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**The Impact of Chinese Foreign Direct Investment  
in Africa**

**Evidence from Panel Data Analysis**

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## **Abstract**

This study analyzes the effects of Chinese Foreign Direct Investment (FDI) on thirty African countries over the period from 2004 to 2023. A Difference-in-Differences model was used to conduct the analysis. Using a panel dataset, the study evaluates the effects of Chinese investments on some economic indicators: Economic Freedom, GDP per capita, Control of Corruption, and Government Effectiveness. Chinese FDI does not seem to have promoted sustainable growth in Africa: some critical issues emerge, suggesting the need to implement appropriate local policies to transform foreign capital inflows into development opportunities.

**Keywords:** Foreign Direct Investment (FDI), China, Africa, Economic Development, Institutions, Difference in Differences (DiD)

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# 1 INTRODUCTION

In recent decades, Chinese economic presence in African countries has increased exponentially. This study focuses on the case of Chinese FDI in Africa. China's rapid rise as a global economic superpower is now well known. Arguably, China sees the African market as an attractive destination for its products, while African countries benefit from China's efforts to build new infrastructure or rehabilitate old ones to provide development assistance. This China-Africa relationship, which theoretically should be based on equal footing (China offers infrastructure and knowledge in return for export opportunities and access to the continent's abundant raw materials), could be problematic. There are concerns that situations of economic dependence may arise, hindering the expansion process of African countries. It is feared that these investments may worsen corruption problems and fail to foster a truly inclusive growth. Thus, it is necessary to understand their consequences. The question to be answered by this analysis is: is Chinese FDI in Africa an opportunity or a risk for the local economies?

In this context, it is useful to clearly understand the meaning of Foreign Direct Investment, in order to understand why the analysis is being carried out and why this is the fundamental subject of the paper. According to the OECD, Foreign Direct Investment is a category of cross-border investment made by a resident in one economy (the direct investor) with the objective of establishing a lasting interest in an enterprise (the direct investment enterprise) that is resident in an economy other than that of the direct investor (OECD (2009)). The form of FDI can vary. In this context, it is legitimate to ask how it can more generally affect a country's political and strategic decisions and how it can have perceptible effects in the country receiving

it. In the case analyzed, it is reasonable to assume that Chinese FDI, even if carried out through agreements between private entities, is part of China's Go Out policy (Davies (2013), Molnar et al. (2021)). Furthermore, in African countries, investments can have varied destinations. Overall, the proceeds from FDI enter the economies of the countries that have received them and are likely to generate effects, especially if the amount of investment is high. Moreover, since some studies show that Chinese FDI differs from Western aid in terms of characteristics and objectives (Kolstad and Wiig (2012), Gehring et al. (2022), Marson and Savin (2022)), it is useful to analyze its effects specifically.

To carry out this analysis, a panel dataset compiled from various official sources is used, employing the econometric method known as Difference-in-Differences.<sup>1</sup> Essentially, the impact of the investments is examined by dividing thirty African countries into two groups characterized by different levels of FDI. The countries that received more FDI from China are the treatment group, while the others serve as the control one. The assumption is that, in the absence of the treatment, their economic performance would have evolved similarly (parallel trend hypothesis). Intuitively, if the outcomes of the first group reach higher values than those of the second following treatment (Chinese investments), it means that the impact of FDI is positive. In addition, the study includes fixed effects by country and by year. This approach allows to control for possible structural differences between countries (e.g., different economic size) and for possible temporal shocks common to all (e.g., periods of recession or economic expansion and increased inflation). This approach makes the causal impact of Chinese FDI more credible.

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<sup>1</sup>The analysis was conducted entirely using Stata software, which provided all the results and graphical representations included in this document.

The data collected show two distinct phases: a pre-treatment period (up to 2007), characterized by limited and fairly stable flows, and a post-treatment period (from 2008 onwards), when investments increased significantly. Perhaps the crisis period of those years may have prompted China to seek investment opportunities in a continent with diverse infrastructure and economic development needs. Therefore, investing in Africa could be motivated by market-seeking and resource-seeking reasons. It is also possible that China intended to increase its geopolitical influence during years of economic instability.

The analysis focuses on the impact of these investments on economic growth (GDP per capita), the quality of institutions (Control of Corruption and Government Effectiveness), and changes in the degree of economic freedom (Economic Freedom). These indicators allow the economy to be analyzed from different perspectives, offering a fairly comprehensive view of the possible effects of FDI. The study shows that Chinese investments do not seem to have promoted sustainable economic development in the countries most exposed to FDI. In fact, exposure to Chinese investment appears to have negative effects in terms of economic freedom as well as institutional quality and efficiency. The trends in countries most exposed to Chinese investment, following treatment, are stagnant or even worsen over time. This trend is highlighted by a simultaneous improvement in countries belonging to the control group. Furthermore, there is no significant effect on GDP per capita. The average standard of living in treated countries does not appear to have improved. These results seem to reflect the way in which foreign capital has been used. Perhaps these resources have often been invested in large projects managed directly by the state, strengthening public intervention in the economy (worsening results in terms of economic freedom). At the same time, the absence of stringent controls could encourage corrupt practices.

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Assuming that China adopts a policy of non-interference in African political decisions Foster (2009), it is possible that corruption will become even more frequent as African countries find themselves having to manage greater economic resources. This could also lead governments to perceive no need to implement necessary reforms, worsening government effectiveness. Therefore, in the absence of certain conditions, the impact of these investments may be limited. For this opportunity to translate into long-term sustainable and inclusive development, high exposure to Chinese FDI must be accompanied by appropriate policies and an internal strategic vision.

After presenting a review of the relevant literature to introduce the debate on Chinese FDI in Africa, the data used to conduct the analysis are illustrated. Next, the methodology adopted is presented from a theoretical point of view, before moving on to its application. Finally, the results obtained and the related conclusions are reported.

## 2 LITERATURE REVIEW

To analyze China's role in the development of African countries, it is essential to examine the type, characteristics, and results of its investments. This reflection is part of the broader issue of how developing countries can best manage foreign capital to promote sustainable growth and integrate into the global market. Recent studies offer interesting and mixed results. Chinese FDI seems to make a significant contribution to African economies through numerous projects, while also entailing certain risks.

Dreher et al. (2021) introduce a new global dataset on official Chinese financing and find evidence of a favorable impact of China's contribution to the economic development of beneficiary countries. On average, each additional project financed by China results in an increase in growth by between 0.41 and 1.49 percentage points within two years of its start. Therefore, China, together with the United States and other OECD-DAC countries, is among the countries that have produced statistically significant results on the growth of recipient countries.

Isaksson and Kotsadam (2018a) take a different view, showing an increase in corruption in areas close to where a Chinese-funded projects are being conducted. It could be a strategic objective, as corrupt local elites could be useful in ensuring control over resources. This highlights a problem in the implementation methods: Chinese FDI, considered highly effective in promoting growth, should be implemented through transparency and control standards to reduce corruption at the local level. These results suggest the need to accompany Chinese investments with measures that allow for the transparent use of resources. This would help prevent economic benefits from being used to encourage corruption and opportunistic behavior.

Another limitation of Chinese investment concerns its social impact. According to a study conducted by McCauley et al. (2022), living in areas directly exposed to the effects of Chinese FDI reduces African citizens' support for the Chinese development model. However, this is an average effect, as different results are observed depending on the sector. Manufacturing projects, in fact, are seen as a positive contribution; on the other hand, those related to natural resources raise mistrust and concern. This result highlights how the impact of investments does not depend exclusively on foreign capital flows, but also on how local communities experience Chinese projects.

Another weakness concerns the political capture of foreign support. As highlighted by Dreher et al. (2019), the distribution of Chinese projects in Africa shows that the regions where African political leaders were born receive significantly higher flows of capital during their years in government. This phenomenon is especially evident in the pre-election phase. This aspect prompts reflection on the system of distributing funds, which are mainly allocated 'on demand' according to priorities identified by local governments. Consequently, this situation could create side effects at the institutional level.

A further element concerns the models of economic support at the political-institutional level. A study by Gehring et al. (2022) compares Chinese and World Bank projects in Africa, highlighting that neither increases the risk of conflict. The study suggests two different approaches: the World Bank appears to be linked to a positive attitude towards democracy, while Chinese aid is associated with greater acceptance of authoritarian models. This result may reflect the difference between a more governance-oriented approach (World Bank) and a more rapid and pragmatic one (China).

These issues have also been addressed by Horn et al. (2021), who have shown that approximately 50% of Chinese loans to developing countries are not recorded in the official databases of the IMF or the World Bank. These ‘hidden debts’ make international economic surveillance and debt sustainability analyses more difficult, as a significant portion of financial exposure to China is not reported through traditional information channels.

Still about possible financial risks, there has also been discussion as to whether China has influenced the investment strategies of other traditional lenders. A study conducted by Humphrey and Michaelowa (2019) shows that China’s presence in Africa does not appear to have clearly and significantly reduced the resources provided by the World Bank and the African Development Bank between 2000 and 2014. Therefore, in the period analyzed, China’s presence in Africa appears to be more complementary than substitutive to traditional financing.

A paper that analyzes financial risks from another perspective is an IMF report by Chen et al. (2024). According to this study, Chinese loans range between concessional loans and market-rate loans. The interest rates and maturities are generally less concessional than those typically offered by international institutions, but, overall, more advantageous than purely commercial loans obtained on the market. In fact, when examining the real cost of debt servicing, Chinese loans have average financial costs that fall between the two extremes: they are not as cheap as multilateral concessional loans, but neither are they as expensive as bonds or private bank loans. This ‘middle ground’ position demonstrates, on the one hand, China’s willingness to allocate capital with lean procedures and without the typical conditions (facilitating rapid access to funds) and, on the other hand, the demand for slightly higher profits in response to the greater risk assumed. This approach can increase the financial vulnerability of

indebted countries if funds are not managed carefully, as increased capital costs and the absence of appropriate control mechanisms can lead to a worsening of debt. In the long term, this could reduce the ability of African countries to make productive investments and ensure economic stability.

China's influence in Africa is particularly strong in the infrastructure sector. According to a World Bank study by Foster (2009), at least 35 sub-Saharan African countries have agreements with China for infrastructure financing, often on a large scale. China favors projects in sectors that are strategic for development, primarily energy and transportation. Between 2001 and 2007, China contributed approximately \$3.3 billion to the construction of 10 large hydroelectric plants in Africa, adding over 6,000 MW of new installed capacity. This represents an increase of approximately 30% of the total hydroelectric capacity available in the region at that time. During the same period, Chinese funding in the railway sector exceeded \$4 billion, directed towards the renovation of over 1,350 km of existing lines and the construction of approximately 1,600 km of new railways. To put this figure into context, the entire railway network of the African continent consists of approximately 50,000 km. Chinese projects have therefore had a decisive impact on the development of African infrastructure capacity in problematic sectors such as electricity and transport, often with interventions that are new in terms of scale and value.

According to this study, China uses innovative financing models linked mainly to natural resources. In several cases, infrastructure loans have been "packaged" through oil or other commodity exploitation procedures, according to the so-called "Angola" model, in which the natural resources of the beneficiary country represent the guarantee of repayment. This formula has allowed some countries (especially oil exporters) to obtain capital for infrastructure

investments above the limits set by their financial solvency, exploiting the promise of future mining revenues.

Furthermore, the substantial introduction of Chinese capital for infrastructure has enabled Africa to pursue essential development opportunities. These investments help to reduce the wide infrastructure gap that has long slowed African development. Aware of this, African governments have generally favored China's "new approach," based on non-interference in internal affairs and respect for the priorities set by the partner country through a cooperative style based on partnership between developing countries. Many African leaders see China as an alternative to traditional aid models designed with strict governance conditions. From another point of view, some civil society observers have expressed concerns about the environmental and social standards used in such projects. The China Ex-Im Bank claims to adhere to its own environmental policies and to comply with the regulations of the host country. However, the absence of stringent supranational safeguards has raised fears of negative repercussions, such as the risk of worsening debt sustainability problems (in countries that take out large loans) or of encouraging practices that lack transparency in the absence of external controls. In summary, although Chinese intervention represents an important opportunity for development in strategic sectors, it requires particular attention in terms of management: economic advantages must be maximized and potential social costs minimized.

