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THE ENVIRONMENTAL AND SOCIAL EFFECTS OF FOREIGN DIRECT INVESTMENTS ON WATER-INDUCED CONFLICTS

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How does the presence of Foreign Direct Investments affect the likelihood of water-induced conflict?

Bachelor Project IRO: Environmental Causes of Conflict

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Abstract

In the contemporary world, billions of people suffer from water shortage due to water contamination and excessive water use. Due to the fast pace of population growth and human-induced climate change, it is considered that the planet's natural resources, such as water, will become even scarcer. As agricultural activities, human health, and the economy may decline due to these factors, relative deprivation may translate into water-induced tensions and conflicts. Simultaneously, research shows that multinational companies that make foreign direct investments (FDI) deteriorate water quality in host countries by engaging in polluting activities. Based on the pollution haven hypothesis, this study explores whether FDI affects the likelihood of water-induced conflicts, by reducing access to safe water. Through a quantitative study, panel data is analysed in 32 countries, from 1997 to 2009. In a two-stage regression model, the results show a strong negative relationship between FDI and water access. The estimated effect of this relationship indicates an increase in the likelihood of water-induced conflict. These results emphasize the importance of creating strong universal environmental regulations that protect natural resources and prevent water-induced tensions.

Keywords: Foreign direct investment, pollution-induced water scarcity, water access, pollution haven hypothesis, water-induced conflict, environmental degradation, water pollution

1. Introduction

Various reports show that human activity substantially affects climate change in a negative way (Koubi et al., 2014). These activities deplete water resources while climate change aggravates the lives of a myriad of livings by changing weather patterns and inducing "droughts, floods, desertification, and rising sea levels" (Koubi et al., 2014, p. 114). Neo-Malthusian views suggest that unsustainable usage of natural resources can stir up social and political tensions that can in turn lead to violent events. The rising levels of water scarcity represent a crucial element in the environmental-conflict literature, and this aspect influences scholars and policymakers to imagine the potential occurrence of future *water wars* (Boehmelt et al., 2014, p. 337). These fears have developed due to anthropogenic causes of climate change and the idea that the balance between water supply and demand for scarce resources is crucial in generating social conflict.

On the other side, cornucopians believe that scarcity can be prevented by technological and human progress (Boehmelt et al., 2014). Some authors have contradicted the idea of water wars (Swain, 2001). Additionally, it is considered that water scarcity can also enable peace talks and cooperation (Bernauer et al., 2012; Koubi et al., 2014). Treaties that feature "provisions for joint monitoring, conflict resolution, treaty enforcement, and the delegation of authority to intergovernmental organizations" are viewed as enablers to reduce potential water conflicts (Tir and Stinnett, 2012, p. 212). However, this paper does not mainly focus on the potential of cooperation. In the context of this study, it is presumed that water pollution-induced activities generate tensions.

Water contamination represents an issue that is less researched than water usage in the environmental-conflict literature. The United Nations World Water Assessment Programme stresses that "2 million tons of sewage", as well as agricultural and industrial waste are released into waters (Gupta and Ruebush, 2019, p. 1). Simultaneously, a variety of scholars argue that there is a causal link between foreign direct investment and environmental degradation, especially water pollution (Duhigg 2009, Jorgenson, 2007; Avazalipour et al., 2013). The pollution haven hypothesis emphasizes that multinational corporations (MNCs) purposely choose states with weak environmental governance that cannot control and sanction FDIs polluting activities (Smarzynska and Wei 2001; Al-mulalli et. al, 2015; Kurtishi-Kastrati, 2013; Aliyu and Ismail, 2015; Garsous and Kozluk, 2017, Demena and Afesorgobor, 2020).

It is considered that the presence of FDIs has substantially increased in the last forty years, in developed as well as developing countries (Adams, 2009; Garsous and Kozluk, 2017). One can argue that the presence of FDI companies is more notable in developing countries, as "50% of worldwide FDI" was received by developing countries in 2012 (Garsous and Kozluk, 2017, p. 7). While many scholars have studied the important link between water resources and conflict, as well as foreign direct investment and pollution-induced water scarcity, there is a lack of analysis vis-a-vis the link between FDI and water-induced conflict. Thus, this paper proposes the research question: *How does the presence of Foreign Direct Investments affect the likelihood of water-induced conflict?*

This research argues that the investigation of the potential relationship between FDIs and water-induced conflicts has important policy implications for the improvement of water management and conflict alleviating measures. The effects of FDI should be better evaluated by states, and polluting activities should be restricted at regional and domestic levels. Institutions, as well as governments, should prioritize the health, environmental, as well as economic implications of water contamination. At a social level, the causes of the lack of water access should be better assessed and prevented. National and regional agreements should reach a consensus vis-à-vis water quality and quantity issues before disputes can escalate.

Furthermore, this paper is structured in three parts. First, the literature review presents a comprehensive critical overview of how the topics of interest are presented in the literature. The paper acknowledges the beneficial features of FDIs and simultaneously stresses the negative aspects of them. Pollution-induced water scarcity is further described as a problem influenced by FDI. However, the main contribution of this study is the highlight of how water-induced conflicts are likely to be influenced by FDI presence. The theoretical framework describes and connects diverse mechanisms that may elucidate this relationship. Lastly, the empirical analysis focuses on how FDI directly leads to the reduction of water access, which in turn generates water-induced conflicts.

2. Literature Review

Multiple articles emphasize the good aspects that come with allowing FDI in their countries. However, many studies fail to address FDI's negative side. The following paragraphs emphasize arguments from both sides of the debate, but mainly concentrating on the negative ones, as well as the connection between FDI and the environment. Various authors analyze different contexts where multinational companies affect environmental degradation, but they fail to expand the discussion by also analyzing the indirect effects of FDI. Additionally, it is reviewed how water-induced conflicts are addressed in the literature, and how they are connected to water scarcity.

