

Nexus between Foreign Direct Investment Inflow and EPI Score in Brazil

Tonmoy Chowdhury

Abstract—Before 1990, foreign investors could not extensively invest in Brazil because of its stringent and conservative trade policy. However, in 1990 Brazil took a remarkable shift in its trade policy from its previous trends by taking a liberal stance in terms of FDI inflow. The liberal trade policy that Brazil took in 1990 remove all the trade barriers that previously hindered the free flow of FDI in Brazil, the sign of which had been reflected in the steady and gradual incremental FDI inflow in the country after that. This New opening of trade atmosphere had brought with it two very different repercussions. In one hand, it accelerated the economic growth by bringing in investment in the needed sectors; on the other hand this acceleration spurred industrial activities that are accompanied by air and water pollution and deforestation as a byproduct. Since then, environmental health and ecosystem of Brazil have been facing tremendous threat owing to these pollution problems which may indirectly distress the EPI score of Brazil. Keeping these issues in mind, the present study investigates the relationship between FDI inflow and EPI score in Brazil. With the help of descriptive statistical tools as well as Pearson correlation test, this study finds the negative relationship between FDI inflow and EPI score in Brazil.

Index Terms—Environmental performance index (EPI), foreign direct investment, EPI score, sustainability.

I. INTRODUCTION

The industrial revolution that was *accompanied by* advancement in transportation and communication system in the eighteenth century expanded the trade and investment in the early nineteenth century. In the early twentieth century, the rate of this expansion got an unprecedented speed. But, in the middle of the twentieth century the world faced some severe crises, such as, the first world war of 1914, the great depression of 1929, and the second world war of 1933. These incidences made the motion of the trade tardy. Many countries followed protectionism trade policy to save their own economy. As trade and investment were considered to be important indicators for attaining high economic growth, few developed countries started to liberalize their trade soon after the Second World War. Later on, several developing countries including Brazil adopted liberalize trade policy in 1970. This wave of change rippled through East Asia, South Asia, East Europe and few countries in Latin America which liberalized their trade in the 1990 [1]. Though Brazil adopted liberal trade policy in the 70's but foreign direct investment was not so open during that time because of the import substitute industrial

policy. As the then Brazilian Government wanted to protect their new born industries from external competition, FDI inflow was limited in Brazil until 90s. Afterwards, due to some internal political turmoil, the Brazilian Government extensively liberalized their trade from 1990 [2], [3], [4]. This country of Latin America, with 210 million populations and plethora of natural as well as mineral resources, was always the center of attraction to the foreign investors. But in spite of great desire, before 1990, foreign investors could not invest in Brazil because of their stringent trade policy. The liberal trade policy adopted in 1990 made the path of foreign investment smooth and easy. If the trend of foreign investment is critically observed, it is found that overtime the amount of FDI inflow has been growing up. In 1970, 1980, 1990, these amounts were \$ 392 million, \$ 1910 million \$ 989 million respectively. Total FDI inflow in 2019 was \$71989 million. No doubt that this rising trend of FDI inflow brought positive impact on economic growth of Brazil but at the same time it also made acute environmental problems. Before 1990, foreign investors put greater emphasis to invest in the service, finance, and transport sectors. But after 1990, the choice of foreign investors diverted toward manufacturing sectors and the most prioritizing areas to them were mining, food manufacturing, oil and gas extraction, paper and allied products, transportation equipment etc. In 2015, eighty four percent of total assets in these industries were own by foreign companies. In 2016, Brazil was the ninth largest manufacturing country in the world [5], [6]. However, these FDI attracting sectors saw the seed of many environmental problems such as air pollution, water pollution, deforestation etc. Environmental health and ecosystem of Brazil have encountered tremendous threat owing to this impetuous expansion of manufacturing activities which may indirectly affect the EPI score of Brazil. EPI mainly works on the protection of natural environment of a country. It is a measurement technique, which measures numerically in what extent a country protects their environment. The main objectives of EPI are: 1) environmental health and 2) ecosystem vitality. Eleven issues and thirty two indicators are used to fulfill these two objectives. ESI is the previous version of EPI and ESI was effective till 2005. Yale University and Colombia University in collaboration with the World Economic Forum and with the Joint Research of the European Commission developed the index. The commission published their first report in 2002 [7]. According to the EPI report published in 2020, Brazil has been suffering from acute air pollution. Each year about forty nine thousand people died for air pollution only. Mining, ore, and metal industries are highly responsible for this air pollution. In one hand mining industries are

Manuscript received September 7, 2020; revised November 25, 2020.

