# Foreign Direct Investment and Environment in Latin America: Sustainable Development Goals

Julia Swart, Paulo van Noije, and Márcio Ferreira Rocha

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**Abstract**

Foreign direct investment (FDI) inflows have been on an increasing trend since the beginning of the 1990s in Latin America. This increase was largely a result of the implementation of the Washington Consensus which led to structural reforms in most Latin American economies. Foreign direct investment was seen as an important instrument to stimulate economic growth, increase employment opportunities, and foster technological progress. In the same period, local pollutants such as carbon dioxide, nitrous oxide, and methane have also increased. Many reasons are behind these emissions, including population growth, economic growth, and increasing urbanization rates. However, there is less understanding

J. Swart (✉)
Utrecht School of Economics, Utrecht University, Utrecht, The Netherlands
e-mail: j.swart@uu.nl

P. van Noije
School of Applied Sciences, University of Campinas, Limeira, Brazil
e-mail: noije@unicamp.br

M. F. Rocha
Institute of Economics, University of Campinas, Campinas, Brazil
e-mail: m161563@dac.unicamp.br



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about the impact that this increase in foreign direct investment has had on local pollution in Latin American countries. On the one hand, foreign direct investment can be a source of technological progress and associated adoption of cleaner technologies (a technique effect). On the other hand, foreign direct investment can adapt to local laxer environmental regulations and intensify pollution through the scale effect. Finally, foreign direct investment can bring in new industries and sectors, which are in less or more polluting sectors (a composition effect). Therefore, to provide an estimate of the impact of foreign direct investment on local pollution, this chapter controls additionally for the three types of effects by using data on foreign direct investment and combining with data from the World Bank on among others, emissions, population density, GDP per capita, trade openness, and human capital. Similar to other papers, this chapter employs panel data estimation for Latin American countries but performs the empirical analysis for a more recent period, 1990–2019. Our main results indicate that FDI has intensified $CO_2$ emissions in Latin American countries. Finally, this chapter discusses the findings in light with the efforts by Latin American governments to achieve the Sustainable Development Goals by 2030.

**Keywords**

Foreign direct investment · Pollution · Latin America · Sustainable Development Goals · SDGs

## Introduction

The environmental agenda held by developed economies for the twenty-first century motivated economic studies to review "classical themes," such as free market, competition, and international trade, from new perspectives and also to add new issues, such as environmental conservation and pollution. Foreign direct investment (FDI) and the role played by multinational companies in the economic development process became an object or part of the historical background in economic studies, from Lenin's Imperialism Theory to the Washington Consensus. This has been the case especially during the Cold War period, when the international support sponsored by capitalist economies turned into an important instrument against the socialist model and as a guarantee for "freedom and democracy." In Latin America, the *Alliance to Progress*, conducted by Kennedy's administration, is a clear example of a stronger collaboration between the South (Latin America) and the North (the United States) (Loureiro 2020).

One of the focuses from the FDI literature in recent years consists in articulating the FDI flows to developing economies (e.g., Latin American countries) and the impact on the pollution levels in those countries. There is no consensus in the literature with respect to whether receiving FDI has a positive or negative impact on the environment. Nonetheless, developing countries tend to favor FDI inflows as a way to compensate for the insufficient financial capital from home investors

and the urgent need to improve standards of living, by among others, creating new jobs.

In the 1990s, following the prescriptions from the Washington Consensus, many Latin American countries opened up to the international market. Policies to deregulate, to foster competition, and to privatize state enterprises, as well as the increase in economic stability in the region, had an immediate positive response from international investors. Figure 1 shows that the percentage of FDI net inflows of GDP for Latin American countries increased substantially at the start of the 1990s. While FDI can increase efficiency and job generation, the effect on the environment can be detrimental if foreign investors choose developing countries because of laxer environmental regulations (*pollution haven hypothesis*). Whether this has happened in Latin America is an empirical question. Therefore, this chapter surveys the empirical literature on this matter to combine the knowledge within this literature and present a new empirical estimate for the relationship between FDI inflows and pollution.

The importance of this theme does not pertain only to Latin American countries. Pollution, such as from $CO_2$ emissions, crosses borders. As such, if investors leave developed countries in search for countries with laxer environmental regulations, this creates a process of *carbon leakage*. That is, emissions decrease in developed countries at the cost of developing countries. However, because many of the problems created by $CO_2$ emissions are global (e.g., climate change) and not only local (e.g. air quality), developed countries also suffer from this *carbon leakage*. It is in this sense that the SDGs were created, with the aim of providing a global response to problems that cannot be solved by each country individually.

This chapter is structured as follows. After this brief introduction, the next section presents the SDGs associated with FDI and the environment, to indicate possible overlaps. Section "Literature Review" then discusses the literature on FDI and the environment, with focus on Latin American countries. Afterwards, Section "Methodology" presents the methodology based on panel data for the period

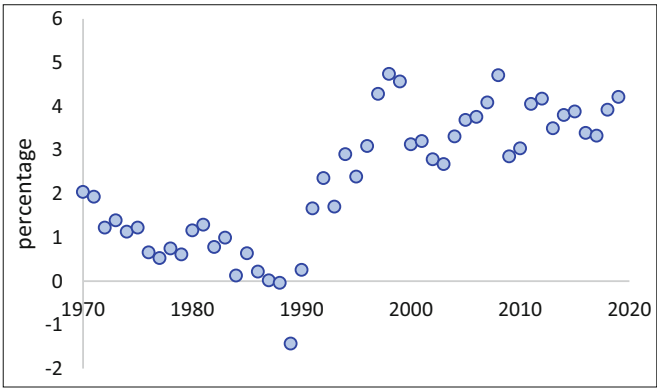


**Fig. 1** Foreign direct investment, net inflows (% of GDP) – average for 24 Latin American countries, 1970–2019. (Source: Authors' own figure, based on data from World Bank (2022) World Development Indicators)

1990–2019. Section "Results and Discussion" presents the results, while Section "Conclusion" concludes based on a discussion of the findings in line with the SDGs for Latin America.

## SDGs, Foreign Direct Investment, and the Environment

The concept of sustainability goes back to the 1987 United Nations Brundtland Commission's report (UN 1987). Then the concept was first defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." The concept makes it explicit that sustainability is not static; instead, nations ought to make decisions which consider the impact in a longer-term perspective, thus considering future generations. At the same time, society, and in particular those more able to implement changes at a larger scale (policy makers, companies, etc.), also need to meet the current needs, which are many.