2.1. Foreign Direct Investments and Environmental Degradation

FDIs represent investments that are placed in an enterprise in a different state than the native state of the foreign direct investor. FDI inflow is regarded as an important presumption of economic development as well as a driving force of economic globalization (Harrison, 1994; Kurtishi-Kastrati, 2013; Liu et al., 2018; Drahokoupil, 2020; Demena and Afesorgobor, 2020). Some known FDI benefits for the host country are represented by the possibility of transferring technology, new varieties of capital inputs, higher quality goods, promoting competition in the domestic market, contribution to the international trade system, human capital development, and profits that contribute to corporate tax revenues (Harrison, 1994; Loungani and Razin, 2001; Lipsey and Sjoholm, 2005; Adams, 2009; Kurtishi-Kastrati, 2013).

Even though it has an important economic role, the literature emphasizes that FDI has both positive and negative effects on host countries. For example, Tandon (2002) contends that multinational enterprises (MNE) are interested in making a profit and not in countries' development. Hoffman et al., (2005) argue that middle-income countries, such as India and Nigeria, are deceived by multinationals to make governments relax their environmental policies in exchange for investments (Hoffmann et al., 2005).

By contrast, FDI may as well have positive effects, depending on the context. It can increase CO2 emissions but it can also spread greener technology (Shahbaz, Nasir, and Roubaud, 2018; Demena and Afesorgobor, 2020; Aliyu and Ismail, 2015). Nevertheless, no studies find evidence that suggests FDIs' technological capabilities are directly declining water pollution, water use, or indirectly, facilitating water access (Duhigg, 2009; Neafie, 2018; Ding, Tang, and He, 2019). In more recent studies, scholars have obtained empirical evidence that indicates the negative impact of FDIs and how their activities damage the environment (Hitam & Borhan, 2012; Yang and Wang, 2016; Solarin et al., 2017; Neafie, 2018; Sabir, Qayyum and Majeed's, 2020).

An increasing number of scholars have specifically researched the critical relationship between FDI and water pollution (Mabey and McNally, 1999; Jorgenson, 2007; Jorgenson, 2009; Liu et al., 2018). Smarznyska and Wei (2001) discuss the underpinnings behind pollution havens but argue that the overall evidence is relatively weak. This study argues that only recent research finds significant negative results between FDI and water quality. Avazalipour et al. (2013) stress that growth in the inflow of FDI in Non-OECD countries leads to water pollution. Duhigg (2009) and Liu et al., (2018) argue that the inflow of FDI may decrease atmospheric pollution, but it amplifies water pollution. As FDIs are considered to be "the strongest driver of trade and economic growth in developing countries", this gives multinational enterprises the power to demand water management institutions to allow them to employ water however they desire to (Neafie, 2018, p. 9).

Micek, Neo, and Gorecki (2011) emphasize that Smithfield, a multinational pig industry, represents a major polluter in Poland and Romania. Anecdotal evidence from Pig Business, a documentary where there is investigated the rise of factory pig farming in Central Eastern Europe, shows locals that complain about water and fauna pollution, by dumping tons of waste, as well as carcasses (Ward, 2009). Another example would be the multinational corporation Pepsi, whose activities led to polluting waterways, decreasing "access to groundwater" and contaminating rivers in India (Neafie, 2018, p. 14). Even though there is a clear link between FDIs and water pollution, current literature fails to investigate whether this relationship has social, political, and security implications.

2.2. Pollution-induced water scarcity

Multiple scholars consider water pollution to be one of the primary causes of water scarcity (Pereira and Cordery, 2009; Kowalczak & Kundzewicz, 2011; Wan et al., 2016; Chakkaravarthy and Balakrishnan, 2019; Ma et al., 2020). Water contamination can be caused by various reasons, such as poor sewage systems, agricultural nutrients, pesticides, industrial emissions of chemicals, carcasses, wastewater sources that may comprise pathogenic bacteria and viruses, or natural toxins (Jury and Vaux Jr., 2007; Schwarzenbach, 2010; Chakkaravarthy and Balakrishnan, 2019; Khalid and Khaver, 2019). Agricultural nutrients and pesticides infiltrate into the groundwater below cropped fields or agriculture leakage accumulates in surface waters from irrigated systems (Jury and Vaux Jr., 2007). Additionally, accidental spills, leaks, industrial oil, waste, or deliberate dumping that comprise various toxic metals or organic composites lead to industrial contamination and pollute the lakes and rivers (Jury and Vaux Jr., 2007; "What are the main causes of water scarcity (and how to fix things)?", 2018).

The World Health Organization stresses that there are circa 2 billion disadvantaged people who have no choice but to drink contaminated water to survive. Water pollution deteriorates human health as the ingestion of polluted drinking water leads to numerous lethal problems that are almost unknown in countries with safe drinking water and appropriate sanitation systems (Jury and Vaux Jr., 2007; Hitam and Borhan, 2012; Drinking-water, 2019).

2.3. Water-induced Conflicts

Various scholars have argued that to some extent, there is a relationship between variations in water availability and inter-state conflict (Møller, 2004; Burke et al., 2009; Salehyan & Hendrix, 2012; Sekhri & Stoereygard, 2014; Boehmelt et al., 2014). World Humanitarian Data and Trends present that in 2017 water represented a substantial factor for conflict in approximately forty-five countries, especially in Syria (Heijden and Stinsen, 2019). Water's value as a resource indicates that water-related insecurity has the potential to provoke tensions within, as well as between countries (Heijden and Stinsen, 2019). The World Economic Forum's Global Risk Report (GRR) has counted water crises as one of the most salient risks in the context of severity for almost a decade (Heijden and Stinsen, 2019). Among the aspects of how water can impede human security, there are floods, pollution-induced water scarcity, which can influence the occurrence of conflicts and political tension (Ligtvoet et al., 2017).

