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Climate Change is Real, But Who is to Blame: South, East, or West?

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Abstract:

Based on contemporary international business (IB) literature, we investigate the relationship between the net FDI inflows and carbon dioxide (CO2) emissions, in order to identify the real impact that foreign direct investment (FDI) has on sustainable development. Using selected World Development Indicators (WDI) over the years 1960-2015, this research illustrates the effect of sustainable multinational enterprises' (MNEs') FDI on global emissions. The main finding of this study indicates that the aggregate worldwide FDI net inflows are positively associated with the increases in global emissions. However, the level of global emissions is significantly reduced by MNEs through stringent internal and external compliance standards. Consequently, the evidence provided in this study is consistent with the findings of prior studies which attest to the fact that the pollution halo hypothesis is more prominent and applicable in IB research than the pollution haven hypothesis. Furthermore, this study uses Poisson regression to affirm the statistical significance of these relationships. More importantly, the key overall findings of this study reveal that the harmful effects of MNEs' FDI on global emissions is severe in Sub-Saharan Africa, North America, the Middle East and North Africa, as well as in East Asia and the Pacific, but less harmful in Europe and South Asia.

Keywords **—Multinational Enterprises, Foreign Direct Investment, Carbon dioxide Emissions, Greenhouse Gas Emissions, Sustainable Development Goals.**

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I. INTRODUCTION

Across the world many environmentalists have raised concerns about the issue of multinational enterprises (MNEs) activities and their impact on the planet 'earth'. This is why global warming has become a crucial matter that many countries put on the negotiation table at various supranational summits. The 2015 United Nations Climate Change Conference of the Parties (i.e., COP 21) led to an agreement by consensus amongst the 195 member countries to reduce their carbon output as soon as possible and to do their best to keep global warming to well below 2 degrees Celsius ([1]). This was amidst agitations by the island states of the Pacific, Seychelles, and Philippines whose existence has been threatened by sea level rise. Hence, the island states jointly demanded unsuccessfully that there should be a further 0.5 degrees Celsius reduction on the benchmark global emission rate.

Although emphasizes have been put forward by many international business (IB) scholars about this phenomenon, it has been well documented in IB literature that many MNEs transfer foreign direct investment (FDI) to countries where they have firm specific advantages (FSAs) and location-bound specific advantages (LSAs) that can result in profitable exploitation of resources ([2],[3],[4],[5],[6],[7]). Furthermore, scholarly studies have swayed from researching the impact of investors' haven on MNE FDI to the impact that pollution havens have on outward and inward MNE FDI. According to Mabey & McNally [8] pollution havens hypothesis "basically states that companies will move their operations to less developed countries in order to take advantage of less stringent environmental regulations. In addition, all countries may purposely undervalue their environment in order to attract new investment. Either way this leads to excessive (non-optimal) levels of pollution and environmental degradation". In a more

unequivocal outburst, the outgoing President of the United States of America, Barack Obama has advocated for a price to be placed on carbon emissions on MNEs ([9]).

This study builds on the previous studies of researchers in order to find out if the effect of sustainable MNEs FDI will augment global emissions. Thus, this article attempts to fill the gap in existing empirical and theoretical literature that does not tacitly state the impact of this phenomenon on the planet, as anticipated by climate change advocates.

The rest of the paper is structured as follows: Section II reviews the relevant background literature and the hypotheses development part of this study. Section III deals with the empirical methodology, while Section IV presents the empirical results, and Section V focuses on the discussions and conclusion of the study.

II. BACKGROUND AND HYPOTHESIS DEVELOPMENT

Contemporary research reveals that IB involves the replication of ideas, knowledge, skills/talent and resources (by MNEs) to generate an iterative conflation of products and services (see [2],[3],[4],[5],[7]). For this process to be repetitive, MNEs use FDI to transfer resources from various areas to another location. The fDi Report [10] reveals that against a background of global geopolitical and economic uncertainty, MNEs' greenfield FDI levels have continued to rise, resulting in a total capital investment of about $713 billion resulting in about 11,930 projects and creating about 1.9 million jobs globally in mainly the extractive industries (particularly in the coal, oil and natural gas sectors of the world economy).

According to the United Nations Conference on Trade and Development –UNCTAD [11] global FDI inflows declined by 16 per cent to $1.23 trillion in 2014, mostly because of the fragility of the global economy, policy uncertainty for investors, (especially because of various regional negotiations) and elevated geopolitical risks. In fact, this fuss in the new world order resulted in new investments, which were also offset by large divestments. Notwithstanding the global demand for a new climate order, increasing human population needs to be catered for by sophisticated human ingenuity that is supported by MNEs through the reallocation of resources through FDIs. If not, the Malthusian notion that population tended to outstrip the food supply, may hold if there is a global resolve to preserve the earth, because many continents like Africa, Asia and South America are unprepared for this and stand a strong chance of starvation due to grinding poverty, ever-recurring epidemics, famine and wars being fought for the control of available resources ([12]).