In this context of risks and opportunities, it is also useful to consider the differences between Chinese and traditional donors. A study by Marson and Savin (2022) shows that, on average, Chinese projects have positive development effects like those of traditional donors, except for debt, where some possible vulnerabilities emerge. This evidence therefore suggests the need to

carefully assess the implications of different development interventions.

The positive impact of Chinese projects is supported by a study by Bluhm et al. (2025) that focuses precisely on the local economic effects of infrastructure investments. This paper analyzes China's "connective financing," i.e., the impact of transportation infrastructure projects on the subnational economic environment. By formulating a new geolocated dataset of projects (roads, railways) financed by China between 2000 and 2014 with satellite measurements of economic activity (night lights), they show that Chinese transport projects decentralize economic activity within the beneficiary regions. There is a narrowing of the spatial concentration of production (measured by a spatial Gini index) of about 2.2 percentage points following the implementation of Chinese-financed transport infrastructure. This would seem to reduce the gap between central and peripheral areas. This situation is more evident in less developed regions close to large cities. The result is the spread of economic activity from urbanized areas to less developed ones in the vicinity. Therefore, Chinese infrastructure investments seem to lead to progress towards more balanced local development.

Chinese FDI has grown rapidly, although initially at low levels. The motivations of these productive capital flows have been investigated. In this regard, Kolstad and Wiig (2012) observed that the characteristics of Chinese FDI differ from those of other investor countries. In the period 2003-2006, FDI flows from the Asian giant were mainly directed towards countries with large domestic markets, which appears consistent with standard theories (Chinese companies direct resources where there is greater demand). However, China is strongly attracted to nations rich in natural resources but characterized by weak institutions. Specifically, the analysis shows a significant interaction effect: Chinese FDI is mainly directed

towards countries with low levels of institutional quality, where raw materials (oil, minerals) are abundant. This shows that Chinese companies are interested in investing where there are considerable opportunities: investments are motivated by market-seeking reasons, with a clear resource-seeking orientation.

This approach is partly supported by Chen et al. (2018). Their study shows that, at the aggregate level, Chinese FDI in Africa does not correlate significantly with property protection or rule of law indices. Western investments, on the other hand, are clearly oriented towards countries with higher institutional quality. As a result, in countries with weakened governments, where competition is lower, the amount of Chinese FDI is quite high, as it fills a void left by other investors. This result inevitably raises questions about the sustainability and compliance with operational standards of Chinese investments in areas characterized by vulnerable institutions.

Although this study confirms China's tendency to invest in fragile institutional contexts, the results reveal a varied picture, which rescales the idea that China directs its investments based on natural resources. In fact, another aspect that was addressed by this study concerns the target areas of Chinese investments. Using the MOFCOM (Chinese Ministry of Commerce) database on all Chinese business projects in Africa from 1998 to 2012, these authors found that few projects invest directly in the extractive sector. Most fall within services (e.g., construction, trade, business services) and manufacturing. This result contrasts with the widespread perception, also suggested by the study by Kolstad and Wiig (2012), that Chinese investments are only interested in resources: in reality, several Chinese companies are entering African markets to offer services or start industrial activities, participating significantly in the development of these sectors.

Another interesting element provided by the study by Chen et al. (2018) concerns the type of investors. Micro data confirm that it is not only large public companies that invest. In fact, many small and medium-sized private Chinese companies are active in Africa. The sector addresses of Chinese companies seem to reflect the conditions of the recipient countries. The study points out that in African countries where the local workforce is more educated and skilled, the presence of Chinese companies is partially higher in skill-intensive areas. Conversely, in countries where domestic capital is scarce, FDI is concentrated in sectors that require large financial resources. Therefore, what emerges from this study is that Chinese investors seek profits by adapting to local situations in the same way as any rational multinational company.

So, when analyzing the impact of these investments on the African development process, studies show both possible advantages and the conditions necessary to achieve them. The presence of Chinese capital can speed up the industrialization process and the creation of new jobs in Africa, especially in the manufacturing sector, if African countries can absorb it effectively.

Considering the conclusions reached in these studies, the example of Ethiopia appears significant. In 2012, at the request of the Ethiopian government, the World Bank launched a comprehensive survey of 69 Chinese companies operating in Ethiopia to analyze their activities, objectives, and contributions. The final report shows that Chinese interest in Ethiopia is based on the prospect of using low-cost labor and entering a developing market. At the same time, the study emphasizes how such investments can help the country improve its economy. In terms of economic change, Chinese FDI offers Ethiopia the opportunity to transition from an agricultural economy to one based on manufacturing and exports, in a partially similar way to

the development process followed in the past by some Asian countries. To achieve this goal, it is necessary to create a favorable business environment.

The GOH (2012) study highlights some problems in the Ethiopian investment area and proposes five key recommendations for reform. Specifically, it calls for simplifying customs clearance procedures and trade regulations, facilitating access to foreign currency and increasing transparency in exchange rate policy, improving the consistency and effectiveness of tax administration, ensuring impartial enforcement of labor regulations, and improving the quality and versatility of skilled workers. According to the report, these measures would enable Ethiopia to make the most of the presence of foreign investors (including Chinese investors) to speed up the transition to a more productive industrial economy. The Ethiopian experience therefore indicates that attracting Chinese FDI, when combined with appropriate structural reforms, can boost industrial development and the creation of skilled employment in Africa. The risk is that certain issues, such as bureaucratic challenges, a lack of local skills, or currency rigidity, may limit the full positive impact of such investments.

Still focusing on Ethiopia, we must not overlook employment trends, which do not appear to be tension-free. According to a study by Chu and Fafchamps (2022), foreign companies in the Ethiopian manufacturing sector, especially Chinese ones, experience more labor disputes (complaints, strikes, and protests) than domestic companies, even when wages and benefits are similar. According to another study on the subject by Oya and Schaefer (2023), which jointly analyzes the cases of Angola and Ethiopia, Chinese companies do not appear to systematically pay lower wages than others. On the contrary, the differences observed seem to depend on the sectors in which the companies operate, not on their nationality. This suggests that conflicts are

not ascribed to lower wages, but probably to more complex factors related to work organization. Another factor to consider is the degree of union participation, which could be influenced by Chinese projects. In this regard, a study by Isaksson and Kotsadam (2018b) analyzes geolocated individual data in 18 African countries. The main finding is that in areas affected by Chinese development projects, union involvement appears to decline, unlike in projects financed by other donors. This finding suggests that China's presence could limit workers' representation, motivating the possible labor conflicts described above.

Overall, current literature highlights a rapidly changing relationship between China and Africa, characterized by developed economic interconnection. Certainly, Chinese investments can create opportunities, generating numerous possibilities for development, as highlighted by some of the studies mentioned above. However, some issues have emerged. There is a clear need to manage certain aspects carefully, such as debt transparency (to avoid excessive accumulation of hidden liabilities), compliance with adequate levels of governance in projects (to limit corruption and favoritism), and the integration of foreign investment into the local economy (creation of local supply chains). In this context, therefore, Sino-African relations could become even closer, supporting the structural transformation of African economies.

### 3 DATA

The study is based on a dataset designed around six key economic and institutional indicators, retrieved from accredited international sources. To provide a comprehensive analysis, each subsection is dedicated to a specific indicator and is further accompanied by analytical statistics and clear graphical illustrations, calculated solely on the sample of African countries examined. Here is a brief summary table of the data used, showing their main features.

Table 1: Variables and sources

Variable	Definition	Scale/Units	Source
$FDI_{it}$	Annual Chinese FDI inflow	million US\$	Statista; CEIC
Economic Freedom	Economic Freedom Index	0–100	Heritage
GDP	Gross Domestic Product	billion US\$	World Bank
GDP per capita	Real GDP per capita	thousand US\$	World Bank
Control of Corruption	WGI governance indicator	[−2.5, 2.5]	World Bank
Government Effectiveness	WGI governance indicator	[−2.5, 2.5]	World Bank

*Notes.* The table shows the data used, with related definitions, units of measurement, and reference sources.

#### 3.1 Foreign Direct Investment

Foreign Direct Investment<sup>2</sup> represents the annual flow of capital invested by China in various African countries. The objective of such investments is to acquire a lasting interest and

<sup>2</sup> $FDI_{it}$  is expressed on a nominal basis.

significant influence in the management of an economic activity in the recipient country (OECD (2009)). Chinese FDI takes various forms: they can be the acquisitions of company shares, but also infrastructure projects managed and organized by Chinese companies. From an economic point of view, this is a fundamental variable because it represents the way in which one economy can influence others. This type of investment can, for example, increase GDP, create jobs, and improve infrastructure. In this paper, the FDI variable is expressed in annual values and represents the total amount invested by China in an African country each year. This variable is the starting point for the construction of the econometric model that has been applied.

FDI data<sup>3</sup> were collected from two sources: CEIC Data and Statista (Statista (2023), CEIC Data (2023)). Both are macroeconomic and financial data platforms that provide up-to-date statistics from official national and international sources. The data for this variable were processed from the Ministry of Commerce of the People's Republic of China, the National Bureau of Statistics, and the State Administration of Foreign Exchange. In fact, the official source of the data on Statista is the Statistical Bulletin of China's Outward Foreign Direct Investment. This document was jointly compiled by the three bodies mentioned above. The only limitation in the construction of this data is Statista's limited time coverage, which ranges from 2013 to 2023. The CEIC Data platform, which in turn draws on the Ministry of Commerce of the People's Republic of China as its primary source, was used to obtain data for previous years. The values after 2013 on CEIC Data match those reported on Statista, confirming their consistency.

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<sup>3</sup>The *FDI<sub>it</sub>* variable has missing values, but they are very few and limited to the earliest years. They were set to zero, given the minimal presence of Chinese investments in those years. This is confirmed by the low values in the adjacent years.

### 3.1.1 Descriptive statistics of Chinese FDI flows in the African sample

Table 2: Descriptive statistics — Chinese FDI flows (mn USD), 2004–2023

Mean	Median	Std. Dev.	Min	Max	Obs.
2427.37	2273.87	1436.05	285.29	5304.83	600

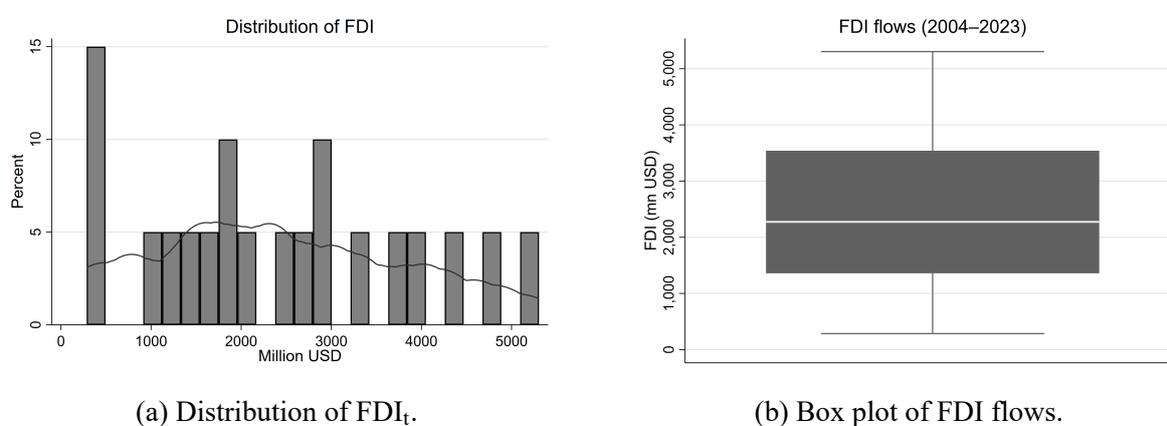


Figure 1: FDI flows in Africa. Summary distribution through histogram and box plot, 2004–2023.