According to Kowalczak & Kundzewicz (2011), water-related conflicts in urban zones are led by three types of water problems, water scarcity, water abundance, or very polluted water. The diffusion of water pollution in upriver land zones affects water quality downriver in the urban sector. Conflicts usually take place over water between urban and rural populations, upriver and downriver riparians, and between various water utilizations ("such as agricultural irrigation, municipal demands, industry, and energy production)" (Kowalczak & Kundzeiwicz, 2011, p. 588)

Yu et al., (2015) argue that water-induced conflicts are influenced by "history, political leverage, perceptions of need, broader conflicts, and other connected issues" (p. 8627). Contrastingly, some scholars argue that water, as well as acute water scarcity, can act as an *agent for peace and cooperation* instead of an incentive for conflicts and war (Wolf, 1998; Salehyan and Hendrix, 2012). The lack of fresh water can decline political stability and enhance vulnerabilities, which may generate violent events (Wolf, 1998). Due to water scarcity and the privatization of a water system in the interest of a multinational company, in a Bolivian town, people's rights were violated and even murders took place, as people's needs clashed with the wishes of an MNC (Rothfeder, 2003; Fitzamaurice, 2007). This example suggests that water scarcity and multinational companies may contribute to violence. However, the author fails to elaborate on this or test if there is indeed a causal correlation.

2.4. Critical Overview

As shown in the previous paragraphs, various scholars have assessed the relationship between FDIs and environmental degradation, including water pollution (Jorgenson, 2007; Avalipour et al., 2013; Liu et al., 2018; Ding, Tang, and He, 2019). A few scholars have investigated the relationship between FDI and access to potable water (Neafie, 2018; Rudra, Alkon, and Joshi, 2018) or pollution-induced water scarcity (Wan et al., 2016; Ma et al., 2020). However, there is no empirical study that tests whether there is a correlation between Foreign Direct Investments (FDIs) and water-induced conflict. This study argues that there is a relationship between FDIs, pollution-induced water scarcity, and water-induced conflicts.

3. Theoretical Framework

The theoretical framework section comprises distinct concepts and theories that offer support to the investigation of the relationship between FDI, pollution-induced water scarcity, and water-induced conflicts. As water scarcity can also be caused by enhanced water usage, this study takes into consideration the lack of water access as a possible indirect causal mechanism of water-induced conflicts. Further, the theoretical mechanisms are linked to each other in a manner that leads to the formulation of the hypothesis of the study. This theoretical framework draws connections between concepts including, *the pollution haven hypothesis (PHH), relative* *deprivation, grievances, and collective action problem*. Based on these ideas, this study creates theoretical scenarios and establishes the research's hypothesis.

The first mechanism that emphasizes the link between FDI and environmental degradation, is the *Pollution Haven Hypothesis* (PHH). Taylor (2004) describes the PHH as being "one of the most hotly debated predictions in all of international economics" (p. 1). The author emphasizes that the process of production of any good induces pollution as a joint product. The avoidance of some level of pollution can be possible, but also needs real resources. Due to the growth of competition for FDI, industries with polluting activities tend to relocate to developing countries, as developed countries implement stricter laws and high costs of pollution abatement (Demena and Afesorgbor, 2020; Taylor, 2004).

Another relevant concept is the *race to the bottom,* which implies that countries relax the environmental regulations to attract FDI (Kurtishi-Kastrati, 2013; Neafie, 2018). *Race to the bottom* literature finds that MNCs increase pollution as well as water use and lead to PHH (Jorgenson, 2007; Neafie, 2018). Consequently, the PHH suggests that the reduction of emissions from many developed countries is partially caused by transferring the environmentally degrading activities to developing countries (Demena and Afesorgbor, 2020). The difference between the *pollution haven hypothesis* and *the pollution halo hypothesis* is that the former represents a host country with weak environmental regulations, and the latter suggests that by implementing general environmental standards, MNCs will share their environmental friendly technology with their counterparts in the host country (Shahbaz, Nasir, and Roubaud, 2018).

In this study, the *pollution-haven hypothesis* highlights the relationship between FDI and pollution-induced water scarcity. Water pollution can deprive people of one of the most important needs a human has. Taking into consideration that water is a common resource and not a commodity, polluting activities directly affect people's health, food, and environment (Mabey and McNally, 1999). As human security is a *universal* concern, pollution represents one of the threats that endanger everyone (UNDP, 1994, p. 22). Water pollution is an important factor that leads to water scarcity, and thus, if people are deprived of it, it can lead to relative deprivation, which is further discussed. Bussotti (2014) exemplifies how in the countries such as Bulgaria and Romania, whose democracy is compared to many African countries, hazard reports are often censored by political power, leaving people with no defense

In this study, *relative deprivation* is employed as a possible explanation for pollution-induced water scarcity that may exacerbate into a water-induced conflict. Gurr (2015) refers to Relative Deprivation (RD) as the tension that develops from an inconsistency between what people should have and what people have, and how this discrepancy incentivizes people to resort to violence. People's perception of what (material) values they should have, instead of what they have, creates frustration that manifests into social mobilization. Moore and Jaggers (1990) emphasize a distinguishment between *fraternalistic relative deprivation* and *individual relative deprivation.* Fraternalistic relative deprivation is different from the individual one, as "it exists only among individuals who have a collective consciousness" when one group compares itself with others (Moore and Jaggers, 1990, p. 23). According to Bernauer et al., (2014), water events that led to "strikes or threats of strikes due to water shortage or poor water quality" have occurred in the past

(p. 7). Thus, this paper argues that lack of access to water leads to *relative deprivation*, which can, in turn, lead to social mobilization among the locals.

Additionally, environmental damage can cause grievances among the local population. The grievance mechanism indicates that resource extraction leads to "grievances among the local population due to land expropriation, environmental hazards, insufficient job opportunities, and the social disruptions caused by labor migration; these grievances, in turn, lead to civil war" (Ross, 2004, p. 41). This paper suggests that grievances can be perpetuated by relative deprivation when people analyse their social or economic situation and feel that they could have more, or that they used to have more. Depending on the severity of the grievance, people may collectively mobilize. According to Moore and Jaggers (1990), deprivation is the one that motivates people to act collectively. In addition, depending on the state's leaders' national or regional decisions and policies, water scarcity or water impurity can lead to cooperation or tensions.