The current challenges are huge. In Latin America, for example, in 2019 the poverty gap at $3.20 a day (2011 PPP) was 3.6% (World Bank 2022), a level which has remained fairly stable since the start of the 2010s. That represents over 23 million people living in severe poverty. Also, in the same year, literacy rate for adults (ages 15 and above) was 94.45%, meaning that illiteracy is still an issue in Latin America. As a final indicator to illustrate the challenges faced by Latin American countries, $CO_2$ emissions have been on an overall increasing trend, as illustrated in Fig. 2 for the period 1990–2010. This problem is also seen at a world level. In 1950, the world

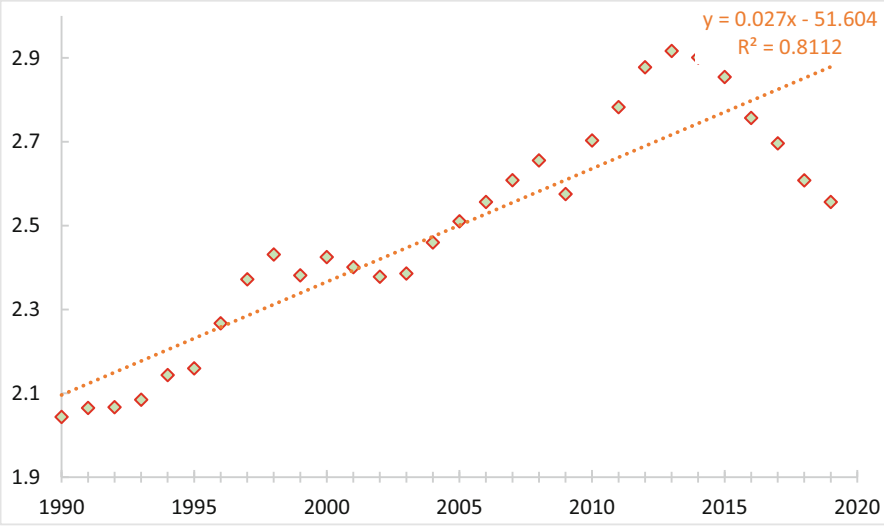


**Fig. 2** $CO_2$ emissions (metrics tons per capita) – Latin America and Caribbean, 1990–2019. (Source: Authors' own figure, based on data from World Bank (2022) World Development Indicators)

emitted about 6 billion tonnes of $CO_2$, but nowadays this has gone up to more than 34 billion tonnes (World Bank 2022).

Despite sustainability implying considerations for the present and the future, it does not mean society is dealing with two opposing effects. That is, the choice society faces is not between the current generation improving their lives but the future generation improving their lives. Mechanisms should be found such that both needs can be met. However, this requires a strong commitment from all agents in society, from the individual to large corporations, transnational organizations, and so on. Additionally, the commitment has to come from local and global agents. This commitment has three pillars: environmental, social, and economic, also known as PPP which stands for planet (the environment), people (social), and profit (economic). These three pillars should also not be going against one another, so society cannot choose to save the environment at the cost of not saving the people, for example. The biggest challenge is to have these three pillars acting with synergy. So, the concept of sustainable development asks for an integrated approach that takes into account environmental concerns along with economic development, in the present and in the future, everywhere in the world.

In line with this conceptualization, a significant change since the beginning of the 2000s was that international organizations such as the United Nations and the World Bank started to pay more attention to looking at the different problems society faces in a more integrated way. For example, the United Nations Member States adopted in 2015 the 2030 Agenda for Sustainable Development. This agenda gives the countries a common blueprint for thinking about an improvement in society's well-being in the present and in the future. With 17 Sustainable Development Goals, this agenda encompasses various topics such as peace, employment, technological progress, and the environment. And, it also asks countries to act together, to form a global partnership, without taking the individual countries' ownership of reaching the SDGs in their own way.

In total, there are 17 SDGs, each of which has various targets, totalizing 169 targets. The 17 SDGs are (see https://sdgs.un.org/#goal_section):

- **SDG1 – No poverty**
  End poverty in all its forms everywhere
- **SDG2 – Zero hunger**
  End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
- **SDG3 – Good health and well-being**
  Ensure healthy lives and promote well-being for all at all ages
- **SDG4 – Quality education**
  Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- **SDG5 – Gender equality**
  Achieve gender equality and empower all women and girls
- **SDG6 – Clean water and sanitation**
  Ensure availability and sustainable management of water and sanitation for all

- **SDG7 – Affordable and clean energy**
  Ensure access to affordable, reliable, sustainable, and modern energy for all
- **SDG8 – Decent work and economic growth**
  Promote sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all
- **SDG9 – Industry, innovation, and infrastructure**
  Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation
- **SDG10 – Reduced inequalities**
  Reduce inequality within and among countries
- **SDG11 – Sustainable cities and communities**
  Make cities and human settlements inclusive, safe, resilient, and sustainable
- **SDG12 – Responsible consumption and production**
  Ensure sustainable consumption and production patterns
- **SDG13 – Climate action**
  Take urgent action to combat climate change and its impacts
- **SDG14 – Life below water**
  Conserve and sustainably use the oceans, seas, and marine resources for sustainable development
- **SDG15 – Life on land**
  Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainable manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
- **SDG16 – Peace, justice, and strong institutions**
  Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels
- **SDG17 – Partnerships for the goals**
  Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

Clearly, all SDGs can be connected. Take SDG1 (no poverty) and SDG5 (gender equality), for example. In many countries, there are still no laws in place which protect women from domestic violence; in many others, enforcement of the law is problematic. This creates many difficulties for women, such as emotional distress and physical injuries, which might prevent or at least place them in a worse position to study and to enter the workforce, all of which contribute to poverty. In this light of connectivity, the SDGS should be understood. Thus, on the one hand, there are 17 separate goals, but on the other hand, achieving them cannot be considered in isolation, as there are clear spin-offs between all goals.

This chapter considers the interactions from FDI to the environment, in particular in terms of $CO_2$ emissions. Already in the 1987 United Nations Brundtland Commission's report (UN 1987), a note was made about the role of FDI as "owners, as partners in joint ventures, and as suppliers of technology in the mining and manufacturing sectors in many developing countries, especially in such

environmentally sensitive areas as petroleum, chemicals, metals, paper, and automobiles" (p. 64, paragraph 58), which emphasizes the responsibility of FDI in terms of the environment of the receiving/developing countries.

The United Nations website (UN 2022) – https://sdgs.un.org/#goal_section – presents information about the 17 SDGs and their targets. Table 1 shows a mapping of key words related to FDI and $CO_2$ emissions that are mentioned in the targets within the 17 SDGs. The selected words in Table 1 were "foreign direct investment"; "trade"; "transnational companies"; "technology" or "technological"; "investment"; "climate"; "pollution"; "environment"; and "sustainable" or "sustainability." The target codes which use one of these words are presented in Table 1, and the description of the target codes can be found on the UN's website under the SDG's webpage – https://sdgs.un.org/#goal_section.

