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Could foreign direct investments be a liability in Sub Saharan Africa in terms of corruption and the environment?

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Abstract

This paper's objective is to bring context and important findings on how foreign direct investments can impact Sub Saharan Africa. Based on previous research and theory data has been collected and gone through several econometric tests to set up two different panel datas:
1. How FDI can impact CO_2 emissions.
2. How FDI can impact corruption.

The method of this study is designed so the results can be reliable and trustworthy. Sub Saharan Africa is to a large extent in a developing faze with a lot of the countries being classified as developing countries. The endowments in natural resources could be of benefit in this regard. Natural resources may be an industry that helps lift the region out of poverty and keep on developing, but may also be a risk when it comes to environmental degradation. A potential interference to this is corruption, which is existent in Sub Saharan Africa. The research shows that FDI does have an effect on CO_2 emissions negatively. This means that the results exhibit FDI inflows leading to CO_2 emissions. The results cannot say anything about corruption since the significance was too low. The evidence backs up previous research and theories compiled in the study.

List of abbreviations

GDP- Gross domestic product

FDI- Foreign direct investments

SSA- Sub saharan Africa

MNE- Multinational enterprise

DRC- Democratic Republic of Congo

CPI- Corruption Perceptions Index

CO2- Carbon Dioxide

FE- Fixed effects

RE- Random effects

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1. Introduction

After taking a look at the FDI and reading some studies it became evident that the public opinion and the manner in which FDI are discussed is very positive. The tone is in support of FDI and that it is something necessary for emerging markets to start growing economically (Moncus & Devlin, 2020). One plausible explanation for this is not only because it provides capital to the regions which may have a greater need of money but also because of other factors caused by FDI, such as spillover effects. Also, there is evidence for correlation between FDI and a rise in economic growth with several studies acknowledging the correlation (World Bank, 2021). So what are the problems with FDI? The case of FDI in SSA is interesting for many reasons. For example it's increase (The world data bank, 2022), the sectors and industries invested in, and the regard for how the capital actually is invested and how they affect their surroundings. Adding to the layers is the fact that the countries in Africa and especially in SSA are pursuing and making changes to invite FDI. Between 2000 and 2012, 55 countries in Africa made changes to 1082 institutional policies to promote and enable a more favorable environment for foreign investors in the region. (Demir, 2016).

The region has abundance in some natural resources, especially minerals and metals, which could be an important market for these countries aiming to grow economically (OECD, 2011). The investments made in the region are largely made up by extraction of natural resources or greenfield projects (UNCTAD, 2022), some examples being new factories, power plants, airports which are built from scratch.

With the popular opinion being that FDIs are something positive and with countries in SSA pursuing it to a farther degree it might be important to take a look at the phenomenon from a different perspective. It is easy to view economic growth, in this case GDP growth, as the ultimate goal. But should it be the ultimate goal? There are other metrics, goals and numbers that could be overlooked. Whilst many studies have been done on just this relationship between FDI inflows and an increase in economic growth, what the studies lack is perception on the surroundings of the region. The tunnel vision on economic growth may lead to ignorance or blindness to other important components.

The region is also indicating high levels of Corruption (Transparency International, 2023) which should be a cause concern with MNE and other countries investing large amounts of capital into projects and operations in the region. And with the region being very rich in natural resources, there could be a risk of exploitation from an environmental and corruption standpoint. This research will hence aim to see environmental effects and corruption as potential consequences from FDI inflows.

1.1 Purpose

The purpose of this thesis is to elaborate on the already researched topic of FDI inflows in SSA. The net inflows in FDI have grown and more and more countries have influence over the region through FDI (Stein & Uddhammar, 2021). The FDI seems to have brought economic growth to the region which is undeniably a good thing but there are other things that might be overlooked. With the country being high in corruption and in natural resources this paper aims to see the potential exploitation of Sub Saharan Africa.

