# THE VOLATILITY OF INTERNATIONAL CAPITAL FLOWS TO SUB-SAHARAN AFRICA, AND THE POTENTIAL FOR PUBLIC FLOWS TO OFFSET SHOCKS TO PRIVATE FLOWS

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This paper contributes to the lively debate on the role of foreign aid in mitigating the effects of negative external shocks. In particular, it scrutinizes the effectiveness of foreign aid in Sub-Saharan Africa, considering the volatility of foreign direct investment (FDI). This volatility is computed using the filtering approach of Hamilton (2018) as the main method to isolate the deterministic trend. In addition, the Driscoll-Kraay estimator is used for robustness checks. The study applies the system generalized method of moments (GMM) estimator to a sample of 45 African countries, using 5-year averages over the period 1988-2022. The results yield original insights. (a) First, FDI volatility hinders economic growth in Africa. (b) Second, foreign aid increases economic performance. (c) Third, it mitigates the negative effect of FDI shocks. (d) Fourth, this positive moderating effect is homogeneous, and not statistically significant, when institutional quality is taken into account. (e) Fifth, foreign aid indirectly acts as a deterrent to institutional development beyond a certain threshold in countries with high institutional quality, as it may generate rent-seeking behavior and erode state capacity, thereby reducing economic growth.

*Keywords:* Foreign aid, foreign direct investment, growth, volatility, Hamilton filter.

Today, there is significant doubt about the prediction of Solow's (1956) model that low-income countries will typically grow faster than developed countries or regions, leading to convergence. The emergence of multiple crises, each of which affected these economies to differing degrees, has strengthened this questioning. African countries suffer the most from external shocks due to their greater vulnerability. Since the Covid-19 pandemic, the growth paths of the least developed countries have been strongly shaped by bilateral aid and direct assistance from developed countries, which have long been influenced by political or strategic interests (Alesina and Dollar, 2000)[1]. Overall, foreign aid refers to technical and financial assistance provided by developed countries and international organizations to developing countries, usually to enhance productive capacity, bridge capital shortages, and support social welfare (Todaro and Smith, 2020). Two main paradigms can be invoked to justify aid effectiveness (Guillaumont and Chauvet, 2001). The first suggests that aid can be seen as a 'reward' supporting good policies (Hansen and Tarp, 2001; Clemens et *al.*, 2012; etc.). The second presents aid as 'insurance' that allows countries to overcome external shocks (Collier and Goderis, 2009; Guillaumont and Laajaj, 2006; Wagner, 2014; Nguegang and Ndamsa, 2023; etc.).

The literature highlights a controversy over the efficacy of aid programs owing to the policy conditionality that characterizes multilateral assistance: financial disbursements are usually conditional on fiscal management reforms, macroeconomic stability, and institutional quality. The traditional pro-aid viewpoint, spearheaded by Jeffrey Sachs, stresses that foreign aid promotes positive economic growth by augmenting a host country's resources, easing restrictions on foreign exchange, transferring knowledge and management skills, and facilitating easier access to global markets (Chenery and Strout, 1966). Conversely, William Easterly's radical anti-aid viewpoint argues that some aid-recipient countries' economic growth has been subpar due to their weak absorptive capacity. In fact, foreign aid can 'crowd-out' domestic resources, transfer funds for inappropriate technology, exac-

1. This phenomenon is known as 'donor capture'.

erbate domestic income inequality and trade imbalance, and generally support corrupt and ineffective governments in the host countries (see Weisskopf, 1972; Griffin and Enos, 1970; Svensson, 2000; Djankov et *al.*, 2008; Moss et *al.*, 2008; etc.). According to another body of research, unstable aid can contribute to macroeconomic instability and become a source of vulnerability in itself (see Lensink and Morrissey, 2000; Pallage and Robe, 2006; Nguegang and Ndamsa, 2023; Nguegang, 2024; etc.).

Cross-border capital movements and the growing interconnection of economies accelerated at the end of the 20th century. In this framework, another form of foreign capital known as foreign direct investment (FDI) is vital to achieve economic growth (Balcilar et *al.*, 2022). According to a large body of research, FDI affects growth through several channels. It can boost tax revenues, update technology, and boost capital accumulation for local investment and R&D (see Nguegang, 2019; Borensztein et *al.*, 1998). Even though a sharp increase in FDI was observed during the 1990s, various crises hindered its macroeconomic effects. In fact, as investments are sometimes partly irreversible, unpredictable shocks lead foreign investors to adopt a 'wait-and-see' attitude, holding back their investments when facing uncertainty. Consequently, FDI became erratic. The literature on the interplay between foreign aid and FDI reveals many gaps. Although this nexus has been extensively analyzed, with a focus on the benefits of foreign aid for FDI inflows through an increase in the marginal productivity of capital of the recipient countries (Harms and Lutz, 2006; Asiedu et *al.*, 2009; Garriga and Phillips, 2014; Chauvet and Mesplé-Somps, 2006, etc.), there remains a 'missing link' between FDI and macroeconomic stability, namely the potential role of aid in offsetting FDI volatility, thereby shedding light on the 'insurance paradigm'. To our knowledge, no study has analyzed the contingent role of aid on the negative effect of FDI volatility and its growth effects, whereas a strand of the literature supports the stabilizing role of aid in the face of external economic shocks (Collier and Goderis, 2009; Guillaumont, 2006; Nguegang and Ndamsa, 2023; etc.). This study also contributes to the debate on the ability of a country to absorb foreign aid and use the funds in a productive manner. This refers to the absorptive capacity of the receiving country, such as policies and 'performance' (Guillaumont and Chauvet, 2001; Burnside and Dollar, 2000). In that regard, the neoclassical growth model suggests that poor countries should have a high return to capital and a fast growth rate in transition to the

steady state (Burnside and Dollar, 2000, 2004). In fact, foreign aid can accelerate growth towards the steady state in the context of imperfect international capital markets and subsistence consumption constraints, and the effect of aid is greater in a low-distortion environment, as various institutional and policy factors can lower the return to capital and reduce the transitional growth to the steady state. Therefore, the originality of this paper is twofold. First, it contributes to the existing literature by addressing an elusive nexus. Second, this paper sheds light on the debate on aid effectiveness by reassessing the principles of aid allocation.

The main question addressed in this paper is as follows: Does foreign aid reduce the dampening effect of FDI volatility on economic growth, considering the various specific features identified in the literature on the effectiveness of aid? The remainder of the paper is structured in five sections. Section 1 reviews the relevant literature, Section 2 presents some stylized facts, Section 3 describes the methodology, data, and estimation, Section 4 outlines the results, and Section 5 provides concluding remarks. The results of this study reveal that volatility of FDI undermines economic growth performance in Sub-Saharan Africa. Moreover, foreign aid has a direct positive and significant effect on economic growth. It also mitigates the adverse effect associated with FDI volatility, highlighting its role as a stabilizing mechanism amidst external financial shocks. However, in countries with high institutional quality, the results also indicate that foreign aid is indirectly harmful to institutional development beyond a certain threshold, as it may generate rent-seeking behavior and reduce state capacity, thereby reducing economic performance.

## 1. Literature review

This section reviews several strands of the literature on the link between FDI, foreign aid, and growth.

### 1.1. How could aid affect growth?

Chenery and Strout (1966) developed a two-gap model of foreign aid to demonstrate its importance in fostering economic progress. The assumptions are that low-income countries suffer from a 'foreign exchange gap' and 'savings-investment gap,' limiting their capacity to finance core development projects. According to endogenous growth

theory, foreign aid can influence economic growth by boosting the stocks of human and physical capital (Bräutigam and Knack, 2004; Dutta et *al.*, 2013; Galiani et *al.*, 2017; Gillanders, 2016; Mallick and Moore, 2008; Juselius et *al.*, 2014; etc.). Juselius et *al.* (2014) confirmed this effect on a sample of 36 African countries. Conversely, another strand of the literature supports the view that aid has no effect on economic growth (Ekanayake and Chatrna, 2010; Jensen and Paldam, 2006).

Some studies show that aid unpredictability may be the cause of the differentiated effects of foreign aid on economic growth (e.g., Feeny and De Silva, 2012; McGillivray et *al.*, 2006; Kodama, 2012; Museru et *al.*, 2014; Kumi et *al.*, 2017, etc.). Other studies suggest that aid instability can reduce well-being through several channels: disruption of fiscal and public investment planning (e.g., Lensink and Morrissey, 2000; Bulír and Hamann, 2003; Hudson, 2015; Kumi et *al.*, 2017; Agénor, 2016; Arellano et *al.*, 2009; Hudson and Mosley, 2008), and fiscal indiscipline (Moss et *al.*, 2008). Svensson (2000) reports that because of rent-seeking activities, aid can cause a reduction in public goods provision in the recipient country, as it is associated with higher corruption. In the same vein, Djankov et *al.* (2008) show evidence that higher levels of aid harm political institutions in the recipient country. In contrast, some studies find that aid promotes growth in recipient countries and that this positive effect is not conditional on a good policy environment (Dalgaard et *al.*, 2004; Karras, 2006). Other studies find that aid has no effect on institutions (Heckelman and Knack, 2009).