For the construction of these graphs and results, the annual aggregate FDI values ( $FDI_t$  variable, which will be explained later on) were used, because they offer a clearer and more immediate summary of the flows. This decision is in line with the model that will be presented below and maintains consistency between the descriptive and empirical analyses. The results show an average value of approximately \$2.4 billion and a median of \$2.27 billion. The standard deviation of \$1.4 billion indicates considerable variability, with a range from less than \$300 million to over \$5.3 billion. The box plot clearly highlights this dispersion, with considerable central values and some higher but not anomalous ones. The histogram shows a concentration of observations between 1000 and 3000 million dollars, while retaining a right-skewed tail: the majority of flows are therefore in the medium-high range, while only some cases are at very high

levels. The different values observed are indicative of high temporal variability in FDI flows. This heterogeneity is significant for the purposes of the thesis, as it shows that in some years there were significantly higher flows than in others. This aspect allows for the identification of a treatment, which in turn serves to divide countries into two distinct groups. Therefore, a comparative method of exposure, such as the one that will be used in the subsequent empirical analysis, is appropriate.

### 3.2 Economic Freedom

Economic freedom is the right to produce, exchange, and consume any product or service without the use of force or coercion. The index used in this study measures economic freedom based on twelve other factors grouped into four categories: Rule of Law, Government Size, Regulatory Efficiency, and Open Markets. Each component represents a specific economic freedom, which is calculated on a scale from 0 to 100. Three factors are grouped in each category. The overall score is assigned by averaging these twelve economic freedoms, weighting them all equally. The composition of the index provides a comprehensive measure, which is able to highlight the different dimensions that are part of an economic system. Therefore, it is a tool that allows for a comparative assessment of economic freedoms between different countries. The source of the data for this index is The Heritage Foundation (Heritage Foundation (2025)), which publishes the results for each country every year.<sup>4</sup>

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<sup>4</sup>Some data for this index are missing (however, not many). For each year with a missing value, I entered the median of the countries belonging to the same group as the one for which the value was missing. I did not use the average to avoid sensitivity to extreme values. I did not repeat the first available value for the missing years to avoid generating too many artificially constant values in sequence in the case of prolonged absences.

### 3.2.1 Descriptive statistics of the Economic Freedom Index in the African sample

Table 3: Descriptive statistics — Economic Freedom (0–100), 2004–2023

Mean	Median	Std. Dev.	Min	Max	Obs.
54.55	55.25	7.04	21.40	72.00	600

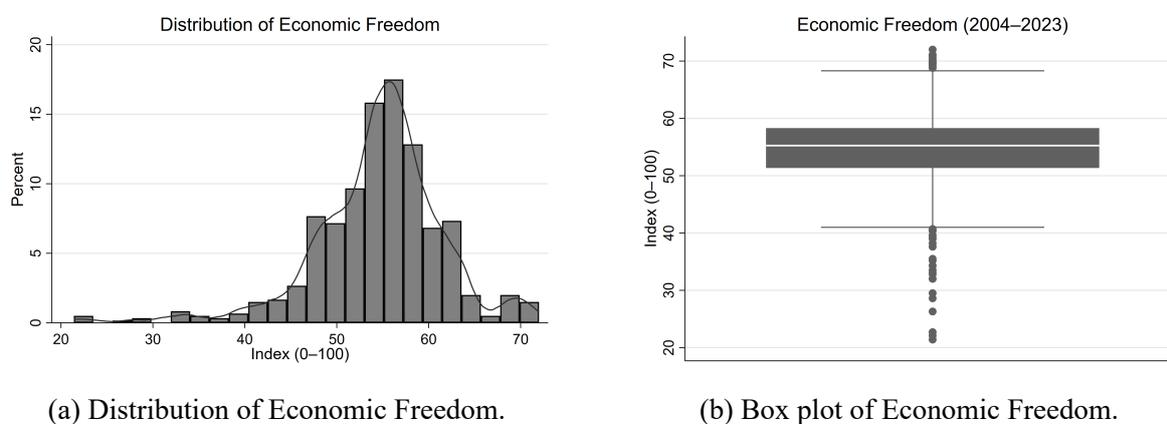


Figure 2: Economic Freedom in Africa. Summary distribution through histogram and box plot, 2004–2023.

The statistics of the Economic Freedom Index show a distribution centered on medium-low values, with an average of 54.5 and a similar median (55.25). The histogram shows a shape close to the normal distribution, with most observations between 50 and 60 and few cases in more pronounced ranges. The standard deviation of just over 7 confirms moderate variability, highlighting levels of economic freedom that are partly similar among African countries, with a few anomalies. The box plot confirms this result, showing a uniform distribution, but with outliers, especially towards the lower end (20–40), which reflect particularly vulnerable institutional contexts. Conversely, scores above 70 are infrequent. From an interpretative perspective, the results show that Africa has a slightly lower average level of economic freedom (54.5) over the period 2004–2023, compared to the global average in 2024 (58.6), according

to data published by The Heritage Foundation. The distribution is fairly uniform around the central value, but with marked differences in extreme cases. Overall, this highlights how Africa is characterized by institutional and regulatory situations that are definitely unfavorable.

### 3.3 GDP and GDP per capita

GDP (Gross Domestic Product)<sup>5</sup> is one of the main and most widely used economic indicators. GDP is the value of goods and services produced within a country over a given period. GDP per capita<sup>6</sup>, on the other hand, is a fundamental indicator because it explains the average level of well-being in a country. This value is calculated by dividing GDP by the total number of inhabitants. It is therefore a derived indicator. The formula is as follows:

$$\text{GDP per capita (current US\$)} = \frac{\text{GDP (current US\$)}}{\text{Total Population}}. \quad (1)$$

Both GDP and GDP per capita data were obtained from datasets provided by the World Bank (World Bank (2024)). All values collected come from official national statistics, central banks, and national accounts of individual countries. In the context of this thesis, both indices play a fundamental role because they express the economic well-being of a population, the former in absolute terms and the latter in relative terms with respect to the total population. If strong exposure to FDI is not associated with a significant increase in GDP per capita, it means that the inflow of foreign capital has not led to an increase in the average wealth of the population.

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<sup>5</sup>GDP is expressed on a nominal basis. This choice is motivated by the need to keep them comparable to FDI values (as will be seen later).

<sup>6</sup>GDP per capita is expressed in real terms (constant 2015 dollars).

### 3.3.1 Descriptive statistics of GDP per capita in the African sample

Table 4: Descriptive statistics — GDP per capita (thousand USD), 2004–2023

Mean	Median	Std. Dev.	Min	Max	Obs.
2004.32	1141.20	2200.22	278.65	13048.07	600

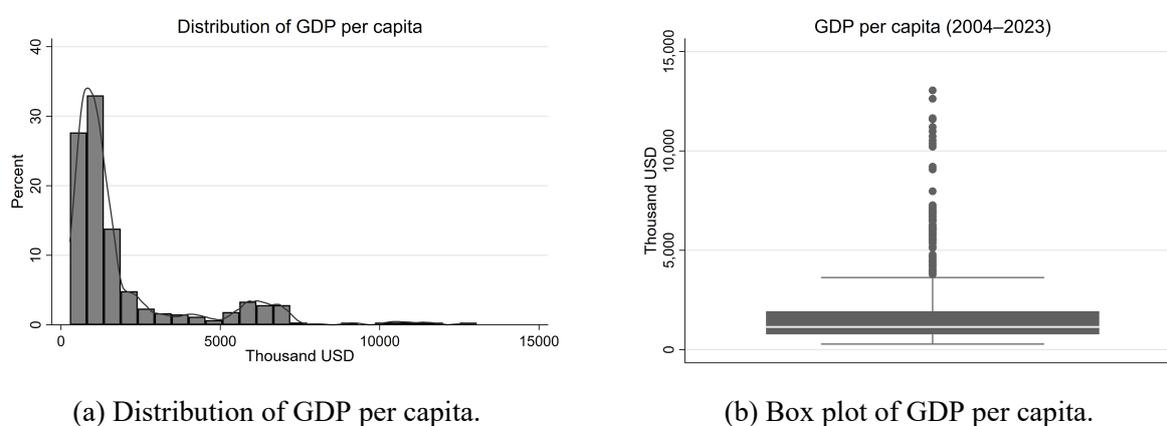


Figure 3: GDP per capita in Africa. Summary distribution through histogram and box plot, 2004–2023.

The data on GDP per capita highlight a marked difference within the sample. The average (approximately \$2,000) is much higher than the median (\$1,141), indicating that a few very wealthy countries are raising the average value. The histogram confirms this cluster: most countries are at low levels (between \$500 and \$2,000), while only a few reach levels above \$10,000. The box plot confirms this picture: the presence of numerous higher outliers illustrates those African economies that are more advanced, in strong contrast to most countries that remain at low levels. This variance is crucial to the analysis as it highlights that the impact of Chinese FDI cannot be uniform. Arguably, in low-income contexts, investments compensate for essential needs, while in more advanced ones, they fit into already established economies, influencing various sectors. GDP is not presented separately in a sub-paragraph dedicated to descriptive

statistics, because it is used exclusively as a tool for normalizing FDI flows. In other words, unlike other indicators, which are outcome variables, GDP only plays an instrumental role. These steps will be explained in detail in the next section.

### **3.4 Control of Corruption and Government Effectiveness**

The WGI (Worldwide Governance Indicators) are a set of six indicators, provided by the World Bank (World Bank (2024)): Voice and Accountability, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. These indicators provide a measure of the quality of public institutions in more than 200 countries over a period of almost thirty years (1996–2023). The WGI are constructed from more than 30 independent data sources, collected through international organizations, research centers, and private companies.

From a methodological point of view, unlike the Economic Freedom Index, which is calculated using a weighted average, the WGI is obtained using a statistical approach known as the Unobserved Components Model (UCM). This method assumes that each dimension of governance (i.e., the six indicators mentioned above) cannot be directly measured. Therefore, many partial indicators are used, such as surveys and expert assessments. Each source constitutes a noisy version of the indicator to be estimated. This method allows to extract the common signal of each sub-indicator to obtain a single noise-free estimate.

A feature of these indicators is that the final scores are standardized so that they have a mean of zero and unit standard deviation across countries. Values close to zero indicate that a country is close to the global average. As a result, the scale of these total scores ranges from -2.5 to +2.5. Positive and negative values indicate performance above and below the global average,

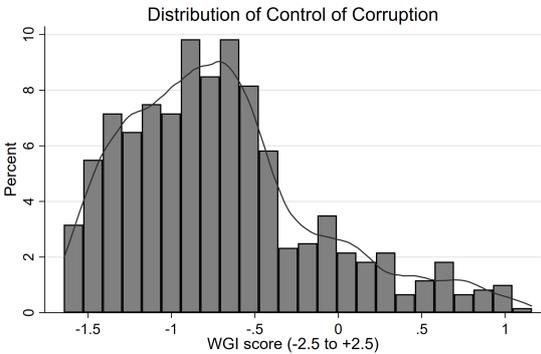
respectively. Two of these indicators were used in the analysis: Government Effectiveness and Control of Corruption.

The first indicator represents the degree to which public power is perceived as being exercised for private purposes. This definition includes both cases of administrative corruption, such as the payment of bribes to public officials, and more serious cases, such as the misappropriation of public resources. The second indicator represents the credibility and consistency of the government in implementing the political decisions that are taken. It is an indicator that reflects the quality of public services provided and, more generally, the competence of the public administration. In this context, these are two very useful indicators as they express both institutional quality and administrative transparency.