The purpose extends to these countries, or countries alike, what FDI can impact and affect further than just economic growth. FDI can impact different countries in different ways and it's important to have an understanding where that comes from. For example there are studies that touch on how FDI can provide capital for the infrastructure construction of the host country, improve the capital utilization rate, and facilitate the industrial structure upgrading (Wu et al, 2021). These are all of course good repercussions but as stated in the introduction SSA could have some concerns regarding FDI with risk of exploitation from high levels of corruption (Transparency International, 2023). With many natural resources in abundance this could call for a bad combination with corruption preventing the proper development needed to fight climate change. This thesis purpose intends to provide important context to the very complex different consequences that than arise from FDI. Could FDI be a cause for environmental degradation and could FDI be a cause for corruption?

Hence, this thesis question is as follows: "Could foreign direct investments be a liability in Sub Saharan Africa in terms of corruption and the environment?

2. Theoretical framework and definitions

This first section will encompass definitions and important background knowledge needed for this study. The definitions are essential to understand what exactly FDI are and other important terms. The second part will present the theoretical framework for environmental degradation and corruption and is the groundwork for the grasp of the study.

2.1 What are FDI?

Foreign direct investments, or FDI, has a definition as following:

"Foreign direct investment (FDI) is a category of cross-border investment in which an investor resident in one economy establishes a lasting interest in and a significant degree of influence over an enterprise resident in another economy. Ownership of 10 percent or more of the voting power in an enterprise in one economy by an investor in another economy is evidence of such a relationship" (OECD, 2023).

This definition places emphasis on the power aspect of FDI's, having more or less to say. This is an important detail for FDI to have in mind.

2.2 Spillover effects and consequences from FDI

Spillover effects in this context can be explained as a byproduct by the investments. The effects that come with the FDI being made and how the investments have affected the surroundings. The byproducts can be many things such as both knowledge spillovers and technological spillovers. These spillover effects are more traditionally looked at in a positive manner as host countries can take examples from more advanced enterprises and their operation (Scarra & Piccalugia, 2022). While spillovers are clearly defined there are essentially no limits to what can be derived from FDI. Several consequences and effects from FDI have been derived empirically which will be touched on later on what exactly that means. Consequences from FDI can be defined in many ways. Some call it the "Impact from FDI " and give examples such as contributions to rising productivity in the US (International Trade Administration). The European Journal of Political Journey demonstrated that, for example, one consequence from FDI is a larger share of votes going to right wing parties (Cohle & Ortega, 2022). The point being that the consequences from FDI are larger than just theoretical spillovers or economic effects and are endless depending on the region and the circumstances.

2.2.1 Horizontal spillover effects

Externalities that arise as a result of the transfer of technology from foreign companies to domestic companies are referred to as horizontal spillovers (Meyer, 2004; Magombeyi & Odhiambo, 2017). This technology transfer takes place without any agreements or business dealings. A particular kind of horizontal spillover impact is the demonstration effect. This impact operates through direct interaction between local agents employing various degrees of technology from the MNE. Newer and more efficient technology makes it simpler for domestic companies to adopt it, which encourages technological spillover brought about by home companies copying foreign technologies and goods (Ibid). Another type of horizontal spillover is the movement of labor. MNE help develop local human capital by aligning local employees with the firm's degree of technology. Via the movement of laborers to local businesses, improvements in human capital contribute to improvements in welfare and more. The improvement in human capital has two effects on the local workers' welfare; it enhances the quality of human capital for individuals, which can in turn lead to an increase in real wages due to raised productivity (Ibid).

2.2.2 Vertical spillover effects

Instead of relying on externalities, vertical spillovers are produced through market activity (Meyer, 2004). Backward and forward links make up these connections (Magombeyi & Odhiambo, 2017) which occur when a foreign company buys intermediate goods from regional businesses, which boosts demand and output in domestic businesses. This essentially means that international trade can lead to spillover effects. This can lead to the transfer of technology and expertise from the overseas subsidiary to regional businesses.

2.3 Economic growth

Economic growth is considered as one of the most important measurements when it comes to economic policy, and one every country should strive for. In this aspect it is essential to include it as an important element of FDI. Economic growth can be defined as the following: "Economic growth describes how much an entity, such as a country, is increasing and improving the goods and services it produces" (McKinsey, 2022). Traditionally it is measured with changes in GDP.

