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Article

Environmental risk and growth in foreign direct investment: Is the composition of FDI in sub-Saharan Africa a speculative type?

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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Environmental risk and growth in foreign direct investment: Is the composition of FDI in sub-Saharan Africa a speculative type?

Williams Ohemeng¹, Kenneth Ofori-Boateng^{2*}, Elvis Kwame Agyapong³ and Joseph Darmoe⁴

Abstract: The study explores the influence of environmental risk (macroeconomic uncertainty and environmental sustainability risk) on the inflow of foreign direct investment (FDI), utilizing data from 37 economies in sub-Saharan Africa (SSA) from 1996 to 2019. The empirical analyses were carried out using Panel Corrected Standard Error (PCSE) estimation technique. The outcomes show that higher level of uncertainty in GDP growth, inflation uncertainty and financial development volatility induce more FDI inflows whilst uncertainty in exchange rate adversely impacts FDI inflows in SSA. The paper highlights how effectiveness of governance, stable political atmosphere and quality of regulatory structures moderate the relationship between environmental risk and FDI with striking varying outcomes. Consistent with the pollution haven hypothesis, the interactions between governance effectiveness, political stability, regulatory structures and environmental risk suggest that the sub-region is attracted to risk loving speculative investors who prefer poorly regulated and weak governance environment. From policy implication, the findings imply that FDI composition in the sub-region may have moved more towards the speculative type, which may not necessarily be classified as pro-growth in nature.

Subjects: Political Economy; Environmental Economics; Economics; Finance; Business, Management and Accounting

Keywords: foreign direct investment; macroeconomic risk; environmental sustainability risk; panel corrected standard errors; Sub-Saharan Africa

JEL Classification: F14; F18; F21; F23; F62

1. Introduction

In pursuit of development, countries all over the globe make the attraction of foreign direct investment (FDI) a driving force of policy objective. Likewise, in their quest to entice foreign investors for the needed funds to the sub-region, most African countries have embarked on aggressive investment-friendly policies, including tax suspensions and tax holidays, liberalization of their economies and promulgation of regulatory policies aimed at making them competitive to investment. Asamoah et al. (2016) identified reform programmes such as the structural adjustment programmes, economic recovery programmes, economic partnership agreements and the financial sector adjustment programmes as purported among other objectives to increase FDI inflow. The recently founded African Continental Free Trade Area (AfCFTA) among 54 nations of the

African Union, aimed at providing single market for goods and services is one sure way of liberalizing economies in Africa, and could pave way for inflow of foreign investment.

Despite efforts by policy makers in Africa to attract foreign investment, the continent appears to benefit less from FDI inflow; significant composition of FDI inflows has been concentrated in Latin American and Asian regions. Indeed, experts of international economics explain that most FDIs move to advanced economies such as USA, Holland, Germany and recently China than developing economies (Robert, 2015). This trend could be attributed to poor institutional and governance structures (Adegboye et al., 2020; Sarkodie & Strezov, 2018) that characterize most emerging economies. The little that comes to developing nations and emerging markets are somehow skewed to Asia and Latin American economies. As an example, in the 1970s, net inflows received by economies in SSA averaged just \$942 million yearly; in the 1980s however, the sub-region recorded inflow of \$1.3 billion on the average per year. Again, in the 1990s, inflows quadrupled, recoding on average an amount of \$4.7 billion per year and from 2000–2010, the amount recorded was twentyfold, averaging \$20.2 billion. From 2010–2017, SSA received an average of \$38.7 billion in FDI inflows per year, representing a fortyfold rise from the reported amount in the 1970s. Although, the share of FDI inflows by SSA as a recipient has witnessed an increment from 1.3% in the 1990s to 1.9% in the 2000s, and to 2.5% from 2000 to 2017, the sub-region's share to the total global FDI inflows could still be said to be small. The seemingly unclarity on the job creation capacity, limited spillovers and cascading effect on local enterprises make the contribution of inflow of FDI into the sub-region contentious subject of enquiry. It is therefore relevant to examine the reasons for the relative inadequacy of FDI inflows and its lack of growth prospect to SSA, with specific focus on environmental risk (macroeconomic and environmental sustainability risk). Revelation from this analysis could form the basis of strategies in respect of policies on FDI inflow into the sub-region to focus on investors who could contribute to economic growth prospects. Although Borensztein et al. (1998), Adams (2009), Agrawal (2015) and Makiela and Ouattara (2018) found FDI to have positive impact on GDP growth, Ang (2008) found little evidence to support spillovers of FDI and hence limited support to GDP growth.

In recent times, many studies have found that the FDI-growth nexus is dependent on other factors. These heterogeneous factors bordering on the absorption capacity of the recipient economy includes the level of economic growth/development (Blomstrom et al., 1994), development of financial markets (Azman-Saini et al., 2010), human capital (Borensztein et al., 1998), stable economy and liberalized markets (Bengoa & Sanchez-Robles, 2003), liberalized trading environment (Balasubramanyam et al., 1996), technology gap (Havranek & Irsova, 2011) and ownership structure of the FDI firm (Javorcik, 2004). The current paper inclines to support the idea of absorption capacity of the recipient nation and its relevance to the FDI-growth discourse. However, this paper concentrates on another essential and relatively less examined relationship in the extant literature, that is, the role of environmental risk in defining the FDI-growth nexus. This paper posits environmental risk from two main perspectives: (i) macroeconomic instability factors and (ii) environmental sustainability risk.

First, investors perceive stability in key macroeconomic factors such as consumer price inflation and foreign exchange rate among others as impetuses for business growth and would therefore choose stable economies over fluctuating economies. In reference to this argument therefore, Doytch (2015) and Doytch (2021) focused on examining FDI inflows to business cycles for South and East Asia, and Eastern Europe and Central Asia respectively. Similarly, Doytch et al. (2021) concentrated on the effect of COVID-19 and global financial crises of 2008 on greenfield FDI on global scale for various industrial sectors. Invariably, significant number of works find a positive influence exerted by FDI on economic performance; there are however some works with contrary outcomes such as Carkovic and Levine (2005) and Herzer et al. (2008), who concluded that foreign inflows do not exert robust or verifiable effect on economic growth. Apart from the inconclusive outcomes in the literature, it is obvious from the literature that most papers on the FDI-growth relationship have relied on exchange rate and inflation volatility to proxy for macroeconomic

uncertainty. It is evident, therefore, to conclude that these studies suffer from aggregation bias. Example, Udoh and Egwaikhide (2008), Solomon and Ruiz (2012), Asamoah et al. (2016) and Das (2018) either used volatility in exchange rate, or inflation or both to proxy for macroeconomic uncertainty, and concluded that uncertainty in the macroeconomic environment has adverse effect on the inflow of FDI. On the other hand, Ang (2008) found contrary evidence in Malaysia that seems to suggest that higher rate of macroeconomic uncertainty results in increased FDI inflow. The current work takes a departure from what exists in the literature by assessing instability in various macroeconomic factors such as GDP growth, money supply, inflation, exchange rate, financial development, terms of trade and trade liberalization on net FDI inflow in the sub-region of SSA. That is, this work sets out to evaluate the various interactions among FDI and macroeconomic instability. Again, we offer new understandings into the role played by disaggregate macroeconomic variables that serve as main influential factors in attracting FDIs in SSA.