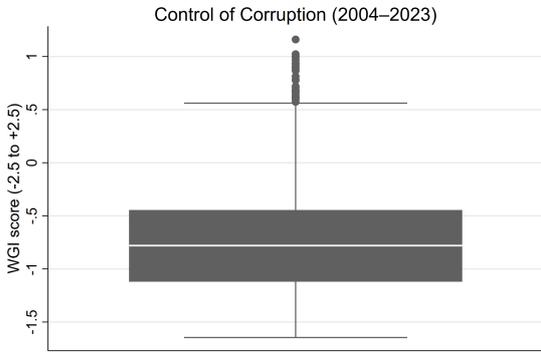
3.4.1 Descriptive statistics of the Control of Corruption indicator in the African sample

Table 5: Descriptive statistics — Control of Corruption, 2004–2023

Mean	Median	Std. Dev.	Min	Max	Obs.
-0.71	-0.78	0.58	-1.65	1.16	600



(a) Distribution of Control of Corruption.



(b) Box plot of Control of Corruption.

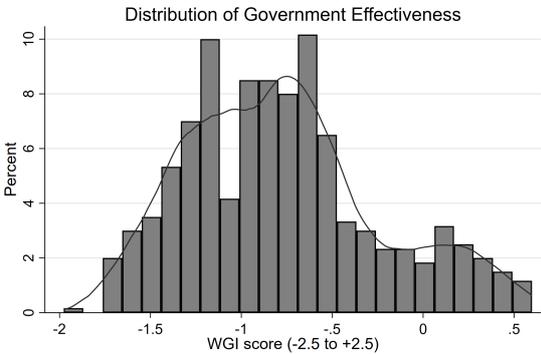
Figure 4: Control of Corruption in Africa. Summary distribution through histogram and box plot, 2004–2023.

The Control of Corruption index shows largely negative values: the average is  $-0.71$  and the median  $-0.78$ , with most countries grouped between  $-1.5$  and  $-0.5$ . This shows that corruption is a widespread problem, while positive values (indicating greater control) are found only in a few isolated cases. The box plot confirms this picture, with a distribution centered on negative values and a few positive outliers. However, there is considerable internal variability (from  $-1.64$  to  $+1.16$ ), highlighting significant institutional heterogeneity: many countries are characterized by structural weaknesses, while only a minority have more solid levels of governance. If corruption is high, FDI may be captured by elites, compromising its impact on development. Conversely, in solid situations, investments are more likely to produce economic and institutional benefits.

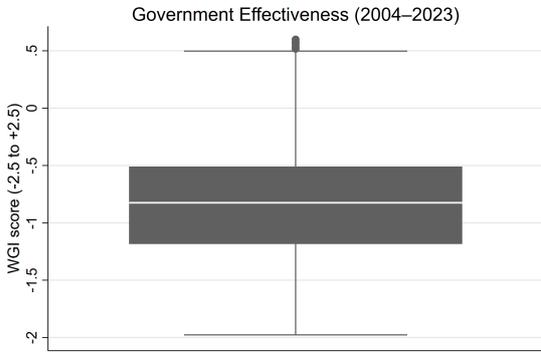
**3.4.2 Descriptive statistics of the Government Effectiveness indicator in the African sample**

Table 6: Descriptive statistics — Government Effectiveness, 2004–2023

Mean	Median	Std. Dev.	Min	Max	Obs.
-0.78	-0.82	0.53	-1.98	0.60	600



(a) Distribution of Government Effectiveness.



(b) Box plot of Government Effectiveness.

Figure 5: Government Effectiveness in Africa. Summary distribution through histogram and box plot, 2004–2023.

The statistics for Government Effectiveness show negative average values (-0.78) and a similar median (-0.82), indicating a general weakness in the administrative capacity of the countries in the sample. The histogram shows a concentration of observations between -1.5 and -0.5, with sporadic positive exceptions, while the boxplot confirms the low frequency of values above zero. The rather low standard deviation (0.53) shows that, despite the differences between countries, they are part of a fragile system as a whole. In concrete terms, most of the countries in the sample are characterized by institutions that are not very effective in providing services and adopting efficient policies. These results are similar to those for the “Control of Corruption” index. Consequently, their interpretation is also consistent: where administrative competence is more qualified, investments could be transformed into structural development and produce consolidated benefits; where it is lacking, the same flows could risk having limited effects.

## 4 METHODOLOGY

The analysis is based on a quantitative approach. To examine the data exhaustively and identify a causal link between the variables, the method known as Difference-in-Differences (DiD) was applied. The analysis covers thirty African countries over a twenty-year period (2004–2023). The total number of countries was divided into two groups based on their degree of exposure to FDI: countries that received more investment on average over these twenty years constitute the treatment group, while those that received less constitute the control group. This approach assumes that, in the absence of investment, the two groups would have followed parallel trends. Intuitively, if Chinese FDI has a positive effect on a country's economic development, in the long run, the treated countries should perform better than the others. Furthermore, the method used allows the effect of FDI to be isolated by controlling for external factors. This is a fixed effects method by country and by year. Essentially, it eliminates both the influence of characteristics specific to each country but constant over time (e.g., economic size, resource endowments) and shocks common to all countries each year (e.g., global economic trends, changes in commodity prices, international crises). In this way, the results obtained reflect only the effect of FDI on the outcome variables considered.

This section provides a general theoretical overview of the models used to perform the analysis. This step serves to correctly frame the empirical application that will be shown in the next section. There, the temporal dynamics of the variable that defines the treatment will be clearly shown and the main implications of the model will be discussed. The sources used in this section to outline the fundamental theoretical aspects of the methodology are: Wooldridge

(2010), Angrist and Pischke (2009), and Cameron and Trivedi (2005).

#### 4.1 Difference-in-Differences (DiD)

Difference-in-Differences is a very useful econometric method that estimates the causal impact of a treatment by comparing changes in outcome for two different groups. The difference between the two is that only one is exposed to treatment (treatment group), while the other is not (control group). If the groups would have shown similar trajectories in the absence of the intervention, any difference between their trends can be causally attributed to the exposure.

The model can be represented by the following equation:

$$Y_{it} = \alpha + \delta D_i + \lambda Post_t + \beta(D_i \cdot Post_t) + \varepsilon_{it}. \quad (2)$$

In this equation:  $Y_{it}$  is the observed outcome for unit  $i$  at time  $t$ ;  $D_i$  is a dummy variable indicating whether unit  $i$  belongs to the treated group;  $Post_t$  is a dummy variable equal to 1 in the period after the intervention;  $D_i \cdot Post_t$  is the interaction identifying the effect of the treatment;  $\beta$  is the coefficient of interest.

The basic model used in this study is partly different:

$$E[y_{it} | d_i, t] = \beta \cdot d_i \cdot post_t + c_i + \tau_t + \varepsilon_{it}. \quad (3)$$

In this equation:  $\beta$  and  $d_i \cdot post_t$  represent, as before, the coefficient of interest and the interaction variable, respectively;  $c_i$  represents individual characteristics that are fixed over time (e.g., initial level of economic development, institutions, sectoral structure);  $\tau_t$  is a temporal effect common

to all units (e.g., global shocks);  $\varepsilon_{it}$  is the error term. In this case, the terms relating to  $D_i$  and  $Post_t$  are not reported separately, because the structural differences between countries and common trends over time are captured by fixed effects (explained in detail below). This allows for a synthetic model in which attention is focused directly on the effect of interaction, which is the central aspect of the analysis.

This econometric technique therefore uses two differences, one over time and one between groups. From a theoretical point of view, the effect of the treatment is calculated by calculating a “difference between differences,” hence the name of the method used. To understand the intuition behind DiD, we must first look at the expected values of the outcome in the two groups before and after the intervention.

For the treated group, the expression is:

$$E[y_{it} | d_i = 1] = \begin{cases} c_i + \tau_0 + \varepsilon_{i0}, & \text{if } t = 0, \\ \beta + c_i + \tau_1 + \varepsilon_{i1}, & \text{if } t = 1. \end{cases} \quad (4)$$

For the control group, it follows that:

$$E[y_{it} | d_i = 0] = \begin{cases} c_i + \tau_0 + \varepsilon_{i0}, & \text{if } t = 0, \\ c_i + \tau_1 + \varepsilon_{i1}, & \text{if } t = 1. \end{cases} \quad (5)$$

By calculating the differences in outcome over time for each group, we obtain the variation in the trend for both.

For the treated group, this gives:

$$\begin{aligned}
 \Delta y_T &= E[y_{i1} | d_i = 1] - E[y_{i0} | d_i = 1] \\
 &= (\beta + c_i + \tau_1 + \varepsilon_{i1}) - (c_i + \tau_0 + \varepsilon_{i0}) \\
 &= \beta + (\tau_1 - \tau_0) + (\varepsilon_{i1} - \varepsilon_{i0}).
 \end{aligned} \tag{6}$$

For the control group, the equation becomes:

$$\begin{aligned}
 \Delta y_C &= E[y_{i1} | d_i = 0] - E[y_{i0} | d_i = 0] \\
 &= (c_i + \tau_1 + \varepsilon_{i1}) - (c_i + \tau_0 + \varepsilon_{i0}) \\
 &= (\tau_1 - \tau_0) + (\varepsilon_{i1} - \varepsilon_{i0}).
 \end{aligned} \tag{7}$$

Finally, calculating the difference between these two variations that we obtained, we get exactly the difference between the performance of the two groups after treatment:

$$\Delta y_T - \Delta y_C = [\beta + (\tau_1 - \tau_0) + (\varepsilon_{i1} - \varepsilon_{i0})] - [(\tau_1 - \tau_0) + (\varepsilon_{i1} - \varepsilon_{i0})] = \beta. \tag{8}$$

This gives us exactly the coefficient of interest that was defined in the initial equation as the coefficient of interaction between the variables  $d_i$  and  $post_t$ . The presence of both variables in the equation allows us to capture both effects described, considering both differences (that over time and that between groups).

The fundamental assumption for the identification to be valid is defined as “parallel trends”: in the absence of the intervention, the difference between the two groups would have been constant over time. From a theoretical point of view, the average effect of the treatment is estimated in

this way:

$$\beta = (E[Y_T | Post] - E[Y_T | Pre]) - (E[Y_C | Post] - E[Y_C | Pre]). \quad (9)$$

Rewriting this equation in terms of potential outcomes, i.e., considering what would have happened with and without the intervention, the result is:

$$\begin{aligned} \beta = & (E[Y_T^1 | Post] - E[Y_T^0 | Post]) \\ & + \underbrace{(E[Y_T^0 | Post] - E[Y_T^0 | Pre]) - (E[Y_C^0 | Post] - E[Y_C^0 | Pre])}_{\text{parallel-trend hypothesis}}. \end{aligned} \quad (10)$$

The second part of the equation represents the bias from non-parallel trends. The “parallel trends” hypothesis establishes that this bias should be equal to zero: in the absence of the treatment, the trend of the treated group is equal to that of the control group.

## 4.2 Fixed Effects

When estimating a causal relationship between two variables, it is essential to consider unobservable elements that could influence their relationship, generating distortion. The fixed effects model allows this issue to be managed, by considering structural differences between units and possible shocks or events common to all. The method consists of eliminating components that are unchanged over time and those common to all, i.e.,  $c_i$  and  $\tau_t$ , to isolate the coefficient of interest  $\beta$ , which is the effect on which we want to focus. A country with stable institutions may receive more FDI and have a higher level of development than others: not

controlling for this could lead to a spurious effect rather than the actual one. Methodologically, what happens is a process of demeaning: the temporal average per unit  $i$ , the cross-sectional average for each year  $t$ , and the total average are calculated to eliminate  $c_i$  and  $\tau_t$ . For this reason, in this specific case we refer to Two-way Fixed Effects (TWFE): both individual-specific FE ( $c_i$ ) and time-specific FE ( $\tau_t$ ) are considered.