2.4 Theories regarding Environmental degradation

2.4.1 Environmental effects

The environment in SSA may be impacted by FDI in both good and bad ways, and the total effect relies on a number of variables, such as the industry, the laws and policies of the host nation, the degree of community involvement and the type of investment.

Positively, FDI can support the growth of more ecologically friendly sectors and procedures in SSA. Multinational firms, for instance, might provide innovative technology and operational procedures that lower greenhouse gas emissions, conserve natural resources, and support renewable energy sources. FDI may also result in the construction of environmentally friendly infrastructure, including public transit networks, energy-efficient structures, and waste disposal facilities (Ojewumi & Akinlo).

On the other hand, FDI's may cause the SSA environment to deteriorate. This can happen when large multinational firms take part in activities that cause significant environmental harm or pollution, such deforestation, land degradation, or oil spills. If FDI results in higher levels of resource consumption or greenhouse gas emissions, it can potentially aggravate already-existing environmental issues like climate change and water shortages. (Ibid*)*

2.4.2 Resource curse theory

Many economists first believed that extraction of natural resources in foreign countries could spark economic growth from scaling the industries and creating jobs. However lately this has been doubted by many scholars and researchers when studying the topic. Most strikingly, economies in developing countries, mainly in mining industries, have shown an increase in corruption and poverty as well as growing more slowly in economic terms (Graham & Tilton, 2005). This has led some to conclude that governments in similar situations, i.e. resource rich countries that are economically poor, should reconsider their policies on FDI and MNE taking over the extraction industries (Campbell et al, 2009). Africa is home to approximately 30% of the world's mineral reserves, 14% of its oil, and 8% of its natural gas are all located in one region. Additionally, the continent is home to up to 90% of the world's platinum and chromium reserves as well as 40% of the world's gold (United Nations).

2.4.3 The pollution Haven hypothesis

The pollution haven theory postulates that differences in environmental regulations between developed and developing countries may be a factor in the general trend away from manufacturing in developed countries, leading to developing countries specializing in more pollution-intensive industries (Cole, 2003). Generally, this makes industries where working with/or extracting resources a lot cheaper in developing countries. The estimated amount spent on meeting environmental norms was $184 billion in the USA alone in 2000, or 2.6% of the US GNP. This shows that developed countries tend to confront an increasing expense of upholding environmental norms over time (Carlin, 1990). This creates a reason for firms and MNEs to establish in countries with less expensive requirements to meet environmental regulations.

2.4.4 Environmental Kuznets curve
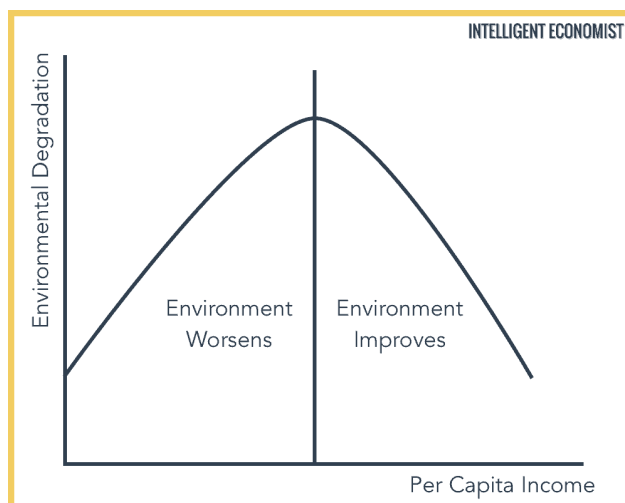
Environmental Kuznets curve, The Intelligent Economist.

Agarwal (2022) states that the environmental Kuznets curve displays an increase in environmental degradation until the per capita income catches up decreasing the environmental degradation. "As the economy shifts towards development and industrialization, the environment is at a higher risk of being harmed by pollution and depletion of natural resources". The cause for the environment to improve, or the degradation to decline, is that technology and awareness of degradation rises.