An explicit reference to FDI is only made once within all 169 targets of the SDGs. It relates to target 10.b which is part of SDG10 "Reduced inequalities." Target 10.b sets that FDI should be encouraged, in particular in least developed countries. Accordingly, it suggests that FDI could be a way to decrease inequalities in these countries. Additionally, target 12.6 which is part of SDG12 "Responsible consumption and production" makes reference to transnational companies. It states that countries should "encourage companies, especially large and transnational companies" to be sustainable (see the UN's website https://sdgs.un.org/#goal_section for the complete target statement). If countries would follow this target set in the SDG12, we would expect that, ceteris paribus, FDI would not have a detrimental impact on the environment. Finally, there are many SDGs targets which make reference to "technology," often setting targets for access to technology, and to: technological development in developing countries, educational advancement, and international cooperation. Additionally, targets 9.4 and 12.a make explicit the need to advance the adoption of clean technologies in all countries (target 9.4) and technology which facilitate the sustainable patterns of consumption and production (target 12.a). SDG17 "Partnerships for the goals" includes many targets related to technology, showing the need for more global cooperation to advance technological progress and the use of sustainable and clean technologies everywhere in the world.

Finally, there are many SDGs targets calling for action in terms of the environment. Target 1.5 within SDG1 "No poverty" and target 2.4 within SDG2 "Zero hunger" calls attention to the vulnerable, who are often more exposed to climate-related shocks. In terms of SDG9 "Industry, innovation and infrastructure," there is a call for more industrialization and infrastructure development in developing countries, which should be done while promoting inclusiveness and environmental considerations (targets 9.1; 9.2; 9.4; and 9.a). Additionally, linking those targets with target 9.b, which sets the need to "support domestic technology development, research and innovation in developing countries," and target 17.16 to "enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships," suggests that transnational companies should have an active role in implementing and fostering sustainable practices when investing in developing countries. Overall, the SDG targets

**Table 1** SDGs and their targets – words related to FDI and $CO_2$ emissions

| SDG | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Foreign direct investment | | | | | | | | | | 10.b | | | | | | | |
| Trade | | 2.b | 3.b | | | | | 8.a | | 10.a | | | | 14.6 | | | 17.10<br>17.12 |
| Transnational company(ies) | | | | | | | | | | | | 12.6 | | | | | |
| Technology/technological | 1.4 | 2.a | | 4.b | 5.b | 6.a | 7.a<br>7.b | 8.2 | 9.4<br>9.5<br>9.a<br>9.b<br>9.c | | | 12.a | | 14.a | | | 17.6<br>17.7<br>17.8<br>17.16 |
| Investment | | 2.a | | | | | 7.a | | | | | | | | | | 17.5 |
| Climate | 1.5 | 2.4 | | | | | | | | | 11.b | | 13.1<br>13.2<br>13.3<br>13.a<br>13.b | | | | |
| Pollution | | | 3.9 | | | 6.3 | | | | | | | | 14.1 | | | |
| Environment | 1.5 | | | | | | | 8.4 | 9.4 | | 11.6<br>11.a | 12.4<br>12.c | | | | | 17.7 |
| Sustainable/sustainability | | 2.4 | | 4.7 | | 6.4 | 7.b | 8.4;<br>8.9 | 9.1<br>9.2<br>9.4<br>9.a | | 11.2<br>11.3<br>11.c | 12.6<br>12.7<br>12.8<br>12.a<br>12.b | | 14.4<br>14.7<br>14.c | 15.1<br>15.2<br>15.4<br>15.a<br>15.b<br>15.c | 16.b | 17.9<br>17.14<br>17.15<br>17.16<br>17.19 |

Source: UN (2022) – https://sdgs.un.org/#goal_section. Note: The word "investment" was only included when investment was referred to in terms of physical capital. That means that the table does not include words such as "investment in poverty eradication"; similarly, the word "environment" was only included when it related to the physical environment; thus, words such as "business environment" were not considered

indicate the need for more collaboration across countries to combat climate change, and they also suggest the important role of developed countries and transnational companies in facilitating a transition to greener production processes and consumption patterns.

## Literature Review

Considering the literature reviewed, this chapter organizes the debate on FDI and the environment as follows: (*i)* during the 1990s and 2000s, a first movement focused on the validation or rebut of the *pollution haven hypothesis* considering the economies individually (i.e., without a regional approach); (*ii)* the most recent movement, supported by a more robust database and more years for the observations, aimed to qualify the causal relation between FDI flows and the increase in pollution levels in developing economies and to call attention to the differences among the economic structures within these economies. Both strands in the literature tend to agree that $CO_2$ emissions per capita are a good *proxy* for "pollution." Finally, the most recent literature has incorporated other elements to the discussion, such as the role played by international capital in the economic development process, the effects in environmental legislation, the economic sectors that received FDI flows, social conditions (unemployment rate, income and others), the relation between sustainability and corporate reputation, and energy production and consumption that demand more or less carbon emissions.

The debate established before is represented in Sapkota and Bastola (2017), which sought to relate FDI flows, the level of development (income, unemployment rate, among others), and the environment. By using panel data (controlling for physical capital, energy, human capital, population density, and unemployment rate) for 14 Latin American countries between 1980 and 2010, the authors test the pollution haven hypothesis (PHH) and the environmental Kuznets curve (EKC) hypothesis and overall validate the PHH and the EKC hypothesis with their results. However, when splitting the 14 Latin American countries into two groups (based on average per capita GDP), the pollution haven hypothesis stood whereas the EKC hypothesis did not, which marked the differences between FDI flows, pollution, and environmental regulation over high- and low-income economies. Therefore, FDI flow regulation should not be considered in isolation from social conditions (for instance, income distribution) in order to pursue an increase in the energy-saving production process and a more efficient factor allocation.

The differences among low-, mid-, and high-income economies were also an issue in Shahbaz et al. (2015) analysis. The authors brought the energy production and consumption to the multivariate models – panel data unit root tests and cointegration techniques – and confirmed the PHH and EKC hypothesis for the long run. Although the authors did not ignore the benefits the increase in FDI inflows grant for the recipient economy (job opportunities, technological changes, and efficient management), they pointed out that those benefits could be counterbalanced by laxer environmental regulations. The results showed that the relation between

$CO_2$ emissions, economic growth, FDI inflows, and energy consumption differed by the income level. In particular, whereas in low-income economies FDI inflows resulted in a more degraded environment, in high-income economies FDI inflows resulted in an improvement in the environment. As underdeveloped economies depend on international capital, the alternative is to combine improvements in environmental regulation with changes in the energy source from the carbon-intensive one to biomass.

Blanco et al. (2013) contributed to the debate by looking for the causality between pollution and FDI inflows from a regional perspective (Latin American economies). The authors emphasized the increase in FDI inflows to underdeveloped countries as a share of world FDI in a short period of time: from 25% in 1990 to 31% in 2000. In seeking to understand this increase, they analyzed the relationship between the inflow of FDI and the flexibility of environmental legislation. The increase in international flows should as such be understood in the context of the dispute of underdeveloped countries to participate on the international capital market and benefit from their economic dynamics. This dispute for international flows follows from the belief that FDI will lead to job generation and economic growth. The authors test whether FDI flows are related to the high levels of pollution observed in underdeveloped countries by implementing a Granger causality test for the period 1980–2007 for 18 Latin American countries. In this way, a causal relationship between international capital flows and emissions is attributed, in addition to allowing results to be obtained with a regionalized approach. The authors find that there is a causal relationship between FDI flows to high-carbon economic sectors and the increase in $CO_2$ emissions, although this relationship is not verified in other sectors of the economy. Another important conclusion was to point to the difficulty for the underdeveloped countries to strengthen the environmental regulation or the capital flows terms, since FDI in "dirty sectors" have a considerable share in total FDI inflows – and the role played by international companies in the domestic economies also did not contribute for more control taking place.

