeveloped economies, thereby restoring a degree of flexibility in industries. In light of our findings, we suggest that authorities in sub-Saharan Africa establish a probity and efficient public administration while treating all cases equally, revitalizing internal control systems, and respecting users.

In terms of control variables, urbanization has a positive impact on industrialization in sub-Saharan Africa. It is often in cities that discoveries and innovations are born, which form the basis for continuous productivity gains (Bairoch, 1988). The history of the world since the Industrial Revolution shows that no country has succeeded in industrializing and becoming wealthy without also urbanizing. Cities give people access to advanced technologies and better knowledge that can help improve productivity. In addition, the increase in the urban population has led to an increase in the workforce in industries, thereby promoting industrial development. This result confirms our intuition and corroborates the findings of (Lewis and Maund, 1976; McArthur and Sachs, 2019), who found that urban population can be an important factor in the development of the manufacturing sector. Given these results, the study suggests, among other things, that governments implement national urban development policies with the aim of promoting secondary cities. Unsurprisingly, trade liberalization promotes industrialization. Indeed, trade expansion promotes the efficient allocation of resources, enabling sub-Saharan African countries to achieve economies of scale, facilitate the dissemination of knowledge, and promote technological progress in their industrial sector. This result is consistent with the study by Chatri et al. (2019), which found that openness is a key factor for industrial development in sub-Saharan Africa.

Furthermore, it is important to note that trade not only helps industries to increase their productivity but also to strengthen their capacity for innovation, which will enable them to increase their production volumes. Conversely, tax burdens are associated with lower levels of industrialization. The negative influence of tax burdens on industrialization is felt through a number of mechanisms. On the one hand, complex and excessive taxation discourages foreign investors, drives away domestic investors, hinders entrepreneurship, and leads to deadweight losses due to the cost of tax compliance and tax avoidance, thereby preventing industrialization. Second, corporate taxes, for example, weigh on savings not only through companies, but also through their shareholders, who are often subject to double taxation. Third, the impact of taxation depends on the form it takes. Taxes on companies and shareholders reduce the capital available for investment and for building larger, more productive structures. In addition, some companies are subject to additional taxation because of their sector of activity or type of production, or simply because they exceed a certain turnover threshold. These results are consistent with the work of Laffer (1974), for whom "too much tax kills tax." Indeed, increasing tax levies leads to a decrease in public revenue rather than an increase, as it discourages economic activity. Similar results appear in Karagöz (2013), who argues that tax burdens weigh heavily on the industrial sector. It is therefore important for SSA authorities to carefully assess the effects of tax policies, as misjudgments can have very serious consequences.

At the level of macroeconomic variables, the results show that the growth rate of GDP per capita has a positive and significant influence on industrialization. This result is explained by the fact that there is an empirical correlation between the degree of industrialization and the level of income per capita in developing countries, Kaldor (1966). These results are opposed to those of Singariya and Sinha (2015) who find that the increase in GDP per capita increases industrialization through the increase in demand for manufactured products. The positive and significant influence of inflation on industrialization is explained by the fact that when the price level increases on the market, industries will tend to increase their level of supply in order to be profitable. Indeed, generally speaking, the reaction of companies to inflation is to simply increase the price of their products or the rate of their services. This result is contrary to that of Nguekeng and Nkouli (2020) who argue that an increase in the inflation rate in an economy reduces industrialization. Based on these results, we suggest that monetary authorities support SSA states in their industrialization policies by opting more for a money supply that is not necessarily exogenous but rather endogenous.

5.2. Result of the effect of capital flows in interaction with corruption control on industrialization

We examine the interaction term of capital flows and corruption in Table 5. The coefficient of the interaction term between foreign direct investment and control of corruption is positive and

significantly different from zero at the 1% level. This result indicates that increasing FDI does not contribute to improving industrialization when accompanied by control of corruption. In theory, control of corruption is supposed to improve industrialization because controlling corruption reduces rigidities and contributes to the establishment of good management of national resources, an honest and efficient public administration while treating all files equally. Naturally, if control of corruption decreases, it is supposed to drive a certain improvement in the effect of FDI on industrialization. However, in the case of our results we obtain a negative effect which indicates that control of corruption reduces the positive effect of FDI on industrialization.

Table 5. Result of the effect of capital flows in interaction with control of corruption on industrialization

Ind	IDE	APD
Control of corruption	1.420* (0.807)	1.809*** (0.606)
Foreign direct investment	0.095*** (0.027)	
Foreign direct investment × Control of corruption	-0.179** (0.077)	
Official development assistance		-0.168*** (0.036)
Official development assistance × Control of corruption		-0.201 (0.071)
Observations	429	429
Number of countries	39	72
Test de Sargan-Hansen p-value	1.000	1.000
Arelanno-Bond AR[1] p-value	0.035	0.025
Arelanno-Bond AR[2] p-value	0.185	0.263

Note: Numbers in parentheses are standard errors. ***(** and *) indicate the coefficient's significance at the 99% confidence level (95% and 90%).

Source: Authors, based on estimation results. Data from World Bank databases (2022).

This result, as counterintuitive as it may seem, could be explained by the fact that corruption functions as a "piece rate" for bureaucrats, which induces more efficient delivery of government services, and it provides room for maneuver for entrepreneurs to circumvent inefficient regulations (Acemoglu and Verdier, 1998). From this perspective, corruption acts as a lubricant that smooths operations. Also, this result indicates that the relationship between FDI and industrialization in SSA is not linear. Indeed, there is a threshold of 0.530 of corruption control beyond which the effect of FDI on industrialization becomes negative. However, we find that regardless of the level of corruption control, the relationship between official aid and industrialization remains linear. This finding could suggest that the ineffectiveness of public aid on industrialization is not due to the level of corruption control in sub-Saharan African countries but rather to other factors. These results suggest that sub-Saharan African countries have an interest in creating conditions to improve corruption control, government effectiveness, and the rule of law in order to attract more external resources from development partners. Furthermore, to address this, we propose that sub-Saharan African authorities grant certain tax benefits to foreign investors so that they can reinvest part of the aid in other sectors of activity that can promote industries.

6. CONCLUDING REMARKS

The main objective of this study was to examine the empirical link between capital flows, corruption and industrialization by considering the interconnection of capital flows and the control of corruption. The data for the study come from the World Bank's Development Indicators database (2022) and cover the period from 2010 to 2021. Specifically, the aim was, firstly, to examine the effect of capital flows on industrialization. Secondly, to analyze the effect of corruption on industrialization. And finally, to determine the role of corruption in the relationship between capital flows and industrialization. To do this, we reviewed the theoretical and empirical

contributions on the relationship between capital flows, corruption and industrialization. Some authors support a positive relationship between capital flows and industrialization, while others suggest a negative relationship. These various findings were empirically verified in different countries. Using the system GMM, the estimation results first showed that capital flows produce ambiguous effects on industrialization in sub-Saharan Africa. Indeed, foreign direct investment promotes industrialization, while official development assistance produces the opposite effect.

Second, controlling corruption increases industrialization in sub-Saharan Africa. Unexpectedly, the results reveal that controlling corruption reduces the positive effect of foreign direct investment on industrialization and accentuates the negative effect of official development assistance. Our results have important policy implications for the current debate on industrialization in sub-Saharan African countries. They suggest that capital flows are important and that greater emphasis should be placed on foreign direct investment (FDI) as opposed to official development assistance (ODA), which can be harmful. Furthermore, we suggest that sub-Saharan African authorities should establish an honest and efficient public administration while treating all issues equally, revitalizing internal control systems, and respecting users.

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