The author is with Dhaka School of Economics, University of Dhaka, Dhaka, Bangladesh (e-mail: tonmoy52@yahoo.com).

polluting air by emitting CO₂ in the air and water by releasing mining waste into the lake, creek and other water bodies, on the other hand excessive expansion of agribusiness is causing deforestation at an unprecedented rate. Forty thousand hectares of forest land was cleared in Brazil from 1990 to 2005 [8]. Processed meat exportation to Europe swelled to more than double in less than a decade from 40 percent to 70 percent from 1990 to 2001. The rising demand for processed meat and dairy products in the international markets encouraged the cattle ranching and the ultimate consequences of which was deforestation. It is well known that, deforestation increases the amount of CO₂ in the atmosphere which is a major ingredient responsible for climate change. Forest is the habitat of seventy percent plant, species and animals and as a result of deforestation all these are losing their habitat. Every year thousands of hectares of forest have been clearing in Brazil [7], [9]. As a result of this, biodiversity of Brazil is facing severe threat. In the light of the above discussion, this study examines the relationship between FDI inflow and EPI score in Brazil.

II. LITERATURE REVIEW

Environmental health and foreign direct investment, these two are disputable issues for many decades. FDI is one of the indicators that place importance on achieving high economic growth. But in many cases this FDI introduces tremendous environmental problems. A large number of studies have been conducted on this issue. In most cases CO₂ emission has been taken as a dummy variable for assessing the environmental quality. Some studies have found positive relationship between these two variables; FDI and environmental quality, others have demonstrated negative relationship, and the others found no relationship at all. Kosatakis *et al.* examine the impact of FDI inflow on environmental quality in Brazil and Singapore. This study considered CO₂ as an indicator of environmental quality. By using ARDL, FMOLS and OLS models the study found two different types of results for two different countries. Negative relationship has been observed between FDI and environmental degradation in Singapore whereas in Brazil positive relationship has been noticed. Environmental Kuznet curve has also been explained in the study and found significant in Singapore and insignificant in Brazil [10]. Kumar *et al.* show the relationship among FDI inflow, CO₂ emission, and air pollution in India. The study used data covering the period from 1981 to 2011. To obtain the results cointegration test, unit root test, and Ganger causality test have applied and got negative relationship between FDI inflow and air quality [11]. Ominy *et al.* find out the impact of FDI on economic growth and environmental degradation. Data covering the period from 1986 to 2015 has been used in the study. CO₂ is used as an indicator of environmental degradation. By using OLS econometric method the study has observed positive relationship between FDI and CO₂ emission [12]. Badri *et al.* explain the relationship among FDI, environmental pollution and economic development on fourteen petroleum exporting countries. Data, covering the period from 1990 to 2009, have been used in the study. The result portrayed that FDI has negative impact on CO₂ emission but positive impact on economic development.