### 1.2. **How can FDI volatility affect economic growth?**

One of the seminal studies analyzing the interplay between FDI and economic growth was conducted by Borensztein et *al.* (1998). They found that FDI has a positive net effect on economic growth through the channel of the stock of human capital available in the host country. Regarding the analysis of volatility, several studies have primarily analyzed the nexus between FDI and business cycles from the perspective of the contribution of business cycle synchronization to FDI rather than the impact of FDI on business cycles (Wang and Wong, 2007; Jansen and Stokman, 2004; and Levy-Yeyati, 2007). Despite this expanding literature, the reverse relationship has received little attention. Although a strand of the literature has shown that FDI is less volatile and therefore more stable than other capital flows (Mensah

and Mensah, 2021), very few studies have attempted to examine the effect of the volatility of FDI on economic growth. Some studies have examined the impact of FDI on output volatility and disregarded the potential volatility of FDI. As an illustration, Vúletin et *al.* (2018) found that output volatility is influenced by the correlation between FDI and other investments as well as the proportion of FDI in overall capital flows. They observed that when FDI makes up a small portion of total foreign capital flow, production volatility is reduced. Using a firm-level panel data set from Lithuania, Javorcik (2004) found evidence of positive productivity spillovers from FDI through its interaction with domestic investment.

Lensink and Morrissey (2002) found that unforeseen fluctuations of FDI flows may have a destabilizing effect on the economic performance, although the magnitude of FDI volatility may reflect the level of political and economic uncertainty in the host country. This negative nexus was confirmed by Lensink and Morrissey (2006) using different measures of FDI volatility. Choong and Liew (2009) investigated the long-run relationship between FDI volatility and economic growth in five ASEAN countries. They found that FDI volatility has an adverse effect on economic growth in Malaysia, Indonesia, the Philippines, and Thailand.

### 1.3. **Interaction between foreign aid and FDI**

FDI is more sensitive to 'economic' openness, such as trade liberalization and property rights, whereas foreign aid responds more to 'political' openness, like the democratization process (Alesina and Dollar, 2000). Kosack and Tobin (2006) support the idea that aid and foreign direct investment are unconnected since aid is typically focused on funding investments in human development (such as health and education) and supporting the government budget. FDI, on the other hand, is by definition a product of the private sector and has a stronger connection to tangible capital (new manufacturing facilities, equipment, etc.). In the same vein, Karakaplan et *al.* (2005) and Kimura and Todo (2007) find no significant effect of aid on FDI, respectively in low- and middle-income countries and in less developed countries.

However, multinational enterprises (MNEs) view foreign aid as a complementary financing support to sustain investment. It might provide the necessary infrastructure for FDI, which appears to lessen the impact of political and economic uncertainty (Harms and Lutz,

2006; Asiedu et *al.*, 2009; Garriga and Phillips, 2014; Jansky, 2012). Chauvet and Mesplé-Somps (2006) found that foreign aid may compensate for weak flows of FDI received by 46 African countries studied over 1974–2001. Donaubauer et *al.* (2016) and Pham (2015) demonstrate that aid projects for infrastructural development improve transportation, communication, finance, and energy, which, in turn, attract more FDI inflows. Harms and Lutz (2006) argued that foreign aid might increase private capital productivity by funding public infrastructure projects. Garriga and Phillips (2014) contend that aid has a significant signaling effect for MNEs to engage in post-conflict developing countries. Further, foreign aid reduces the impact of country risk. Because information on post-conflict countries is costly to obtain owing to their opacity, MNEs rely heavily on foreign aid donors when making investment decisions (Garriga and Phillips, 2014).

Concerning the linkage between aid and FDI volatility, studies are very scarce. If FDI is unstable, it may contribute to macroeconomic instability. Therefore, aid can raise the marginal productivity of capital in recipient countries with higher external exposure to economic shocks (Collier and Goderis, 2009; Guillaumont, 2006), such as volatility of FDI. Guillaumont and Laajaj (2006), Wagner (2014), and Nguegang and Ndamsa (2023) argue that greater vulnerability or greater exposure to external shocks can contribute to a higher absorptive capacity of aid and improve economic growth. Conversely, Balcilar et *al.* (2022) show that aid can be viewed as a dampening factor for investment volatility in 19 heavily indebted poor sub-Saharan African countries studied over the period 1980-2018. They conclude that, even if foreign aid contributes to filling financial gaps in poor countries, it can be a significant dampening factor for investment volatility.

Overall, the above review reveals several gaps. Firstly, despite a growing literature combining FDI and aid, there is still no consensus on the nature of the nexus between the two concepts. Secondly, volatility aspects have been less researched, especially for FDI volatility and its effect on economic growth. To our knowledge, no study has investigated the effectiveness of foreign aid through its stabilizing/destabilizing effect on external shocks coming from the volatility of FDI. This is a major gap, as it is well-documented that foreign aid can modulate the effect of external economic shocks on economic growth in vulnerable countries.

## 2. Economic growth, FDI, and foreign aid in Africa: Some stylized facts

In this section, some descriptive statistics are provided, and trivariate analysis is conducted to underline the relevance of this study.

### 2.1. FDI and volatility

While a general upward trend of the total net FDI is observed in developed countries, a downward trend is observed in Africa, reflecting the growth of FDI inflows relative to FDI outflows[2]. During the 1990s, Africa received low FDI inflows. From the 2000s onwards, this trend changed, with large FDI inflows from developed countries. Despite all the crises that the world has experienced, FDI remains stable at a modest level, confirming the conventional view that it is one of the most stable capital flows. Although this upward trend weakened with Covid-19, FDI inflows to Africa subsequently reached record post- crisis levels.

Some evidence of this can be seen at the level of Sub-Saharan African countries grouped by institutional level. Over the period 1988-2022, an overall decline in the financial balance is perceptible in all countries, irrespective of institutional level (see Table 1). This reflects the growing attractiveness of Sub-Saharan African countries as mentioned in previous studies (e.g., Nguegang et *al.*, 2019; Nguegang et *al.*, 2025). However, trend analysis indicates that countries with the lowest institutional quality tended to be more attractive than those with the highest institutional quality. Since the 2010s, this pattern has reversed, resulting in a marked gap during the 2018-2022 period. On average, low and high institutional quality countries recorded a net FDI total of -0.40 USD billion over the entire study period, showing the predominance of inward over outward FDI regardless of the level of institutional quality. The maximum net FDI total was recorded in Mauritius, at 12.70 USD billion, showing the high attractiveness of this small island state. In contrast, the lowest net FDI total was recorded by South Africa, at -40.60 USD billion, showing an increase in FDI outflows compared with inflows. The period 2012 to 2022 shows fewer negative FDI inflows for all Sub-Saharan African countries.

2. The World Bank defines the total net FDI in the financial account balances as the change in assets (net FDI outflows) minus the change in liabilities (net FDI inflows). Data are in current U.S. dollars. Consequently, a negative sign means that FDI inflows are greater than FDI outflows.

Table 1. **Patterns of FDI (USD billions) in 46 Sub-Saharan countries**

| Period | High institutional quality countries | Low institutional quality countries |
|---|---|---|
| **1988-1992** | -0.03 | -0.07 |
| **1993-1997** | -0.04 | -0.10 |
| **1998-2002** | -0.09 | -0.32 |
| **2003-2007** | -0.26 | -0.52 |
| **2008-2012** | -0.82 | -0.77 |
| **2013-2017** | -1.16 | -0.72 |
| **2018-2022** | -0.41 | -0.30 |
| **Mean** | -0.40 | -0.40 |
| **Std.Dev** | 0.44 | 0.28 |
| **Min.** | -1.10 | -0.77 |
| **Max.** | -0.03 | -0.74 |

*Notes*: Figures in the table denote the mean for all countries in each institution's category of the average annual value of FDI. Standard deviation, minimum and maximum are computed based on yearly data
*Source*: Authors' calculation.

Table 1 suggests that the FDI series may be nonstationary, given the large fluctuations recorded, and is thus a candidate for the volatility analysis. Table 2 shows the level of volatility of FDI in Sub-Saharan African countries classified by the level of institutional quality. Two indicators of volatility, similar to the one used for empirical investigation (Cariolle, 2012), are reported (see section 3.2 for more details). The volatility of total net FDI in low institutional quality countries ranges from 73.38% to 111.19%. In high institutional quality countries, it is lower, ranging from 57.63% to 85.59%. UMICs recorded the highest level of volatility among the three income groups: it is more than 100%. This issue arises because of the very high fluctuation of the total net FDI in South Africa, which appears as an outlier, as shown in Figure A1 (see Appendix).