Secondly, institutional heterogeneity is strongly connected to disparities in economic outcomes across the globe and therefore FDI inflows are attracted in the same manner; thus, as put forth by Mid (2019), economies with feeble institutions perform poorly while those with strong institutions tend to have better performance trajectory. However, according to pollution haven hypothesis, investors ride on the opportunity offered by countries with weaker institutions and accompanied higher rate of carbon (CO₂) emission but with significant returns on investment to invest in such countries. For SSA countries which are known for relatively weak institutions, an important question that one would ask is, what category of investors, and for that matter, FDIs are attracted to the region? Thus, can we conclude that the type of FDIs attracted to the region are funds from risk-lovers and speculative investors or are pro-growth risk averse investors? Speculative investors would normally take advantage of the lapses in the system, as well as the incentive package offered by governments and policy makers to invest in these weak institutional environments and cash in on their investments and leave the country. For such investors, uncertainty in the macroeconomic environment as well as relaxed ecological regulatory structures as those found in the sub-region of SSA present the right opportunity for increasing their investment portfolio and returns.

Finally, a cursory look at the empirical literature suggests that institutions play influential role in FDI growth among economies (see Aziz, 2018; Buchanan et al., 2012; Ezeoha & Cattaneo, 2012; Masron & Abdullah, 2010). However, directly examining the impact of institutional structures in attracting foreign investment inflow into SSA, Nondo et al. (2016) failed to find a statistically significant relationship between FDI inflow and quality of institutions. Asamoah et al. (2016) report that institutional quality moderates the effects of macroeconomic uncertainty on the inflow of FDIs. The current study, which is a regional study, therefore, examines individually, the moderating role of institutional factors such as government effectiveness, stable political atmosphere and regulatory quality on the nexus between environmental risk and FDI inflow in the sub-region of SSA.

2. Literature review

The theoretical base of FDI can be traced back to the works of earlier economists including Adam Smith and David Ricardo that focused essentially on theoretical reasons for international trading. International trading is postulated by earlier researchers as being influenced by specialization advantages as described by the doctrines of absolute advantage theory, and comparative advantage underpinned by factor endowments (Dima, 2010). These theories are essentially influenced by the capacity of countries to absolutely produce at a lower cost than others or countries' ability to benefit from specialization even though absolute advantage does not exist. Dima (2010) proceed to identify other relevant theories including the factor proportion by Heckscher (1919) and Ohlin (1933), product life cycle by Vernon (1979), the new international theory of trade by Krugman (1983) and the theory of competitive advantage by Michael Porter (1985) as modern theories that explain the reason and pattern of international trading in a manner of augmenting the works of

earlier economists in international trading research. Recently, Reinert (2020) considers FDI to be viewed from the perspective of international production as a window in the world economy.

Referencing the literature, Dima (2010) concludes that market imperfections are the main driving force of internationalization of firms. As a result of imperfections in market conditions occasioned by right to ownership of technology, exclusive access to resources, access to cheap source of factors of production, economies of scale and distribution system, businesses move resources or expand to different geographical locations, hence foreign direct investment. Specific theories of FDI based on the aforementioned can therefore be cited to include the theory of international production (Reinert, 2020), the theory of internalization, location theory, demand structure hypothesis, transaction cost theory and the eclectic theory. According to Dima (2010), the theory of international production posits that conditions prevalent in the host country form the basis of the decision by a firm to operate abroad as against the choice of investing in other countries. The theory suggests that the decision to invest in an economy does not depend on only the endowment of factors of production and their productivity but includes multiple factors such as the condition of macroeconomic factors, institutional environment and the environmental sustainability factors, in reference to the purpose for this study.

The theory of internalization is premised on firms' pursuit of internal solutions to problems occasioned by international market imperfections by creating their own internal market beyond the borders of their home country (refer to Dima, 2010; Kurtishi-Kastrati, 2013). The location theory, according to Kurtishi-Kastrati (2013), emphasizes that an organization's decision regarding FDI is impacted by the locational advantages that could accrue to the business such as access to large market, lower cost of inputs, improved infrastructural network and liberalized trading environment. The demand structure hypothesis as explained by Dima (2010) postulates that the decision to invest in a foreign country could be influenced by the similarity in demand structure between the original country and the receiving economy; thus, the similarity of economic structures makes commercial activities between two nations easy and therefore enhances FDI. The enactment of trade treaties among nations is an example of ways to ensure similar economic structures to enhance FDI. The transaction cost theory as explained by Nayyar (2014) indicates that FDI is influenced by differences in cost of engaging in transactions for a company and that of outside companies; thus, the external market failing to provide cost effective means of using its technological know-how and processes of production in delivering goods and services, thereby creating an internal market by investing in many countries to take advantage of its internal cost-effective process. The eclectic theory also asserts that a company's decision in respect of investment in a foreign country is dependent on three set of factors—competitive advantage, internationalization advantage and locational priorities. The theory therefore implies that FDI results from firms' ownership advantage which is exploited by locating firms in foreign territories and profitably through internalization (Nayyar, 2014).

Empirically, a number of papers focusing on various geographical locations of the globe have evaluated the nexus between FDI and macroeconomic risk in the literature with inclusive outcomes on the direction of impact. As already alluded to, most of these papers have proxied macroeconomic uncertainty with volatility in exchange rate whilst a few others use volatility in inflation. Studying the impact of macroeconomic uncertainty and political risk on FDI in Asian, Latin American and African economies, Solomon and Ruiz (2012) used exchange rate uncertainty to denote macroeconomic instability. Solomon and Ruiz (2012) concluded that both political instability and exchange rate instability reduce FDI, with the magnitude of impact of political risk being higher than exchange rate uncertainty. This conclusion indicates the importance of trend of political environment in the attraction of FDI into an economy. For the effect of exchange rate instability on FDI, Sharifi-Renani and Mirfatah (2012) and Kyereboah-Coleman and Agyire-Tettey (2008) support the conclusion by Solomon and Ruiz (2012) using data from the Iranian and Ghanaian economies respectively. Whilst in Nigeria, Udoh and Egwaikhide (2008) found results that conform to conclusions by Solomon and Ruiz (2012) using exchange rate and inflation rate

uncertainty to proxy macroeconomic instability, Ang (2008) found out that for the Malaysian economy, increased rate of macroeconomic uncertainty results in higher rate of inflow of FDI into the country contradicting the position of the aforementioned papers.

Also using exchange rate volatility as proxy for macroeconomic uncertainty for sample of data from developing countries Das (2018) could not conclude on the overall direction of impact of macroeconomic uncertainty on inflow of FDI. Depending on the income level of a country, Das (2018) either found macroeconomic uncertainty to have positive effect or adverse impact on FDI inflow. For the East-Asian economy, Dhakal et al. (2010) found out that exchange rate uncertainty has favorable impact on FDI. Doytch (2015) also focused on 15 economies in South and East Asia to examine the response of sectoral FDI to business cycles from 1980 to 2011. Results showed a countercyclical behavior of services FDI and acyclical behavior of both extractive industries FDI and manufacturing FDI. Similarly, for 19 Eastern European and Central Asian economies, Doytch (2021) concluded that aggregate inflows of services FDI are countercyclical, increase during periods of contractions among the economies and decrease during periods of economic booms, while the rest of the FDI inflows are acyclical. Asamoah et al. (2016) used GMM estimation technique in examining the impact of macroeconomic instability (proxied by exchange rate volatility) on inflow of FDI into SSA; the study concluded that FDI inflow is negatively affected by macroeconomic uncertainty. Asamoah et al. (2016) however found out that improved institutional structures reduce the negative impact of macroeconomic volatility on FDI inflow into the sub-region of SSA.