EKC has shown effective in this study [13]. Kareem *et al.* illuminate the impact of FDI on oil exploitation in Niger delta region. By using logistic regression econometric model the study found that oil spillage, land degradation and air pollution were growing up with the rising amount of FDI inflow [14]. Lazreg elucidates the relationship between FDI and sustainable development considering CO₂ as an indicator of sustainable development. Cointegration test, FMOLS model and Ganger causality test have been used to explain the data. With the help of these methods the study found bidirectional relationship between FDI and CO₂ emission. That means FDI is responsible for CO₂ and CO₂ is responsible for FDI [15]. Pimonenko *et al.* work on methodology of environmental performance index. The study found that, countries, which have good EPI score their SDG index and social progress index have also well [16]. Duasa *et al.* focus on environmental performance and economic development. The study used OLS method and finds that the economic development positively and the population size negatively contribute on environmental performance to the countries [17]. Chowdhury *et al.* measure the relationship between GDP growth rate and EPI score in BRICS. With the help of descriptive statistical techniques and Pearson correlation test, the study shows that GDP growth rate and EPI score are positively related in few cases and negatively related in other cases [18]. Shahabadi *et al.* work on factors affecting EPI in selected OPEC countries. By using panel data analysis the study found that governance and HDI affects positively and significantly the EPI, but openness and CO₂ affects negatively and insignificantly [19]. From the literature review, it has been observed that most of the studies examine the impact of FDI inflow on environmental performance. But in my limited observation no research work has been conducted yet on the impact of FDI inflow on the EPI score in Brazil. In light of the above statement in mind, this study examines the relationship between FDI inflow and EPI score of Brazil.

III. METHODOLOGY

Descriptive statistical tools such as table graph, percentage, ratio etc. as well as Pearson correlation test have been used to analyze the data. Data has been collected from various sources. UN organizations, regional and sub-regional organizations, various types of research papers, government and non-government institutions are the sources of the data. Data of EPI score has been collected from Yale University and Columbia University websites. Data on FDI has been extracted from UNCTAD and WB websites respectively. All observations are annual. EPI publishes its data in every two years and the first EPI data bring out in 2002. The study has used Pearson correlation test to identify the connection between the variables FDI inflow and EPI score of Brazil.

IV. RESULT AND DISCUSSION

Brazil is one of the top foreign investment recipient countries across the world. In terms of FDI inflow, it is the ninth largest receiver country. Main investing countries in

Brazil are: Netherlands, USA, Germany, Spain, France, UK, Canada, Chile, Bahamas, Luxembourg etc [3].

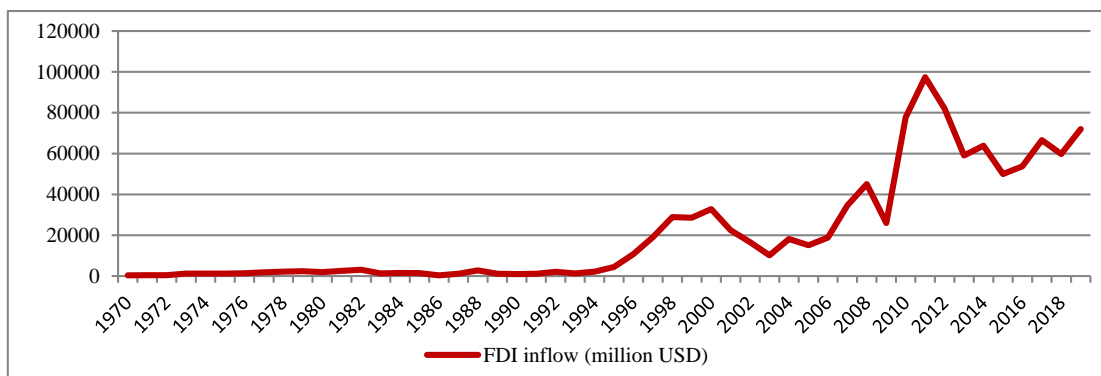


Fig. 1. FDI inflow in Brazil from 1970 to 2019.
Source: UNCTAD, <http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx>