2.5 Theories regarding corruption

2.5.1 Dependency theory

The dependency theory is more focused on other aspects of economic growth and comes with a broader perspective on development. The theory redefines development to mean that it is more important for a state's citizens to grow as a whole rather than transferring money to the host state. When a MNE settles down across borders and employs the people of the host country, uses the resources, pays the taxes and so on, the host country will become more and more dependent on the MNE, especially if it's a poor country. (Barton & Fisher) This can lead to corruption as local officials may feel pressure to accommodate the demands of the foreign investor, even if it is not in the best interest of the host country. The angle of incentive from the MNE also has some weight. The branches and extensions of the enterprise will mainly focus on the company and to maximize returns and not the host country and might use corruption to get the most optimal deals. The theory also states that once a country is dependent on other countries or companies it becomes increasingly harder to become independent (Ibid). With time the operations in the countries form after each others demands and supplies and become more forged together.

2.5.2 Corruption as a culture

The multidimensional nature of corruption and its relation to cultural norms are examined in the paper titled "When Corruption is Cultural: Exploring Moral, Institutional and Rule-Based Concepts of Corruption." The article contends that corruption is not only an institutional or legal issue, but also a cultural one that is deeply ingrained in societal norms and practices. The framework that the article suggests sees corruption as a multifaceted issue with moral, institutional, and rule-based dimensions. Theory states us to look at the role that social customs, values, and norms play in corruption. Additionally, it explores the challenges associated with addressing corruption in different cultural contexts and emphasizes the importance of culturally sensitive and context-specific strategies to combat corruption (Beltrán & Gonzalez, 2019).

Moral corruption can be caused by many things but one thing that stands out is social inequalities. When people can identify these differences and certain unfairness it seems to correlate with corruption. Theory also states that corruption can be a form of social

determinism. This means that it's just part of cultures just like some cultures arrive late to get togethers and there's no particular reason why. "This kind of social determinism is implausible precisely because it eschews any explanation or understanding of the social phenomenon at all. Things are simply what they are" (Ibid).

2.5.3 What causes corruption?

Theory declares that spending decisions can be a major factor in causing corruption. Investment projects have been shown to be frequent acts in regions with high corruption (Tanzi, 1998). Because of discretion and secretiveness in high public officials over public investment projects the details surrounding the investments can become distorted and changed. Tanzi (1998) states that public projects most certainly have in the past been carried out to give commissions to the people that carry out the projects and the public officials that decided so. In other words, the money public officials get from projects shift what really should be done. Lets say a community needs new roads but the commissions for carrying out different projects are bigger. Public officials may not choose what's in the best interest for the community. Corruption comes into the picture when companies contest each other to carry out the projects and give the best offer to the public officials. This is a major problem for countries with high regulations since more discretions make it harder to see the corruption taking place. The phenomenon of corruption is indubitably more complex than this and several more potential causes are listed. Like financing of parties, regulatory quality and taxation (Ibid).

3. Empirical studies of FDI in Sub Saharan Africa

This chapter provides some context-creating and important studies previously done.