Table 2. **Volatility of FDI in 46 Sub-Saharan African countries, 1988–2022**

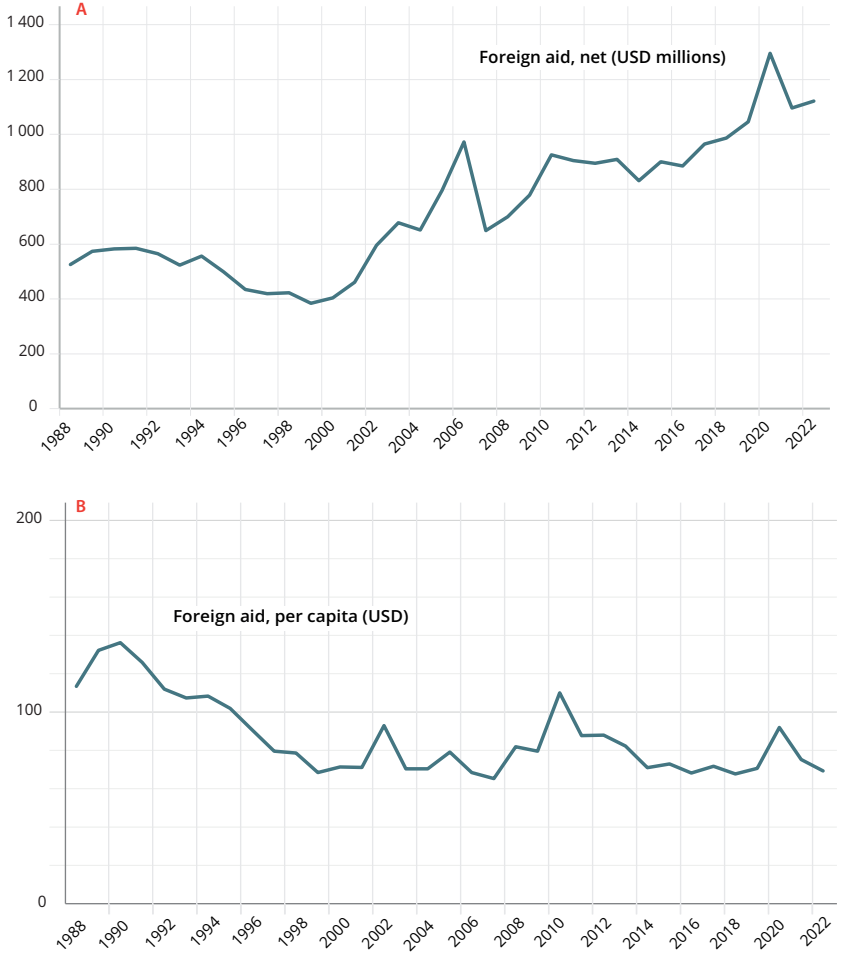
| | High institutional quality countries | Low institutional quality countries |
|---|---|---|
| **H Filter** | 57.63 | 73.38 |
| **SD** | 85.59 | 111.19 |

*Notes*: This table presents the estimates based on average FDI volatility across the years 1988–2022 for countries in each income group. Two volatility indicators are used: (1) SD: volatility of FDI using standard deviation, and (2) H Filter: volatility of FDI based on the standard deviation of the cyclical component isolated with the Hamilton Filter.
*Source*: Authors' calculation

## 2.2. **The slowdown in foreign aid to Africa**

Over the years, the volume of aid (USD billions) from the donor countries of the Development Assistance Committee (DAC) to Africa has continued to increase, reaching a record level in 2020 of approximately USD 1.337 billion during the Covid-19 pandemic (see Figure 1). In 2020, the DAC recognized the importance of development aid, particularly in the context of a health crisis, and pledged to spare no effort in preserving the aid budgets of DAC donor countries. Overall, 2007 was the year in which growth was lowest, with a drastic fall of

Figure 1. **Foreign aid in Sub-Saharan Africa over time, 1988-2022**




*Source* : Author, based on World Development Indicators (World Bank).

32% compared to 2006. Declines of more than 10% were recorded in 8 key years, excluding the previous one: 1995, 1996, and 2021, with estimated declines of 12%, 13%, and 16%, respectively. On the other hand, there was a sharp rise of 28% between 2001 and 2002.

It should be noted, however, that changes in the net volume of aid mask a salient fact. An analysis of aid flows per capita shows a completely different picture. The overall trend is downwards (Figure 1). Furthermore, the current state of aid policy in the world does not seem to augur well for the development of aid, following the Trump administration's plans to dismantle the U.S. Agency for International Development (USAID). The highest level of aid per capita, USD 131.7, was recorded in 1989. During the Covid-19 pandemic, this level remained relatively modest. In terms of annual growth, the greatest rate of change was observed in 2010, with an estimated rate of 37%. However, an analysis by country shows that it is in the Small Island Developing States (SIDS) that aid benefits the population the most, in line with previous studies (Nguegang and Ndamsa, 2023; Nguegang, 2024). Among the top five aid recipients, the first four are SIDS: Cabo Verde, Sao Tome and Principe, Seychelles, and Mauritius.

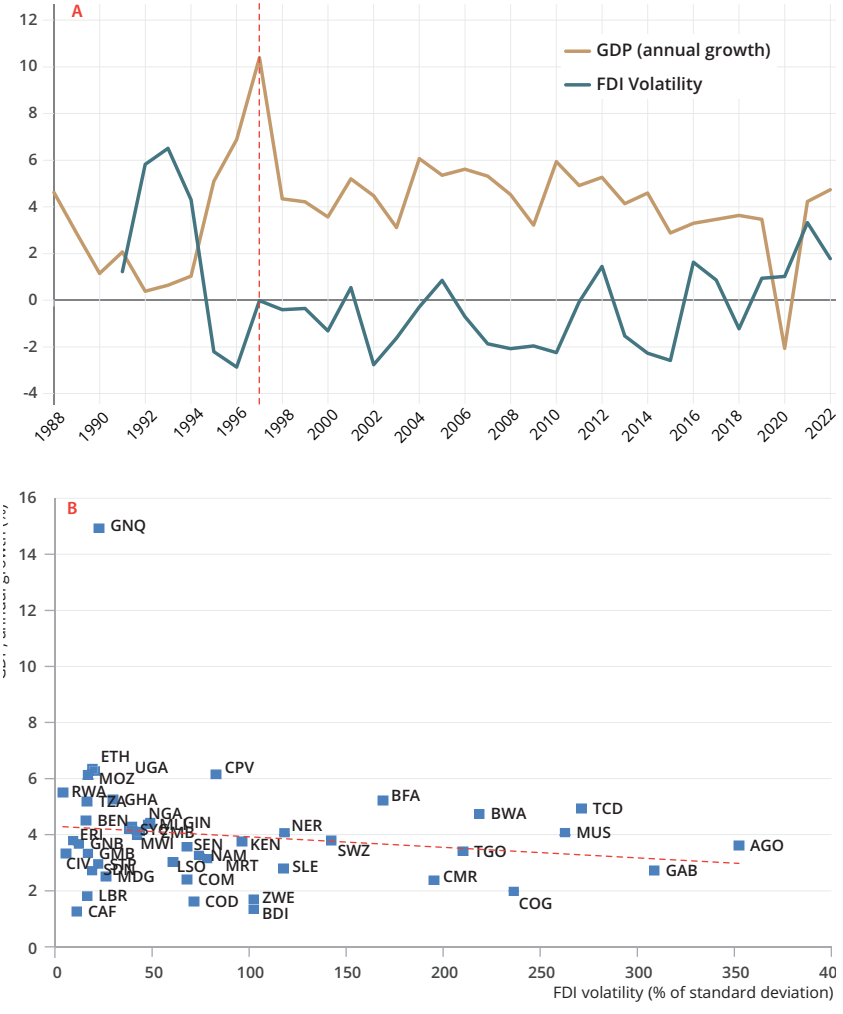
### 2.3. **Growth, FDI volatility, and aid: A trivariate analysis**

During the period 1988-2022, growth peaked in 1997, when FDI volatility was low (Figure 2a). Two countries recorded remarkable growth levels in the same year: Liberia (106.28%) and Equatorial Guinea (149.97%), due respectively to the resumption of economic activity after a long period of civil war and the dramatic increase in oil production. During the Covid-19 pandemic, which spared no economy in 2020, although FDI volatility was moderate, Sub-Saharan Africa recorded its weakest performance, making the period 1998-2022 the one with the lowest growth. The effects of this crisis were particularly pronounced in vulnerable SIDS, such as Cape Verde (-20.81%) and the Seychelles (-11.74%). However, these levels remain less dramatic than the historic lows recorded during the civil war in Liberia in 1990 (-51.03%) and the Rwandan genocide in 1994 (-50.25%).

Figure 2b suggests a positive correlation between FDI volatility and economic growth. Equatorial Guinea again appears as an outlier owing to the spectacular economic growth it recorded in 1997. Thereafter, growth declined markedly, although temporary surges were observed in 2001, 2004, and 2008, mainly as a result of increases in oil

production (Nguegang et *al.*, 2019). Furthermore, since 2010, the country has recorded negative growth rates.