Apparently, some pundits may disagree with the climate change rave, the way that Malthus assumption that "the strange contrast between over-care in breeding animals and carelessness in breeding men" can result in demagogue was debunked ([13]). According to the National Aeronautics and Space Administration – NASA [14] the Antarctic sea ice have reached a new record maximum area (weblink: Antarctic sea ice reaches new record maximum http://www.nasa.gov/sites/default/files/antarctic_seaice_sept19_1.jpg), however, studies show that globally, the decreases in Arctic sea ice far exceed the increases in Antarctic sea ice (weblink: global sea ice diminishing despite Antarctic gains http://www.nasa.gov/content/goddard/nasa-study-shows-global-sea-ice-diminishing-despite-antarctic-gains).

HowMuch.net [15] posits that when country sizes are morphed by the amount of FDI it attracts (as shown in Fig. 1), China, Hong Kong, United States, United Kingdom and Singapore are the countries with the highest rate of inward FDI in the world. However, some notable characteristics of these countries are that they have large market size with huge growth prospects, and are located in close proximity with other similar FDI attracting economies, which are majorly heavy polluters due to the high-technology manufacturing that takes place in these countries. Furthermore, the degree of economic freedom did not deter foreign investors

from participating in mostly unfree economies such as Brazil, India, China and Russia (BRIC) as widely publicized in IB literature. However, free countries and mostly free countries attracted a large share of the global FDI, unlike repressed economies that got the least share of FDI in mineral-rich but corruption-prone economies ([16]).

Fig. 1 FDI map of the world, *Source*: HowMuch.net [15]

According to the United Nations [17] the adoption of the Addis Ababa Action Agenda (AAAA) means that "a new global framework for financing sustainable development that aligns all financing flows and international and domestic policies with economic, social and environmental priorities… [will be implemented and] draw upon all sources of finance, promote technology and innovation, reform trade, harness data, and address systemic issues to transform the global economy and achieve the Sustainable Development Goals (SDGs)… [Which] is an integral part of the 2030 Agenda for Sustainable Development".

Fig. 2 shows that net resource transfers (which is made up of the net flow of capital and capital servicing, the net foreign earnings of labor, plus the net change in reserves) has been negative for many decades. This implies that FDI resources are flowing from developing to developed countries. Whereas, the developed countries have consistently benefited from the virtuous cycle of economic development, least developed countries (LDCs) with acute resource deficits receives little FDI transfers in net terms, and are perpetually trapped in the vicious cycle of poverty, as a result of this global imbalance. In 2015, about $700 billion of capital left both the developing and transition economies, which is a new global minimum benchmark in net outflows, surpassing the Great Recession decline level.

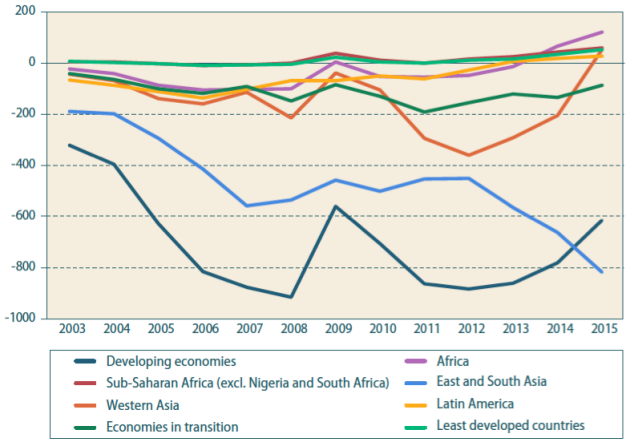

Fig. 2 Net transfer of resources to developing economies and economies in transition (in billion US $), 2003–2015, *Source*: United Nations [17]

Some IB researchers have suggested that the widely held notion that FDIs led to economic growth have resulted to increased scrutiny by both the media and government authorities on the activities of MNEs worldwide, because the profitable exploitation of natural resources attracts commensurate responsibilities and taxes. Mabey and McNally [8] rightly points out that the effects of FDI on the environment became a major topic of discussion particularly as FDI often goes directly into resource extraction, infrastructure and manufacturing operations in relatively underestimated sectors of the economy in Africa and other transition economies of Eastern Europe, where they have their largest FDI penetration, unlike the rest of the world that aggregate FDI flows into these sectors of the economy are in decline.

The finding of the study carried out by Aliyu and Ismail [18] indicate that energy consumption does have a positive elasticity effect on Carbon dioxide (CO2) emissions, and provides empirical evidence to substantiate the pollution haven hypothesis for

CO2 emissions, because energy intensity associated with FDI inflows has significant increasing effect on the greenhouse gas emissions across the sample countries.