In the context of the population, according to Hendrix and Haggard (2015), the capability of groups to act represents a feature of political institutions that may ease or hinder collective action. When grievances appear, affected groups may protest depending on the political freedom that they have, or through policy. Additionally, regime type and the quality of governance are also important factors. Gurr (2015) emphasizes that the intensity of relative deprivation depends on the perception level of the discrepancy between value expectations and value capacities. Even though deprivation and mobilization represent essential conditions for conflicts to escalate, they are not enough. The state must go through a critical crisis to guide the political opportunity (Moore and Jaggers, 1990). An example of this situation may be represented by the Syrian conflict. Unsustainable policies led to the water crisis by exploiting finite water resources and land (Kelley et al., 2015). As the drought has occurred, unsustainable policies continued, and relative deprivation led people to social mobilization and conflict.

However, the individuals or groups who do not suffer from grievances or relative deprivation may face the collective action problem. Various scholars analyse the collective action problem, which is also considered a social dilemma, as it represents a situation where all people would benefit from cooperation but fail to cooperate due to conflicting interests between the ones that discourage joint action (Friedberg et. al, 1999; Ostrom, 2010). In this case, the state leaders may suffer from the collective action problem, which can stop governments and companies to take action and stop the processes that contaminate waters.

Another factor that can impede cooperation for the reduction of water shortage can be related to the power asymmetric conflict analysis model. The water pollution conflict between China's Jiangsu and Zhejiang Provinces is led by power asymmetry. More specifically, power asymmetry refers to the decision-makers (DMs) who in a negotiation or conflict, they control the preferences of other DMs by profiting from supplementary opportunities demonstrating the specific DMs' stronger position (Yu et al., 2015).

3.1.Theoretical discussion

Water is an essential resource and its distribution is affected by national governance and water management. Thus, the deprivation of water can exacerbate grievances, which can turn against the government (Hendrix et al., 2009). Neafie (2018) finds that there is a strong negative relationship between FDI and access to potable water, as increasing FDI inflows reduce access to potable water due to “water-intensive and wastewater-inducing production processes” (p. 19). It is considered that the middle class may mitigate the negative effects by politically mobilizing (Rudra, Alkon, and Joshi, 2018).

Thus, based on the aforementioned theories, this paper argues that FDIs lead to pollution-induced water scarcity, which reduces access to safe water. As water pollution and water shortage create health problems, threaten agricultural activities, and the economy, grievances can lead to water-induced conflict. Due to the collective action problem, institutions and governments can fail to act in time. In addition, based on the salience of the grievances, more or less violent levels of social unrest can occur. Consequently, this study proposes the following hypothesis:

H: FDI increases the risk of water-induced conflict by decreasing access to safe water sources

3 Research Design

This section focuses on the methodology employed within this research. The primary focus of this model is to evaluate the relationship between FDI and water-induced conflict. For the empirical analysis, a two-stage regression model is used to assess how the link between FDI and water access influences the likelihood of water-induced conflict. This study uses a panel data set of about 32 the Mediterranean, the Middle East, and the Sahel countries from 1997 to 2009. The choice for the sample selection is based on the Water Events Scale (WES) data availability. The WES precisely selects "the time, location, and intensity of water-related conflictive and cooperative events" (Bernauer et al., 2012, p. 529). In the first stage, the effect of FDIs on water access is estimated. In the second stage, the relationship between this predicted value and water-induced conflict is measured. This paper argues that pollution-induced water scarcity may lead to water-induced conflict. However, due to the limited data availability of water pollution, the empirical section of the paper solely focuses on the evaluation of the link between FDIs and water access, which in turn influences the likelihood of water-related conflicts.

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3.1. Dependent Variable: Water Access

The first dependent variable is water access, determined by *the percentage of people using at least basic water services.* Throughout the paper, the terms "water access" and "the percentage of people using at least basic water services" are used interchangeably for the sake of clarity. To test the link between FDI and water access, *the percentage of people using at least basic water services* is used as a proxy for pollution-induced water scarcity. This variable represents the new indicator of the World Development Indicator (WDI) database which assesses water access and comprises "both people using basic water services as well as those using safely managed water services" (World Bank). Basic drinking water services refer to the drinking water obtained from an improved source. Additionally, among improved water sources are including piped water, boreholes or tubewells, protected springs, and packaged or delivered water" (World Bank). According to Rudra, Joshi, and Alkon (2018), it is advantageous to use *access to improved water sources*, as it encapsulates both the quality as well as quantity of water supplied to the poor.

The efforts of the Millennium Development Goals led to the improvement of access to safe drinking water for a myriad of people (Martinez-Santos, 2017). However, the indicators are considered to overemphasize the bettered water sources, neglecting that various sources are still contaminated and dangerous (Baum et al., 2014; Martinez-Santos, 2017). Consequently, more factors that may lead to water contamination should be analysed. Both Neafie (2018) and Rudra, Alkon, and Joshi (2018) find that FDI is decreasing access to clean potable water in developing nations due to pollution and enhanced water usage. Hoekstra et al., (2011) and Wang et al., (2021) describe the ratio of greywater footprint as an essential indicator for assessing water pollution and quality-induced water stress. However, due to the lack of water pollution data accessibility, it is difficult to calculate the grey water footprint (Wang et al., 2021).

Even though this paper argues that FDIs affect water-induced conflicts by inflicting pollution-induced water scarcity, water usage also has to be taken into consideration. If analysing only one factor, quantity or quality, the study cannot appropriately encapsulate the maximum effect that a diminution to water access may have on the social and political attitudes of the people (Neafie, 2018). When MNC uses extensive quantities of water and/or contaminates water, the low-income individuals are "directly impacted because they rely primarily upon surface water and bore wells" (Rudra, Alkon, and Joshi, 2018, p. 370). Thus, this study employs water access as the first dependent variable.