Figure 2. **Patterns of growth and FDI volatility in Sub-Saharan Africa, 1988-2022**

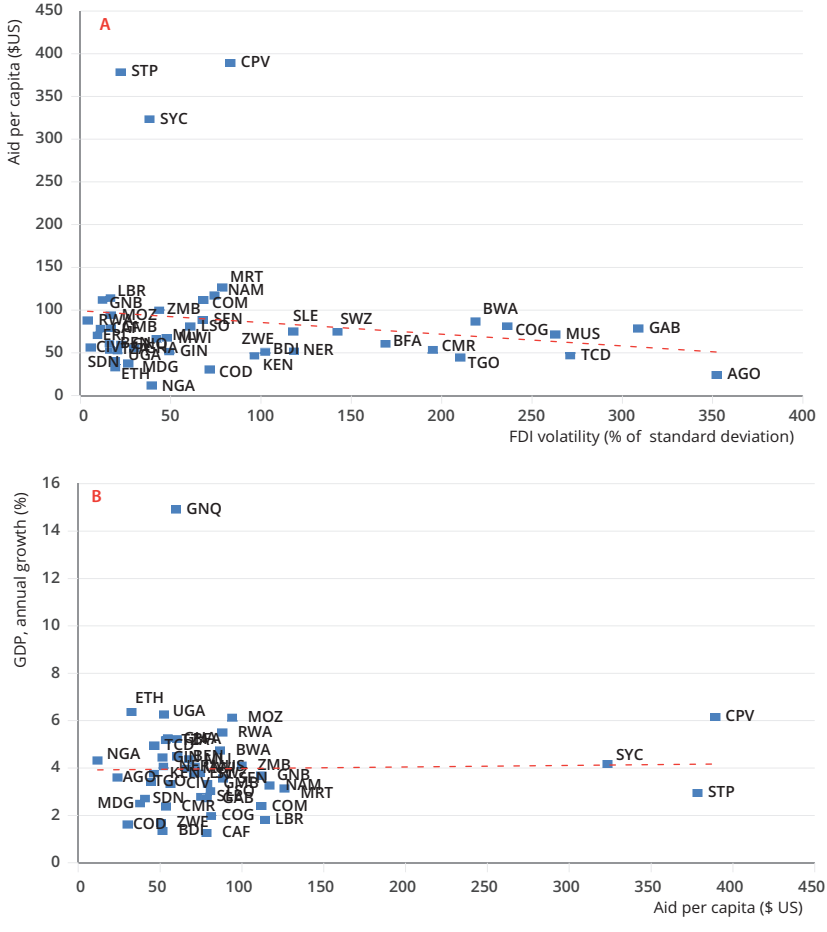



*Source* : Author, based on World Development Indicators (World Bank).

Figure 3 presents bivariate scatter plots of the linkage between FDI volatility, aid per capita, and economic growth. Figure 3a especially emphasizes the linkage between FDI volatility and growth in Afric[3] *al.* It shows a negative correlation, except for three countries, major recipient countries for foreign aid: Seychelles (SYC), Cape Verde (CPV), and

Sao Tome and Principe (STP). These SIDS are major aid recipients because of their specific vulnerability (small size, insularity, remoteness, etc.), which increases their exposure to external shocks. Because of their higher vulnerability, they are less attractive to FDI. This correlation is stronger in Sierra Leone (SLE), Liberia (LBR), Senegal (SEN), and Eswatini (SWZ). Regarding the linkage between volatility and annual growth of GDP, Figure 3b suggests a negative correlation between FDI volatility and economic growth, except in Equatorial Guinea (GNQ).

Figure 3. **Patterns of the linkage among volatility of FDI, growth, and foreign aid**




*Source* : Author, based on World Development Indicators (World Bank).

3. Table A1 in the appendix provides the pairwise correlation matrix for further information regarding the correlation of the remaining variables.

## 3. Data and methodology

This section provides the data sources, the model specification, and the empirical strategy before moving on to the findings.

### 3.1. Data

This study uses a pooled cross-sectional sample of 45 aid-recipient African countries, divided into two groups for a broader analysis. The sample covers the period from 1988 to 2022 (see Table 3).

Table 3. **List of sampled countries**

| Low institutional quality countries (institutions < Q2)[a] | | High institutional quality countries (institutions ≥ Q2)[b] | |
|---|---|---|---|
| Angola | Liberia | Benin | Mozambique |
| Burundi | Niger | Botswana | Namibia |
| Cameroon | Nigeria | Burkina Faso | Rwanda |
| Central African Rep. | Sierra Leone | Cabo Verde | Sao Tome and Principe |
| Chad | Sudan | Eswatini | Senegal |
| Comoros | Togo | Gabon | Seychelles |
| Congo Dem. Rep. | Zimbabwe | Gambia | Tanzania |
| Congo | | Ghana | Uganda |
| Cote d'Ivoire | | Lesotho | Zambia |
| Equatorial Guinea | | Madagascar | Kenya |
| Eritrea | | Malawi | |
| Ethiopia | | Mali | |
| Guinea | | Mauritania | |
| Guinea-Bissau | | Mauritius | |

*Note*: a: Low institutional quality (Category A). b: High institutional quality countries (Category B). Category A consists of countries where the level of institutions is below the median (corresponding to Q2, *Q2* = –0.67), and Category B consists of countries where it is at or above the median. There are 21 countries in Category A and 24 countries in Category B.
Source: Author's calculation.

The study period is determined by data availability. The variables used in this study are sourced from two databases: World Development Indicators (WDI) and Worldwide Governance Indicators (WGI). For instance, data on foreign aid are only available up to 2022. The dependent variable is the logarithm of GDP growth. Two variables of interest are included in this study: Net FDI and Net Official Development assistance and Official Aid received. Three standard economic variables are used as controls: the logarithm of population, trade openness, and the inflation rate. Institutional quality is measured by the average of the six governance indicators developed by

Kaufmann et *al.* (2011), sourced from WGI. Table 4 provides further details on the measurement of variables.

Tableau 4. **Description, sources, and measurement of variables**

| Variables | Description (measurement) | Codes | Sources |
|---|---|---|---|
| **Economic growth (*Log Gdp*)** | Logarithm of the annual percentage growth rate of GDP | NY.GDP.MKTP.KD.ZG | WDI |
| **Foreign Direct Investment (*FDI*)** | Net inflows (current US$) | BN.KLT.DINV.CD | WDI |
| **Volatility of FDI (*% Vol FDI*)** | Volatility of FDI | | Author's computation |
| **Aid** | Net inflows received as constant 2021 US$, | DT.ODA.ALLD.KD | WDI |
| **Aid per capita (*Aid/Pop*)** | Net inflows received (as constant 2021 US$) μdivided by the population size | | Author's computation |
| **Trade Openness (*% Trade*)** | Sum of exports and imports of goods and services (% of GDP) | NE.TRD.GNFS.ZS | WDI |
| **Inflation rate (*% Inflation*)** | annual % of consumer price index | FP.CPI.TOTL.ZG | WDI |
| **Population growth (*Log Population*)** | Logarithm of the number of residents regardless of legal status or citizenship (in millions) | SP.POP.TOTL | WDI |
| **Composite institution index (*Institutions*)** | Mean of the individual governance indicators with values ranging from -2.5 (weak) to 2.5 (strong): Control of Corruption, Government effectiveness, Political Stability, Regulatory quality, Rule of Law, Voice and Accountability. | Control of corruption (CC.EST); Government effectiveness (GE.EST); political stability (PV.EST); Rule of law (RL.EST), regulatory quality (RQ.EST), and Voice and accountability (VA.EST) | Author's computation using WGI |

*Source*: Author's construction.

## 3.2. **Empirical model**

To analyze the moderating role of foreign aid on the cyclical effect of volatility of FDI in Africa, this study uses the empirical framework of Chauvet and Guillaumont (2006). This empirical investigation allows us to assess the stabilizing effect of aid on exogenous shocks coming from the volatility of FDI. The econometric model is as follows:

$$log\ Gdp_{i,t} = \sigma + \alpha_0 log\ Gdp_{i,t-5} + \alpha_1 Vol\ Fdi_{i,t} + \alpha_2 Aid/Pop_{i,t} + \alpha_3 Vol\ Fdi_{i,t}\ \mathrm{X}\ Aid/Pop_{i,t} + \vartheta \mathrm{X} + \mu_i + \varepsilon_{i,t} \quad (1)$$

In this growth equation, non-overlapping 5-year averages are used over the period 1988–2022 for country $i$ ($i$ = 1,2,..., $N$) at time period ($t$ = 1,2,..., $T$). The use of five-year data averages helps to limit instrument proliferation, mitigate short-run disturbances by controlling the potential effect of the idiosyncratic economic dynamics, and control for cyclical output movements. $Gdp_{i,t}$ is the annual growth of real $GDP$ of country $i$ in period $t$. '$Vol\ Fdi_{it}$' denotes the volatility of FDI; it is calculated by decomposing the FDI series (see Eq. 3, 4, and 5); '$Aid_{it}$' denotes foreign aid, '$Vol\ Fdi_{it}$ X $Aid/Pop_{it}$' measures the moderating effect of foreign aid. $\sigma$ denotes the constant term. The stabilizing character of aid is measured by its net effect. If this net effect is positive[4], it implies that, on average, aid reduces the effect of FDI volatility on growth. Conversely, if this net effect is negative, it implies that aid exacerbates the negative effect of FDI volatility. In the regressions considering the differentiated level of institutional quality, the threshold of aid is calculated to determine the amount beyond which it becomes a 'curse'. $X$ is the vector of predetermined covariates and the vector of the associated coefficients. Previous studies suggest several core control variables: level of institutions (Nguegang et al, 2019), inflation rates (De Gregorio, 1992), population (Brida et *al.*, 2024), and trade openness (Niluka et *al.*, 2023). $\mu_i$ are the unobserved individual-level effects; $\varepsilon_{i,t}$ captures the observation-specific errors.