The starting equation is:

$$y_{it} = \beta x_{it} + c_i + \tau_t + \varepsilon_{it}. \quad (11)$$

Next, the average per unit  $i$  (over  $t$ ), the average per year  $t$  (over  $i$ ), and the total average are:

$$y_i^* = \beta x_i^* + c_i + \tau^* + \varepsilon_i^*; \quad (12)$$

$$y_t^* = \beta x_t^* + c^* + \tau_t + \varepsilon_t^*; \quad (13)$$

$$y^{**} = \beta x^{**} + c^* + \tau^* + \varepsilon^{**}. \quad (14)$$

These three equations are used to construct a transformed variable that eliminates the individual fixed components  $c_i$  and temporal components  $\tau_t$ , using the following formula:

$$\begin{aligned} \tilde{y}_{it} &= y_{it} - y_i^* - y_t^* + y^{**} \\ &= (\beta x_{it} + c_i + \tau_t + \varepsilon_{it}) - (\beta x_i^* + c_i + \tau^* + \varepsilon_i^*) \\ &\quad - (\beta x_t^* + c^* + \tau_t + \varepsilon_t^*) + (\beta x^{**} + c^* + \tau^* + \varepsilon^{**}) \\ &= \beta(x_{it} - x_i^* - x_t^* + x^{**}) + (\varepsilon_{it} - \varepsilon_i^* - \varepsilon_t^* + \varepsilon^{**}). \end{aligned} \quad (15)$$

To summarize the formula, we finally obtain that:

$$\tilde{y}_{it} = \beta \tilde{x}_{it} + \tilde{\varepsilon}_{it}. \quad (16)$$

In conclusion, following the demeaning process, only the residual part “within”  $\tilde{y}_{it}$  of the outcome, the corresponding part of the explanatory variable  $\tilde{x}_{it}$ , and the centered residual error  $\tilde{\varepsilon}_{it}$  remain: the model estimates the effect of variations isolated from fixed factors, allowing for a cleaner causal estimate of the coefficient  $\beta$ .

### 4.3 Methodological Caveats

The two models described are very useful, because they allow to estimate the causal effect of a treatment in a credible way. However, there are some aspects that need to be taken into consideration. This subsection outlines some critical issues, which will be discussed in more detail in the next section. The two studies Bertrand et al. (2004) and Callaway et al. (2024) address some of these issues.

The parallel-trend hypothesis states that in the absence of treatment, the outcome trajectories for the two groups should evolve ‘in parallel’. In other words, the forces influencing the outcome must act on the two groups in a similar way. This is crucial because, if the hypothesis is verified, when a sudden change is observed following a specific event, this unexpected change becomes clearly attributable to the event in question. However, if the hypothesis is not fully respected, the change could be attributed to other possible causes. Furthermore, if variations to the basic model outlined in the previous subsections are adopted, the results and methodology used must

be treated with caution. In this regard, the study by Callaway et al. (2024) addresses the issue of “staggered treatment,” in which exposure to treatment occurs at different times for different units. In other words, this means that some units receive treatment before others: the control group in a certain year may become the treatment group in the following year. This makes the interpretation of the results more complex, because in this scenario comparisons are made not only between treated and untreated groups, but also between groups treated before others. Finally, when working with panel data, errors are often serially correlated within units. As suggested in the study by Bertrand et al. (2004), one possible solution is to cluster errors at the treatment unit level, if there are not too few of them. Ignoring this factor risks obtaining underestimated standard errors and false statistical significance. The result would be distorted and inaccurate estimates.

## 5 EMPIRICAL FRAMEWORK

In this section, the theoretical elements defined above are applied and discussed. Before formalizing the model as briefly anticipated, a graph showing the trend of FDI over the period under analysis is presented. This step serves to correctly frame the context in which the method described above was applied. Subsequently, the model used is presented in detail, along with the main variables involved. Finally, methodological choices and possible critical issues are discussed and analyzed.

### 5.1 FDI Over Time

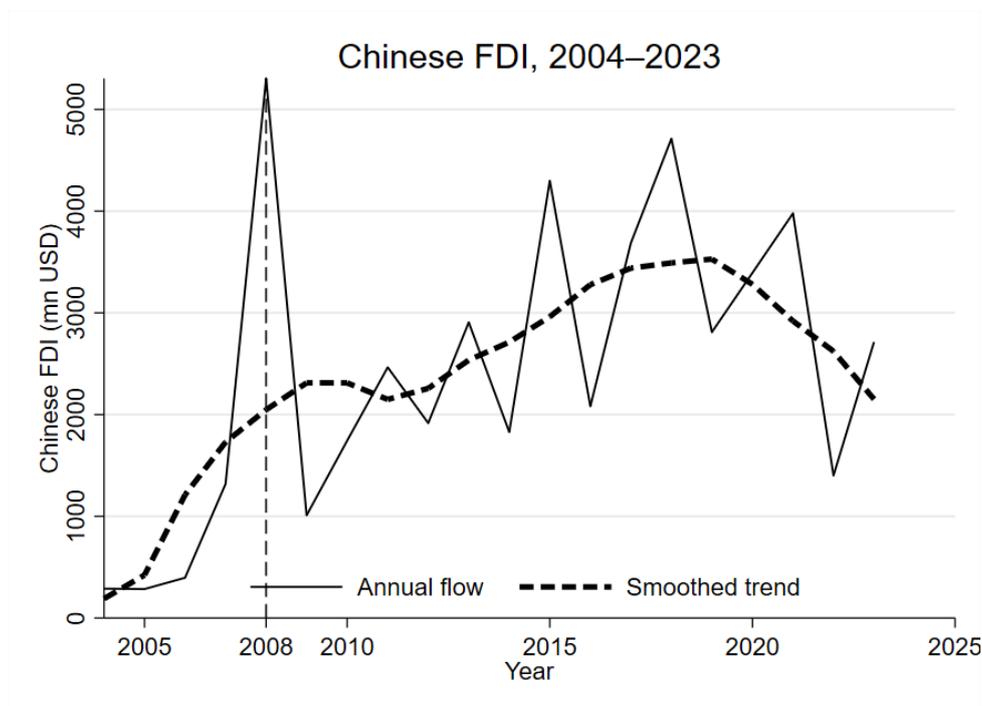


Figure 6: Chinese FDI timeline. Annual flows to sample countries (thin) and smoothed trend (thick), 2004–2023; dashed line at 2008 marks the pre/post split.

The graph in this subsection was constructed using the  $FDI_t$  variable of the model (its construction is explained in detail in the following subsections). The trend shows the annual evolution of Chinese FDI flows to the thirty African countries in the dataset from 2004 to 2023. The thinner, continuous black line shows the total values observed each year, while the thicker, dashed line offers a more “smoothed” reading of the overall trend. The vertical line at 2008 separates the graph into two distinct phases: an initial period with low FDI volumes (until 2007) and a subsequent period characterized by higher investments (from 2008 onwards).

In the first phase, flows are modest and stable. This clearly does not imply an absence of investment, but indicates that in the early period, China’s presence on the African continent was still in its initial stages. The year 2008, on the other hand, represents an important turning point. In fact, a marked peak can be observed in this year. Beyond the isolated shock, what is clear is the difference in the level of investment before and after: once the peak of 2008 was passed, flows, on average, reached higher values than in the previous period. The following decade is characterized by years with high flows and others with more modest investments. However, the dashed line captures the underlying upward trend that distinguishes the entire period after 2008. This dynamic suggests a consolidation of China’s presence in African countries.

There could be many reasons why China decided to invest more heavily in Africa around 2008. Certainly, 2008 was a year of fundamental importance, as it marked the beginning of the global financial crisis. The context of uncertainty during those years may have prompted China to strengthen its economic ties with emerging economies. Africa may have appeared to be a strategic partner, with various infrastructure needs in key sectors and a large margin for new investments aimed at economic development. Certainly, in addition to market-seeking

reasons, China may also have been motivated by resource-seeking motivations, especially in the following of the financial crisis. Furthermore, these investments may also have had geopolitical significance. At a time when the crisis had highlighted possible vulnerabilities in Western economies, China may have taken the opportunity to increase its international influence. Therefore, it is possible that intensifying investment in Africa meant not only securing greater economic resources, but also building closer political relations. Overall, it is plausible to consider the increase in these investments not as a sudden or random phenomenon: China may have found fertile ground in Africa to consolidate its influence.

## 5.2 Econometric Specification

The methodology used is an extension of the classic Difference-in-Differences method. In this study, a continuous treatment over time is used, but two distinct groups (treatment and control) are clearly identified. This will be explained in more detail in the next subsection. This approach is explained by the fact that there is no single policy event in a specific year in the data used. Chinese FDI is a gradual and constant phenomenon in all the years analyzed. Furthermore, all African countries have received investment from China, even if with varying intensity (). The coefficient of interest  $\beta$  shows how much the outcome varies differentially based on changes in the intensity of investment flows, comparing the two groups of countries. This method allows to better capture the incremental nature of the phenomenon.

The regression model estimated for each outcome variable used is:

$$y_{it} = \beta(D_i \cdot FDI_t) + c_i + \tau_t + \varepsilon_{it}. \quad (17)$$

In this model:  $y_{it}$  is the variable of interest that varies with each regression (Economic Freedom, GDP per capita, Control of Corruption, and Government Effectiveness);  $\beta$  is the coefficient of interest, which captures the DiD effect;  $D_i$  is the binary variable that identifies the treatment (its construction is explained in detail below);  $FDI_t$  is the continuous variable over time, representing the intensity of total Chinese FDI in each year (from 2004 to 2023);  $c_i$  indicates the fixed effect for country  $i$ ;  $\tau_t$  indicates the fixed effect of year  $t$ ;  $\varepsilon_{it}$  is the error term.

As can be seen, no additional controls other than interaction were included in the model. This choice was motivated by a specific methodological criterion. The inclusion of certain controls in the model could have introduced variables that were themselves influenced by FDI. This choice could have reduced the model's ability to capture the effect of interaction. Therefore, a parsimonious approach was preferred, aimed at avoiding distortions and maintaining a clear interpretation of the results obtained. Furthermore, for this purpose and in line with the description above, errors are clustered within units in the model. This will also be highlighted in the section on results.

The key term in the model is  $D_i \cdot FDI_t$ , which represents an interaction between a fixed characteristic of each country and the time treatment component. Like the classic DiD formulation ( $y_{it} = \beta \cdot d_i \cdot post_t + c_i + \tau_t + \varepsilon_{it}$ ), here  $D_i$  acts as a treatment indicator, while  $FDI_t$  plays the role of a continuous measure of treatment over time. Intuitively, when  $D_i = 1$  (highly exposed country), the outcome  $y_{it}$  is affected by the trend of  $FDI_t$  through  $\beta$ , while when  $D_i = 0$  (low exposure country) the interaction is zero and the country does not experience the effect of the treatment. Therefore, the estimate of  $\beta$  represents the residual differential variation (considering fixed effects by country and year) between the two groups over time.

### 5.3 Treatment and Exposure

The application of the model was made possible by the construction of three fundamental variables, namely  $T_i$ ,  $D_i$ , and  $FDI_t$ .  $T_i$  represents each country's normalized historical exposure to Chinese FDI flows. This variable was calculated as the average, normalized by GDP, of annual FDI flows to country  $i$  during the period analyzed (2004–2023). Formally, for each country  $i$ :

$$T_i = \frac{1}{T} \sum_{t=2004}^{2023} \frac{FDI_{it}}{GDP_{it}}. \quad (18)$$

In this equation:  $FDI_{it}$  is the flow of Chinese FDI received by country  $i$  in year  $t$ ;  $GDP_{it}$  is the gross domestic product of country  $i$  in year  $t$ ;  $T$  is the number of years considered (in this case, 20). This formula therefore represents the arithmetic mean of the annual  $FDI/GDP$  ratios for each country over the entire time horizon. The decision to normalize this value for GDP is motivated by the different economic sizes of the countries: a billion dollars of FDI has a different impact on a small economy than on a large one. Therefore, dividing the amount of investment received each year by the corresponding GDP allows for a comparable measure between countries.<sup>7</sup> Furthermore, the calculation was performed over the entire period to reflect each country's overall long-term historical exposure.