3.2. Independent Variable: Foreign Direct Investment, net inflows (% of GDP)

In the first stage, the foreign direct investment represents the independent variable. According to the World Bank, foreign direct investment(s) are net inflows of investment to obtain a “lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor”. The data covers a period between 1970-2019 and it is obtained from the World Bank. However, as aforementioned, this study only focuses on the period between 1997 and 2009. As the relationship between FDI and water pollution has been tested and confirmed in the literature, it is considered that subnational data would be more precise (Rudra, Alkon, and, Joshi, 2018). However, as nobody has investigated before the relationship between FDI and water-induced conflicts, the sample of this study comprises only the countries provided by Bernauer et al., (2012). As Neafie (2018), this study employs only net inflows and not total FDI because it focuses on fluctuations over time, "which would be influenced by new inflows during that period" and offer a more specific result of how FDI directly affects changes in water access (p. 17).

3.3. Dependent Variable: Water Events Scale (WES)

In the second stage, the water events scale (WES) represents the dependent variable. Bernauer et al., (2012) have created the WARICC dataset with "compiled event data on water-related conflict and cooperation in 35 Mediterranean, Middle Eastern, and Sahel countries for 1997-2009" (Boehmelt et al., 2014, p. 340). The WES indicates the severity and influence of a domestic water-related event. They define an event as "unilateral actions by individuals, firms, NGOs, or state authorities, or interactions between them over water-related issues" (Boehmelt et al., 2014, p. 340). This study does not focus on investigating whether FDI or pollution-induced water scarcity have contributed to cooperation among countries. Nevertheless, Bernauer et al., (2012) explain that WES has an 11-point scale, where +5 indicates the most cooperative event and -5 represents the most conflictive activity at a domestic level. Additionally, this scale evaluates the level of intensity/impact of a specific event. The +5 points on scale exemplify events that potentially improved the overall condition of water quality/quantity in a country. The entire dataset includes 10.352 water-related events, among which there are 1790 conflictive non-violent events and 70 events that include physical violence (Boehmelt et al., 2014). In this study, only the 32 countries presented below (Figure 1) are used in the analysis. In Figure 1, the events are presented by location with an ascending data order. The average score of conflictive/cooperative water events has been calculated per year. As the area chart shows, France had the most conflictive events in 2000 with an average score of "-4". Among the countries with the most cooperative events, there is Mali with an average score of "3" in 2001.

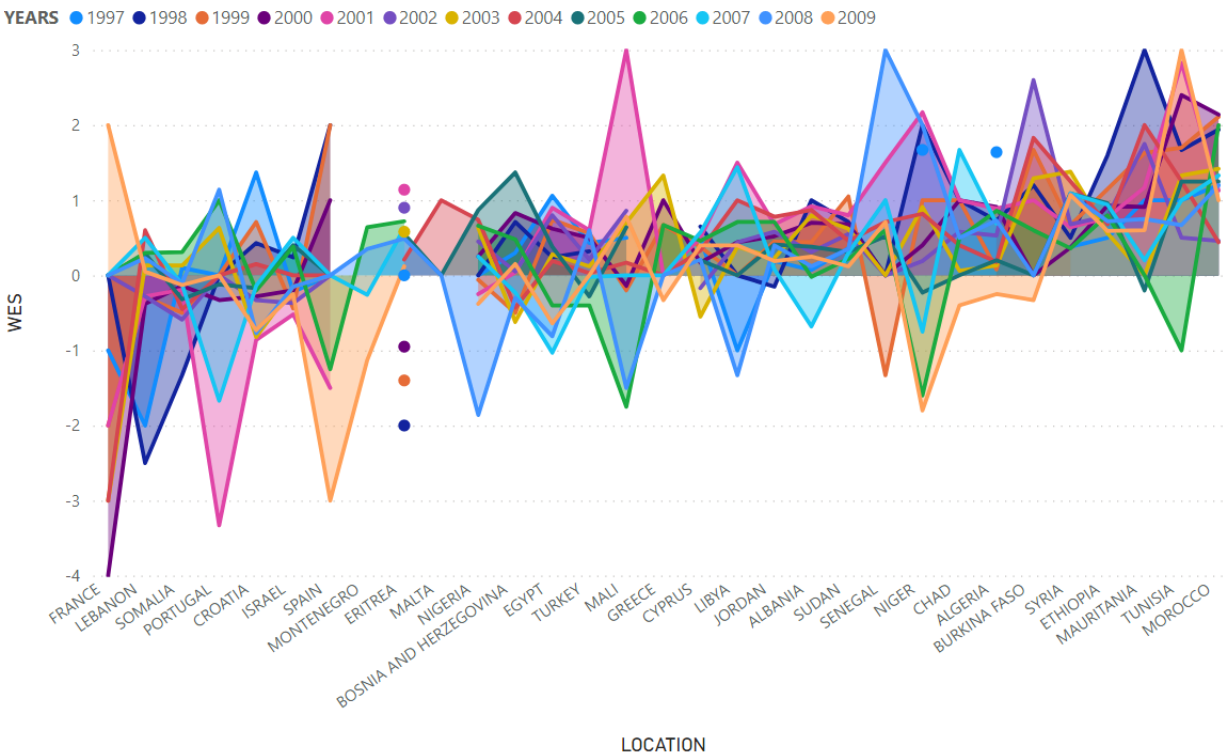

Figure 1. Water Events Scale by years and location. Adapted from Boehmelt et al., (2014), p. 341.