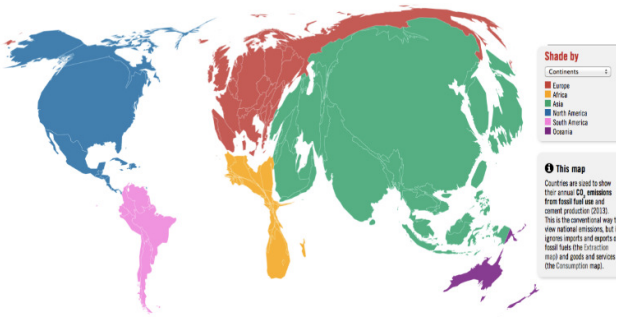

Figure 3 The Carbon Map of Global Emissions, *Source*: CarbonMap.Org [19]

Fig. 3 shows the morphed carbon map of global emissions, which illustrates the fact that Asia, North America and Europe are the greatest polluters in the world. While South America, Africa and Oceania are the least polluters. This implies that any successful supranational agenda to reduce global emissions and increase the level of sustainable development in the world needs to be adopted and implemented by Asia, North America and Europe. Liang [20] observed that FDI could be beneficial to a developing country's economy and environment when MNEs crowd out inefficient local firms that are not environmentally conscious through the use of efficient technology in the host country, as purported by the pollution halos hypothesis. This raises environmental standards, and runs contrary to the widely held view that relatively lenient environmental policies in the developing countries gives them a comparative advantage when attracting pollution intensive manufacturing that might harm the host country's environment ([21]).

Smarzynska and Wei [22] admitted that the pollution haven hypothesis is plausible, even with relatively weak empirical data to back it up. However, the dirty secret that needs to be uncovered includes the possibility that host country bureaucratic corruption may deter inward FDI, but are positively correlated with laxity of environmental standards. Moreover, empirical researches on this phenomenon have attributed these undesirable outcomes in part to complications with finding exogenous measures of regulatory stringency and to particular forms of unobserved heterogeneity, such as a lack of geographic mobility or the high capital intensity of polluting industries ([23]).

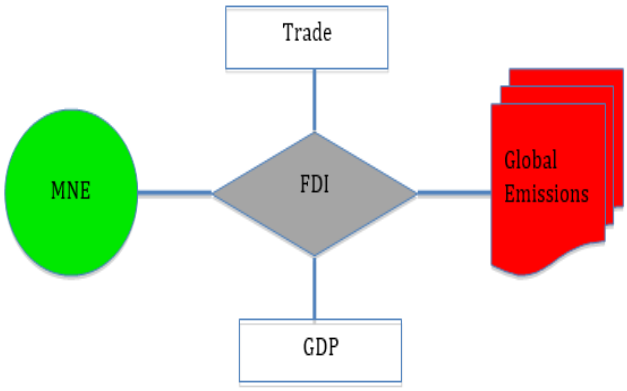

Fig. 4 Conceptual model of the study

Taken together, several researchers have linked MNE's FDI growth to increased levels of trade and GDP growth ([2],[3],[4],[5],[7]). However, the findings of few studies have linked FDI to higher levels of global emissions ([21],[20],[23],[18]). Using these theoretical lenses that are based on the pollution halo hypothesis and the pollution haven hypothesis, I develop a conceptual framework and posit hypotheses on the influence of MNE's FDI on global emissions. This framework is depicted in Figure 4. Interestingly, studies carried out by the Centre for Global Geography Education [12] reveals that humanity faces significant threats from the impact of climate change on the environment. According to the United Nations [17] the net transfer of resources to developing economies and economies in transition have contributed not just to the development of these regions, but have also caused substantial levels of air, water, noise and land pollution. This is why the implementation of the SDGs binds all nations to comply with the COP 21 agreement, and also mandates MNEs to reduce their carbon footprints. As such, the issue of sustainable development has become an integral base for

compliance and responsibility all over the world in IB literature ([1]).

Based on this conceptual framework, a theoretical model was developed, in order to derive formal propositions for this study. Besides, this model describes the salient intuition that forms the background of this study, while detailed econometric derivation and supporting arguments are explicated fully in the empirical investigation section of this study. Following prior work by Wagner and Timmins [23] we deduce the following hypotheses:

Hypothesis 1: The world FDI net inflows are positively associated with the increases in global emissions.
Hypothesis 2: The FDI net inflows into Sub-Saharan Africa are positively associated with the increases in global emissions on the continent.
Hypothesis 3: The FDI net inflows into North America are positively associated with the increases in global emissions on the continent.
Hypothesis 4: The FDI net inflows into the European Union are positively associated with the increases in global emissions on the continent.
Hypothesis 5: The FDI net inflows into the Middle East and North Africa are positively associated with the increases in global emissions on the continent.
Hypothesis 6: The FDI net inflows into East Asia and the Pacific are positively associated with the increases in global emissions on the continent.
Hypothesis 7: The FDI net inflows into South Asia are positively associated with the increases in global emissions on the continent.

III. EMPIRICAL METHODOLOGY

A. Empirical Investigation

We test the predictions of our model using a data sample of the net global FDI inflows of the world and the global emissions level, as well as other relevant variables during the period 1960-2015. Our sample duration was selected because the compilation of the relevant data on this phenomenon began in 1960 till date. Apart from the worldwide data that is used in this study, regional data were collated for Sub-Saharan Africa, North America, European Union, Middle East and North Africa, East Africa and Pacific, and South Asia. The dataset elements and the diverse sources from which they are aggregated are described below.