Measuring volatility relies on two steps: the choice of a 'stationarisation' method to calculate the reference value, and the measure of the deviation between the values of an economic variable and its equilibrium value (Cariolle, 2012). In this study, the Hamilton filter, well known as an alternative to the popular Hodrick-Prescott filter, is used as a 'stationarisation' technique to isolate the cycle by decomposing a logged series, $Fdi_{t+h}$ into predicted components: the permanent (or trend) component, $\tau_{t+h}$ , with $\tau_{t+h} = E[Fdi_{t+h} | Fdi_t, Fdi_{t-1}, Fdi_{t-2}\ Fdi_{t-3}]$ and the transitory (or cyclical) component, $\psi_{t+h}$ which is a forecast error[5]:

$$Fdi_t = \tau_{t+h} + \psi_{t+h}. \quad (2)$$

The cyclical component is calculated as the difference between the actual series and the trend: $\psi_{t+h} = Fdi_t - \tau_{t+h}$ (see Eq. 2). Hamilton

4. That is to say 2+3(Mean of Vol Fdii,t)>0

5. According to Cariolle (2012), the advantage of the filtering method compared with other existing methods is that it does not impose *a priori* any particular and sometimes arbitrary formalization on the behavior of the series. Additionally, the statistical filtering method allows the trend to change over time.

(2018) argues that the Hodrick and Prescott (1997) filter introduces spurious dynamic relations, spurious predictability and spurious cycles that have no basis in the underlying data-generating process. Hamilton defines the trend component as the value expected for the original series at date *t*, based on its behavior up to date (lead length) *t* + *h*:

$$Fdi_{t+h} = \beta_0 + \beta_1 Fdi_t + \beta_2 Fdi_{t-1} + \beta_3 Fdi_{t-2} + \beta_4 Fdi_{t-3} + \psi_{t+h} \qquad (3)$$

The Hamilton filter is defined as the solution to the following optimization problem for $\beta_j$ (j = 1,2,3 and 4):

$$\{\hat{\beta}_{0|T}, \cdots, \hat{\beta}_{4|T}\} = arg\ min_{\beta_0,\cdots,\beta_4} \sum_{s=4}^{T-h} (Fdi_{s+h} - \beta_0 - \beta_1 Fdi_s - \beta_2 Fdi_{s-1} - \beta_3 Fdi_{s-2} - \beta_4 Fdi_{s-3})^2$$

$$\text{To obtain:} \quad \hat{\psi}_{t+h|T} = Fdi_{t+h} - \hat{\beta}_{0|T} - \hat{\beta}_{1|T} Fdi_t - \hat{\beta}_{2|T} Fdi_{t-1} - \hat{\beta}_{3|T} Fdi_{t-2} - \hat{\beta}_{4|T} Fdi_{t-3} \qquad (4)$$

To analyze the effect of episodic variations on yearly data, Hamilton (2018) recommends a forecast of twenty years (*h* = 20). Following the strategy of Balcilar et *al.* (2022) to measure fluctuations around the deterministic trend, volatility is calculated as the absolute value of the percentage change in the deviation of FDI from the trend component obtained with the Hamilton filter.

$$VolFdi_{i,t} = 100 \times \left| \frac{[(Fdi_{i,t} - \tau_{i,t}) - (Fdi_{i,t-1} - \tau_{i,t-1})]}{\tau_{i,t-1}} \right| \qquad (5)$$

Alternatively, the standard deviation (SD) is used as a traditional measure of volatility. It helps to measure the distribution of series $Fdi_t$ from its long-run trend. Following a large body of existing studies (Kalemli-Ozcan et *al.*, 2014), this approach is one of the most popular. It assumes stationarity in first differences and therefore imposes restrictive assumptions on the behavior of the series without prior testing (Cariolle, 2012). The formula is as follows:

$$Vol\ Fdi_{i,t} = 100 \times \sqrt{1/T \left( \sum_{t=1}^{T} Fdi_{it} - \overline{Fdi}_{it} \right)^2} \qquad (6)$$

Where $\overline{Fdi}_{it} = 1/T \sum_{t=1}^{T} FDI_{it}$, the average of FDI for the country *i*.

### 3.3. **Estimation procedure**

In this study, a linear dynamic panel-data model is estimated using the system-generalized method of moments (GMM) outlined by Arel-

lano and Bover (1995) and fully developed by Blundell and Bond (1998). This method instruments the first-differenced equations with lagged levels and the level equations with lagged differences of the endogenous variables. It is used to address endogeneity (simultaneity bias and reverse causality), and is recommended when the time dimension is short and when the autoregressive parameter is relatively large. Roodman (2009a) highlights additional advantages of the system GMM: (a) in a dynamic model, this method accounts for temporal dynamics; (b) it allows all explanatory variables to be treated as potentially endogenous; and (c) it allows for the use of internal instruments when it is difficult to find external instruments that are economically relevant for the identification strategy. Two diagnostic tests, Hansen's (1982) *j* test for over-identifying restrictions and second-order autocorrelation tests, are used to check respectively the validity of the instruments and the hypothesis that there is no second-order serial correlation coming from the error term. When the number of instruments *j* used by the system GMM estimator is large relative to the cross-section (the number of countries, *i*, in this study), the Hansen *j* test and the *AR(2)* test can lose power (Nguegang et *al.*, 2025, and Nguegang, 2025). It is an indication of the so-called type I error (Roodman, 2007). The simple 'rule of thumb' is that the number of instruments must be less than the number of countries, (Roodman, 2009b). Roodman (2009b) proposed reducing the number of instruments by collapsing them.

In the presence of cross-sectional dependence, the system GMM can no longer be considered reliable. Therefore, for the robustness check, the robust standard errors proposed by Driscoll and Kraay (1998) are used.

## 4. Results and discussion

This section provides the empirical results obtained with various econometric approaches for different purposes. In this section, the absorptive capacity of aid is tested against the criteria for aid allocation, i.e., good policies.

### 4.1. Benchmark results

The results using the system GMM estimators appear free of endogeneity problems, as suggested by the diagnostic tests for second-order autocorrelation and Hansen's. These two statistics are not significant at the 5% level, so that we cannot reject, respectively, the null hypotheses

of no second-order serial correlation and of valid over-identifying restrictions, thereby validating the choice of instruments. For all the estimates, the 'rule of thumb' is respected as $r > 1$. Regarding the control variables, except inflation, the signs of the other coefficients are consistent with the existing literature. Trade openness and the annual growth of the population positively affect growth.

The results in Table 5, in which FDI volatility is obtained using Hamilton's filtering method, show that volatility is an uncertainty factor that reduces economic growth in Sub-Saharan Africa. All other things being equal, the coefficient associated with FDI volatility is negative and statistically significant at the 1% level across all regressions. Indeed, this result is robust in a bivariate analysis and when additional variables are added to the model (see Table 5, Columns 1-4). This result is in line with the investigations of Lensink and Morrissey (2002), Lensink and Morrissey (2006), and Choong and Liew (2009), supporting an adverse effect of unpredictable FDI fluctuations on economic performance. On the other hand, foreign aid appears, ceteris paribus, to stimulate growth. Although the magnitude of the effect remains modest, consistent with the findings of Clemens et *al.* (2012) and Frot and Perrotta (2012), the aid coefficient is positive across all specifications, and achieves statistical significance at the 1% level in most estimations (Table 5, Columns 1, 2, and 4). This result is in line with the studies supporting the positive effect of aid on growth (Burnside and Dollar, 2000; Chenery and Strout, 1966; Bräutigam and Knack, 2004; Dutta et *al.*, 2013; etc.). However, this result contrasts with several studies (Jensen and Paldam, 2006; Ekanayake and Chatrna, 2010; Boone, 1996; and Mosley et *al.*, 1987) demonstrating that aid has no significant effect on investment or growth. It also contradicts the result obtained by Nguegang and Ndamsa (2023), showing that aid itself can become a factor of destabilization.

The results suggest that the negative effect of FDI volatility can be significantly mitigated by foreign aid, since the interaction of aid with FDI volatility (*Vol Fdi* X *Aid*) has a positive and significant coefficient (see Table 5, Columns 2-4). The results provide evidence of the stabilizing effect of aid as its net effects on growth are positive and statistically significant (see Table 5, Columns 2 and 4). Consequently, there is a complementarity between foreign aid and FDI as largely supported by many studies (Chauvet and Mesplé-Somps, 2006; Harms and Lutz, 2006; Asiedu et *al.*, 2009; Garriga and Phillips, 2014; Jansky, 2012). It is also in line with the studies of Guillaumont and Chauvet (2001)

and Pallage et *al.* (2006), suggesting that aid can be viewed as 'insurance' that compensates for negative shocks. Nevertheless, this result is not in line with the results of Balcilar et *al.* (2022), showing that aid can be a dampening factor for FDI volatility. Conversely, aid associated with institutional quality produces a synergy that hinders growth due to rent-seeking behaviors and fiscal indiscipline in recipient countries, making them less accountable to their citizens (see Table 5, Column 5). This aid-institutions paradox is in line with many studies (e.g., Djankov et *al.*, 2008; Moss et *al.*, 2008; Svensson, 2000, etc.).