Figure 3 describes the types of scale-based values between "3" and "-4". A value of "5" represents an event that leads to a significant improvement of water quality/quantity. Contrastingly, a "-5" score indicates a situation where the deterioration of WQQ is associated with physical and potentially deadly violence. This figure is adapted from Boehmelt et al., (2012), and not reproduced. As the countries have faced an unequal number of water events, in this study, the average value is calculated per year and country. In Figure 2, it is observable that the values are between "3" and "-4". However, a value of "0" refers to a relatively neutral impact, for example, making declarations on water subjects. If the value is below "-1", it refers to events that risk having a negative effect on water. This study focuses only on the results reported in **Figure 1.**

Value	Classification
3	Events with a medium degree of intensity that may regionally or nationally lead to an improvement effect of Water Quality/Quantity (WQQ)
2	Formally established measures that promise an improvement of WQQ.
1	Events that may lead to a locally small-scale improvement of WQQ.
0	Activities that have an unobservable effect on WQQ.
-1	Events that may locally have a small negative impact on the WQQ.
-2	Tense intrastate (domestic) or inter-state (international) situations may lead to the decline of WQQ.
-3	A vast disagreement of the public concerning policies and water quality/quantity-related decisions.
-4	Events that have a high chance of decreasing WQQ.

Table 1. The Categorized Events Based on their Value. Adapted from Boehmelt et al., (2012), p. 342.

3.4.Control Variables

The model includes five control variables to improve the accuracy of prediction of the effects of FDI. Additionally, the chosen control variables are considered to be important for both stages.

Total Population includes all residents without considering their citizenship and legal status. Various scholars (Fearon & Laitin, 2003; Homer-Dixon, 1999; Koubi et al., 2012; Boehmelt et al., 2014; Rezaeedaryakenari et al., 2020) contend that population size represents a crucial predictor of violence in conflict studies.

GDP per capita is used as a proxy for economic development which represents an important standard control variable. Moreover, it is viewed by the literature as having a negative effect on conflict (Collier and Hoeffler, 2004). Urban population growth, total population, and GDP per capita are all World Bank's World Development Indicators and have been transformed as logged variables to reduce skewness (Neafie, 2018). Boehmelt et al., (2014) find that a higher economic development may decline the likelihood of high-intensity civil conflict but amplify the risks of facing non-violent disputations regarding water resources.

Domestic investment is measured as a percentage of GDP and it has been logged. It is employed as a control variable to isolate the impact of FDI on water resources (Rudra, Alkon, and Joshi, 2018). It is "measured through gross fixed capital formation (GFCF)" which was previously named gross domestic direct investment (Neafie, 2018, p. 18). The data is taken from the United Nations Statistics division.

Regime type is measured as polity2, which is taken from the Center for Systemic Peace (CSP). Polity2 is considered to be a revised version of the POLITY score which encapsulates "political regime authority spectrum on a 21-point scale ranging from -10 (hereditary monarchy) to + 10 (consolidated democracy)" (Indicators, 2021). Moore and Jaggers (1990) stress that the state has a crucial influence in "determining the level and types of violet collective action manifested in society" (p. 27).

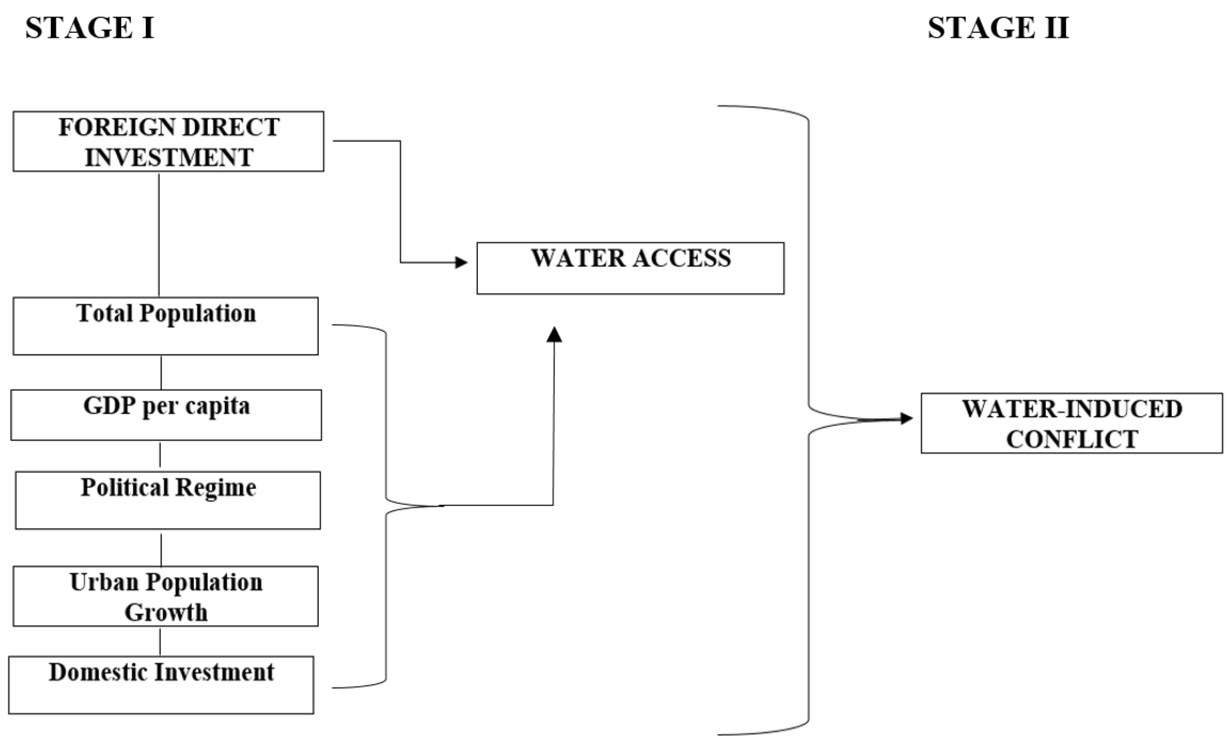

Figure 2*. Two-stage regression model*

3.5. Two-stage Regression Model

As mentioned, to test how FDI affects the likelihood of water-induced conflict, a two-stage regression model is employed based on panel data from 32 countries, during the period between 1997 and 2009. In the first stage, the estimated value of the relationship between FDI and water access is assessed, controlling for the *logged total population, logged GDP per capita, political regime, logged urban population growth, and logged domestic investment*. In the second stage, the effect of the FDI-water access relationship is tested on the water events scale (WES). Additionally, various linear regression assumptions have been verified and are presented in

Appendix I. For both of the stages, the parameters are estimated with robust standard errors to solve potential heteroskedasticity.