With respect to the association between FDI inflow and environmental sustainability risk, the literature is dominated by studies that examine the dynamic relationship between FDI, environmental degradation, sustainable development and economic growth, with varying magnitude and direction of impact (refer to Ayamba et al., 2019, 2020; Bokpin, 2017; Caesar et al., 2018; Haibo et al., 2019; Nadeem et al., 2020; Obobisa et al., 2021). There has therefore been little attention to the subject matter, where an assessment is made towards verifying the impact of environmental sustainability risk on FDI.

In summary, the theories discussed illustrate that FDI is impacted by multiple factors such as the economic policy of host country, the economic performance of host country, access to market, availability of factors of production, competitive production factor cost, policy environment, macroeconomic environment, infrastructural network, political and institutional environment. The reviewed empirical literature also shows that the direction and magnitude of influence of macroeconomic risk on FDI are inclusive; geographical jurisdiction as well as the choice of macroeconomic uncertainty variable play important role in the discourse, hence creating a gap worth studying.

3. Methodology

The paper pursued three sequential estimation procedures in arriving at the outcomes. First, volatility data of the macroeconomic factors were ascertained by the use of the Generalized Autoregressive Conditional Heteroscedastic (GARCH) model. We then modelled the effect of macroeconomic volatility and environmental sustainability risk (CO2 emissions) on FDI by using the Panel Corrected Standard Error (PCSE) estimation approach. We finally interacted the institutional factors with the key variables in a panel setting to verify the moderating roles these institutional factors play in the growth of FDIs.

To model for the macroeconomic uncertainty, GARCH model of Bollerslev (1986) and Taylor (1986) is employed. This approach was adopted by Asamoah et al. (2016), Gökbulut and Pekkaya (2014), and Akgül and Sayyan (2005) to model uncertainty of key macroeconomic variables in the literature. The GARCH model permits the conditional variance to be determined by its own lags. The mean equation and the conditional variance equation presented as GARCH (1, 1), which has been proven to be adequate to capture the volatility clustering in the data are presented below.

$$MV_t = \vartheta + \theta MV_{t-1} + \mu_t \quad (1)$$

where $\mu_t \approx N(0, \sigma_t^2)$

$$\sigma_t^2 = \emptyset + \delta \varepsilon_{t-1}^2 + \delta \sigma_{t-1}^2 \quad (2)$$

From equations (1) and (2), MV_t denotes macroeconomic variable at time t , σ_t^2 measures the volatility associated with the various macroeconomic variables (money supply, GDP growth, inflation rate, exchange rate, financial development, terms of trade and trade openness) for each of the countries. \emptyset and ϑ are the constant terms whilst δ and δ denote the coefficients of the Autoregressive Conditional Heteroskedasticity (ARCH) and GARCH terms respectively.

The PCSE estimation technique by Beck and Katz (1995) is used in analyzing the nexus between FDI and the various environmental risk factors (volatility of macroeconomic factors and CO2 emission). According to Sundjo and Aziseh (2018), inferences made from ordinary least squares (OLS) standard errors are incongruous in panel data estimations as a result of contemporaneous correlation and unit level heteroskedasticity that normally exist in the data. For PCSE estimation therefore, standard errors, variance and co-variance are calculated on the assumption of contemporaneously correlated and heteroscedastic disturbances across panels. In PCSE estimation, the disturbances can be said to be without assumption of being i.i.d. The application of PCSE permits correct inference from panel data and considers deviations from spherical errors, presenting it as a superior estimation technique (Sundjo & Aziseh, 2018). Beck and Katz (1995) and Greene (2000) highlight the efficiency of the PCSE as a panel data estimation technique by positing that it accounts for contemporaneous effect and provides results that are heteroskedastic-covariance consistent, therefore controlling for data heterogeneity. Beck and Katz (1995) again posit that to control for heterogeneity, autocorrelation and cross-sectional dependence in panel data with fixed effect, the PCSE technique performs better. Bailey and Katz (2011) again aver that the PCSE adequately models and purges serial correlation, hence affirming its robustness in panel data estimations. Again, for efficient results, Wooldridge (2010) recommends the usage of PCSE because it controls for unobserved effect and errors that may not be i.i.d. white noise. In summary, the PCSE can be said to be efficient estimation technique that controls for fixed effect, unobserved effect and heterogeneity in panel data. As a result of its advantage in usage in the form of producing standard errors that are thoroughly underestimated and with insignificant loss of efficiency, it has been used extensively in the literature by research works such as Ntow-Gyamfi et al. (2020), Ikpesu et al. (2019), Chinelo and Fredrick (2017), and Jorgenson et al. (2014), among others. This study therefore finds the estimation technique robust and useful in analyzing the data for correct inferences.

The study makes use of annual data set of 37 SSA economies from 1996 to 2019. The dependent variable is the net FDI inflow. The parsimonious model we estimated is:

$$FDI_{it} = \omega + \sum_n^7 \vartheta_n MUNC_{it} + \phi GE_{it} + PS_{it} + \phi RQ_{it} + \gamma GDPG_{it} + \psi FTS_{it} + \lambda POPG_{it} + \varepsilon_{it} \quad (3)$$

where $i = 1, \dots, 37$ and $t = 1996, \dots, 2019$. $MUNC_{it}$ denotes macroeconomic uncertainty for country i , at year t , GE_{it} , PS_{it} and RQ_{it} represent governance effectiveness, political stability and regulatory quality respectively for country i , at year t (measures of institutional quality), and $GDPG_{it}$, FTS_{it} , and $POPG_{it}$ represent GDP growth, fixed telephone subscription and population growth respectively for country i , at year t , (set of control variables which are attractive to foreign investors). ω is the constant term whilst the coefficients of the explanatory variables are denoted by ϑ , ϕ , ϕ , γ , ψ and λ according to the order of appearance in the model. The error term ε_{it} is a vector comprising time invariant country-specific, time-specific and the residual effects.

To also verify the effect of environmental sustainability risk, proxied by CO2 emissions on the inflow of net FDI in the sub-region of SSA, the natural log of CO2 emission ($\ln CO2_{it}$) with π denoting its coefficient is introduced and presented as equation (4) below.

$$FDI_{it} = \omega + \sum_n^7 \vartheta_n MUNC_{it} + \pi \ln CO2_{it} + \varphi GE_{it} + \chi PS_{it} + \phi RQ_{it} + \gamma GDPG_{it} + \psi FTS_{it} + \lambda POPG_{it} + \varepsilon_{it} \quad (4)$$

The study is again set out to verify the moderating role of institutional quality, that is, government effectiveness, political stability and regulatory quality on the nexus between the macroeconomic uncertainty variables, CO2 emission and net FDI inflow. Equations (5), (6) and (7) modelled below are set out to achieve this objective.

$$FDI_{it} = \omega + \sum_n^7 \vartheta_n MUNC_{it} + \pi \ln CO2_{it} + \varphi GE_{it} + \chi PS_{it} + \phi RQ_{it} + \alpha (ENVR_{it} * GE_{it}) + \gamma GDPG_{it} + \psi FTS_{it} + \lambda POPG_{it} + \varepsilon_{it} \quad (5)$$

$$FDI_{it} = \omega + \sum_n^7 \vartheta_n MUNC_{it} + \pi \ln CO2_{it} + \varphi GE_{it} + \chi PS_{it} + \phi RQ_{it} + \alpha (ENVR_{it} * PS_{it}) + \gamma GDPG_{it} + \psi FTS_{it} + \lambda POPG_{it} + \varepsilon_{it} \quad (6)$$

$$FDI_{it} = \omega + \sum_n^7 \vartheta_n MUNC_{it} + \pi \ln CO2_{it} + \varphi GE_{it} + \chi PS_{it} + \phi RQ_{it} + \alpha (ENVR_{it} * RQ_{it}) + \gamma GDPG_{it} + \psi FTS_{it} + \lambda POPG_{it} + \varepsilon_{it} \quad (7)$$

From the above equations, α measures the coefficient of the interactive variables, $ENVR_{it}$ denotes environmental risk comprising a vector of macroeconomic variables and CO2 emissions whilst the remaining variables and symbols follow the definitions in equations (3) and (4).