B. WDI Data

The world development indicators (WDI), which is provided by the World Bank, contains data on over 1,420 major macroeconomic indicators covering statistics from all the countries of the globe. The WDI has been consistently used in various studies relating to the impact of FDI on national growth and development, and on studies concerning global emissions, et cetera by researchers, private institutions, supranational bodies and government ([24],[16],[25]). Information on sixteen (16) variables was elicited from the WDI database (see Table A1). In addition, the annual data collated was used to estimate the yearly impact of these indicators on both global and continental emissions level during the period between 1960-2015.

C. Methodology

The aim of the empirical part of this study is to reveal the effect of sustainable MNEs' FDI on global emissions level. The extant literature suggests that both the pollution halo hypothesis and pollution haven hypothesis influence the level of MNE's FDI inflows. Therefore, following Aliyu and Ismail [18], the global FDI net inflows is used to estimate the relationship between this phenomenon and the global emissions level.

Concerns about collinearity, heteroskedasticity, serial autocorrelation, validity and reliability issues were addressed by computing Cronbach alpha values of each variable, as well as through rigorous factor loadings, unique variances, principal component analysis (PCA) and regression analysis that utilized robust standard errors to affirm the statistical significance of these relationships. In addition, controls were used to estimate the measurement of each variable that might directly influence the analysis in order to avoid spurious correlations, so that a valid and reliable conclusion can be made.

D. Dependent Variable

Similar to Aliyu [26], the Foreign Direct Investment, net inflows (Balance of Payment - BoP, in current US$) coded as *FDInetBOPin*is the dependent variable. This variable was selected because there is no singular measure of the FDI that have consistently been surveyed across the globe. Other FDI measurements were not selected because they are not elaborate enough to be used in this study.

E. Independent Variables

The following global emissions related independent variables were employed in this study: (1) Adjusted savings: carbon dioxide damage (% of GNI) coded as *ASCO2Damage*, (2) Adjusted savings: natural resources depletion (% of GNI) coded as *ASNRD*, (3) CO2 emissions (kt) coded as *CO2Emissions*, (4) CO2 emissions from electricity and heat production, total (% of total fuel combustion) coded as *CO2EHP*, (5) CO2 emissions from manufacturing industries and construction (% of total fuel combustion) coded as *CO2MIC*, (6) CO2 emissions from residential buildings and commercial and public services (% of total fuel combustion) coded as *CO2RBCPS*, and (7) CO2 emissions from transport (% of total fuel combustion) coded as *CO2Transport*.

F. Mediators

The following mediator variables was used to determine the strength of the relationship that exists between the dependent and independent variables in this study, and are as follows: (1) Electric power consumption (kWh per capita) coded as *EPC*, (2) Forest area (sq. km) coded as *ForestA*, (3) GDP (current US$) coded as *GDP*, and (4) Manufacturing, value added (current US$) coded as *MVA*.

G. Control Variables

To account for other possible effects of sustainable MNEs' FDI on global emissions, the following variables were selected as control: (1) Mortality rate, adult, male (per 1,000 male adults) coded as *MRAM*, (2) Population, total coded as *PopulationT*, (3) Total greenhouse gas emissions (kt of CO2 equivalent) coded as *TGGE*, and (4) Trade (% of GDP) coded as *Trade*.

H. Model

A Poisson regression was used to analyse the effect of sustainable MNE's FDI on global emissions, as specified in the hypotheses section of this study. This procedure was adopted in order to avoid estimation biases. Furthermore, the predicted proportion of the estimation is represented by the formula $In\ \{E(y)\} = x\beta,\ y \sim Poisson$, where y is the expected distribution of the Poisson family y using a link identity function to rationalize the explanatory variables ([27],[28],[29]). The macro-econometrics investigation for this study was analyzed using the Poisson regression procedure of STATA (13.0) together with graphical simulations and illustrations. Consequently, all the hypotheses (i.e., 1, 2, 3, 4, 5, 6 and 7) were interpreted based on the discussed hypothesized moderation effects.

IV. RESULTS

In order to examine the reliability and internal consistency of the dataset that was used in this study, Cronbach alpha (α) test was conducted for all the econometric variables and is reported in Table 1. It can be observed that all the econometrics variables' Cronbach α were above the recommended threshold of 0.70, hovering between 0.90 to 0.95 level ([30],[31]).

Likewise, Table 1 indicates that the principal components and correlations of all the variables show that there exist fair distributions between them. In support of this analysis, the

appendix section presents a factor loading graph in Figure A1 that pinpoints variable values within the range of -1 to 1. While Figure A2 shows that the scree plot of eigenvalues after factor is characterized by a smooth "L" shaped transition. This demonstrates that the dataset has a good fit with the statistical model equation for this study.

Table 2 provides the descriptive statistics and correlations between this study's econometric variables. The correlations indicate that collinearity does not pose a problem in this study. Moreover, there exist positive and significant correlations between the effect of sustainable MNE's FDI and the level of global emissions, which is consistent with Hypothesis 1. Besides, this is consistent with Hypotheses 2, 3, 4, 5, 6 and 7, which also indicates that there exist a positive and significant relationship between the effect of sustainable MNE's FDI and the level of regional emissions (see Table 3).