4. Results

Table 2 comprises the results of the first linear regression model with the estimated effect of the relationship between FDI and water access. The F-statistic indicates the ratio of improvement that is generated from fitting the model (Field, 2018). The F-value is statistically significant ($F(6, 239) = 109.267$, $p < 0.001$). R-squared explains 76% of the variation of water access, which means that the regression model fits well the observations. After the multiple linear regression is conducted, Model I shows a strong negative relationship between FDI and water access. As predicted in the theoretical discussion, FDI negatively affects water access. When FDI inflow increases, access to water decreases, while all other factors are held constant. For every 1-unit increase of FDI flows, the percentage of people that use at least basic water decreases by -1.968E-10 ($p < 0.001$). This result indicates that FDI affects water access, either by polluting or by enhancing water usage, as the p-value is less than any reasonable significance level ($p < 0.001$). The Adjusted R-squared indicates that the model generalizes well, as its value is identical to the one of R-squared (Field, 2018).

Additionally, there is a positive relationship between population and *the percentage of people using at least basic drinking water service* (water access) ($b2 = 5.929$, $p < 0.01$). However, there is a strong negative relationship between urban population growth and water access ($b3 = -11.285$, $p < 0.001$). Consequently, as the urban population grows, water access decreases. With an additional dollar per GDP per capita, water access increases by 27.780 ($p < 0.001$). The logged domestic investment is statistically insignificant, which means that it has no impact on water access as long as FDI is present. Simultaneously, as the political regime becomes more authoritarian, water access decreases (b6 = -0.0534, $p < 0.01$).

Table 2. Linear Regression Model: The Impact of FDI on Water Access with logged control variables (Parameter Estimates with Robust Standard Errors)

	Model I
(Constant)	-29.717*
	(16.913)
FDI net inflows	-1.968E-10***
	(4.106E-11)
Logged Population Total	5.929**
	(2.073)
Logged Urban Population	-11.285***
Growth	(2.715)
Logged GDP per capita	27.790***
	(1.731)
Logged domestic	-1.939
investment	(1.173)
Polity2	-0.534**
R^2	0.73
Adj. R^2	0.73
N	240

Note: OLS regression coefficients with standard errors in brackets.

***p < 0.001, **p < 0.01, *p < 0.05

Table 3. Hierarchical Linear Regression Model: The Estimated Effect of FDI-Water Access on Water-induced Conflict with and without logged controlled variables (Parameter Estimates with Robust Standard Errors)

	Model I	**Model II**
(Constant)	1.518***	3 .498***
	(0.239)	(0.862)
Predicted Value	-0.014***	0.007
(FDI + Water Access)	(0.003)	(0.009)
Logged Population		-0.263**
Total		(0.096)
Logged GDP per		-0.502*
capita		(0.257)
Polity2		-0.043***
R^2	0.76	0.19
Adj. R^2	0.73	0.18
N	240	240

Note: OLS regression coefficients with standard errors in brackets.

***p < 0.001, **p < 0.01, *p < 0.05

Table 3 presents the results from the hierarchical linear regression from the second stage of which is used to evaluate the predictive power of FDI-water access on water-induced conflict. The first model where only the effect of the predicted value is tested on water-induced conflicts is stronger than the second model. The F value is higher in the first model ($F = 24.519$, $p < 0.001$). The coefficient of determination shows that 76% of the variance in WES is explained by the predicted value alone. The relationship between the estimated effect of FDI on water access, and water-induced conflict is negative. With an additional point of FDI-water access, the water events scale decreases by -0.014 ($p < 0.001$). As a negative value of WES indicates a more conflictive event, the hypothesis that FDI increases water-induced conflict by decreasing water access is confirmed. Although the findings indicate a strong statistically significant effect, based on the WES scale, there is not such a high impact. Events from this category belong to "conflictive interactions, difficulties, or small-scale crises" (Bernauer et al., p. 7).

The second model where the effect of the predicted value on WES is tested while holding constant for logged population total logged GDP per capita, and polity2, is considerably weaker than the first model. The R-squared shows that only 19% fit the model. Whilst the constant is significant, the estimated value is not. However, there is a negative statistically significant relationship between total population and WES ($p < 0.01$). With an additional point increase of the population, water-induced conflict increases ($b_2 = -0.263$).

Additionally, on an apparent look, it seems like GDP per capita may also increase conflict, but the result is not statistically significant ($b_3 = -0.502$, $p = 0.176$). Nevertheless, as the level of democracy (polity2) decreases, there is a higher likelihood for water-induced conflict to occur ($b_4 = -0.043$, $p < 0.001$).

Model 1 includes only the predicted value as the independent variable and WES, the dependent variable. The results suggest that there is a strong relationship between FDI-water access and water-induced conflict. Adding controlling variables significantly decreases the coefficient of determination. This demonstrates that adding more variables to the model does not improve the model fit. The scatterplot (see in Appendix) also depicts a strong negative correlation between the estimated effect between FDI-water access and WES as the data points to a downward slope from the upper-left to the lower-right. This also confirms this research's hypothesis; the FDI presence decreases water access and affects the likelihood of water-induced conflict.