4. Sources and description of data

The study makes use of data collected from the World Development Indicators (WDI), the World Governance Indicators (WGI) and the database of the International Monetary Fund (IMF) from 1996 to 2019. The dataset therefore is made up of unbalanced panel from 37 SSA countries out of the 48 countries because of unavailability of datapoints for most of the key variables for some of the countries. Dataset including the net foreign investment inflow to GDP, broad money, GDP growth, consumer price inflation, local currency to the US Dollar exchange rate, export price index, import price index, trade (% of GDP), CO2 emissions, fixed telephone subscriptions per 100 people and population growth were compiled from the WDI, whilst governance effectiveness, political stability and regulatory quality indexes were sourced from the WGI. Financial development index was also compiled from the IMF database. We proxy environmental sustainability risk by the natural log of CO2 emissions sourced from the WDI. Higher rate of emissions indicates higher degree of sustainability risk and vice versa. Macroeconomic risk is also denoted by the uncertainty in key economic variables as already alluded to.

As already highlighted, environmental risk has been defined to encompass instability in various macroeconomic variables and environmental sustainability risk. Inflow of foreign investment into the sub-region is also represented by the net inflow of FDI as a proportion of GDP. In Table 1, we focus on presenting the various countries with their respective descriptive statistics for the key variable, net FDI inflow to GDP. Results presented in the table indicate that there has been great deal of variability in the level of foreign investment inflow for the various countries. Relative to GDP such countries including Liberia (25.13%), Equatorial Guinea (20.06%), Mozambique (12.47%) and Congo Republic (10.25%) reported higher degree of foreign investment inflow whilst Burundi

Table 1. Country descriptive statistics - net inflow foreign direct investment

Country	Obs.	Mean	Median	Std. Dev.	Max.	Min.
Benin	24	0.0079	0.0052	0.0108	0.0305	-0.0066
Botswana	24	0.0254	0.0195	0.0189	0.0750	0.0045
Burkina Faso	24	0.0106	0.0062	0.0102	0.0365	0.0002
Burundi	24	0.0047	0.0002	0.0116	0.0476	-0.0006
Cameroon	24	0.0157	0.0175	0.0103	0.0436	-0.0011
Cape Verde	24	0.0658	0.0633	0.0305	0.1267	0.0130
Chad	24	0.0646	0.0382	0.1135	0.4628	-0.0485
Comoros	24	0.0049	0.0036	0.0054	0.0226	0.0001
Congo Republic	24	0.1025	0.0851	0.1316	0.3944	-0.0870
Cote D'Ivoire	24	0.0191	0.0172	0.0104	0.0603	0.0107
Equatorial Guinea	24	0.2006	0.0930	0.3555	1.6182	-0.0402
Ethiopia	24	0.0277	0.0303	0.0169	0.0558	0.0026
Gabon	24	0.0357	0.0380	0.0367	0.0920	-0.0501
Gambia	24	0.0351	0.0287	0.0230	0.0780	-0.0012
Ghana	24	0.0451	0.0401	0.0274	0.0947	0.0096
Guinea	24	0.0336	0.0166	0.0466	0.1883	-0.0084
Guinea Bissau	24	0.0159	0.0144	0.0110	0.0427	0.0010
Kenya	24	0.0100	0.0071	0.0092	0.0346	0.0004
Lesotho	24	0.0356	0.0362	0.0192	0.0871	0.0042
Liberia	20	0.2513	0.0912	0.3301	1.0334	0.0030
Madagascar	24	0.0400	0.0321	0.0370	0.1345	0.0020
Malawi	24	0.0273	0.0148	0.0287	0.1015	-0.0015
Mali	24	0.0251	0.0253	0.0155	0.0634	-0.0032
Mauritania	24	0.0624	0.0432	0.0802	0.2765	-0.1162
Mauritius	24	0.0238	0.0252	0.0168	0.0570	-0.0060
Mozambique	24	0.1247	0.0631	0.1144	0.3946	0.0139
Namibia	24	0.0482	0.0406	0.0298	0.1091	-0.0033
Niger	24	0.0358	0.0232	0.0366	0.1216	-0.0007
Nigeria	24	0.0151	0.0158	0.0070	0.0293	0.0050
Rwanda	24	0.0175	0.0185	0.0145	0.0409	0.0008
Sierra Leone	24	0.0578	0.0446	0.0706	0.3230	0.0002
South Africa	24	0.0150	0.0113	0.0129	0.0598	0.0023
Sudan	23	0.0354	0.0330	0.0177	0.0765	0.0000
Tanzania	24	0.0310	0.0282	0.0122	0.0566	0.0140
Togo	24	0.0294	0.0239	0.0395	0.1882	-0.0337
Uganda	24	0.0340	0.0320	0.0123	0.0666	0.0200
Zambia	24	0.0524	0.0482	0.0194	0.0942	0.0155

(0.47%), Comoros (0.49%), Benin (0.79%) and Kenya (1.00%) recorded lower rate of foreign investment inflow for the study period.

In Table 2, the descriptive statistics of the various variables for the study are presented. On the average, and over the time period for the study per the sample of countries, the sub-region recorded 4.31% net inflow of FDI relative to the total GDP value. The reported standard deviation

Table 2. Variable descriptive statistics

	Obs.	Mean	Median	Std. Dev.	Max.	Min.	VIF
Net FDI Inflow/ GDP	875	0.0431	0.0233	0.0960	1.6182	−0.1162	
Money Supply Uncertainty	888	0.0121	0.0113	0.1093	0.6667	−1.3337	1.06
GDP Growth Uncertainty	888	0.0060	0.0011	0.0551	1.6351	0.0000	1.08
Inflation Uncertainty	864	−0.0191	0.0016	0.4186	2.9275	−8.3918	1.09
Exchange Rate Uncertainty	888	0.2803	0.0111	5.2200	154.59	0.0000	1.06
Financial Dev. Uncertainty	834	0.0011	0.0002	0.0036	0.0651	0.0000	1.20
Terms of Trade Uncertainty	888	0.1272	0.0257	0.2928	2.4679	−1.8237	1.15
Trade Uncertainty	888	0.0510	0.0084	0.2937	5.5609	0.0000	1.04
Natural Log CO ₂ Emissions	840	7.6147	7.5416	1.5803	13.129	4.3439	1.41
GDP Growth	875	0.0469	0.0448	0.0732	1.4997	−0.3639	1.11
Fixed Telephone Subs.	888	2.4349	0.7889	4.9765	34.273	0.0000	2.21
Population Growth	880	0.0253	0.0265	0.0096	0.0812	−0.0062	1.78
Gov't Effectiveness	839	−0.7291	−0.7623	0.5983	1.0570	−1.8849	7.11
Political Stability	840	−0.4980	−0.3633	0.8633	1.2192	−2.6992	2.00
Regulatory Quality	840	−0.6263	−0.6098	0.5806	1.1273	−2.2749	6.09

(higher than the mean) however indicates variability in foreign investment inflow from one country to the other, meaning that the inflows of foreign investment in the sub-region are not evenly distributed among the various countries in the region. The institutional and governance variables depict negative averages, an indication of the relatively lower strength of quality of governance and institutions in SSA, comparing to other regions of the globe. Can these institutions therefore moderate the effect of risk in macroeconomic factors and environmental sustainability on the degree of FDI inflow in the region?