Gonzalez-Perez et al. (2011, 2020) and Gonzalez-Perez (2022) analyzed the link between FDI and pollution within the corporate governance literature by considering corporate social responsibility (CSR) as a business strategy for multinational companies to adapt their external environment and improve economic performance. Therefore, the companies sought to appear responsible for better work conditions and also environmental regulation. In this regard, companies investing abroad via FDI should indirectly improve the environmental regulation in order to give the multinational companies a good reputation within the local society, government, and other institutions. Therefore, there is a concern with the $CO_2$ emissions as a good "doing business" practice, which leads the companies to seek sectors not intensive in $CO_2$ emissions or pressure for good environmental actions and practices.

Ceretta et al. (2020) found an alternative approach to analyze the relation between FDI and pollution. Most of the discussion, as explored before, did not consider the carbon emissions in the energy production process and its relation to economic growth. The authors argue that if the effects of FDI on GDP are considered as an important way to measure the relation between economic development and

pollution, then the discussion should consider the energy sources of that process. This would require extending the analysis to the use of carbon or renewable sources – one of the most important points in the environmental agenda for the new century. The authors argue that the studies which sought to relate economic growth and $CO_2$ emissions did not distinguish, among the variables, the use of renewable and nonrenewable energies, considering instead total energy consumption. In this respect, the objective was to qualify this relationship by considering the different energy sources while adopting a panel data approach with threshold, including as variables the emission of carbon dioxide, consumption of fossil fuels, renewable energy consumption, and GDP per capita based on purchasing power parity as a proxy for economic growth. Based on an extensive review of the literature, the authors argue that, despite the different methods and data used, there is a positive relationship between economic growth and an increase in $CO_2$ emissions, in which the choice of more or less sustainable production modes is related to the costs involved between these options. In more general terms, there would be a "balance point" between sustainable and fossil sources that does not inhibit investment or growth in the case of underdeveloped countries. Regarding methodological aspects, the authors used a longitudinal data panel covering the following variables: carbon dioxide emissions, consumption of fossil fuels, consumption of renewable energy, and GDP per capita based on purchasing power parity, and including 37 countries (European countries, China, Brazil, the United States, and South Africa), which were analyzed for the period between 1996 and 2013. The results of the study were presented by organizing those countries into groups defined by the level of their GDP per capita. Over time, the change of countries from one group to another attests to the development process they went through and, above all, that the relationship between the variables used could potentially change from one group to another. As for their findings, in the case of low GDP per capita countries, the relationship between the use of fossil fuels and carbon dioxide emissions was more pronounced than in other groups, so that, in these countries, the consumption of fuels from nonrenewable sources is the main cause of $CO_2$ emissions; in the second group, economic growth is the main cause.

Overall, the literature on FDI and pollution adopts different methodologies and econometric techniques, but without reaching a definitive consensus (see Table 2). The only consensus, perhaps, is the imperative need to attract international capital flows to stimulate economic development and advance the economic structure towards a higher economic complexity. This chapter contributes to the debate on FDI and pollution by evaluating the data from a regional perspective over a recent period in order to qualify the costs or benefits for the environment resulting from a development strategy supported by international capital flows.

Globalization, neoliberal social and economic reforms, and new instruments of financing the development process in many developing countries allowed companies, led by their business strategies, to reorganize the economies, resulting in an increase in economic growth. Economic growth increases, ceteris paribus, $CO_2$ emissions and energy demand by a scale effect. Additionally, the underdevelopment of these countries and their lack of financial capital increases their dependence on

**Table 2** Selection of empirical papers analyzing the impact of foreign direct investment on the environment

| Study | Countries | Years | Methodology | Dependent variable | Independent variables | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | FDI | GDPpc | GDPpc2 | Fixed capital | Unemployment rate | Human capital | Population density | Energy use | FDI per sector (% GDP) | Income |
| Sapkota and Bastola (2017) | 14 Latin American countries | 1980–2010 | Panel data | $CO_2$ emissions (metric tons per capita) | x | x | x | x | x | x | x | x | | |
| Blanco, Gonzalez and Ruiz (2013) | 18 Latin American countries | 1980–2017 | Panel Granger causality tests | The growth of per capita $CO_2$ a (metric tons per capita) | x | x | | | | | | | x | |
| Tang and Tan (2015) | Vietnam | 1976–2009 | Multivariate cointegration and Granger causality | $CO_2$ emissions | X | X | | | | | | X | | X |
| Shahbaz et al. (2015) | 99 countries (low, mid, and high income) | 1975–2012 | Panel data | $CO_2$ emissions | X | X | | | | | | X | | |
| Soares et al. (2019) | 30 developing countries | 1990–2014 | Panel data | $CO_2$ emissions / GDP | X | X | | | | | | X | | |
| Ceretta et al. (2020) | 37 países (europeus, Brasil, China, Estados Unidos e África do Sul) | 1996–2013 | Threshold panel data | $CO_2$ emissions | | X | | | | | | X | | |

foreign investment inflows to avoid balance of payment restrictions and an interruption of the economic growth process. In other words, the questions mentioned before refer to the economic development pattern available to the underdeveloped countries pursuing social and economic development during the "Global Era."

Shahbaz et al. (2015) endorses these structural perspectives and argue that in the late 1980s, when neoliberal social and economic reforms took place in the international economy, the term now often used "globalized economy" was also created. The investment decisions and business strategies were oriented by a wide understanding of how the "new economy" should be organized, i.e., globally, and the outsourcing mindset reorganized the FDI inflows, destabilizing the economies, once organized in a "national" framework. At the same time, the financial development allowed new instruments that increased the volume of capital available to the companies. According to the authors, GDP per capita growth, energy demand and $CO_2$ emissions rose as FDI reached more countries in various regions (Asia Pacific, Middle East, Latin America, among others). The relation between FDI flows and increase in emissions was a matter of time to be noted.

The economic growth and possibilities opened by FDI flows created a dependence on the national economies to maintain the country's attractiveness to investors, while the neoliberal reforms led to a more open economy in commercial, financial, and technological ways. The authors endorsed the pollution haven hypothesis by linking the economic development pattern to the government's tendency to make the environmental regulation less rigid, considering the evidence discussed by Xing and Kolstad (2002) and He (2006). Thus, based on the literature, there are still open questions with respect to the link between FDI inflows and pollution. However, this chapter combines the different papers that have addressed this topic to analyze it from a Latin American perspective.