5. Conclusion

The results of the two-stage regression model offer an answer to the research question. As hypothesized, FDI increases the risk of water-induced conflict by decreasing access to basic water services. The theory and findings offer support for the pollution haven hypothesis, as well as for the race to the bottom theory. For the advantageous economic features of FDI, people risk losing access to basic water sources. Additionally, the findings indicate the same relation that Neafi (2018) obtained: "International sources of degradation" can have a greater impact than domestic ones (Neafie, 2018, p. 24). In addition, as suggested in the theoretical framework, the political regime influences the likelihood of water-induced conflict. The findings suggest that authoritarian states are more likely to face conflicts. The findings of the urban population growth that decreases water access seem to be confirming neo-Malthusian fears. As there are more people, natural resources become scarcer.

From a human security perspective, the effect of FDI on water access should be urgently addressed to reduce water scarcity and the health risks that come with it. The results also have an important impact on the environment-conflict nexus. Economic factors should be addressed more in this context. The results highlight that FDI influences the likelihood of water-induced conflict. As aforementioned, the relationship between FDI and water access has substantial effects on water management policy-making. If individuals, groups, or organisations become more aware of the dangerous impact of FDI on water quality and quantity, they can hold the governments accountable for their unsustainable policies.

Even though the results are statistically significant, the chosen sample of 32 countries is relatively small. For future research, a larger sample may lead to more generalizable results. Nevertheless, the estimated effect of FDI on water access does not seem to lead to violent conflict or water wars. The analysis can only confirm that there is a negative effect on water quality and quantity that could lead to tensions. This may indicate either that the water events are not severe enough to generate social mobilization, or that there is a lack of social cohesion. A recommendation for the future is to select a larger sample, while simultaneously trying to control for other factors, such as corruption. Thus, the presence of the negative impact may become more salient. Using corruption as a control variable could isolate the effect that FDI has on water access. It can show to what extent is corruption at fault for the environmentally harmful activities. Additionally, more tests such as a moderation model, to compare the strength of the relationship.

For the sake of transparency, two existing limitations need to be addressed. First, a greywater footprint is considered to be the best indicator of water pollution and quality-induced pollution (Wang et al., 2021). Due to a lack of data accessibility, this indicator is not used. Second, the water access variable included, suffers from many missing values, as it comprised the data only for the years between 2000 and 2009. Nevertheless, the results proved to be statistically significant.

As a recommendation for policy implications, this paper also suggests the implementation of expert groups formed out of policy-makers and academic scholars that could find specific solutions depending on the severity of the pollution that FDI causes. Qualitative research can also help to assess what is the specific perception of people regarding this relationship. From a theoretical point of view, relative deprivation and grievances may represent theoretical important factors. However, their strength of prediction cannot be empirically tested, and more exogenous factors may influence the analyzed relationships. As the water event scale includes various cooperative events, the cornucopian perspective can also be relevant. However, in the current literature, there was not found any study that would indicate a positive relationship between FDI and water access. In the past, the existence of a negative relationship was considered to be contested.

Overall, this research highlights the existence of the relationship between FDI and water-induced conflict based on a two-stage process. This research contributes to the literature by offering a new perspective that can shape new environmental legislation, as well as treaties for water management among countries to limit water-induced tensions. As water is an essential valuable resource for every human, it should be in everyone’s interest to protect it. Thus, the exploration of this relationship in different contexts should continue.

Although FDI is now interpreted as one of the potential factors that may affect the likelihood of water-induced conflict, more factors should be analysed and compared in a comprehensive analysis. As long as these factors are going to be allowed to damage the environment and trigger social and political unrest, people will increasingly suffer. It is predicted that a higher number than 5 billion individuals may be water deprived by 2050. The UN report suggests that this prediction is made based on enhanced demand, polluted supplies (Water shortages could affect 5bn people by 2050, 2018). Thus, if these activities are not stopped by collective action Neo-Malthusianism can predict the future.

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http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG; GDP per capita (constant 2000 US$) http://data.worldbank.org/indicator/NY.GDP.PCAP.KD; GDP per capita growth (annual %25) http://data.worldbank.org/indicator/NY

Appendix 1 – Assumptions

The Normal Q-Q Plot shows a straight line with a few dots below and above the line. This might suggest a small issue with kurtosis. As the quantiles are close to the diagonal line, distribution is considered to be normal (Field, 2018). In the first stage, as well as in the first model of the second stage, there are concerns of heteroskedasticity. Thus, the parameters are estimated with robust standard errors. Fortunately, for the first model of the second stage of the regression model, all the tests for heteroskedasticity are statistically insignificant. The Breuch-Pagan Test shows a p-value of 0.126. Multicollinearity is not an issue for neither of the models, as VIF is below 5.00. However, as the controlling variables are tested in the first stage, in the second stage, there are strong signs of multicollinearity. Thus, GDP per capita from the second stage was excluded from the second model. This shows that the addition of the controlling variables into the second model is unnecessary. Additionally, in the first stage, there is a strong sign of positive autocorrelation as Durbin-Watson equals 0.246. The Kolmogorov-Smirnov and Shapiro-Wilk tests suggest that the variables are not normally distributed as $p < 0.05$. Nevertheless, the histogram shows normally distributed data.

Appendix II

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
WES_pyear	388	-4.00	3.00	.3149	.91888
FDInetinflows	405	-497796507.90	85137061931.00	4492442333.6862	12174102740.64668
percentage_people_with_water_access	314	18.70	100.00	77.7555	25.10993
polity2	373	-9.00	10.00	2.0161	6.31560
log10_populationtotal	416	5.58	8.19	6.9783	.60516
log10_urbanpopgrowth	400	-2.90	.90	.3080	.37946
log10_GDP_per_capita	398	2.05	4.66	3.4168	.67616
log10_domestic_investment	350	8.25	16.14	11.1012	1.25626
Unstandardized Predicted Value	309	44.50565	124.52199	80.8450743	18.89054969
Valid N (listwise)	237				

Online Appendix:

https://drive.google.com/file/d/1UAijx82TQYOUm4OhH7syBPErwmxFBSSM/view?usp=sharing