Table 5. **System GMM estimates – Standard Deviation method**

| Variables | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| *Log GDP growth (t-5)* | 0.284*** | 0.253*** | 0.254*** | 0.133** | 0.178*** |
| | *(0.0863)* | *(0.0605)* | *(0.0855)* | *(0.0535)* | *(0.0359)* |
| *% Vol Fdi* | -0.000367 | **-0.00128*** ** | **-0.00194*** ** | -0.00215*** | -0.00537*** |
| | *(0.000591)* | *(0.000300)* | *(0.000302)* | *(0.000420)* | *(0.00116)* |
| *Aid/Pop* | **0.00208*** ** | **0.00183*** ** | 0.000906 | **0.00217*** ** | **0.0108*** ** |
| | *(0.000585)* | *(0.000554)* | *(0.000727)* | *(0.000642)* | *(0.00233)* |
| *Vol Fdi X Aid* | 0.000005 | **0.00001*** ** | **0.00001*** ** | **0.000016*** ** | |
| | *(0.000034)* | *(0.000002)* | *0.000002)* | *(0.000004)* | |
| *Institutions* | | | | | -0.00319 |
| | | | | | *(0.00358)* |
| *Log Population* | 0.218*** | 0.185*** | 0.266*** | 0.305*** | 1.020*** |
| | *(0.0432)* | *(0.0402)* | *(0.0604)* | *(0.0660)* | *(0.166)* |
| *% Inflation* | | 0.000148** | 0.00238*** | 0.00144** | 0.00964*** |
| | | *(0.000058)* | *(0.000568)* | *(0.000558)* | *(0.00131)* |
| *% Trade* | | | 0.00521*** | 0.00526*** | 0.0157*** |
| | | | *(0.00175)* | *(0.00142)* | |
| **Institutions** | | | | -0.0960 | 0.265 |
| | | | | *(0.0871)* | *(0.727)* |
| **Dummy 1988-1992** | | | | | |
| **Dummy 1993-1997** | -0.0714 | -0.0706 | 0.0774 | -0.153** | -0.962*** |
| | *(0.121)* | *(0.123)* | *(0.110)* | *(0.0729)* | *(0.325)* |
| **Dummy 1998-2002** | 0.0605 | 0.1000 | 0.134 | 0.0526 | -0.205 |
| | *(0.0930)* | *(0.0665)* | *(0.103)* | *(0.0586)* | *(0.356)* |
| **Dummy 2003-2007** | 0.307*** | 0.322*** | 0.281*** | 0.184** | 0.488* |
| | *(0.0787)* | *(0.0765)* | *(0.0898)* | *(0.0708)* | *(0.283)* |
| **Dummy 2008-2012** | | | | -0.0642 | |
| | | | | *(0.0486)* | |
| **Dummy 2013-2017** | -0.0494 | -0.0263 | 0.133* | | -0.391 |
| | *(0.0949)* | *(0.0955)* | *(0.0678)* | | *(0.338)* |
| **Dummy 2018-2022** | -0.413*** | -0.388*** | -0.229*** | -0.391*** | -1.338*** |
| | *(0.0913)* | *(0.0886)* | *(0.0698)* | *(0.0336)* | *(0.251)* |
| **Constant** | -2.594*** | -1.990*** | -3.611*** | -4.097*** | -13.80*** |
| | *(0.673)* | *(0.625)* | *(1.025)* | *(1.072)* | *(2.438)* |

| Variables | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Time FE** | Yes | Yes | Yes | Yes | N.A. |
| **Stabilizing effect of aid** | No | Yes | No | Yes | N.A. |
| **Net effect** | | 0,0028 | | 0,0037 | N.A |
| **AR(1)** | 0.005 | 0.003 | 0.009 | 0.04 | 0.004 |
| **AR(2)** | 0.532 | 0.379 | 0.129 | 0.160 | 0.147 |
| **Hansen J test** | 0.675 | 0.599 | 0.791 | 0.329 | 0.342 |
| **Number of instrument *(j)*** | 24 | 28 | 32 | 36 | 36 |
| **Observations** | 228 | 228 | 195 | 194 | 194 |
| **Ratio *(i/j)*** | 1.875 | 1.607 | 1406 | 1.25 | 1.25 |
| **Number of countries *(i)*** | 45 | 45 | 45 | 45 | 45 |

*Note*: see note in Table 5.
*Source*: Author's calculation.

The results remain consistent when the volatility of FDI is measured with an alternative method. Table 6 presents the results with the standard deviation method as an alternative measure for volatility. The negative effect of volatility of FDI is confirmed for all the estimates (Table 6, Columns 1-4).

Table 6. **System GMM estimates – Hamilton filtering method**

| Variables | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| ***Log GDP growth (t – 5)*** | 0.284*** | 0.253*** | 0.254*** | 0.133** | 0.221*** |
| | *(0.0863)* | *(0.0605)* | *(0.0855)* | *(0.0535)* | *(0.0385)* |
| ***% Vol Fdi*** | **-0.000367** | **-0.00128*** ** | **-0.00194*** ** | **-0.00215*** ** | **-0.00421** ** |
| | *(0.000591)* | *(0.000300)* | *(0.000302)* | *(0.000420)* | *(0.00205)* |
| ***Aid/Pop*** | **0.00208*** ** | **0.00183*** ** | **0.000906** | **0.00217*** ** | **0.0117*** ** |
| | *(0.000585)* | *(0.000554)* | *(0.000727)* | *(0.000642)* | *(0.00296)* |
| ***Vol Fdi X Aid*** | **0.000005** | **0.00001*** ** | **0.00001*** ** | **0.000016*** ** | |
| | *(0.000034)* | *(0.000002)* | *(0.000002)* | *(0.000004)* | |
| ***Institutions X Aid*** | | | | | **-0.00969** ** |
| | | | | | *(0.00411)* |
| ***Log Population*** | 0.218*** | 0.185*** | 0.266*** | 0.305*** | 1.411*** |
| | *(0.0432)* | *(0.0402)* | *(0.0604)* | *(0.0660)* | *(0.208)* |
| ***% Inflation*** | | 0.000148** | 0.00238*** | 0.00144** | 0.00770*** |
| | | *(5.80e-05)* | *(0.000568)* | *(0.000558)* | *(0.00239)* |
| ***% Trade*** | | | 0.00521*** | 0.00526*** | 0.0220*** |
| | | | *(0.00175)* | *(0.00142)* | *(0.00350)* |
| **Institutions** | | | | **-0.0960** | **1.905*** ** |
| | | | | *(0.0871)* | *(0.651)* |
| **Dummy 1988-1992** | | | | | |

| Variables | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Dummy 1993-1997 | -0.0714 | -0.0706 | 0.0774 | -0.153** | 0.466 |
| | *(0.121)* | *(0.123)* | *(0.110)* | *(0.0729)* | *(0.304)* |
| Dummy 1998-2002 | 0.0605 | 0.1000 | 0.134 | 0.0526 | 0.547** |
| | *(0.0930)* | *(0.0665)* | *(0.103)* | *(0.0586)* | *(0.263)* |
| Dummy 2003-2007 | 0.307*** | 0.322*** | 0.281*** | 0.184** | 0.934*** |
| | *(0.0787)* | *(0.0765)* | *(0.0898)* | *(0.0708)* | *(0.299)* |
| Dummy 2008-2012 | | | | -0.0642 | 0.109 |
| | | | | *(0.0486)* | *(0.337)* |
| Dummy 2013-2017 | -0.0494 | -0.0263 | 0.133* | | |
| | *(0.0949)* | *(0.0955)* | *(0.0678)* | | |
| Dummy 2018-2022 | -0.413*** | -0.388*** | -0.229*** | -0.391*** | -1.171*** |
| | *(0.0913)* | *(0.0886)* | *(0.0698)* | *(0.0336)* | *(0.249)* |
| Constant | -2.594*** | -1.990*** | -3.611*** | -4.097*** | -20.63*** |
| | *(0.673)* | *(0.625)* | *(1.025)* | *(1.072)* | *(3.302)* |
| Time FE | Yes | Yes | Yes | Yes | Yes |
| Stabilizing effect of aid | No | Yes | No | Yes | N.A. |
| Net effect | | 0.00242 | | 0.0023 | N.A |
| AR(1) | 0.001 | 0.003 | 0.004 | 0.003 | 0.004 |
| AR(2) | 0.830 | 0.932 | 0.494 | 0.372 | 0.221 |
| Hansen J test | 0.052 | 0.069 | 0.637 | 0.298 | 0.281 |
| Number of instruments | 24 | 28 | 32 | 36 | 36 |
| Observations | 208 | 208 | 179 | 178 | 178 |
| *Ratio (i/j)* | 1.875 | 1.607 | 1.406 | 1.25 | 1.25 |
| Number of countries | 45 | 45 | 45 | 45 | 45 |

*Notes*: log is the natural logarithm, % denotes percentage. ***, **,* denote significance at the 1%, 5%, and 10% levels, respectively; standard errors are in parentheses. N.A.: Not applicable
*Source*: Author's calculation.