## Methodology

Based on the literature summarized in Table 2, this chapter uses more recent data for Latin American countries only to review the findings in the literature. To determine the effect of FDI inflow on $CO_2$ emissions, this chapter uses panel data analysis for Latin American countries, for the period 1990–2019. Figure 3 illustrates the relationship between these two variables for the countries in the sample. This chapter considers all Latin American countries with more than half a million inhabitants in 2015, which results in a selection of 24 countries (Table 3). Table 3 shows that these countries are diverse when considering the level of $CO_2$ emissions, the level of development, and the inflows of FDI. In 2018, Haiti had the lowest level of $CO_2$ emissions per capita (0.30 metric tons), which was more than 40 times lower than that of Trinidad and Tobago (12.78 metric tons). In 2018, Haiti was also the poorest of this sample of countries, with a GDP per capita 21 times smaller than Puerto Rico, the wealthiest country in this sample. In terms of FDI inflows, Haiti was also one of the worst performing countries in our sample, receiving approximately 37 times less FDI (as percentage of GDP) than Guyana, in 2018. For the empirical analysis, this

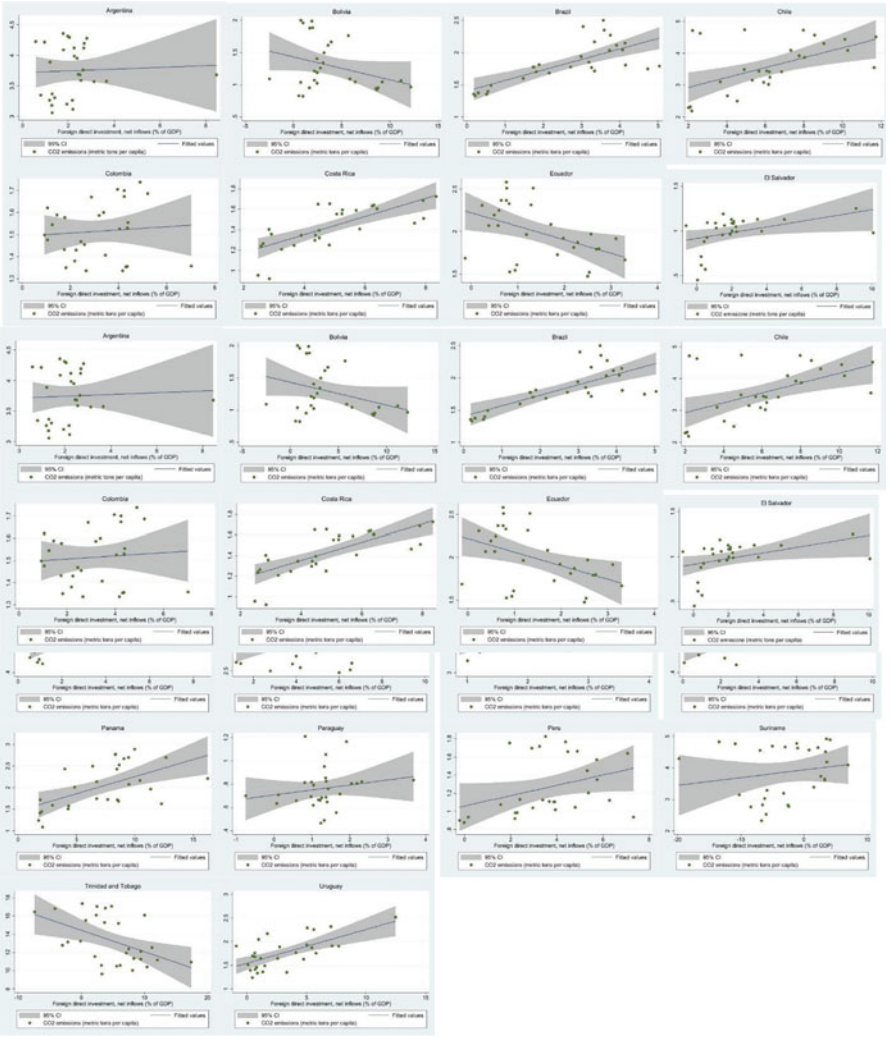


**Fig. 3** $CO_2$ emissions against FDI inflows: Latin American countries, 1990–2019. (Source: Authors' own figure, based on data from World Bank (2022) World Development Indicators)

chapter excluded 3 of the 24 countries (Cuba, Puerto Rico, and Venezuela) from the dataset because of insufficient data. This resulted in a panel with data for 21 countries and 30 years.

Table 4 presents the nine variables included in the empirical model. Most variables have been included following Sapkota and Bastola (2017) for the same reasons as presented in their paper. Accordingly, this chapter lists the expected signs of the variables below; refer to their paper for a more in-depth elaboration. Additionally, in this chapter, the empirical analysis also controls for three additional variables:

**Table 3** Countries in the dataset: $CO_2$ emissions, GDP per capita, and FDI, in 2013 and 2018

| | $CO_2$ emissions (metric tons per capita) | | GDP per capita (constant 2015 US$) | | Foreign direct investment, net inflows (% of GDP) | |
|---|---|---|---|---|---|---|
| Country | 2013 | 2018 | 2013 | 2018 | 2013 | 2018 |
| Argentina | 4.34 | 3.99 | 14,072 | 13,112 | 1.78 | 2.26 |
| Bolivia | 1.76 | 2.00 | 2831 | 3291 | 5.71 | 0.75 |
| Brazil | 2.40 | 2.04 | 9248 | 8582 | 3.04 | 4.08 |
| Chile | 4.72 | 4.62 | 13,333 | 13,901 | 7.98 | 2.61 |
| Colombia | 1.67 | 1.60 | 5867 | 6272 | 4.24 | 3.38 |
| Costa Rica | 1.64 | 1.65 | 11,090 | 12,505 | 6.29 | 4.84 |
| Cuba | 2.42 | 2.20 | 7318 | 8041 | – | – |
| Dominican Rep. | 2.11 | 2.36 | 6187 | 7998 | 2.55 | 3.21 |
| Ecuador | 2.51 | 2.31 | 6084 | 5952 | 0.76 | 1.29 |
| El Salvador | 1.03 | 1.06 | 3591 | 3920 | 1.11 | 1.59 |
| Guatemala | 0.86 | 1.11 | 3802 | 4160 | 2.87 | 1.26 |
| Guyana | 2.61 | 3.13 | 5505 | 6179 | 4.81 | 24.66 |
| Haiti | 0.26 | 0.30 | 1360 | 1413 | 1.12 | 0.66 |
| Honduras | 1.06 | 1.02 | 2228 | 2475 | 5.78 | 5.99 |
| Jamaica | 2.65 | 2.90 | 4884 | 5044 | 3.82 | 4.92 |
| Mexico | 3.95 | 3.74 | 9283 | 9946 | 3.99 | 3.08 |
| Nicaragua | 0.74 | 0.81 | 1916 | 2086 | 8.79 | 6.43 |
| Panama | 2.77 | 2.43 | 12,695 | 14,868 | 8.33 | 8.45 |
| Paraguay | 0.81 | 1.21 | 5130 | 5871 | 0.81 | 0.82 |
| Peru | 1.66 | 1.70 | 6030 | 6574 | 4.88 | 2.91 |
| Puerto Rico | – | – | 29,426 | 29,753 | – | – |
| Suriname | 4.18 | 3.61 | 9673 | 9020 | 3.63 | 3.28 |
| Trinidad &Tobago | 16.79 | 12.78 | 18,336 | 16,457 | −4.14 | −2.96 |
| Uruguay | 2.17 | 1.89 | 15,168 | 16,038 | 1.72 | 2.75 |
| Venezuela | 6.32 | 4.78 | – | – | 0.58 | – |

manufacturing (% of GDP); electricity from dirty sources; and trade openness. The reasons for including these three variables are described below and lead to 10 hypotheses.