3.1 FDI in Sub Saharan Africa

FDI inflows to Sub-Saharan Africa have increased substantially since the 1990s, according to the United Nations Conference on Trade and Development (UNCTAD, 2021). In the early 1990s, FDI inflows to the region were relatively low, and Sub-Saharan Africa was largely excluded from the global investment flows. However, the global investment landscape began to shift after the end of the Cold War, and developing countries, including those in Sub-Saharan Africa, became attractive investment destinations. UNCTAD's World Investment Report 2021 indicates that FDI inflows to Sub-Saharan Africa reached an all-time high of $32 billion in 2020, despite the adverse effects of the global COVID-19 pandemic. In 2019, FDI inflows to the region amounted to $38 billion, representing an 18% decline from the previous year. The region's inflows in 2020 were still greater than the five-year average, nevertheless. Sub-Saharan Africa has had erratic FDI inflows with large variations from year to year. The majority of FDI's that has entered the area has gone to a limited number of resource-rich nations, including South Africa, Nigeria, and Angola.
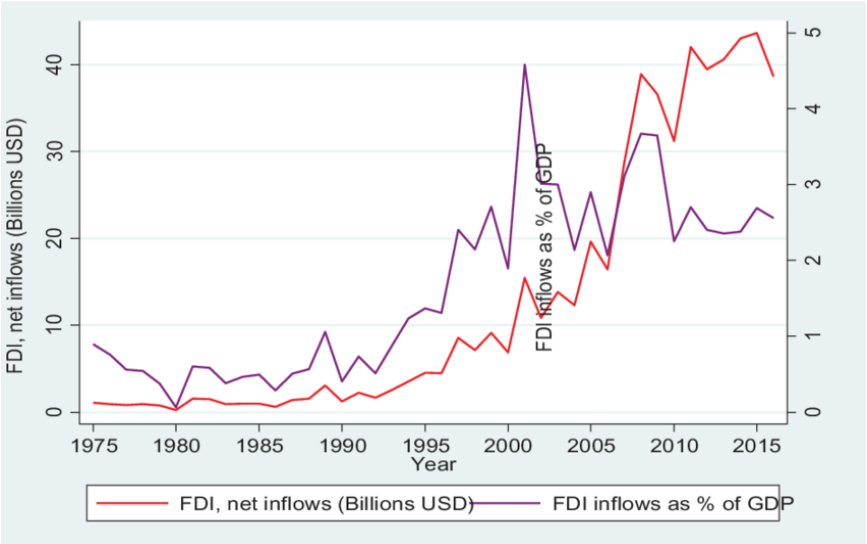
(Lartey & Meniago, 2020)

3.2 Economic growth in Sub Saharan Africa

The World Bank reports that Sub-Saharan Africa has had substantial economic growth since 1970. In the 1970s, the real GDP per capita of the area grew at a 1.9% yearly rate. This rate

grew to 2.7% in the 1980s, but several factors, including political upheaval and decreasing terms of trade, caused it to decline to 0.7% in the 1990s. The economic growth of Sub-Saharan Africa returned in the 2000s, with an average annual growth rate of 4.4%. Real GDP per capita in the area increased at a 1.4% annual pace from 2010 to 2019 despite a decline in the early 2010s (World Bank, 2023). Studies have also shown that the poverty rate in the region has decreased in correlation to economic growth (George et al, 2015).

$1/Day Poverty and Growth in Sub-Saharan Africa, 1970-2006
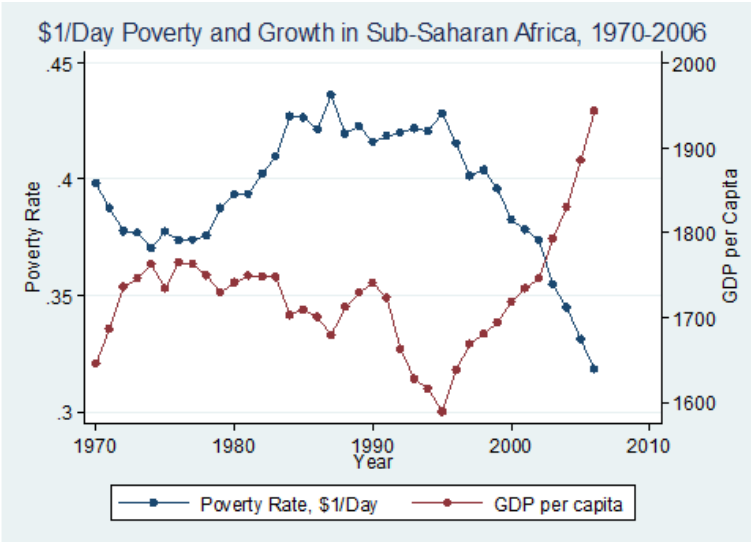
(Ibid)

3.3 FDI and Economic growth

As said in the introduction there have been studies done in the relationship between FDI and economic growth. The collective GDP in the region has increased from 1970-2021, just as the FDI net inflows. This does not confirm a correlation or a relationship. But there are studies that have found a positive correlation between FDI inflows and economic growth in Sub-Saharan Africa. According to a research paper published in the International Journal of Business and Management FDI inflows are an important source of capital for many African countries, and can lead to increased economic growth (Jugurnath, Chuckun and Fauzel, 2016). The study suggests that FDI inflows can provide benefits such as technology transfer, job creation, and access to new markets, all of which can contribute to economic growth in the region (Ibid).