## 4.2. **Robustness checks**

### *Alternative estimation strategy*

Table 7 presents robustness checks of the baseline results using the Driscoll-Kraay estimator and the various metrics of FDI volatility. The results appear consistent. The signs associated with the control variables are consistent with the growth literature regarding population growth, inflation, trade openness, and the quality of institutions. Regarding the core variables of interest, the results confirm the negative effect of FDI volatility on growth, the positive association between aid and growth, and the stabilizing role of aid on the nexus between FDI volatility and growth, regardless of how volatility is measured (Table 7, Panels A and B). Overall, the results are robust to the choice of estimation technique.

Table 7. **Driscoll-Kraay estimates (robustness checks)-Full sample**

| Variables | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | **Panel A: Deviation with the Hamilton filtering method** | | | | |
| *% Vol Fdi* | **-0.00142**** | **-0.00141**** | **-0.0014***** | **-0.00128*** | **-0.00220**** |
| | *(0.000574)* | *(0.000572)* | *(0.000335)* | *(0.000537)* | *(0.000657)* |
| *Aid/Pop* | **0.000954**** | **0.000946**** | **0.00147**** | 0.000664 | **0.00952***** |
| | *(0.000293)* | *(0.000290)* | *(0.000524)* | *(0.00034)* | *(0.00113)* |
| *Vol Fdi X Aid* | **0.000008**** | **0.000008**** | **0.000009***** | 0.000008 | |
| | *(0.000002)* | *(0.000002)* | *(0.000002)* | *(0.000005)* | |
| *Log Population* | 0.0814* | 0.0825* | 0.208*** | 0.220*** | 0.849*** |
| | *(0.0362)* | *(0.0363)* | *(0.0328)* | *(0.0379)* | *(0.0597)* |
| *% inflation* | | -0.000312 | -0.00454* | -0.00337 | -0.00637 |
| | | *(0.000230)* | *(0.00224)* | *(0.00283)* | *(0.00851)* |
| *% Trade* | | | 0.00478 | 0.00157 | **0.00903**** |
| | | | *(0.00285)* | *(0.00138)* | *(0.00259)* |
| *Institutions* | | | | 0.315** | 1.612*** |
| | | | | *(0.0820)* | *(0.0925)* |
| *Institutions X Aid* | | | | | **-0.0116***** |
| | | | | | *(0.00192)* |
| **Constant** | 0.00472 | -0.00672 | -2.309** | -2.047** | -9.935*** |
| | *(0.566)* | *(0.564)* | *(0.754)* | *(0.662)* | *(1.011)* |
| **Stabilizing effect of aid** | Yes | Yes | Yes | No | N.A. |
| **Observations** | 230 | 230 | 197 | 178 | 178 |
| **Number of countries** | 45 | 45 | 45 | 45 | 45 |
| **R-squared** | 0.067 | 0.070 | 0.163 | 0.217 | 0.189 |
| | **Panel B: traditional SD method** | | | | |
| *% Vol Fdi* | **-0.002**** | **-0.0019**** | **-0.0020***** | **-0.0017**** | **-0.00423**** |
| | *(0.000608)* | *(0.000627)* | *(0.000474)* | *(0.000508)* | *(0.00150)* |
| *Aid/Pop* | 0.000163 | 0.000186 | **0.00133*** | 0.00004 | **0.00603**** |
| | *(0.00050)* | *(0.00051)* | *(0.00067)* | *(0.00054)* | *(0.00234)* |
| *Vol Fdi X Aid* | **0.000007**** | **0.000007**** | **0.00006***** | 0.000008* | |
| | *(0.000002)* | *(0.000002)* | *(0.000002)* | *(0.000003)* | |
| *Log Population* | 0.0749* | 0.0762* | 0.203*** | 0.221*** | **0.846***** |
| | *(0.0376)* | *(0.0386)* | *(0.0337)* | *(0.0410)* | *(0.100)* |
| *% Inflation* | | -0.000161 | -0.00306 | -0.00234 | -0.00379 |
| | | *(0.000255)* | *(0.00300)* | *(0.00330)* | *(0.00932)* |
| *% Trade* | | | 0.00498* | 0.00198 | 0.0122** |
| | | | *(0.00255)* | *(0.00117)* | *(0.00304)* |
| *Institutions* | | | | 0.333*** | 1.253*** |
| | | | | *(0.0778)* | *(0.246)* |
| *Institutions X Aid* | | | | | -0.00576 |
| | | | | | *(0.00550)* |

| Variables | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Constant** | 0.238 | 0.216 | -2.143** | -1.979** | -9.629*** |
| | *(0.607)* | *(0.621)* | *(0.767)* | *(0.763)* | *(1.855)* |
| **Stabilizing effect of aid** | Yes | Yes | Yes | No | N.A. |
| **Observations** | 264 | 264 | 224 | 195 | 195 |
| **Number of countries** | 45 | 45 | 45 | 45 | 39 |
| **R-squared** | 0.084 | 0.085 | 0.173 | 0.22 | 0.179 |

*Note*: see note in Table 5.
*Source*: Author.

### *Heterogeneity analysis: Does the level of institutional quality matter?*

Considering that the level of policies in the recipient country of aid may play a major role in 'shaping' its effect, the heterogeneity analysis with the median criterion is conducted to examine the incidence of institutional quality on the effectiveness of aid. This criterion provides a simple and robust way to divide the sample into two comparable subsamples of countries. Two groups of countries are distinguished: countries with a high level of institutional quality and low institutional quality countries (see section 3.1 for more details).

The effect of aid on economic growth appears to be greater in countries with higher institutional quality. Whereas this effect is positive and significant in countries with high institutional quality (Table 8, Columns 3 and 4), it is positive but not significant in countries with low institutional quality (Table 8, Columns 1 and 2). This evidence is in line with the results of several studies (such as Burnside and Dollar 2000, 2004; Balcilar et *al.*, 2020, etc.) positing that institutional quality affects aid performance. Nevertheless, this result is not in line with the study of Heckelman and Knack (2009), indicating that foreign aid has no effect on institutions.

Table 8 shows that FDI volatility has a negative and significant effect on growth regardless of the level of institutional quality. Conversely, the effect of aid inflows is positive both in low and high institutional quality countries (Table 8, Columns 1-4). However, this effect is statistically significant in high institutional quality countries, while it is non-significant in low institutional quality countries (see Table 8, Columns 3 and 4). This result is in line with the investigation of Burnside and Dollar (2000, 2004), indicating that the effectiveness of foreign aid is a function of institutional quality, given that the return on aid is reduced by distortions such as corruption, government bureaucracies, and a

riskier legal environment. Nevertheless, this result is not in line with investigations of Dalgaard et *al.* (2004), and Karras (2006), demonstrating that the effect of aid is not conditional on the institutional environment. Therefore, following the 'reward' viewpoint of aid, foreign aid can be more effective in countries with good policies and institutions as suggested by several studies (e.g., Clemens et *al.*, 2012; Hansen and Tarp, 2001; etc.). On the flip side, this result is not in line with investigations of Dalgaard et *al.* (2004) and Karras (2006), supporting that aid has no effect on institutions.

Following the 'insurance paradigm', the results suggest that aid reduces the negative effect of FDI volatility on growth, as the coefficient associated with the interaction term (*Vol Fdi* x *Aid*) is positive but not significant in countries with the lowest institutional quality (Table 8, Panels A and B, Column 2). This result is in line with the studies suggesting that aid helps to overcome external shocks (Collier and Goderis, 2009; Guillaumont and Laajaj, 2006; Nguegang and Ndamsa, 2023; Nguegang, 2024; etc.).

Surprisingly, foreign aid indirectly undermines institutions in 'high institutional quality countries', which in turn reduces economic growth (Table 8, Panels A and B, Column 4). As argued by Moss et *al.* (2008), aid-recipient countries that are less dependent on tax revenues may become less accountable and responsive to their citizens. This fosters 'rent-seeking' behavior and erosion of state capacity, as underlined by Svensson (2000), thereby 'crowding out' growth. Additionally, this study provides evidence that, beyond a certain threshold (Table 8, Panels A and B, Column 4), aid can harm institutional quality in the aid-recipient country. This result is in line with the investigation of Djankov et *al.* (2008), indicating that higher levels of aid undermine political institutions in the recipient country. As a result, the argument supporting that foreign aid is more productive when policy is better '[…] could appear only to be a moral one, and, […] politically appealing' (Guillaumont and Chauvet, 2001).