*Foreign direct investment* – This is the main variable that this chapter intends to test; the expected sign of it is ambiguous. On the one hand, FDI can bring new technologies and processes that are cleaner and therefore reduce pollution (a negative sign for the FDI coefficient); on the other hand, FDI can come to Latin America to take advantage of laxer environmental regulation and as such result in an increase in pollution (a positive sign for the FDI coefficient). Which of the two effects prevails can be determined empirically.

H1a: FDI improves the environment if FDI facilitates the adoption of cleaner technologies.

H1b: FDI is detrimental to the environment if FDI inflows take advantage of laxer environmental regulations in the target country.

**Table 4** Variables used in the empirical analysis: 21 Latin American countries, 1990–2019

| Variable code | Variable name | Description | Data source | Mean | Std.dev. | Min | Max |
|---|---|---|---|---|---|---|---|
| $CO_2$ | Carbon dioxide emissions | $CO_2$ emissions (metric tons per capita) | World Bank (2022) | 2.550 | 2.660 | 0.025 | 17.735 |
| GFK | Gross fixed capital formation | Gross capital formation (constant 2015 US$) | World Bank (2022) | 3.56e+10 | 6.86e+10 | 5.49e +08 | 3.81e+11 |
| Unemp | Unemployment rate | % of total labor force (modeled ILO estimate) | World Bank (2022) | 7.381 | 3.941 | 1.58 | 20.52 |
| HK | Human capital | Adjusted net enrolment rate, primary (% of primary school age children) | World Bank (2022) | 92.604 | 6.808 | 58.112 | 100 |
| GDPpc | GDP per capita | GDP per capita (constant 2015 US$) | World Bank (2022) | 6978.344 | 5577.093 | 1134.138 | 30375.84 |
| Dens | Population density | Population density (people per sq. km of land area) | World Bank (2022) | 99.463 | 115.343 | 2.597 | 431.441 |
| Energy | Energy use | Energy use (kg of oil equivalent per capita) | World Bank (2022) | 1331.504 | 2047.655 | 188.949 | 15108.69 |
| Manuf | Manufacturing (% of GDP) | Manufacturing, value added (% of GDP) | World Bank (2022) | 15.961 | 7.207 | 2.631 | 48.443 |
| Dirtyelect | Electricity from dirty sources | Electricity production from oil, gas, and coal sources (% of total) | World Bank (2022) | 45.322 | 28.576 | 0 | 100 |

Note: All World Bank (2022) data was retrieved from the World Development Indicators

*Gross fixed capital formation* – Expected sign is positive: more capital implies, ceteris paribus, more energy and thus more pollution. In the regressions, we divide this variable by $10^9$, so the data is in billions of constant 2015 US$.

H2: An increase in gross fixed capital formation has a detrimental impact on the environment.

*Unemployment rate* – There are two opposing effects, making the effect from a theoretical perspective ambiguous. On the one hand, the effect would be positive if, as a result of the high unemployment rate, the government devotes less resources to the environment. On the other hand, the expected sign would be negative if the unemployment rate pushes labor tax down and, to compensate, environmental taxes go up, increasing the cost of pollution. Despite these two opposing effects in the literature, we expect that for Latin American countries, the first effect prevails, and the expected sign is positive. The reason is that overall, in Latin America, there is a critique about the insufficient attention paid by policy makers to the environment.

H3a: An increase in the unemployment rate improves the environment if it results in a lower labor tax and as a result higher environmental tax.

H3b: An increase in the unemployment rate is detrimental to the environment if the government focuses on labor policies to the detriment of the environment.

*Human capital* – Expected sign is negative: more human capital implies, ceteris paribus, more skills to implement environmental-friendly institutions, technologies, and processes. This variable has been linearly interpolated, as often done in the literature.

H4: An increase in human capital improves the environment.

*GDP* per capita – We test for the EKC by including the quadratic term. In this case, we would expect a positive sign for the linear term and a negative sign for the quadratic term. This variable is taken in natural logarithmic form.

H5: Economic development has a detrimental impact on the environment at low levels of economic development. After a threshold level has been reached, economic development results in an improvement in the environment.

*Population density* – The sign can be either negative or positive, depending on which of these two effects prevails: (*i)* (negative) higher population density increases opposition to polluting firms and (*ii)* (positive) in areas with higher population density it becomes more difficult to keep track of all polluting activities.

H6a: Higher population density improves the environment if it implies more opposition to polluting firms.

H6b: Higher population density is detrimental to the environment if it creates a hurdle to control all polluting firms.

*Energy use* – Expected sign is positive: more energy use implies, ceteris paribus, more capital-intensive industries and, therefore, more pollution.

H7: An increase in energy use is detrimental to the environment.

*Manufacturing (% of GDP)* – We add this variable to capture the *composition effect* on the environment from economic activity. The variable GDP per capita already takes into account the *scale effect*, but it does not control for the composition of the economic activities, which can be more or less focused on clean/dirty goods.

The composition effect refers to changes in the mix of economic activity, such as specialization in cleaner or dirtier goods. We follow Swart and van Marrewijk (2011) and take the value added of manufacturing as a percentage of the GDP to control for this effect. The expected sign is positive.

H8: An increase in manufacturing is detrimental to the environment.

*Electricity from dirty sources* – We add this variable to capture the *technique's effect* on the environment from economic activity. This effect concerns the use of a cleaner or dirtier technology. The percentage of oil, coal, and gas in electricity generation is a fairly direct measure of this effect (Swart and van Marrewijk 2011). The expected sign is positive; that is, the more intensive the use of electricity from dirty sources, the more pollution there will be.

H9: An increase in electricity from dirty sources is detrimental to the environment.

*Trade openness* – We add this variable to take into account the extensive literature on the impact of trade openness on the environment. In the literature, the sign of the coefficient has been both positive and negative. Managi et al. (2009) find that for non-OECD countries, the sign is positive, such that trade openness is worse for the environment. We will test whether this holds for our sample of Latin American countries.

H10: An increase in trade openness is detrimental to the environment for countries who specialize in the production of products which are polluting.