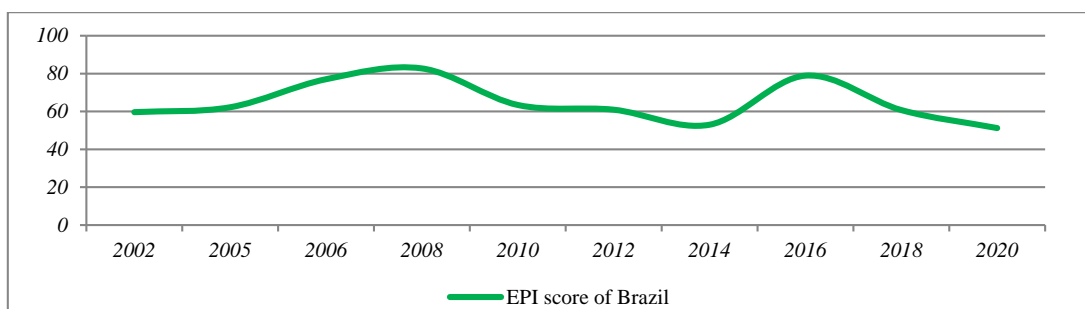


Fig. 2. EPI score of Brazil from 2002 to 2020.
Source: Yale Center for Environmental Law and Policy

The Fig. 1 given above show that from 1970 to 1994, the amount of FDI entered into Brazil was not very remarkable. In 1970, total amount Brazil got as FDI stood at \$392 million. In 1980, 1990, and 1994 the amount of FDI inrush gradually picked up with a slight fall in 1990 and those were \$1910 million, \$989 million, and \$2150 million respectively. Although the amount of FDI inflow increased gradually so far, after 1994, it soared at an impressive pace. In 2000, this FDI figure reached at \$ 32779 million. However since 2000, the overall FDI volume reflected a declining trend that continued till 2006. In 2008, The FDI influx picked up and reached at \$45058 million. The FDI inflow peaked at its highest point in 2012 which was \$82060 million. From 2012 onward until 2019, the rising pattern reversed slightly for some years, but in 2019, the FDI amount got a significant rise and arrived at \$ 71989 million.

recorded in 2008. After 2008, the EPI score started to decline gradually and the country got its lowest score in 2014 which was 52.97. Afterwards, the score again increased till 2018, but once again it obtained its lowest score in 2020.

Table I shows that in 2002 FDI inflow in Brazil was \$ 16.59 billion and EPI score was 59.6. In 2005, FDI inflow fall compare to 2002 and EPI score improved from 59.6 to 62.2. But, in 2006 and 2008, we noticed that in these years FDI inflow increased and EPI score also improved as well. In 2006 and 2008 FDI inflow was \$18.882 billion and \$45.058 billion and EPI score were 77, and 82.7 respectively. Afterwards, in all the years, we noticed negative relationship between FDI inflow and EPI score. In 2010, 2012, 2014, 2016, 2018, and 2020 EPI score of Brazil were 63.4, 60.9, 52.97, 78.6, 60.7, and 51.2 respectively and FDI inflow in these periods was \$77.678billion, \$82.06billion, \$63.846billion, \$53.7billion, \$59.802billion, and \$71.989 billion respectively.

Fig. 3 portrays that EPI score of Brazil was improving from 2002 to 2008. After that time, declining tendency has been noticed in the EPI score of Brazil till 2014. EPI score of Brazil reached its highest in 2016 and the score was 78.9. Later on downward trend have been observed again in EPI score. On the contrary, in FDI inflow of Brazil, figure has shown an increasing trend from 2006 to 2012. In 2012 this FDI inflow climbs at its peak point and that was \$82.06 billion. Later on, FDI inflow has fallen again and continued till 2016. Afterwards rising trend of FDI inflow has been observed.

Correlation result - To identify the relationship between the two variables Pearson correlation has been applied in the current study. The value of the Pearson correlation counts

TABLE I: EPI SCORE AND FDI INFLOW IN BRAZIL FROM 2002 TO 2020

Year	EPI Score	Year	FDI inflow in Brazil (billion USD)
2002	59.6	2002	16.59
2005	62.2	2005	15.066
2006	77	2006	18.882
2008	82.7	2008	45.058
2010	63.4	2010	77.678
2012	60.9	2012	82.06
2014	52.97	2014	63.846
2016	78.9	2016	53.7
2018	60.7	2018	59.802
2020	51.2	2019	71.989

Source: Yale Center for Environmental Law and Policy and UNCTAD

The Fig. 2 has displayed that EPI score in 2002 was 59.6. The score began to increase after 2002 and the highest score

on +1 to -1. If the value of the correlation is +1, a positive relationship is existed between the variables. On the contrary, if the value of the correlation is -1, it is assume

that negative relationship is existed between the variables. No relation is appeared if the value of the correlation coefficient will zero.