We also proceed to subject the dataset to variable acceptability test for model specification by using the variance inflation factor (VIF), with the results also presented in Table 2. Liao and Valliant (2012) recommend maximum threshold of VIF of 10, beyond which a variable is deemed unacceptable for model specification. Following this threshold, and as observed from the table, none of the variables has VIF in excess of 10. We hence proceed to accept all the variables for the purpose of the analyses. In Table 3, the Pearson's correlation matrix is also presented to verify the level of multicollinearity among the variables. Following the recommendation of maximum threshold of 0.85 by Elith et al. (2006), it can be observed that in general, the variables do not portray multicollinearity issues since the reported correlation between the variables are below 0.85, with the exception of correlation between government effectiveness and regulatory quality indexes.

5. Empirical results and analysis

This section of the paper concentrates on analyzing the findings of the various models estimated with the aim of realizing the objectives set out in the study. Presented first in Table 4 is the result of the model purported at examining the influence of uncertainty (risk) in various macroeconomic factors on FDIs (i.e., Equation 3) and when CO₂ emission was introduced into the model to verify the impact of environmental sustainability risk on the inflow of net FDI in the sub-region of SSA. Column (1) and (2) respectively report the outcomes. In column (1), we can observe from the table that, as we disaggregate the uncertainty data, GDP growth uncertainty, inflation uncertainty and financial development uncertainty exert positive impact on FDI inflow into the sub-region. The results in respect of GDP growth, financial sector development and rate of inflation suggest that, as uncertainty increases, foreign investors are attracted to the region for investment purposes. This implies that risk loving foreign investors are attracted by the instability in growth of output, instability in general price level of goods and services and precarious financial system in SSA region as the ideal destination for investment. Rational risk loving investors are moved by the excessive returns offered by the markets to invest in the sub-region. These results support the work of Ang (2008), who found evidence to indicate that higher rate of macroeconomic uncertainty results in an increased FDI inflow in Malaysia. The results from the table also indicate that volatility in exchange rate negatively impact the inflow of FDI into the sub-region, a confirmation of the aggregation bias conclusion observed by Asamoah et al. (2016). However, there is no evidence to suggest that uncertainty in money supply, terms of trade uncertainty and trade openness uncertainty affect the inflow of foreign investment into the sub-region. The results also show that growth in GDP and stable political atmosphere have significant positive impact on foreign investment inflow into SSA, conforming to general expectations; regulatory quality strikingly has negative influence on the inflow of investment into the sub-region, buttressing the pollution haven hypothesis in the sub-region.

In column (2), the study verifies the effect of CO₂ emissions on FDI inflow in SSA by introducing the natural log of CO₂ emission in the model. The outcome indicates that even though there is a negative impact exerted on FDI inflow by CO₂ emission, the magnitude of influence is insignificant. This implies that foreign investors' decision in respect of investment in SSA does not depend on the level of CO₂ emission. It also shows that the sub-region appears as an attractive investment destination for investors who generally do not consider the discourse on environmental degradation as priority in investment decisions.

Table 5 investigates the moderating role of government effectiveness in the nexus between the various macroeconomic uncertainty variables and CO₂ emission on the inflow of foreign investment into the sub-region. Columns (1) to (8) present the results of the influential role of governance effectiveness on one hand with macroeconomic risk (disaggregated as money supply uncertainty, GDP growth uncertainty, inflation uncertainty, exchange rate uncertainty, financial development uncertainty, terms of trade uncertainty, trade uncertainty) and CO₂ emission respectively. Apart from the interactions with GDP growth uncertainty and inflation uncertainty, which moderates the magnitude of the influence on net FDI from 6.447 to 4.272 and -0.266 to -0.189 respectively (refer to columns (2) and (3)), the rest of the interactions have no influence on FDI. With respect to governance effectiveness and GDP growth uncertainty interaction, the result implies that foreign investors prefer to invest in the sub-region when there exists general state of instability in the macroeconomic environment. For the interaction between inflation uncertainty and governance effectiveness, the result signifies that as the governance structures improve, investors who were hitherto attracted to the sub-region significantly reduce their investment portfolios. These observed outcomes also mean that the sub-region attracts foreign investors who prefer environments with rising rate of inflation,¹ general instability in the macroeconomic environment and deteriorating level of governance. This implies that the sub-region attracts foreign investors who prefer precarious and poorly governed environments; investors attracted to the sub-region are therefore the speculative type, who focus only on returns rather than supplementing the long-term growth agenda of economies.

Table 3. Pairwise correlation matrix

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
Net FDI Inflow/ GDP (A)	1														
Money Supply Uncertainty (B)	0.02	1													
GDP Growth Uncertainty (C)	0.28	0.06	1												
Inflation Uncertainty (D)	0.03	0.02	0.01	1											
Exchange Rate Uncertainty (E)	-0.02	0.01	-0.01	0.14	1										
Financial Dev. Uncertainty (F)	-0.02	-0.01	-0.02	0.02	-0.02	1									
Terms of Trade Uncertainty (G)	0.04	0.04	0.09	0.01	0.02	-0.05	1								
Trade Uncertainty (H)	0.07	0.05	0.01	0.01	-0.01	-0.01	-0.04	1							
Natural Log CO2 Emissions (I)	-0.08	-0.08	-0.06	0.16	0.05	0.29	0.03	-0.07	1						
GDP Growth (J)	0.32	-0.05	0.18	0.02	0.00	-0.06	0.02	0.03	0.02	1					
Fixed Telephone Subs. (K)	-0.05	-0.01	-0.03	-0.02	-0.03	0.34	-0.13	-0.04	0.22	-0.04	1				
Population Growth (L)	0.12	0.01	0.12	0.02	0.00	-0.25	0.20	0.08	-0.21	0.18	-0.59	1			
Gov't Effectiveness (M)	-0.09	-0.12	-0.09	0.12	-0.06	0.33	-0.27	-0.10	0.39	0.02	0.64	-0.51	1		
Political Stability (N)	0.04	-0.17	0.01	-0.05	-0.16	0.17	-0.14	-0.09	-0.02	0.02	0.46	-0.26	0.58	1	
Regulatory Quality (O)	-0.13	-0.14	-0.12	0.07	-0.10	0.29	-0.20	-0.13	0.36	-0.04	0.59	-0.44	0.90	0.60	1