To test the hypotheses about the signs of the control variables, this chapter follows the literature (see Table 2) and considers a panel data model. Equation (1) describes the panel data model:

$$\begin{aligned} \mathrm{CO2}_{it} = {} & \alpha_i + \beta_1 \mathrm{FDI}_{it} + \beta_2 \mathrm{unemp}_{it} + \beta_3 \mathrm{HK}_{it} + \beta_4 G\mathrm{DPpc}_{it} + \beta_5 \mathrm{GDPpc}_{it}^2 \\ & + \beta_6 \mathrm{dens}_{it} + \beta_7 \mathrm{energy}_{it} + \beta_8 \mathrm{manuf}_{it} + \beta_9 \mathrm{dirtyelect}_{it} + \beta_{10} \mathrm{trade}_{it} \\ & + \beta_{10} \mathrm{GFK}_{it} + \varepsilon_{it} \end{aligned} \tag{1}$$

In Eq. (1), $i$ is an index for country, and $t$ is an index for time; the first term on the right-hand side of the equation, $\alpha_i$ is a variable that captures unobserved heterogeneity for country $i$; and $\varepsilon_{it}$ is the error term. Equation (1) is the starting equation; however, because of collinearity reasons, we drop the variables energy and unemployment, reducing our model to Eq. (2).

$$\begin{aligned} \mathrm{CO2}_{it} = {} & \alpha_i + \beta_1 \mathrm{FDI}_{it} + \beta_2 \mathrm{HK}_{it} + \beta_3 \mathrm{GDPpc}_{it} + \beta_4 \mathrm{GDPpc}_{it}^2 + \beta_5 \mathrm{dens}_{it} \\ & + \beta_6 \mathrm{manuf}_{it} + \beta_7 \mathrm{dirtyelect}_{it} + \beta_8 \mathrm{trade}_{it} + \beta_8 \mathrm{GFK}_{it} + \varepsilon_{it} \end{aligned} \tag{2}$$

Regarding the estimation procedure, this chapter uses a Hausman test to choose between a random and a fixed effect model. The chapter also takes into account the possible endogeneity of FDI and unemployment (Sapkota and Bastola 2017) by first empirically testing whether this is indeed an issue within our dataset. For this purpose, this chapter conducts the Davidson and Mackinnon test (Davidson and Mackinnon 1993), which suggests using the one-period lag for both of these variables. The test indicates that these variables can be taken as exogenous (we can reject

the null hypothesis of endogeneity), and therefore, the second step, which would have been to use the lag variables as instruments and use the instrumental variable approach, is not presented.

## Results and Discussion

Table 5 presents the main results. Models (1a) and (1b) consider all variables as motivated previously, except variable energy, which is highly correlated with GDP per capita (0.8478) and variable unemployment. Models (2a) and (2b) remove the variable GFK for similar reasons. The variable GFK is correlated with education

**Table 5** Fixed effects and random effect model, Latin American countries, 1990–2019

| Variables | Fixed effect (1a) | Random effect (1b) | Fixed effect (2a) | Random effect (2b) |
|---|---|---|---|---|
| FDI | 0.005<br>(0.004) | 0.004<br>(0.004) | 0.012**<br>(0.004) | 0.010**<br>(0.004) |
| HK | −0.004**<br>(0.002) | −0.004**<br>(0.002) | −0.004*<br>(0.002) | −0.004*<br>(0.002) |
| GDPpc | −3.659***<br>(0.763) | −3.389***<br>(0.743) | −3.170***<br>(0.897) | −2.945***<br>(0.859) |
| $GDPpc^2$ | 0.270***<br>(0.044) | 0.257***<br>(0.043) | 0.250***<br>(0.052) | 0.238***<br>0.0499 |
| Dens | −0.002**<br>(0.001) | −0.002**<br>(0.001) | −0.004***<br>(0.001) | −0.003***<br>0.001 |
| Manuf | −0.017***<br>(0.004) | −0.016***<br>(0.004) | −0.016***<br>(0.004) | −0.0152***<br>(0.004) |
| Dirtyelect | 0.010***<br>(0.001) | 0.011***<br>(0.000) | 0.011***<br>(0.001) | 0.012***<br>(0.001) |
| Trade | 0.003***<br>(0.001) | 0.002**<br>(0.001) | 0.002**<br>(0.001) | 0.001*<br>(0.001) |
| GFK | 0.001***<br>(0.000) | 0.001***<br>(0.000) | | |
| Unemployment | −0.007<br>(0.004) | −0.005<br>(0.004) | | |
| Constant | 14.954***<br>(3.434) | 12.172***<br>(3.172) | 10.862***<br>(3.840) | 9.795**<br>(3.637) |
| Wald $Chi^2$ | 60345.86<br>(0.000) | 1648.05<br>(0.000) | 151.70<br>(0.000) | 1250.40<br>(0.000) |
| $R^2$ | 0.7989 | 0.8030 | 0.6900 | 0.7326 |
| Hausman FE vs. RE | | −12.92 | | 40.09<br>(0.000) |
| D-M exogeneity | 0.034<br>(0.967) | | 2.423<br>(0.5058) | |

Note: Dependent variable is $CO_2$ emissions per capita. The table presents the coefficients and the standard errors, the latter in between brackets. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively

(0.311), GDP per capita (0.3979), and trade (0.358). For both models, the preferred one is the fixed effect (based on the Hausman test), but present the random effect model for completeness. Table 6 presents a few variations of the fixed effect model by doing a stepwise reduction in the control variables. The final column in Table 5 restricts the inclusion of the FDI variable while controlling for the scale (GDP per capita), composition (manufacturing), and technique (dirty electricity) effects.

The results in Tables 5 and 6 are overall in line with the literature and the expectations presented before. The expected sign for FDI was ambiguous in the literature; our findings indicate that FDI has contributed to pollution in Latin American countries (Hypothesis H1b). FDI can take advantage of laxer environmental regulation and, as such, result in an increase in pollution (a positive sign for the FDI coefficient). This result matches the one found by Sapkota and Bastola (2017) and therefore offers more support for the need to establish policies and mechanisms to avoid attracting FDIs that are polluting or, alternatively, to provide incentives for greener types of foreign investment.