Once all the  $T_i$  values were obtained, the  $D_i$  variable was calculated to distinguish the countries into two groups based on their degree of exposure to FDI. As mentioned above,  $D_i$  is a dummy variable that takes the value 1 for countries whose  $T_i$  exposure exceeds a certain

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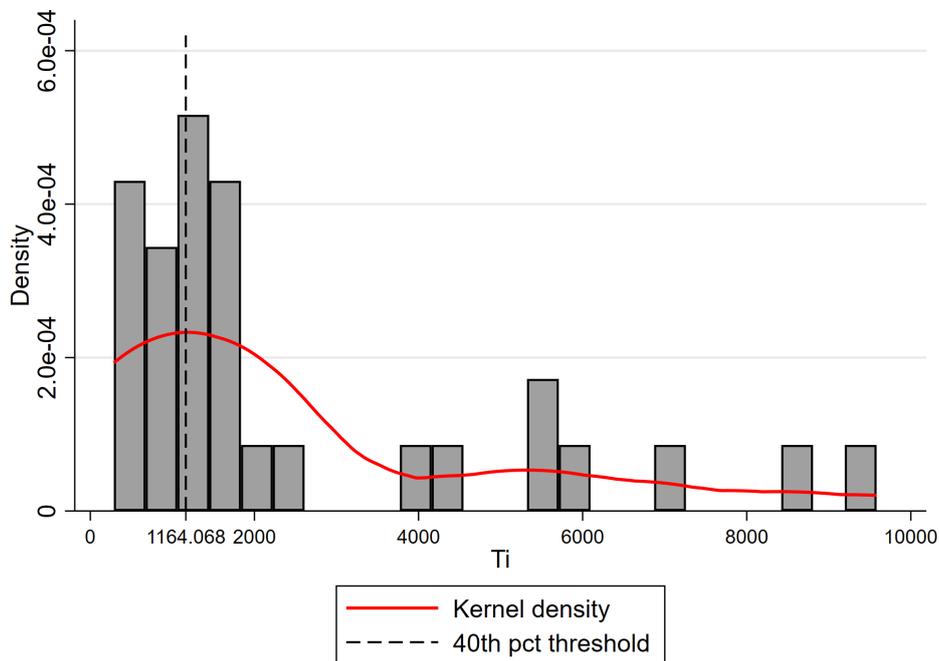
<sup>7</sup>The different scales ( $FDI_{it}$  in millions,  $GDP$  in billions) were harmonized before calculating the ratio.

threshold and 0 otherwise. In this paper, the threshold was set at the 40th percentile of the  $T_i$  distribution. Formally, the  $D_i$  variable was calculated as follows:

$$D_i = \begin{cases} 1 & \text{if } T_i > P_{40}(T), \\ 0 & \text{if } T_i \leq P_{40}(T). \end{cases} \quad (19)$$

In these equations,  $P_{40}(T)$  represents the 40th percentile of the  $T_i$  distribution. The following figure shows the histogram of the  $T_i$  variable and clearly defines the threshold value identified for the construction of  $D_i$ .

Figure 7: Distribution of the variable  $T_i$



*Notes.* The y-axis shows the density (total area = 1). The red line is the kernel estimate; the dashed vertical line indicates the threshold  $\tau = 1164,068$ .

The choice to use this threshold is motivated by the need to create two groups that are comparable in terms of size and to ensure a sufficient difference in treatment intensity. A higher threshold would have included too many countries that are quite exposed to Chinese investment in the control group. Conversely, a lower cutoff would have included too many countries that are poorly exposed in the treatment group. Overall, the 40th percentile is an optimal compromise: it considers most countries as treated, ensuring that the high-exposure group has benefited from Chinese investment, and, at the same time, includes in the control group a comparable number of countries that have received few resources. Clearly, the decision to set a threshold for dividing the two groups leads to countries with similar exposure to Chinese investment being split into different groups when they fall close to the cutoff point. Here, the distinction between treated and untreated countries may be less clearly defined, but this is an inevitable critical issue in any method that requires the setting of a threshold. The problem would have occurred regardless of the value chosen. Furthermore, looking at the values of the two groups as a whole, on average, the difference between the more and less exposed groups is significant. This is the fundamental aspect of the analysis: it is necessary to identify two sets of countries which, despite some limitations that must be acknowledged, have very different exposures on average. This element is crucial because it allows for a clear assessment of the differential effects of Chinese investments. The table below lists the 30 countries used in the analysis and ranks them according to their degree of exposure (based on  $T_i$ ). If this is greater than the threshold, a country falls into the treatment group, otherwise it falls into the control one. The values for the variable  $T_i$  and, consequently, the threshold have been rescaled. They are shown in this way only to make them easier to read. This also applies to the histogram.

Table 7: Country list and exposure group (sorted by  $T_i$ )

Country	Group	$T_i$	Country	Group	$T_i$
Zambia	treated	9582.503	Botswana	treated	1420.053
Niger	treated	8652.457	South Africa	treated	1362.762
Congo DR	treated	6904.939	Sudan	treated	1198.747
Liberia	treated	5958.672	Togo	control	1140.950
Zimbabwe	treated	5458.115	Mali	control	1108.914
Guinea	treated	5404.602	Sierra Leone	control	1099.538
Mozambique	treated	4400.772	Gabon	control	992.724
Tanzania	treated	3786.494	Rwanda	control	991.026
Mauritania	treated	2271.983	Benin	control	828.883
Chad	treated	1851.956	Ivory Coast	control	810.841
Kenya	treated	1759.222	Cameroon	control	639.666
Ethiopia	treated	1746.701	Namibia	control	591.222
Ghana	treated	1723.614	Senegal	control	524.076
Uganda	treated	1716.715	Nigeria	control	461.371
Angola	treated	1559.198	Equatorial Guinea	control	286.836

*Notes.* Countries are ordered by  $T_i$  (mean of  $(FDI/GDP)_{it}$  over 2004–2023). Group = *treated* if  $T_i > \tau$ , *control* otherwise. Threshold  $\tau = 1164,068$ . All values have been rescaled by a factor of one million.

The last fundamental variable is  $FDI_t$ , which represents the total Chinese FDI flows received by all countries in the dataset. Formally, flows to all countries are summed each year:

$$FDI_t = \sum_i FDI_{it}. \quad (20)$$

This variable shows the overall trend in treatment. If China increases its investments in a given year,  $FDI_t$  will take on a higher value, recording greater treatment during that period. This variable changes only with respect to time, not according to country. However, the effect will depend on each country's  $D_i$  exposure:  $FDI_t$  reflects the intensity of treatment year by year, which will have different consequences depending on whether a country falls into the high or low exposure group. The choice to construct this variable is motivated by the intention to model a treatment trend common to all countries.

The combination of these three variables leads to the interaction  $D_i \cdot FDI_t$ , described above. This construction allows to distinguish between countries that are more and less exposed to Chinese investment, and to understand the intensity of the effect over the entire period considered. The answer to the research question will be condensed into the values of the coefficient of interest  $\beta$ , associated with the interaction.

## 5.4 Interpretation and Limitations

The model adopted allows for a clear distinction between the two groups, while maintaining information on the temporal variation and intensity of FDI. The  $FDI_t$  variable was not transformed into a dummy to avoid losing the quantitative dimension of the phenomenon, which concerns the African continent as a whole. The aim of the analysis is to understand whether the increase in Chinese investment causes differential effects between the two identified groups:

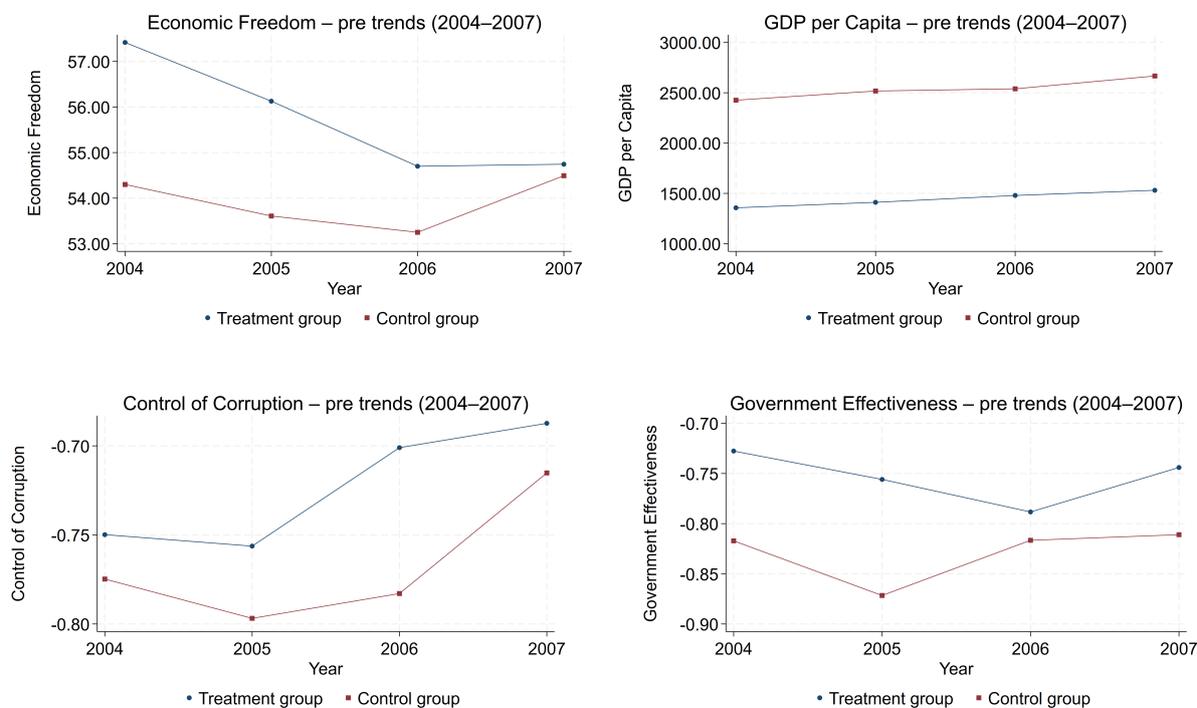
modifying the variable would have oversimplified the model. This is where the concept of staggered treatment introduced in the previous section and discussed in the study by Callaway et al. (2024). comes in. The use of the  $T_i$  variable in the interaction term would have placed the model in a situation of staggered treatment, with consequent interpretative difficulties. The decision to construct a binary specification, i.e.,  $D_i$ , made it possible to avoid the problem, even though it entailed a limitation: even countries belonging to the “control” group receive a small amount of investment. This does not allow for the construction of a pure non-treatment group. However, on average, the difference between the two groups is still significant.

Certainly, interpreting the  $\beta$  coefficient is more complex than in the standard case, because the time variable is not binary. In fact, it does not express the average difference between treated and untreated, but rather the different sensitivity of the two groups to the increase in total FDI. The  $\beta$  coefficient answers the following question: how much does the outcome vary in the most exposed countries compared to the least exposed ones as Chinese investment in Africa increases? Clearly, these methodological choices have limitations, which should be kept in mind. In fact, the  $D_i$  variable not only fails to clearly define two groups in which only one receives the treatment in full, but also does not eliminate differences that exist within the groups. Furthermore, the estimated effect represents an impact that may hide complex dynamics over time or between subgroups of countries. Despite these limitations, the model represents a useful compromise, because it permits estimation of how a phenomenon common to the entire African continent produces differential effects. In this sense, the specification adopted ensures a reasonable balance between methodological rigor and descriptive capacity, making it useful for analysis purposes.

## 5.5 Parallel Trend Hypothesis

This subsection analyzes the parallel trend hypothesis of the model to verify whether, before Chinese investments increased exponentially (2008), the trends of the two groups analyzed followed parallel paths. To carry out this verification, the dynamics up to 2008 are observed for each outcome variable. The graphs shown here represent a part of those that will be displayed in the section dedicated to the results. These will show the trend of the outcome variables throughout the entire time period. Overall, the paths of the two groups in the four graphs seem to evolve in a fairly similar way. However, in some cases this is more evident than in others.