In Table 6, the moderating effect of political stability in the nexus between uncertainty in the various macroeconomic factors and CO2 emission on net inflow of foreign investment in SSA is analyzed and presented. Columns (1) to (8) are defined as in Table 5. Reported results in the table show that political stability does not exert any significant effect in moderating the relationship between uncertainty in all the macroeconomic variables (money supply, GDP growth, inflation, exchange rate, financial development terms of trade and trade openness) and CO2 emission on FDI. Though political stability has been found to be essential in attracting foreign direct investment on its own, the results from the interaction variables suggest otherwise. This means that, when economies in the sub-region are characterized by instability in key macroeconomic factors, the

Table 4. Effect of environmental risk on net investment inflow in SSA

	(1)	(2)
Money Supply Uncertainty	0.0210 (1.07)	0.0228 (0.83)
GDP Growth Uncertainty	0.338*** (5.69)	0.338*** (5.30)
Inflation Uncertainty	0.0157** (2.33)	0.0288** (2.44)
Exchange Rate Uncertainty	-0.00230** (-2.44)	-0.00244** (-2.33)
Financial Dev. Uncertainty	1.042** (2.46)	0.839* (1.79)
Terms of Trade Uncertainty	0.00344 (0.29)	0.000616 (0.05)
Trade Uncertainty	0.0148 (0.32)	0.0137 (0.27)
Government Effectiveness	-0.00604 (-0.39)	-0.0117 (-0.67)
Political Stability	0.0179*** (4.79)	0.0162*** (3.55)
Regulatory Quality	-0.0334** (-2.25)	-0.0236 (-1.44)
GDP Growth	0.505*** (5.22)	0.551*** (5.17)
Fixed Telephone Subs.	0.000304 (0.74)	0.000408 (0.88)
Population Growth	0.0295 (0.08)	0.0290 (0.07)
Natural Log-CO2 Emissions		-0.000946 (-0.63)
Constant	0.00279 (0.27)	0.00901 (0.50)
Observations	736	662
No. of Countries	37	37
R-Sq.	0.169	0.179
Wald Chi2	147.2	127.8
Prob.	7.60e-25	1.88e-20

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. t statistics in parentheses.

Table 5. Moderating role of government effectiveness-relationship between environmental risk and foreign investment inflow

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Money Supply Uncertainty	-0.0700	0.0282	0.0234	0.0228	0.0227	0.0238	0.0219	0.0225
GDP Growth Uncertainty	(-0.71) 0.333***	(1.01) 6.447***	(0.85) 0.338***	(0.83) 0.338***	(0.83) 0.338***	(0.87) 0.340***	(0.80) 0.339***	(0.82) 0.335***
Inflation Uncertainty	(5.01) 0.0267**	(3.89) 0.0284**	(5.29) -0.266	(5.30) 0.0289**	(5.32) 0.0286**	(5.35) 0.0295**	(5.36) 0.0287**	(5.28) 0.0312**
Exchange Rate Uncertainty	(2.41) -0.00232**	(2.47) -0.00230**	(-1.63) -0.00000477	(2.44) -0.000131	(2.42) -0.00243**	(2.41) -0.00245**	(2.42) -0.00247**	(2.38) -0.00238**
Financial Dev. Uncertainty	(-2.21) 0.789*	(-2.24) 0.775*	(-0.00) 0.806*	(-0.01) 0.838*	(-2.32) 0.952*	(-2.36) 0.868*	(-2.34) 0.620	(-2.30) 0.703
Terms of Trade Uncertainty	(1.69) 0.000956	(1.74) 0.00228	(1.75) -0.0000207	(1.79) 0.000657	(1.82) 0.000576	(1.82) 0.0425**	(0.90) 0.00108	(1.53) 0.000982
Trade Uncertainty	(0.07) 0.0132	(0.19) 0.0137	(-0.00) 0.0135	(0.05) 0.0136	(0.05) 0.0137	(2.05) 0.0135	(0.08) 0.267	(0.08) 0.0133
Natural Log-CO2 Emissions	(0.27) -0.00128	(0.28) 0.000385	(0.27) -0.00104	(0.27) -0.000924	(0.27) -0.000968	(0.27) -0.000827	(0.44) -0.000762	(0.27) 0.000265

(Continued)

Table 5. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(-0.87)	(0.25)	(-0.69)	(-0.62)	(-0.65)	(-0.54)	(-0.49)	(0.19)
Government Effectiveness		-0.00852	-0.0219	-0.0116	-0.0117	-0.0109	-0.0156	-0.0135
-0.0267								
	(-0.50)	(-1.27)	(-0.66)	(-0.67)	(-0.61)	(-0.88)	(-0.73)	(-1.27)
Political Stability	0.0160***	0.0174***	0.0166***	0.0162***	0.0162***	0.0166***	0.0163***	0.0164***
	(3.59)	(3.67)	(3.59)	(3.54)	(3.54)	(3.61)	(3.59)	(3.60)
Regulatory Quality	-0.0213	-0.0207	-0.0240	-0.0236	-0.0238	-0.0240	-0.0247	-0.0239
	(-1.29)	(-1.28)	(-1.45)	(-1.43)	(-1.45)	(-1.47)	(-1.55)	(-1.45)
GDP Growth	0.556***	0.508***	0.550***	0.551***	0.551***	0.545***	0.545***	0.554***
	(5.14)	(4.73)	(5.15)	(5.17)	(5.17)	(5.12)	(5.10)	(5.18)
Fixed Telephone Subs.	0.000198	0.000663	0.000309	0.000414	0.000467	0.000691	0.000388	0.000370
	(0.41)	(1.40)	(0.68)	(0.89)	(1.04)	(1.40)	(0.85)	(0.83)
Population Growth	-0.00364	-0.0128	-0.0403	0.0266	0.0360	0.0466	-0.0103	0.0585
	(-0.01)	(-0.03)	(-0.10)	(0.06)	(0.09)	(0.11)	(-0.03)	(0.14)
GE*MS_U	-0.134							
	(-0.77)							
GE*GDP_U		4.272***						
		(3.70)						
GE*INFL_U			-0.189*					
			(-1.78)					

(Continued)

Table 5. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GE*EXR_U				0.00228 (0.25)				
GE*FD_U					-0.693 (-0.77)			
GE*TOT_U						0.0331 (1.63)		
GE*TO_U							0.194 (0.41)	
GE*LnCO2								0.00192 (1.26)
Constant	0.0153 (0.87)	-0.00848 (-0.44)	0.0130 (0.72)	0.00880 (0.49)	0.00911 (0.50)	0.00322 (0.17)	0.00542 (0.25)	-0.00193 (-0.10)
Observations		662	662	662	662	662	662	662
662								
No. of Countries	37	37	37	37	37	37	37	37
R-Sq.	0.180	0.191	0.180	0.179	0.179	0.180	0.181	0.179
Wald Chi2	129.2	148.7	138.3	129.3	133.2	140.9	129.7	168.0
Prob.	3.11e-20	4.30e-24	4.92e-22	2.88e-20	5.10e-21	1.55e-22	2.49e-20	6.12e-28

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. t statistics in parentheses. MS_U = Money Supply Uncertainty, GDP_U = GDP Growth Uncertainty, INFL_U = Inflation Uncertainty, EXR_U = Exchange Rate Uncertainty, FD_U = Financial Development Uncertainty, TOT_U = Terms of Trade Uncertainty, TO_U = Trade Openness Uncertainty, LnCO2 = Natural Log of CO2 Emissions, GE = Government Effectiveness.