**Table 6** Fixed effects with less control variables, Latin American countries, 1990–2019

| Variables | Fixed effect (3) | Fixed effect (4) | Fixed effect (5) | Fixed effect (6) |
|---|---|---|---|---|
| FDI | 0.012** (0.004) | 0.014** (0.004) | 0.014** (0.003) | 0.014** (0.005) |
| HK | −0.004* (0.002) | −0.003 (0.002) | | |
| GDPpc | −3.170*** (0.897) | −2.889** (0.9226) | −3.258*** (0.900) | −4.200*** (0.898) |
| $GDPpc^2$ | 0.250*** (0.052) | 0.240*** (0.053) | 0.260*** (0.052) | 0.309*** (0.052) |
| Dens | −0.004*** (0.001) | −0.004*** (0.001) | −0.004*** (0.001) | |
| Manuf | −0.163*** (0.004) | −0.011** (0.004) | −0.011** (0.004) | −0.011** (0.004) |
| Dirtyelect | 0.011*** (0.001) | 0.012*** (0.001) | 0.012*** (0.001) | 0.010*** (0.001) |
| Trade | 0.002** (0.001) | | | |
| GFK | | | | |
| Constant | 10.862** (3.840) | 9.385* (3.943) | 10.751** (3.875) | 14.896*** (3.861) |
| Wald $Chi^2$ | 151.70 (0.000) | 150.45 (0.000) | 174.60 (0.000) | 196.04 (0.000) |
| $R^2$ | 0.690 | 0.438 | 0.435 | 0.600 |
| D-M exogeneity | 0.109 (0.741) | 0.203 (0.652) | 0.223 (0.637) | 0.175 (0.676) |

Note: Dependent variable is $CO_2$ emissions per capita. The table presents the coefficients and the standard errors, the latter in between brackets. ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

The estimated coefficients that match the expectations presented before were for the variables: human capital (negative – Hypothesis H4), dirty electricity (positive – Hypothesis H9), trade openness (positive – Hypothesis H10), gross fixed capital formation (positive – Hypothesis H2), and population density (positive – Hypothesis H6b). In the case of trade openness, the results in this chapters reinforce the findings from Managi et al. (2009) that trade openness is detrimental to the environment, suggesting, according to Hypothesis H10, that Latin American countries specialize in products that are more polluting. As for FDI, this calls for policy action to consider this side effect of economic integration into the world market. Policy action does not mean moving towards more autocracy but simply implementing stronger environmental policies to counteract the environmental problems which come along with more integration. Like FDI, trade openness can be beneficial to the economy by increasing competition, creating jobs, and fostering technological progress; however, it can also result in *carbon leakage* from developed countries with stronger environmental regulations to developing countries with laxer environmental regulation.

For population density, this chapter finds that the estimated coefficient is negative, suggesting that higher population density decreases pollution. This could be because, for example, the society in a more populated area has more opposition to pollution from firms. Finally, we found a U-shaped curve for GDP per capita, which is in contrast with other papers in the literature (no evidence for Hypothesis H5). This could be a result of the different sample sizes included in this chapter. Using Model 1a, the turning point in the GDP per capita and $CO_2$ emission curves would be around an income level of approximately US$876, which is well below the income level of all countries in the sample adopted in this chapter. In this sense, these countries would be in the upper part of the curve, in which more development leads to more pollution.

Overall, reestimating the panel data model with this more recent data and controlling for additional variables shows that the results are in line with expectations. For the ambiguous variable, mainly FDI, but also trade openness, the findings show that both are detrimental for the environment in Latin America. The next section discusses this finding in light with the efforts by Latin American governments to achieve the Sustainable Development Goals by 2030.

## Conclusion

This section presents a brief discussion of the findings from sections "SDGs, Foreign Direct Investment, and the Environment" and "Methodology" in light with the efforts by Latin American governments to achieve the Sustainable Development Goals by 2030, which have been included in the national government's planning.

In the current context, a fair environmental balance needs to be developed in favor of human life with dignity and for the benefit of the whole society. A key challenge is that the efforts to combat climate change and the investments related to it also benefit the poor (UNSDG 2018). Therefore, the paradigm of environmental depredation

needs to be modified to a new development model where the environment is preserved for current and future populations through a balance between environmental resources and the needs of human life.

Developing countries, in particular, are more exposed to the risk of environmental degradation because the social and economic challenges they face are higher. This is the case for all Latin American countries analyzed in this chapter. Latin American countries still have a large contingent of people who are living in poverty and/or whose elementary needs have not yet been met. These strong social demands tend to hamper the arguments for restricting economic growth in favor of the environment. At the same time, this is a region that is highly dependent on the environment. The environment is important in Latin America either because of the natural resources and the economic wealth attached to it or because of the importance of conserving biodiversity and nature as they impact the climate, the intensity and frequency of rainfalls, the quality of soil, and so on.

It is in this context that the debate on the relationship between FDI in Latin American countries and their effects on the environment must be inserted, especially when based on the SDGs, as this type of investment can bring ambiguous results on the goals set by the UN. Nonetheless, despite making explicit reference to FDI only once in the SDGs target, the SDGs are clear in calling for more sustainable action from all countries and stakeholders. Target 12.6 is emphatic and asks countries to encourage transnational companies to act more sustainably.

Whether countries and transnational corporations are following and taking the SDGs into account is something that still needs to be further investigated. A study carried out by Aust et al. (2019) sought to analyze how FDI impacted the achievement of the SDGs on the African continent. The results show that FDI generally has a positive impact on the SDGs. However, this result is obtained with a negative relationship between FDI and the possibility of achieving the goals of SDG 13 (Climate Action). This last result is counterbalanced by the positive results of FDIs in some areas, such as renewable energy, drinking water, basic infrastructure, and sanitation, making the result positive in the aggregate of the SDGs.

This chapter focused on the relationship between FDI flowing to Latin American countries and their impact on $CO_2$ emissions. The results indicate that FDI has contributed to pollution in Latin American countries (a positive sign for the FDI coefficient), and one possible explanation is that FDI can come to take advantage of laxer environmental regulation. These results are overall in line with the literature.

This scenario suggests that the choice of strategy by governments with regard to achieving the goals of the SDGs is not trivial. Some of the SDGs are linked to economic growth and others to the environment; however, their implementation should take each other into account. This chapter shows that according to the literature, and to the updated empirical analysis from sections "Methodology" and "Results and Discussion" that Latin American countries have not been successful as of yet. Therefore, if Latin American countries intend to fulfill all SDG targets by 2030, they need to revise the way they attract FDIs.

This can be done, for example, through: policies that avoid attracting polluting FDIs; incentives for greener types of foreign investment; and with compensation

policies, that is, FDI policies have the function of carrying out compensatory measures that mitigate the results in relation to the environment. These policies should provide ways of continuing to foster FDI while simultaneously reducing the damage pointed out in relation to the environment.

Finally, one last reflection and some questions that the chapter raises are: if these policies above mentioned are effectively implemented, can this not result in carbon leakage from Latin American countries to other, more backward countries (e.g., some countries on the African continent)? In other words, given that the SDGs aim to improve the planet as a whole, to what extent do policies applied in a set of countries transfer the pollution problem to other countries? Are these policies then desirable? SDG17 calls for more global partnership, and as such, a final question is: would it be possible to elaborate a global strategy for FDI that contains a parameter on the maximum tolerable levels of environmental degradation? This chapter shows that these questions need urgent answers in order to improve the benefits of FDI in developing countries.

## Cross-References


- ▶ Governance of Climate Justice: Taxation Transfers and Green Bonds
- ▶ Strategic Planning of the Brazilian Energy Sector and the SDGs
- ▶ Structural Change and Goal 9 in Latin America: Challenges and Bottlenecks
- ▶ Sustainable Development Goals Progress in Latin America


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