Figure 8: Pre-treatment trends by exposure group (2004–2007).



*Notes.* Each panel shows the average outcome in the pre-treatment period (2004–2007) for the two groups.

The Economic Freedom index shows the most controversial result. Initially, the two trends follow similar trajectories. However, at the end of the pre-treatment period, the gap between the two groups narrows significantly. This does not invalidate the hypothesis, but highlights the need to interpret the results relating to this index with greater caution. It is possible that, in addition to Chinese investments, other factors may have influenced the changes in the index. However, the difference may have been partially reduced before 2008, given the non-total absence of investments in previous years. Perhaps economic freedom is more sensitive to investment than other indices used, with effects becoming more evident when it increases. This would explain why in the early years the trends of the two groups remained essentially parallel and only at the end the gap narrowed.

However, in all other cases, the hypothesis appears to be valid. This is especially evident when looking at the graphs relating to Control of Corruption and GDP per capita<sup>8</sup>. In both cases, the two trends appear to move in parallel. The same can be said for Government Effectiveness. In this case, the two dynamics are not perfectly parallel, but on average, the distance between the two groups does not change. Overall, therefore, the hypothesis seems reasonably satisfied. This provides a reliable basis for interpreting the results reported in the next section, keeping in mind the considerations made for the Economic Freedom index.

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<sup>8</sup>It should be noted here that the results attributed to GDP per capita are not statistically significant. Therefore, this result is less relevant than the others. However, the graph has been included for clarity.

## 6 RESULTS

This section presents the results of the analysis. The equation  $y_{it} = \beta(D_i \cdot FDI_t) + c_i + \tau_t + \varepsilon_{it}$  was applied using the four outcome variables presented in the “DATA” section: Economic Freedom, GDP per capita, Control of Corruption, and Government Effectiveness. The interaction term has an influence on each of these variables: its effect is captured by the coefficient of interest  $\beta$ . The results obtained are summarized in the following table.

Table 8: Difference-in-Differences estimates: interaction between high exposure and FDI (t) across outcomes

	Economic Freedom	GDP per Capita	Control of Corruption	Government Effectiveness
<b>Coefficient of interest</b>				
Interaction between $D_i$ and $FDI_t$	-0.0007773	0.0526642	-0.0000494	-0.0000376
Std. err. (clustered)	(0.0003159)	(0.0460739)	(0.0000172)	(0.0000156)
t-stat	-2.46	1.14	-2.87	-2.41
p-value	0.020	0.262	0.008	0.022
95% CI	[-0.0014234, -0.0001312]	[-0.0415676, 0.146896]	[-0.0000846, -0.0000141]	[-0.0000694, -0.0000057]

*Notes.* All regressions include country and year fixed effects. Standard errors clustered at the country level.  $N = 600$ ; countries = 30.

As can be seen, in addition to the value of the  $\beta$  coefficient, other statistical measures have been calculated to provide a complete picture of the analysis. This approach allows for a more in-depth and accurate interpretation of the results.

Looking at the estimates, two important aspects emerge. The first is that the effect of Chinese FDI on GDP per capita is not statistically significant: although the  $\beta$  coefficient is positive, the high p-value indicates that there is no significant impact on average income. The second aspect concerns the other three variables that have negative and significant coefficients. This highlights a deterioration in the performance of the countries most involved with China. In response to Chinese FDI, there are lower scores for economic freedom, and a weakening in corruption control and government effectiveness. Clearly, the relevance of these effects varies, but all the results seem to point in the same direction: countries that have received high flows of Chinese capital show worse institutional performance than less involved ones.

Each subsection will analyze the results for each outcome variable from an economic perspective, seeking to provide an idea of the magnitude of these effects. In addition, some graphs will be presented in each subsection. To construct these figures, countries were divided into two groups based on their exposure to FDI. This division was defined by the variable  $D_i$ . Subsequently, for each group, the annual average of the variable considered was calculated. The charts show the evolution of these values over time. The average was calculated to mitigate internal variability and to make the two dynamics at play clearly and transparently visible. This provides a more stable result that is representative of the structural differences between groups. The treatment group always start from higher levels, except in the case of GDP per capita. However, the initial difference appears to be fairly limited, especially when compared to that observed at the end of the period, following the sharp reversal in favor of the countries belonging to the control group.

### 6.1 Economic Freedom

In the model analyzed, the  $\beta$  coefficient relating to the Economic Freedom index is negative and equal to -0.0007773. This result is significant: the  $p$ -value is 0.020. The 95% confidence interval (ranging from -0.0014234 to -0.0001312) does not include zero and is concentrated on values below it. Essentially, there seems to be a reduction in the degree of economic freedom in countries most exposed to Chinese investment. The value of this coefficient may seem small. However, it indicates that an additional billion dollars of FDI corresponds to a decrease in the economic freedom index of approximately 0.8 points. Considering that the African countries in the sample analyzed are concentrated between 50 and 60 points, a shift of almost one point should not be overlooked. The results are supported by the following graph.

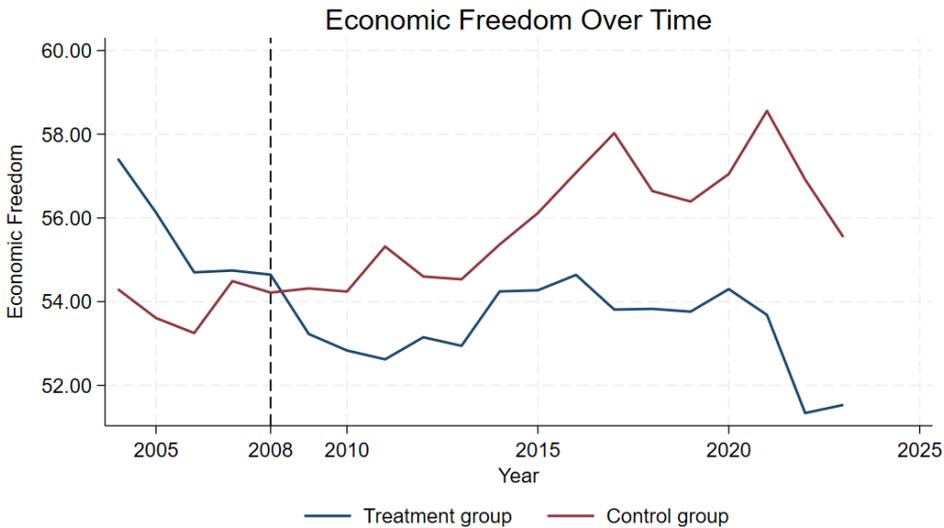


Figure 9: Economic Freedom index trends (Di). Time series for more-treated (blue) and less-treated (red) country groups, 2004–2023.

The graph illustrates the trend over time of the Economic Freedom Index in the two groups (high and low exposure to FDI). Initially, the countries most involved in Chinese investment

(blue line) showed higher levels of economic freedom than the others (red line). This trend seems to have continued until 2006/2007. In the following years, there was a reversal: throughout the remaining period, the less treated countries showed more marked progress than the highly exposed ones. Furthermore, the difference between the two groups seems to become increasingly evident over time. In other words, the countries most affected by FDI are stagnant or even in relative decline. The two trends shown in the graph are perfectly consistent with the results of the regression, i.e., with the estimated negative coefficient. This picture seems to suggest that greater penetration of Chinese capital is associated with less progress in pro-market reforms.

From an economic perspective, we must ask ourselves why Chinese FDI is associated with a contraction (or lack of expansion) in economic freedom. One possible hypothesis is based on the nature of Chinese investments. It is possible that the agreements signed do not focus on encouraging market-oriented reforms and that China has decided to adopt a policy of “non-interference” in internal affairs and respect for the existing political and economic structure. In this interpretation, African governments receiving large inflows of Chinese capital do not feel the pressure and need to implement liberalizing economic reforms. Another possible explanation is based on how Chinese capital is used. It’s likely that a large part of these funds are going to big infrastructure projects, which need significant state involvement. These situations tend to strengthen public intervention in the economy, because it’s actually the state that manages and carries out these kinds of projects, leaving less room for private entrepreneurial initiative. The risk is that the economy will remain relatively closed to competition and overly dependent on centralized decisions. In this context, FDI not only fails to contribute to an improvement

in the degree of economic freedom in African countries, but could also encourage economic models with strong state participation (even if unintentionally). A final factor to consider is the lack of new opportunities for local entrepreneurship, which could be counteracted by the presence of the Asian giant. If many projects are awarded to Chinese companies, which import materials and technologies from China, the development of the African entrepreneurial structure may be limited. This could prevent small and medium-sized African enterprises from entering production circuits, hindering the transfer of skills and know-how that could contribute to their growth. The result is an uncompetitive domestic market and a low degree of economic freedom due to the limited space left for the local private sector to grow and innovate.

## 6.2 GDP per capita

The result for the coefficient of interest of the GDP per capita variable is positive and equal to 0.05266. Unlike the other indicators, this effect is not statistically significant: the  $p$ -value is high, equal to 0.262. The absence of significance indicates that the interaction does not contribute to a clear explanation of the outcome. The 95% confidence interval for this coefficient is wide and includes zero (approximately -0.042 to 0.147). This indicates that there is no substantial evidence of an effect other than zero. Despite the amount of capital inflows, the average standard of living in the most ‘treated’ countries has not improved significantly. This seems to suggest that investments have not translated into widespread benefits for the population as a whole. The graph for this index is shown below. The visual result is consistent with that obtained through regression: Chinese FDI does not seem to have had an effect on the GDP per capita of African countries.

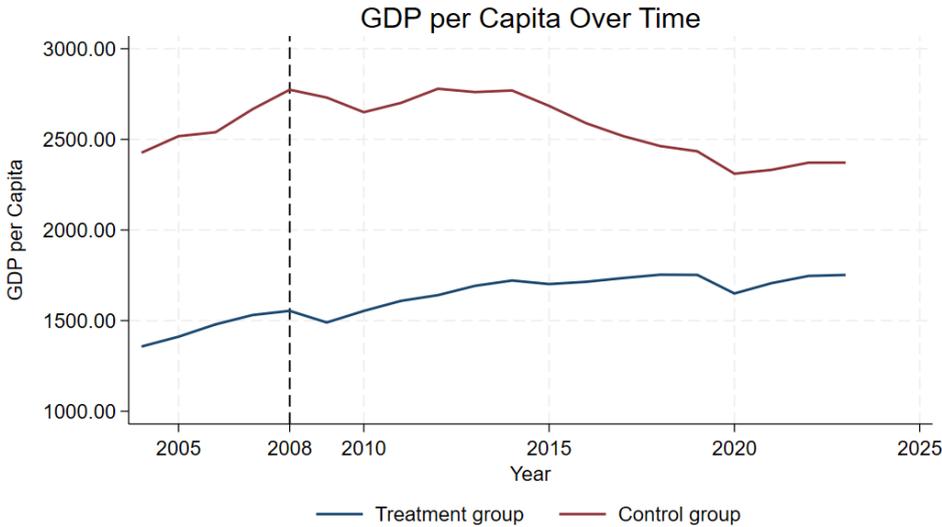


Figure 10: GDP per capita index trends (Di). Time series for more-treated (blue) and less-treated (red) country groups, 2004–2023.

From an interpretative point of view, this is perhaps the most worrying aspect, because it indicates that Chinese investments have not translated into greater average individual well-being. It follows that the direct economic benefits of FDI have not been widely disseminated among the population, or that any increases in GDP have not been sufficient to bring about a real increase in average income. It is plausible that the benefits of Chinese investment remain concentrated in specific sectors or groups without spreading to the rest of the economy. In this case, the FDI-linked development model risks being perceived as biased in favor of Chinese interests or a small local elite. In this case, given that GDP per capita is an average indicator, it could hide internal inequalities. It is therefore possible that the economic benefits of investment have been concentrated in a few hands and have not been distributed inclusively, leaving the average income level unchanged. One possible reason could be corruption (anticipating the findings of the next subsection). If part of the resources

is captured by non-transparent practices, it means that it cannot be reinvested in productive activities. This could reduce the overall added value, explaining the lack of significant impact.