Table 6. Moderating role of political stability-relationship between environmental risk and foreign investment inflow

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Money Supply Uncertainty	0.0306	0.0217	0.0207	0.0206	0.0226	0.0217	0.0220	0.0241
	(0.81)	(0.80)	(0.75)	(0.76)	(0.83)	(0.80)	(0.80)	(0.88)
GDP Growth Uncertainty	0.337***	0.373***	0.337***	0.337***	0.338***	0.333***	0.338***	0.338***
	(5.27)	(5.23)	(5.28)	(5.23)	(5.30)	(5.21)	(5.33)	(5.20)
Inflation Uncertainty	0.0271**	0.0291**	0.0233*	0.0295**	0.0290**	0.0293**	0.0282**	0.0272**
	(2.37)	(2.44)	(1.90)	(2.49)	(2.45)	(2.49)	(2.29)	(2.35)
Exchange Rate Uncertainty	-0.00243**	-0.00258**	-0.00465	-0.0880	-0.00242**	-0.00230**	-0.00251**	-0.00214**
	(-2.28)	(-2.50)	(-1.62)	(-1.49)	(-2.31)	(-2.08)	(-2.54)	(-2.19)
Financial Dev. Uncertainty	0.816*	0.859*	0.842*	0.797*	0.951**	0.882*	0.738	0.764*
	(1.77)	(1.82)	(1.80)	(1.73)	(1.97)	(1.83)	(1.02)	(1.68)
Terms of Trade Uncertainty	0.000896	0.000316	0.000317	0.000907	0.000598	0.0148	0.000918	0.000197
	(0.07)	(0.02)	(0.02)	(0.07)	(0.05)	(1.05)	(0.07)	(0.02)
Trade Uncertainty	0.0130	0.0143	0.0136	0.0134	0.0136	0.0135	0.0927	0.0127
	(0.26)	(0.29)	(0.27)	(0.27)	(0.27)	(0.27)	(0.22)	(0.26)
Natural Log-CO2 Emissions	-0.000953	-0.00116	-0.000952	-0.000545	-0.00108	-0.00111	-0.00101	0.00144
	(-0.63)	(-0.80)	(-0.63)	(-0.34)	(-0.71)	(-0.74)	(-0.69)	(0.69)
Government Effectiveness	-0.0107	-0.0107	-0.0121	-0.0112	-0.0116	-0.0116	-0.0107	-0.0133
	(-0.61)	(-0.61)	(-0.69)	(-0.65)	(-0.66)	(-0.65)	(-0.64)	(-0.77)
Political Stability	0.0174***	0.0150***	0.0165***	0.0167***	0.0164***	0.0133***	0.0152**	-0.00666

(Continued)

Table 6. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regulatory Quality	(3.39) -0.0230 (-1.40)	(3.33) -0.0247 (-1.51)	(3.59) -0.0235 (-1.43)	(3.62) -0.0250 (-1.51)	(3.48) -0.0237 (-1.44)	(2.63) -0.0229 (-1.40)	(2.39) -0.0246* (-1.67)	(-0.38) -0.0235 (-1.43)
GDP Growth	0.554*** (5.13)	0.557*** (5.14)	0.554*** (5.15)	0.552*** (5.18)	0.552*** (5.17)	0.551*** (5.18)	0.546*** (5.31)	0.559*** (5.26)
Fixed Telephone Subs.	0.000365 (0.79)	0.000483 (1.06)	0.000438 (0.93)	0.000345 (0.77)	0.000419 (0.91)	0.000501 (1.06)	0.000425 (0.93)	0.000300 (0.70)
Population Growth	0.0782 (0.19)	0.0637 (0.15)	0.0302 (0.07)	-0.00502 (-0.01)	0.0263 (0.06)	-0.0261 (-0.06)	0.0232 (0.06)	-0.00815 (-0.02)
PS*MS_U	-0.0528 (-0.63)							
PS*GDP_U		0.351 (0.84)						
PS*INFL_U			-0.0386 (-0.91)					
PS*EXR_U				-0.0347 (-1.45)				
PS*FD_U					-0.246 (-0.43)			
PS*TOT_U						0.0174 (1.20)		
PS*TO_U							0.0606 (0.19)	
PS*LnCO2								0.00294

(Continued)

Table 6. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.00814 (0.44)	0.00936 (0.53)	0.00867 (0.48)	0.00812 (0.45)	0.0100 (0.55)	0.0103 (0.58)	0.00890 (0.49)	-0.00956 (-0.44)
Observations	662	662	662	662	662	662	662	662
No. of Countries	37	37	37	37	37	37	37	37
R-Sq.	0.179	0.180	0.179	0.179	0.179	0.180	0.179	0.180
Wald Chi2	127.0	128.6	134.2	129.6	130.1	134.2	130.6	129.0
Prob.	8.19e-20	4.04e-20	3.15e-21	2.52e-20	2.01e-20	3.22e-21	1.60e-20	3.31e-20

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. MS_U = Money Supply Uncertainty, GDP_U = GDP Growth Uncertainty, INFL_U = Inflation Uncertainty, EXR_U = Exchange Rate Uncertainty, FD_U = Financial Development Uncertainty, TOT_U = Terms of Trade Uncertainty, TO_U = Trade Openness Uncertainty, LnCO2 = Natural Log of CO2 Emissions, PS = Political Stability.

Table 7. Moderating role of regulatory quality-relationship between environmental risk and foreign investment inflow

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Money Supply Uncertainty	-0.0860	0.0214	0.0219	0.0217	0.0228	0.0189	0.0224	0.0221
	(-0.72)	(0.76)	(0.79)	(0.79)	(0.83)	(0.67)	(0.82)	(0.81)
GDP Growth Uncertainty	0.328***	1.278	0.336***	0.338***	0.339***	0.324***	0.339***	0.327***
	(4.75)	(0.59)	(5.23)	(5.29)	(5.36)	(4.94)	(5.34)	(5.17)
Inflation Uncertainty	0.0258**	0.0279**	-0.241***	0.0287**	0.0282**	0.0281**	0.0283**	0.0333**
	(2.26)	(2.50)	(-2.64)	(2.46)	(2.43)	(2.50)	(2.37)	(2.38)
Exchange Rate Uncertainty	-0.00232**	-0.00239**	-0.00423***	-0.0966	-0.00238**	-0.00258**	-0.00246**	-0.00213**
	(-2.17)	(-2.29)	(-3.04)	(-1.23)	(-2.28)	(-2.35)	(-2.37)	(-2.07)
Financial Dev. Uncertainty	0.791*	0.839*	0.841*	0.841*	1.082**	0.836*	0.734	0.545
	(1.69)	(1.80)	(1.81)	(1.80)	(2.14)	(1.81)	(1.26)	(1.18)
Terms of Trade Uncertainty	0.000920	0.000666	-0.000775	0.000310	0.000521	-0.0448**	0.00111	0.00178
	(0.07)	(0.05)	(-0.06)	(0.02)	(0.04)	(-2.24)	(0.09)	(0.14)
Trade Uncertainty	0.0123	0.0137	0.0133	0.0137	0.0137	0.0146	0.131	0.0123
	(0.25)	(0.28)	(0.27)	(0.27)	(0.28)	(0.29)	(0.32)	(0.25)
Natural Log-CO2 Emissions	-0.00147	-0.00107	-0.00119	-0.000767	-0.00107	-0.00160	-0.000902	0.00215
	(-0.93)	(-0.71)	(-0.78)	(-0.50)	(-0.73)	(-0.98)	(-0.60)	(1.52)
Government Effectiveness	-0.0103	-0.0109	-0.0146	-0.0117	-0.0113	-0.0117	-0.0106	-0.0122
	(-0.58)	(-0.64)	(-0.82)	(-0.67)	(-0.64)	(-0.68)	(-0.62)	(-0.70)
Political Stability	0.0156***	0.0156***	0.0168***	0.0164***	0.0159***	0.0154***	0.0162***	0.0168***