As earlier stated, in order to test the seven hypotheses for this study, a Poisson regression analyses was conducted; the ensuing results are presented in Table 3. Model 1 indicates that the log likelihood value of -7.55 signifies a strong goodness of fit amongst our statistical variables and hypothesis. The pseudo-R squared value of 0.99 also implies that the variables in this model exhibit high predictive ability. Similarly, statistical measurements in Model 2, 3, 4, 5, 6 and 7 indicate that the model for this analysis can efficiently predict this study's hypotheses.

Model 1 is the baseline model that includes the effect of world FDI net inflows on global emissions, the independent variables in this equation all have a negative and significant impact on the dependent variable (except for the adjusted savings: natural resources depletion variable which has a positive but significant $|p<0.001|$ relationship with the FDI net inflows). In addition, all the mediator and control variables were negative and significant when regressed with the dependent variable (except for the manufacturing, value added in (current US$) variable which has a positive and significant relationship with FDI net inflows. I also find that very high levels of FDI net inflows accelerate the level of sustainability, since the level of CO2 emissions reduces as MNEs increases their activity levels. This is consistent with the pollution haven hypothesis ([20]).

Interestingly, I also find that Model 1 measurement of Hypothesis 1 (LR Chi-squared = 1.21, Prob > Chi2 = 0.00) has a positive and significant impact on the dependent variable, which is the FDI level. So, the hypothesis that the world FDI net inflows are positively associated with the increases in global emissions is accepted, but consistent with the work of theorists He [21] and Liang [20] the adjusted savings in the levels of global emissions is substantially reduced by MNEs in compliance to stringent internal and external regulations.

The analysis of Hypothesis 2, 3, 5 and 6 in Models 2,3, 5 and 6 reveals that the FDI net inflows into Sub-Saharan Africa, North America, Middle East and North Africa, and East Asia are jointly positively associated with the increases in global emissions on these continents (i.e., when computed with relevant emission sources). This is because the net FDI inflows into these regions significantly affected the levels of global emissions in these areas, particularly due to massive electricity and heat production, manufacturing and construction, residential buildings, commercial and public services, and transport related CO2 emissions. The findings of the statistical analysis of this study are therefore consistent with the pollution haven hypothesis in research studies carried out by Mabey and McNally [8], Wagner and Timmins [23], and Aliyu and Ismail [18].

In Models 4 and 7 it was observed that the FDI net inflows into the European Union and South Asia are jointly positively associated with the increases in global emissions on these continents ($p< 0.001$). Though, the adjusted savings from the natural resources depletion rate increases over time. This implies that the emission levels reduce over time due to stringent internal and external compliance requirements that MNEs have to conform with, as reported in Model 1, which is

TABLE I
PRINCIPAL COMPONENTS/CORRELATION/TEST SCALE

	Obs (Sign)	Eigenvalue	Difference	Proportion	Cumulative	Item-test correlation	Item-rest correlation	Average interitem correlation	Alpha
FDInetBOPin	46 (+)	12.139	9.09918	0.7587	0.7587	0.9114	0.8886	0.3723	0.8990
ASCO2Damage	45 (+)	3.01793	2.62743	0.1902	0.9552	0.2313	0.1156	0.4435	0.9228
ASNRD	45 (+)	0.39050	0.24579	0.0246	0.9798	0.3845	0.2746	0.4251	0.9173
CO2Emissions	54 (+)	0.14471	0.07765	0.0091	0.9889	0.9673	0.9544	0.3665	0.8967
CO2EHP	54 (+)	0.06707	0.01068	0.0042	0.9931	0.8922	0.8625	0.3734	0.8994
CO2MIC	54 (+)	0.05639	0.02670	0.0036	0.9967	-0.7726	-0.8244	0.5521	0.9487
CO2RBCPS	54 (-)	0.02969	0.01423	0.0019	0.9986	0.9204	0.8957	0.3702	0.8982
CO2Transport	54 (-)	0.01546	0.01070	0.0010	0.9995	-0.4982	-0.5900	0.5190	0.9418
EPC	43 (+)	0.00476	0.00101	0.0003	0.9998	0.9315	0.9116	0.3679	0.8972
ForestA	26 (-)	0.00375	0.00261	0.0002	1.0001	0.9432	0.9274	0.3710	0.8984
GDP	56 (+)	0.00114	0.00067	0.0001	1.0002	0.9754	0.9697	0.3663	0.8966
MVA	24 (+)	0.00047	0.00055	0.0000	1.0002	0.9663	0.9562	0.3691	0.8977
MRAM	55 (-)	-0.00008	0.00017	-0.0000	1.0002	0.8408	0.7867	0.3744	0.8998
PopulationT	56 (+)	-0.00025	0.00037	-0.0000	1.0002	0.9341	0.9161	0.3677	0.8972
TGGE	43 (+)	-0.00062	0.00141	-0.0000	1.0001	0.9405	0.9220	0.3700	0.8980
Trade	56 (+)	-0.00203	.	-0.0001	1.0000	0.9547	0.9405	0.3656	0.8963
Test Scale								0.3981	0.9137