Table 8. **Driscoll-Kraay estimates-Heterogeneity analysis**

| | Low institutional quality countries | | High institutional quality countries | |
|---|---|---|---|---|
| **Variables** | **(1)** | **(2)** | **(3)** | **(4)** |
| | **Panel A : Deviation with the Hamilton filtering method** | | | |
| *% Vol Fdi* | **-0.00560**** | **-0.00271***** | **-0.00546**** | **-0.00356*** |
| | *(0.00167)* | *(0.000320)* | *(0.00206)* | *(0.00146)* |
| *Aid/Pop* | 0.0129 | 0.0457* | **0.00415**** | **0.0141***** |
| | *(0.00686)* | *(0.0208)* | *(0.00120)* | *(0.00183)* |
| *Vol Fdi X Aid* | 0.000038* | | 0.00003 | |
| | *(0.000016)* | | *(0.000039)* | |
| *Log Population* | 1.104*** | 1.066*** | 0.575*** | 0.614*** |
| | *(0.111)* | *(0.109)* | *(0.130)* | *(0.124)* |
| *% Inflation* | -0.00551 | -0.00529 | -0.00756 | -0.00888 |
| | *(0.00903)* | *(0.00897)* | *(0.0356)* | *(0.0364)* |
| *% Trade* | 0.0298*** | 0.0284*** | 0.000617 | -0.00119 |
| | *(0.00498)* | *(0.00509)* | *(0.00483)* | *(0.00459)* |
| **Institutions** | **3.526***** | 1.972 | **0.708**** | **2.151***** |
| | *(0.713)* | *(1.221)* | *(0.198)* | *(0.243)* |
| *Institutions X Aid* | | 0.0300 | | **-0.0226***** |
| | | *(0.0233)* | | *(0.00389)* |
| **Constant** | -12.31*** | -13.42*** | -4.825* | -5.859** |
| | *(1.413)* | *(0.875)* | *(2.157)* | *(2.080)* |
| **Threshold of aid** | N.A. | No | N.A. | **95.176** |
| **Stabilizing effect of aid** | No | N.A. | No | N.A. |
| **Observations** | 71 | 71 | 114 | 114 |
| **R-squared** | 0.299 | 0.296 | 0.151 | 0.229 |
| **Number of countries** | 21 | 21 | 24 | 24 |
| | **Panel B : traditional SD method** | | | |
| *% Vol Fdi* | -0.00966 | **-0.00865**** | **-0.00704***** | **-0.00535**** |
| | *(0.00543)* | *(0.00232)* | *(0.00142)* | *(0.00160)* |
| *Aid/Pop* | -0.000210 | 0.0426 | 0.00247 | **0.00935***** |
| | *(0.0115)* | *(0.0277)* | *(0.00183)* | *(0.00188)* |
| *Vol Fdi X Aid* | 0.000015 | | 0.000023 | |
| | *(0.000107)* | | *(1.66e-05)* | |
| *Log Population* | 1.031*** | 1.046*** | 0.673*** | 0.749*** |
| | *(0.179)* | *(0.138)* | *(0.154)* | *(0.152)* |
| *% inflation* | 0.000517 | -0.000307 | -0.0321 | -0.0424 |
| | *(0.0122)* | *(0.0114)* | *(0.0229)* | *(0.0224)* |
| *% Trade* | 0.0389*** | 0.0395*** | 0.00293 | 0.00265 |
| | *(0.00567)* | *(0.00648)* | *(0.00425)* | *(0.00416)* |
| **Institutions** | 3.275*** | 1.231 | 0.988*** | **1.975***** |
| | *(0.515)* | *(1.679)* | *(0.181)* | *(0.184)* |

| | Low institutional quality countries | | High institutional quality countries | |
|---|---|---|---|---|
| **Variables** | **(1)** | **(2)** | **(3)** | **(4)** |
| | **Panel B : traditional SD method** | | | |
| ***Institutions X Aid*** | | 0.0404<br>*(0.0365)* | | **-0.0137***<br>*(0.00538)* |
| **Constant** | -10.45**<br>*(3.520)* | -12.98***<br>*(2.563)* | -5.830*<br>*(2.684)* | -7.320**<br>*(2.599)* |
| **Threshold of aid** | N.A. | No | N.A. | N.A. |
| **Stabilizing effect of aid** | No | N.A. | No | **144.16** |
| **Observations** | 82 | 82 | 123 | 123 |
| **R-squared** | 0.282 | 0.288 | 0.219 | 0.249 |
| **Number of countries** | 21 | 21 | 24 | 24 |

*Note*: see note in Table 5.
*Source*: Author.

## 5. Conclusion

Under the framework of aid conditionality, the aim of this study was to investigate the stabilizing or the destabilizing effect of foreign aid on the nexus between FDI volatility and growth in Africa using a panel of 45 African countries over more than three decades (1988–2022). FDI volatility is measured as the standard deviation of the cycle isolated with the Hamilton filter. This filtering approach is a superior alternative to the widely used Hodrick-Prescott filter. As a robustness check, the standard deviation of FDI confirms the consistency of the results. The issue of simultaneity and reverse causality is addressed by employing a dynamic panel model. Therefore, the system GMM estimators were utilized to overcome endogeneity issues and to account for temporal dynamics. Due to a potential cross-sectional dependence, Driscoll and Kraay estimators were used as an alternative strategy. Additionally, quantile regression was used to provide a broader perspective related to the linkage between variables across different quantiles of economic growth.

The results reveal a robust negative linkage between growth and volatility of FDI in Africa. Furthermore, foreign aid was found to positively contribute to economic growth. Moreover, it mitigates the negative effect of instability due to the volatility of FDI. Nevertheless, the results need to be qualified insofar as aid is indirectly detrimental to institutions in good policy environments, exacerbating the negative effect of FDI volatility. Overall, this study indicates that it is not certain

that the absorptive capacity of foreign aid is greater in countries with good 'performance'. In that case, foreign aid can be viewed as an incentive to adopt good policies. The conclusion of this study brings the issues of aid effectiveness and aid selectivity back to the forefront. Institutional quality does not always seem to guarantee a good absorptive capacity of foreign aid, which calls into question the relevance of traditional aid allocation criteria. These criteria could be broadened to include exogenous/external instability factors, such as exposure to unpredictable fluctuations in FDI, given the stabilizing effects of aid in such circumstances.

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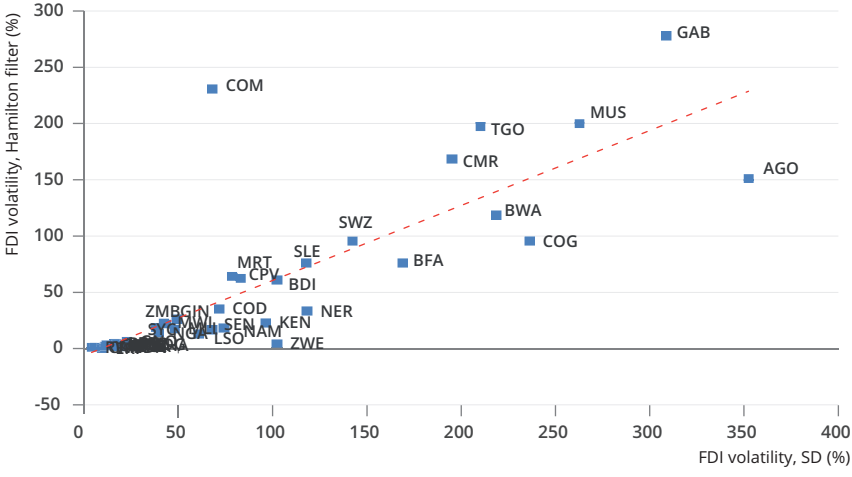
# APPENDICE

Figure A1. **Correlations between magnitudes of volatility indicators calculated using Hamilton filter and standard deviation method**




*Source* : Author's calculation.

Table A1. **Descriptive statistics and pairwise correlation matrix**

| | GDP | Trade | Pop | Inflation | Aid | H filter | SD |
|---|---|---|---|---|---|---|---|
| ***GDP*** | 1.0000 | | | | | | |
| ***Trade*** | 0.0517* | 1.0000 | | | | | |
| | *(0.0584)* | | | | | | |
| | (0.0215) | (0.9888) | | | | | |
| ***Pop*** | 0.0211 | -0.2900*** | 1.0000 | | | | |
| | *(0.3942)* | *(0.0000)* | | | | | |
| ***Inflation*** | -0.0409* | -0.0260 | 0.0330 | 1.0000 | | | |
| | *(0.0997)* | *(0.3420)* | *0.1839)* | | | | |
| ***aid*** | 0.0083 | 0.2542*** | -0.2753*** | -0.0315 | 1.0000 | | |
| | *(0.7395)* | *(0.0000)* | *(0.0000)* | *(0.2061)* | | | |
| ***H filter*** | -0.0820*** | -0.0083 | 0.0016 | -0.0005 | -0.0504 | 1.0000 | |
| | *(0.0089)* | *(0.8085)* | *(0.9595)* | *(0.9869)* | *(0.1093)* | | |
| ***SD*** | -0.1254*** | 0.1440*** | -0.0571** | 0.0757** | -0.114*** | 0.311*** | 1.0000 |
| | *(0.0000)* | *(0.0000)* | *(0.0433)* | *(0.0073)* | *(0.0001* | *(0.0000)* | |
| **Obs** | 1,594 | 1,309 | 1,610 | 1,590 | 1,634 | 985 | 1,219 |
| **Mean** | 3.948111 | 64.05679 | 16, 300,000 | 44.24122 | 85.13129 | 53.916 | 93.440 |
| **Std. Dev.** | 7.744309 | 32.24745 | 27, 100,000 | 700.3053 | 95.67512 | 174.28 | 135.620 |
| **Min** | -51.03086 | 2.698834 | 68,755 | -31.56592 | -16.11215 | 0 | .0441044 |
| **Max** | 149.973 | 222.1782 | 223, 000,000 | 26762.02 | 1064.701 | 2049.967 | 653.7565 |

***, **,* denote 1%, 5% and 10% significant level respectively.
*Source*: Author's construction.