(Continued)

Table 7. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regulatory Quality	(3.49) -0.0163 (-0.97)	(3.33) -0.0236 (-1.44)	(3.62) -0.0224 (-1.35)	(3.56) -0.0222 (-1.33)	(3.49) -0.0219 (-1.34)	(3.31) -0.0152 (-0.86)	(3.59) -0.0259 (-1.62)	(3.73) -0.0674** (-2.33)
GDP Growth	0.559*** (5.11)	0.547*** (5.08)	0.557*** (5.19)	0.554*** (5.20)	0.552*** (5.19)	0.553*** (5.14)	0.545*** (5.07)	0.557*** (5.24)
Fixed Telephone Subs.	0.000120 (0.23)	0.000360 (0.80)	0.000432 (0.91)	0.000302 (0.66)	0.000634 (1.43)	-0.0000344 (-0.06)	0.000395 (0.86)	0.000322 (0.73)
Population Growth	-0.0125 (-0.03)	-0.0353 (-0.08)	-0.0522 (-0.13)	0.0268 (0.07)	0.0423 (0.10)	-0.0711 (-0.17)	0.00136 (0.00)	0.105 (0.25)
RQ*MS_U	-0.201 (-0.79)							
RQ*GDP_U		0.589 (0.43)						
RQ*INFL_U			-0.250*** (-2.91)					
RQ*EXR_U				-0.0690 (-1.20)				
RQ*FD_U					-2.641* (-1.86)			
RQ*TOT_U						-0.0528 (-1.62)		
RQ*TO_U							0.0841 (0.29)	
RQ*LnCO2								0.00552**

(Continued)

Table 7. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.0178 (0.92)	0.0111 (0.61)	0.0129 (0.72)	0.00961 (0.53)	0.00974 (0.54)	0.0226 (1.09)	0.00805 (0.43)	-0.0193 (-1.00)
Observations	662	662	662	662	662	662	662	662
No. of Countries	37	37	37	37	37	37	37	37
R-Sq.	0.181	0.179	0.181	0.179	0.179	0.181	0.180	0.181
Wald Chi2	125.3	126.6	125.8	139.0	138.5	132.1	129.7	134.1
Prob.	1.73e-19	9.66e-20	1.38e-19	3.70e-22	4.61e-22	8.33e-21	2.41e-20	3.41e-21

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses. MS_U = Money Supply Uncertainty, GDP_U = GDP Growth Uncertainty, INFL_U = Inflation Uncertainty, EXR_U = Exchange Rate Uncertainty, FD_U = Financial Development Uncertainty, TOT_U = Terms of Trade Uncertainty, TO_U = Trade Openness Uncertainty, LnCO2 = Natural Log of CO2 Emissions, RQ = Regulatory Quality.

state of political atmosphere may be irrelevant in attracting FDI. It also implies that the precarious state of macroeconomic environment is enough basis for decisions by foreign investors to engage in SSA, an indication of the sources of funds (speculative type) attracted to the sub-region.

Finally, in Table 7, we also report on the influential role of regulatory quality on the nexus between uncertainty in the various macroeconomic variables, CO2 emissions and FDI inflow in the sub-region. The results from columns (3) and (8) show that when we interacted regulatory quality with the variables of interest, the signs and the magnitudes of inflation uncertainty and CO2 emission barely changed. However, the interaction between regulatory quality and financial development uncertainty results in not only the directional impact changing from positive to negative, but also the magnitude changed significantly. The rest of the interactions have no effect on FDI. These results indicate that as the level of quality of regulations in the sub-region improves, FDI inflow reduces especially with rising level of inflation uncertainty and financial sector uncertainty. It may also be concluded per the findings that regulatory quality adversely affects the ability of the region to attract foreign direct investments since the sub-region is relatively attracted to investors who prefer poorly regulated and unstable inflationary conditions and financial environment. It can also be inferred from the interactions between regulatory quality and CO2 emission that FDIs rather increase in the midst of polluted environment in SSA. In effect, the sub-region is attracted to investors who succeed in poorly regulated environments.

In a nutshell, the study indicates that the sub-region of SSA attracts foreign investors with appetite for risk; such investors increase the value of investment in the region when there exists volatility in most of the macroeconomic variables in poorly regulated and governed environment. This concluding generally contrasts the findings from Asamoah et al. (2016) who generalized their finding by using exchange rate volatility instead of disaggregated factors of macroeconomic uncertainty as employed in the current study.

6. Conclusion and recommendations

This study aimed at analyzing the impact of environmental risk on net inflow of foreign investment into the SSA region using unbalanced panel data from 37 countries sourced from the WDI, WGI and the IMF database from 1996 to 2019. For the purpose of this paper, we looked at environmental risk from both the perspective of uncertainty in macroeconomic variables and risk in environmental sustainability. We generated volatility data for the various macroeconomic factors (money supply, GDP growth, inflation rate, exchange rate, financial development, terms of trade and trade openness) using GARCH framework and investigated the phenomena using PCSE estimation technique.

In summary, the paper concludes that GDP growth uncertainty, inflation uncertainty and financial growth uncertainty have positive effect on FDI inflow whilst exchange rate uncertainty adversely impact on the net inflow of FDI in SSA. Again, the paper reveals that uncertainty in money supply, terms of trade uncertainty and trade openness uncertainty do not significantly impact on the inflow of foreign investment into the sub-region. We observe from the results that government effectiveness has significant positive moderating role on the nexus between some specific macroeconomic uncertainty variables (GDP growth uncertainty and inflation uncertainty) and net inflow of investment into SSA. The study further concludes that the magnitude of impact of money supply uncertainty, exchange rate uncertainty, financial development uncertainty, terms of trade uncertainty and trade openness uncertainty on FDI inflow are not moderated by effectiveness of governance in the sub-region. Contrary to the conclusion that stable political environment attracts foreign direct investment, strikingly when we interacted the role of political stability on the key macroeconomic uncertainty variables and environmental risk (CO2 emissions), the study reveals that political stability does not influence the effect of these variables on inflow of FDI into the sub-region. The findings also suggest that the effect of regulatory structures on FDI is insignificant when regulatory quality is interacted with the selected macroeconomic risk and CO2 emission. In conclusion, the study infers

that the sub-region attracts investors who prefer unstable macroeconomic conditions, polluted environment, poorly regulated and governed environment, in order to fuel their speculative activities.

The study generally concludes that the sub-region of SSA attracts foreign investors with appetite for risk in poorly regulated and governed environment, contrasting conventional findings; it however supports Ang (2008)'s conclusion on macroeconomic uncertainty in Malaysia. As Ang (2008) puts it, "this is likely to be the case when foreign investors perceive a higher level of uncertainty as greater potential investment return. Hence, the results imply that the composition of FDI may have shifted towards more speculative type of foreign investment, which is not necessarily pro-growth in nature". The study recommends that policy makers in the sub-Saharan African region may want to take a second look at the freebies being handed to these speculative investors in their quest to attract pro-growth FDI.

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Note

1. The plausible reason could be that these investors know the link between inflation and interest rate.

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