TABLE II
DESCRIPTIVE STATISTICS AND CORRELATIONS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Foreign direct investment, net inflows	1.00															
2. Adjusted savings: carbon dioxide damage	0.20	1.00														
3. Adjusted savings: natural resources depletion	0.34	-0.29	1.00													
4. CO2 emissions (kt)	0.89	0.10	0.27	1.00												
5. CO2 emissions: electricity & heat production	0.79	0.19	0.03	0.95	1.00											
6. CO2 emissions: manufacturing & construction	-0.64	-0.21	0.16	-0.87	-0.97	1.00										
7. CO2 emissions: residential, commercial & govt.	0.82	0.07	0.19	0.97	0.98	-0.93	1.00									
8. CO2 emissions: transport	-0.27	-0.12	0.16	-0.61	-0.74	0.83	-0.73	1.00								
9. Electric power consumption: kWh per capita	0.86	0.21	0.12	0.98	0.97	-0.86	0.99	-0.45	1.00							
10. Forest area (sq. km)	0.81	0.48	0.76	0.91	0.99	-0.24	0.97	-0.08	0.93	1.00						
11. GDP (current US$)	0.89	0.17	0.24	0.96	0.91	-0.81	0.92	-0.51	0.98	0.91	1.00					
12. Manufacturing, value added (current US$)	0.77	-0.04	0.82	0.98	0.85	0.41	0.94	0.52	0.97	0.87	1.00	1.00				
13. Mortality rate, per 1,000 male adults	0.80	0.05	0.18	0.93	0.91	-0.88	0.94	-0.73	0.98	0.95	0.80	0.95	1.00			
14. Population, total	0.85	0.20	0.12	0.98	0.99	-0.94	0.99	-0.73	0.99	0.99	0.95	0.94	0.93	1.00		
15. Total greenhouse gas emissions (kt)	0.86	0.08	0.20	0.98	0.95	-0.84	0.97	-0.50	0.99	0.90	0.98	0.94	0.96	0.98	1.00	
16. Trade (% of GDP)	0.91	0.18	0.33	0.98	0.96	-0.89	0.97	-0.67	0.97	0.96	0.95	0.89	0.90	0.98	0.96	1.00
Mean	75.0	0.46	1.99	21.13	39.55	22.81	14.48	20.33	2087.18	40.52	25.05	7.49	247.56	5.10	38.41	40.70
Standard Deviation	8.25	0.03	1.03	71	7.15	4.11	3.59	0.91	552.23	396693.2	23.50	2.53	51.85	1.31	7415071	12.03
Minimum	12.4	0.39	0.72	9.39	28.56	17.10	8.80	18.78	1200.59	39.99	1.37	4.73	182.09	3.04	26.26	23.48
Maximum	317.2	0.52	4.37	35.85	49.42	29.40	20.76	22.00	3104.38	41.28	78.09	11.99	376.48	7.35	53.53	61.14

Notes: n=56. The CO2 emissions (kt), Forest area (sq. km), and total greenhouse gas emissions (kt) are expressed in millions. The foreign direct investment, net inflows, and total Population are expressed in billion units. TheGDP (current US$) and manufacturing, value added (current US$) figures are expressed in trillions of US $.

TABLE III
POISSON REGRESSION MODEL ANALYSIS AND RESULTS

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	957.10 (0.00)	211.79 (0.01)	1318.80 (0.01)	335.05 (0.00)	-155.64 (0.01)	34.69 (0.00)	461.20 (0.01)
Adjusted savings: carbon dioxide damage	-0.75 (0.00)	3.63 (0.00)	-1.73 (0.00)	-22.96 (0.00)	-10.45 (0.00)	-5.88 (0.00)	-1.23 (0.00)
Adjusted savings: natural resources depletion	0.36 (2.50)	-0.07 (3.75)	-4.57 (0.00)	0.31 (0.00)	0.04 (2.68)	-0.14 (2.68)	0.39 (0.00)
CO2 emissions (kt)	-1.37 (1.89)	-3.90 (2.18)	-0.00 (8.54)	-7.82 (6.19)	-2.09 (1.26)	1.10 (4.66)	2.29 (2.64)
CO2 emissions: electricity & heat production	-1.38 (4.15)	0.50 (0.00)	5.74 (0.00)	-2.79 (9.02)	0.78 (0.00)	0.17 (5.41)	-0.37 (0.00)
CO2 emissions: manufacturing & construction	-1.57 (4.91)	0.54 (0.00)	9.23 (0.00)	-3.09 (0.00)	0.26 (0.00)	0.21 (4.80)	-0.21 (0.00)
CO2 emissions: residential, commercial & govt.	-2.29 (5.01)	0.77 (0.00)	7.20 (0.00)	-3.21 (9.93)	0.72 (0.00)	0.33 (8.57)	-0.79 (0.00)
CO2 emissions: transport	-1.41 (6.55)	0.52 (0.00)	6.33 (0.00)	-3.13 (0.00)	2.09 (0.00)	0.09 (3.57)	-0.45 (0.00)
Mediators							
Electric power consumption (kWh per capita)	-0.00 (2.97)	0.00 (3.52)	0.01 (4.75)	0.00 (1.96)	0.01 (2.49)	0.00 (3.30)	0.02 (1.47)
Forest area (sq. km)	-0.00 (4.16)	-0.00 (6.56)	-0.00 (1.73)	0.00 (5.38)	-0.00 (3.94)	-8.33 (1.04)	-0.00 (7.33)
GDP (current US$)	-2.44 (1.79)	1.55 (1.87)	1.32 (7.50)	2.81 (1.07)	-2.22 (1.40)	-3.15 (7.61)	-1.13 (2.82)
Manufacturing, value added (current US$)	2.06 (1.04)	4.46 (1.34)	-4.32 (2.69)	-3.26 (8.10)	-8.48 (1.66)	5.66 (4.07)	4.94 (8.62)
Controls							
Mortality rate, per 1,000 male adults	-0.07 (4.26)	-0.02 (1.75)	-0.42 (1.49)	0.05 (3.79)	0.36 (0.00)	0.03 (8.68)	-1.00 (0.00)
Population, total	-1.14 (4.43)	-5.91 (1.46)	-1.62 (8.15)	-2.36 (2.51)	1.16 (6.56)	9.15 (1.44)	-1.06 (4.13)
Total greenhouse gas emissions (kt)	-2.44 (3.49)	1.08 (7.08)	-2.80 (1.14)	-1.74 (4.38)	3.46 (1.60)	9.83 (1.04)	-2.18 (1.41)
Trade (% of GDP)	-0.08 (5.50)	0.06 (1.63)	-0.36 (2.25)	0.09 (8.29)	-0.02 (1.75)	0.05 (3.02)	-0.00 (4.48)
Year effects	Included	Included	Included	Included	Included	Included	Included
Number of observations	56	56	56	56	56	56	56
Log likelihood	-7.55	-1.57	-224.23	-2.331	-1.66	-5.208	-9.93
LR Chi-Squared	1.21	2.46	7.13	7.12	8.53	2.85	3.69
Prob> Chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R2	0.99	0.99	1.00	0.99	1.00	1.00	1.00