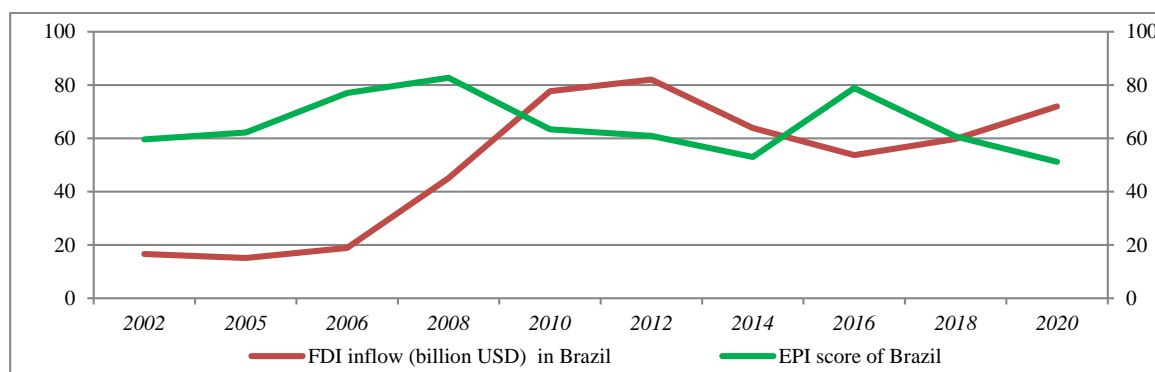


Fig. 3. FDI inflow and EPI score in Brazil from 2002 to 2020
Source: UNCTAD and Yale Center for Environmental Law and Policy

In the Table II given below, it is seen that value of the correlation coefficient is -.327. It implies that there is a negative relationship between the two variables- FDI inflow and EPI score of Brazil, but the strength of the association between the variables is small. Its P-value is .356, which is not statistically significant.

TABLE II: PEARSON CORRELATION

		EPI score	FDI inflow in Brazil
EPI score of Brazil	Pearson Correlation	1	-.327
	Sig. (2-tailed)		.356
	N	10	10
FDI inflow in Brazil	Pearson Correlation	-.327	1
	Sig. (2-tailed)	.356	
	N	10	10

V. CONCLUSION AND POLICY IMPLICATION

From the above discussion, it has been found that except for few years' observations, there has been a negative relationship between FDI inflow and EPI score in Brazil. Whenever the country received highest amount of foreign investment, it affected negatively on it EPI score. In 2012, when Brazil received its largest amount of FDI that is \$82.06 billion, its EPI score fell from 63.4 in 2010 to 60.9 in 2012. On the other hand, in 2016, when EPI score of Brazil was 77, FDI inflow of that period fell from \$63.84 billion in 2014 to \$53.7 billion. So, negative relation has been seen between these variables; FDI inflow and EPI score of Brazil. From the Pearson correlation table it has also been found that there is a negative relationship between FDI inflow and EPI score in Brazil but the association between the variables is small. As Brazil considers FDI as an important indicator for economic growth and development so they always took FDI friendly investment policy without considering their environment. If environmental issues are not considered carefully during policy making period, natural environment will face severe threat in future. Therefore, to ensure healthy environment as well as sustainable growth and development, the Government of Brazil should regulate the function of the foreign companies and emphasize on environment friendly

investment policy.

CONFLICT OF INTEREST

The author declares no conflict of interest.

CONTRIBUTIONS

The draft paper and the final paper have been done by the author.

ACKNOWLEDGMENT

Special thanks to my younger brother, Ratan Chowdhury, for supporting me to successfully complete this research paper.