### 6.3 Control of Corruption

The coefficient associated with the Control of Corruption variable is negative and statistically significant: the value of  $\beta$  is -0.00005 and its  $p$ -value is 0.008. The 95% confidence interval, ranging from -0.000085 to -0.000014, confirms the robustness of the result. These results identify a very robust estimate, highlighting the strength of the relationship between the variables: the trend of this index seems to be explained effectively by the interaction. The observed significance is indicative of a systematic effect: in countries with high exposure to FDI, control of corruption seems to decrease compared to those with less exposure. In this case, an additional billion dollars of FDI corresponds to a reduction in corruption control of approximately 0.05 points. Considering that the scale of this indicator ranges from -2.5 to +2.5 and that most of the African countries analyzed fall between -1.5 and -0.5, this deterioration, while seemingly modest, is significant when comparing neighboring countries.

Overall, there seem to be a relationship between Chinese investment and a slight deterioration in institutional quality in terms of transparency and integrity. This dynamic seems to suggest that foreign resources may have reinforced practices of limited administrative efficiency. Thus, the impact of FDI may have accentuated certain structural weaknesses, with effects that become apparent over time. The result is a situation in which potential institutional vulnerabilities are not reduced but tend to worsen. This evidence is further shown in the following graph, which visually represents these dynamics.

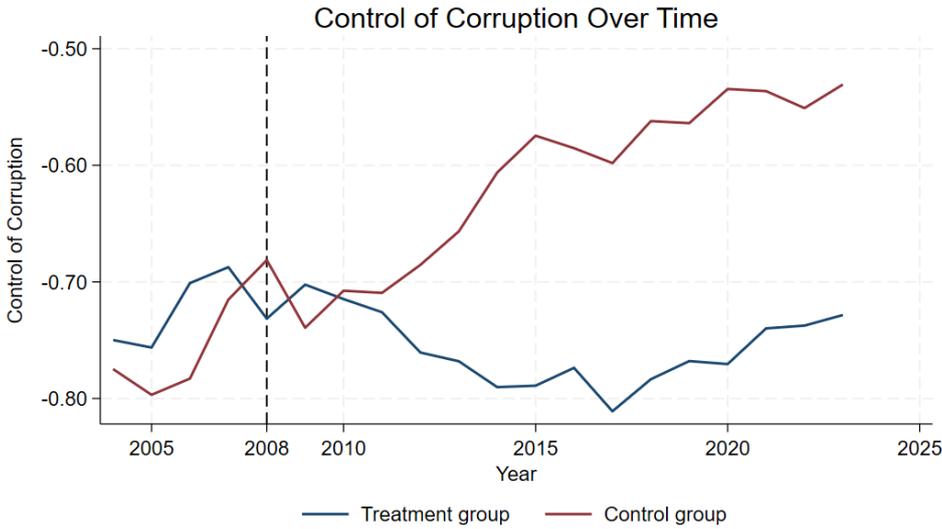


Figure 11: Control of Corruption index trends (Di). Time series for more-treated (blue) and less-treated (red) country groups, 2004–2023.

The graph shows a trend similar to that observed for the Economic Freedom Index. In fact, initially the most treated countries (blue line) showed higher levels than the others (red line), even if they were quite similar. Subsequently, over the years and with the increase in FDI flows, the situation reversed: while the countries least involved progressively improved their level of control over corruption, the highly exposed ones tended towards a progressive decline. Again, the reversal occurred between 2005 and 2010, i.e., in the years when there was a significant increase in Chinese investment (2008 was the year with the highest investment in absolute terms). At the end of the period analyzed, the most treated group shows a lower capacity to control corruption than the other one, consistently with the estimated negative coefficient.

The initial interpretation of this result lies in the vulnerability of African institutions. In the absence of a context capable of consciously managing large flows of foreign capital, corruption may arise, favoring the diversion of funds and inappropriate capital management. Without strict

controls, an environment where the ruling elites become the main beneficiaries of investments and corruption is tolerated as an integral part of the political system may emerge. A second interpretation is similar to that already presented regarding the Economic Freedom Index. If we assume that China has decided to adopt a policy of “non-interference” in internal affairs, local governments do not perceive external pressure to increase the fight against corruption. This mechanism could prevent the proper use of Chinese capital. Finally, it is important to highlight a possible regressive effect. In the absence of adequate pre-existing controls, increased foreign investment could further weaken control institutions: a system that is unable to monitor a few resources is unlikely to be able to do so when the sums involved multiply. In other words, a large inflow of FDI could lead to a negative spiral: the greater the need for adequate supervision, the less effective the control systems become.

#### **6.4 Government Effectiveness**

For the Government Effectiveness index, the coefficient is -0.000038. Again, the effect is significant (the  $p$ -value is 0.022). The 95% confidence interval contains only negative values (ranging from -0.000069 to -0.000006). As in the analysis of corruption issues, these results show a slight deterioration in government effectiveness due to high exposure to FDI. Here, the magnitude of the effect is similar to that already seen for Control of Corruption. In fact, an additional billion dollars of FDI is associated with a reduction in the indicator of approximately 0.04 points. Considering that, in this case too, most countries are concentrated in a rather narrow range (again between -1.5 and -0.5), this is an effect to be considered.

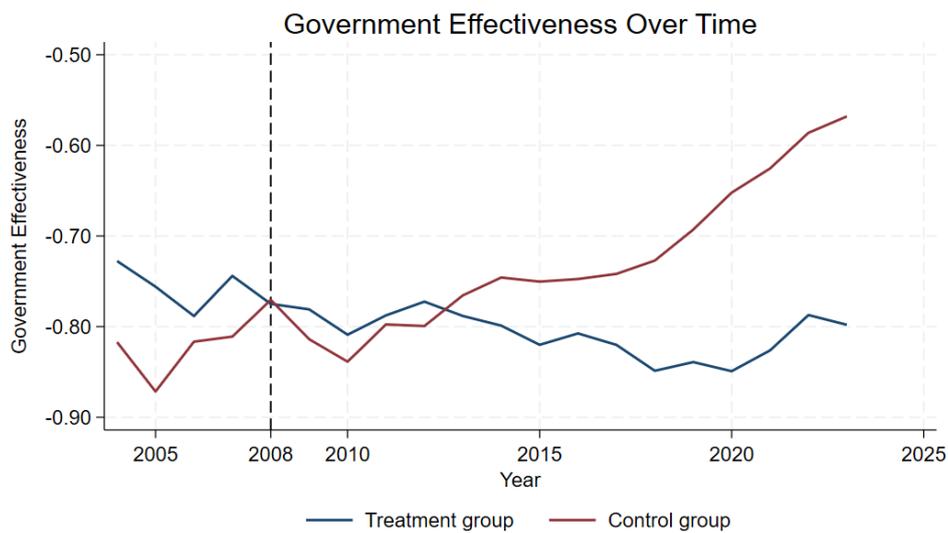


Figure 12: Government Effectiveness index trends (Di). Time series for more-treated (blue) and less-treated (red) country groups, 2004–2023.

Both the regression results and the graph show that the high inflow of Chinese capital seems to be associated with stagnant or even declining institutional performance. These results suggest that the inflow of capital from China does not appear to have strengthened the quality of institutions. On the contrary, it may have favored political dynamics that have hindered economic development. The starting situation is similar to the cases already observed: the countries most affected (blue line) achieved higher levels of government effectiveness than the others (red line) in the early years. While the trend for the first group is progressively downward, that of the second is upward, with a clear progression beginning around 2012. Compared to the two previous cases, here the reversal began a few years later. Perhaps, government effectiveness deteriorates more gradually, and the effects of poor management and lack of adequate reforms are more observable over time.

Overall, less exposed countries have more effective governments, as can already be seen from

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the regression results. Again, it may be that China does not make its investments conditional on complex structural reforms. The easy availability of capital may determine the observed effect. Consequently, Chinese FDI, instead of stimulating innovation, may consolidate inefficient administrative structures. In other words, the high inflow of resources may not have contributed to strengthening the administrative capacity of African countries, due to a weak institutional context and the absence of reform constraints. Another interpretation lies in the opportunity cost of reforms. A large amount of resources could allow governments to postpone internal interventions that are often politically costly (e.g., the reorganization of public services). In fact, the inflow of FDI could temporarily cover financial gaps. This would be a real moral hazard phenomenon: the availability of resources discourages governments from taking action.

## 7 CONCLUSION

Chinese investments in African countries, although massive and strongly focused on the provision of services and infrastructure, do not seem sufficient to trigger a process of expansion within the economic system of the recipient countries. The available data do not show a significant increase in GDP per capita. This suggests that the simple injection of foreign capital does not automatically translate into a general improvement in living conditions. There is no widespread and uniform growth in wealth. The picture is further worsened by the assessment of certain qualitative indicators which, rather than showing progress, reveal trends in the opposite direction. In contexts characterized by greater exposure to Chinese FDI, there are signs of institutional deterioration: corruption control appears less effective and government action is less efficient. These characteristics paint a picture in which dependence on foreign capital is likely to intensify existing problems rather than resolve them. From this perspective, based on the results obtained, although Chinese interventions have probably contributed significantly to bridging historical infrastructure deficits, they have not proved sufficient to initiate a process of endogenous, balanced, and sustainable development (at least for the moment).

In terms of public policy, this analysis suggests some important guidelines. The institutions of African countries receiving investments should develop forward-looking projects, using Chinese capital to consolidate their internal potential rather than to fill their structural vulnerabilities. A virtuous approach could include, for example, alongside Chinese infrastructure financing, forms of investment in education and support for local entrepreneurship. In essence, for Chinese FDI to represent real development, it must be framed within a national strategic vision aimed at

inclusive and sustainable growth.

Always about the analysis, new relevant areas of study are emerging for further research in the future. A first line of inquiry could be the further exploration of the differences between types of Chinese investments: distinguishing between those in public infrastructure, industrial investments, and loans to governments to verify any positive effects of some compared to others. A second line of research could consist of expanding the analysis to include additional development indicators, such as poverty rates, inequality, unemployment, or social development, to obtain a more complete picture of the socio-economic impact. Furthermore, future studies could use different methodologies (e.g., counterfactual analyses at the project level, or in-depth qualitative case studies in individual countries) to evaluate and expand the causal interpretation of the quantitative results obtained in this study.

Ultimately, the initial research question cannot be answered with absolute certainty. As previous studies have also shown, Chinese investment in Africa is a phenomenon involving numerous dynamics: it is difficult to summarize it using quantitative models. In light of these considerations, it is not easy to give a definitive answer. However, although the reality is certainly very complex, the analysis conducted has highlighted that Chinese FDI in Africa currently represents more of a risk to local African economies. Therefore, based on the results obtained, Chinese FDI cannot be considered a real advantage. Nonetheless, it could certainly become an opportunity in future.

In conclusion, the relationship between Chinese FDI and development in Africa appears to be much more complex than a simplistic view might suggest. As discussed in the literature, Chinese investments certainly represent an enormous opportunity in terms of resources and capital for

African economic growth, but their actual impact depends on a variety of factors related to the socio-cultural context and local policies. In the absence of a solid institutional environment and internal development strategies, the inflow of capital risks creating infrastructure without building real endogenous development, with the result that recipient countries remain potentially indebted, with weakened institutions and an unenhanced local productive base. Conversely, with transparent governance and appropriate complementary policies, Chinese FDI could contribute to the economic development of the African continent. The challenge lies in knowing how to convert opportunities into reality. Foreign capital must become the starting point for a sustainable economic development, capable of generating widespread and lasting value.

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