Notes: All tests are two-tailed: $p < 0.001$ at 95 per cent confidence interval. Standardized coefficients reported, and standard errors are in parentheses.

consistent with the pollution halos hypothesis (see [8],[21],[20]).

Furthermore, in Model 4 it was observed the forest area increased with higher levels of FDI net inflows, unlike the net effects that resulted in the reduction of the forest area in Sub-Saharan Africa, North America, Middle East and North Africa, and East Asia and Pacific regions of the world. More so, the control variables of this study revealed that increased FDI net inflows led to a reduction in the world population, particularly in Sub-Saharan Africa, North America, the European Union and South Asia. However, the population of the Middle East and North Africa, and East Asia and Pacific regions increased with higher levels of net FDI inflows ([12],[11],[17]).

I. Additional Analyses and Robustness Checks

To ensure the robustness of the statistical analysis results, and to also explore the Poisson regression results further, additional analyses were performed. First, in the theoretical section of this study, the effect that the MNE's FDI net inflows has on global emissions was the main focus. However, another variable (i.e., Carbon Emissions in kt) that may accurately measure the impact of this phenomenon on the level of global emissions was used as the dependent variable, and the ensuing statistical analysis revealed similar results. The robustness of this study's statistical result was checked using alternative model specifications (nevertheless the result is not presented in this study). In addition, the Poisson regression analysis revealed that all the hypotheses have a positive and significant relationship. This implies that our datasets are robust and that these analyses were consistent in all iterations.

V. DISCUSSION AND CONCLUSIONS

This study epitomizes meaningful advances in several aspects with respect to calls by the United Nations [17] for a more nuanced treatment of the new global framework for financing sustainable development that aligns all financing flows and international and domestic policies with economic, social and environmental priorities in the IB literature. In particular, the pollution halo hypothesis, as observed by He [21] and Liang [20] is responsible for the new drive by MNEs to advance sustainable development in areas where they operate.

The results presented reveals that this study's Hypotheses were positive and statistically significant to collectively influence the dependent variable. Building on the success of MNE's FDI in IB, I therefore recommend that forward and backward linkages should be exploited by large MNEs to encourage the growth of trade and manufacturing value added across the globe. In addition, since the FDI net inflows contributes to substantial growth in GDP levels, as well as reduces the impact of environmental degradation on the planet, it is recommended that this form of trade facilitation should be fostered across the globe ([18]). Likewise, regional, national, state and local governments, as well as supranational bodies should integrate environmental standards into various investment policies, so that the impact of climate change can be mitigated worldwide using sustainable energy investments that improve efficiency, and also abide by global standards ([17]). Besides, I also call for the development of venous industries across the world, which should operate side-by-side with their associated arterial industry. This way, high economic growth can be consolidated with the treatment, reuse and/or sustainable recycling of the remnants from the arterial industry. Likewise, the importance of policy advocacy and intervention cannot be overemphasized in climate change debate, activism and action.

In terms of implications for future research, this study highlights the importance of sustainable MNE's FDI on global emissions, and also puts forward a notion of green development worldwide. However, this should be a lunch pad to probe other FDI net inflow related effects on the environment. I therefore recommend further research into salient areas such as how and why MNEs resist pollution havens, in favor of pollution halos, in order to determine the new trends in the field of IB research. Also, it is important to affirm that Mother Nature

have shaped the planet since the Ice Age over a period of 4.5 billion years ([32]). That said, FDI net inflows should be used to further global economic growth and help reduce the impact of poverty on the vulnerable populations of the world, where life is still at the subsistence level. In fact, empirical research that focuses on sustainable development in IB is still in its early stage, and therefore creates a gap in literature that scholars can fill.