REFERENCES

- [1] S. Mehdi, "Trade liberalization, industrialization and development: Experience of recent decades," MPRA paper no 26355, 2010.
- [2] UNCTAD, *Investment Policy Review Brazil*, 2005.
- [3] UNCTAD. World Investment Report 2019. [Online]. Available: https://unctad.org/en/PublicationsLibrary/wir2019_overview_en.pdf
- [4] M. P. Veiga, "Foreign direct investment in Brazil: Regulations, flows, and contribution to development," 2004.
- [5] F. Alves, *Doing Business and Investing in Brazil*, 2013.
- [6] Columbia University. (2017). The top 20 Brazilian multinationals. Columbia Center on Sustainable Investment. [Online]. Available: <http://ccsi.columbia.edu/files/2013/10/EMGP-Brazil-Report-2018-final.pdf>
- [7] J. D. Fiorino, "Explaining national environmental performance: What do we know and what should we learn?" Working paper, no. 202-885-3864. 4400 Massachusetts Avenue NW, Washington, D.C., 20016. 2010.
- [8] L. Bennett, *Deforestation and Climate Change*, Washington, D.C. 20036, 2017.
- [9] S. Margulis, "Causes of deforestation of the Brazilian Amazon," World Bank working paper, no. 22, Washington D. C., 2003.
- [10] I. Kosatakis, S. Lolos, and E. Sardanou, "Foreign direct investment and environmental degradation: Further evidence from Brazil and Singapore," MPRA paper no. 75643, 2016.
- [11] V. Kumar and Chander, "Foreign direct investment and air pollution: Ganger causality analysis," *Journal of Business and Management*, vol. 2, pp. 12-16, 2016.
- [12] O. S. Ominiy and Q. J. Adayi, "Foreign direct investment and environmental sustainability in Nigeria," *Journal of Research in Business and Management*, vol. 5, no. 1, pp. 28-34, 2017.
- [13] A. A. Badri and J. K. Parvizkhanlu, "Foreign direct investment and environmental consequences of economic growth," *International Journal of Modern Management & foresight*, vol. 1, no. 1, pp. 1-8, 2014.
- [14] D. S. Kareem, M. G. Alam, M. O. G. Chukwa, O. M. David, and K. O. Oke, "Foreign direct investment and environmental degradation of

oil exploitation: The experience of Niger Delta,” *International Journal of Applied Economics and Finance*, vol. 6, no. 4, pp. 117-126, 2012.

- [15] M. Lazreg, “The nexus between foreign direct investment and environmental sustainability in North Africa,” *Environmental Economics*, vol. 9, no. 1, pp. 57-68, 2018.
- [16] T. Pimonenko, O. Lyulyov, O. Chygryn, and M. Palienko, “Environmental performance index: Relation between social and economic welfare of the countries,” *Environmental Economics*, vol. 9, no. 3, pp. 1-11, 2018.
- [17] J. Duasa and R. Afroz, “Modeling environmental performance and economic development,” *International Journal of Trade, Economics and Finance*, vol. 4, no. 6, pp. 384-387, 2013.
- [18] T. Chowdhury and S. Islam, “GDP growth rate and environmental performance index: Evidence from BRICS countries,” *Environmental Economics*, vol. 8, issue 4, pp. 31-36, 2017.
- [19] A. Shahabadi and S. Feyzi, “The relationship between natural resources abundance, foreign direct investment and environmental performance in selected oil and developed countries during 1996-2013,” *International Journal of Resistive Economics*, vol. 4, no. 7, pp. 101-116, 2016.

Copyright © 2021 by the authors. This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited ([CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)).



Tonmoy Chowdhury is a citizen of Bangladesh. She is working as a lecturer of environmental economics in Dhaka School of Economics, Dhaka, Bangladesh. She got her bachelor (BSS in economics) and master’s degree (MSS in economic) in economics from the Department of Economic at the University of Dhaka. Currently she is doing her MPhil in the Department of Economics at the University of Dhaka. Her research interest includes international trade, trade and environment, agriculture and environment, food security and sustainable development.