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APPENDIX

Fig. A1Factor loadings graph

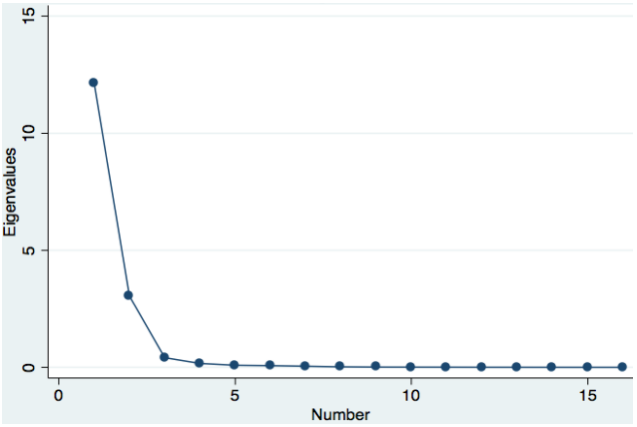

Fig. A2Scree plot of eigenvalues after factor

TABLE A1
VARIABLE DESCRIPTION AND DATA SOURCE

Variable	Description and Data Source
Foreign direct investment, net inflows (BoP, current US$)	Foreign direct investment refers to direct investment equity flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital. Ownership of 10 percent or more of the ordinary shares of voting stock is the criterion for determining the existence of a direct investment relationship - International Monetary Fund, Balance of Payments database, supplemented by data from the United Nations Conference on Trade and Development and official national sources.
Adjusted savings: carbon dioxide damage (% of GNI)	Carbon dioxide damage is estimated to be $20 per ton of carbon (the unit damage in 1995 U.S. dollars) times the number of tons of carbon emitted - World Bank staff estimates based on Samuel Fankhauser's "Valuing Climate Change: The Economics of the Greenhouse" (1995).
Adjusted savings: natural resources depletion (% of GNI)	Natural resource depletion is the sum of net forest depletion, energy depletion, and mineral depletion. Net forest depletion is unit resource rents times the excess of roundwood harvest over natural growth (capped at 25 years) - World Bank staff estimates based on sources and methods in World Bank's "The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium" (2011).
CO2 emissions (kt)	Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring - Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States.
CO2 emissions from electricity and heat production, total (% of total fuel combustion)	CO2 emissions from electricity and heat production is the sum of three IEA categories of CO2 emissions: (1) Main Activity Producer Electricity and Heat (2) Unallocated Autoproducers (3) Other Energy Industries contains emissions from fuel combusted in petroleum refineries, for the manufacture of solid fuels, coal mining, oil and gas extraction and other energy-producing industries - IEA Statistics.
CO2 emissions from manufacturing industries and construction (% of total fuel combustion)	CO2 emissions from manufacturing industries and construction contains the emissions from combustion of fuels in industry - IEA Statistics.
CO2 emissions from residential buildings and commercial and public services (% of total fuel combustion)	CO2 emissions from residential buildings and commercial and public services contains all emissions from fuel combustion in households - IEA Statistics.
CO2 emissions from transport (% of total fuel combustion)	CO2 emissions from transport contains emissions from the combustion of fuel for all transport activity, regardless of the sector, except for international marine bunkers and international aviation. This includes domestic aviation, domestic navigation, road, rail and pipeline transport - IEA Statistics.
Electric power consumption (kWh per capita)	Electric power consumption measures the production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants - IEA Statistics.
Forest area (sq. km)	Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems and trees in urban parks and gardens - Food and Agriculture Organisation.

TABLE A1 (CONTINUED)
VARIABLE DESCRIPTION AND DATA SOURCE

Variable	Description and Data Source
GDP (current US$)	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products - World Bank national accounts data, and OECD National Accounts data files.
Manufacturing, value added (current US$)	Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs - World Bank national accounts data, and OECD National Accounts data files.
Mortality rate, adult, male (per 1,000 male adults)	Adult mortality rate is the probability of dying between the ages of 15 and 60 -that is, the probability of a 15-year-old dying before reaching age 60, if subject to age-specific mortality rates of the specified year between those ages - United Nations Population Division's World Population Prospects.
Population, total	Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship - United Nations Population Division. World Population Prospects.
Total greenhouse gas emissions (kt of CO2 equivalent)	Total greenhouse gas emissions in kt of CO2 equivalent are composed of CO2 totals excluding short-cycle biomass burning (such as agricultural waste burning and Savannah burning) but including other biomass burning (such as forest fires, post-burn decay, peat fires and decay of drained peatlands), all anthropogenic CH4 sources, N2O sources and F-gases (HFCs, PFCs and SF6) - Emission Database for Global Atmospheric Research (EDGAR).
Trade (% of GDP)	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product - World Bank national accounts data, and OECD National Accounts data files.