More studies have suggested the same. According to a report published by the OECD in 2012, there is a positive correlation between FDI and economic growth in developing countries. The report states that FDI inflows can have a positive impact on economic growth by providing access to capital, technology, and managerial skills. This can lead to increased productivity,

job creation, and export growth, which can in turn contribute to overall economic development.

The report cites several case studies of developing countries that have experienced significant economic growth as a result of FDI inflows. For example, in Ghana (included in this study), FDI inflows helped to expand the country's export sector and led to increased job creation and productivity. Similarly, in Vietnam, FDI played a key role in the country's transition to a market-oriented economy, leading to significant economic growth and poverty reduction (Ibid).

Overall, the report suggests that FDI can play a positive role in promoting economic growth and development in developing countries, particularly when accompanied by supportive policies and institutions (Ibid)

The correlation between emerging markets, like the ones in sub saharan africa, and FDI's causing economic growth is something that this paper will assume throughout.
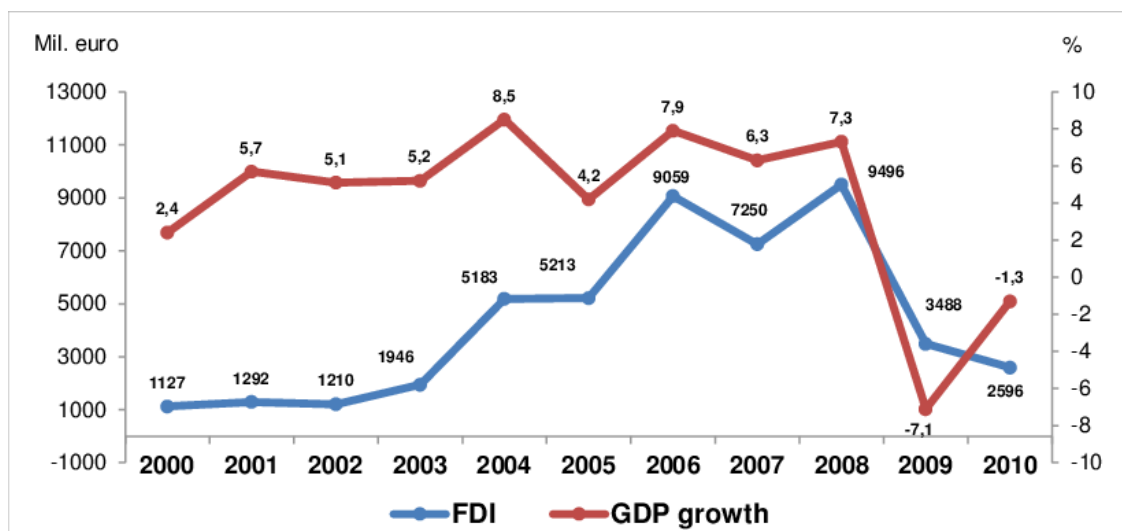
Correlation graph between FDI and GDP growth worldwide 2000-2010 (Tatomir, 2011).

3.4 Evidence from FDI and their consequences and spillover effects
This segment will provide the evidence that exists today of what can happen with FDI inflows. It is documented that FDI can have a decent impact on productivity (OECD, 2002). It is shown that foreign firms are a lot more productive than their domestic peers, indicating that they are doing something better than the others. In theory this creates opportunities for the

domestic firms to learn and imitate the foreign firms to some degree and therefore gaining knowledge, technology or whatever it may be from the foreign firms (Ibid). It has also been shown that FDI's can be traced as horizontal and/or vertical spillovers. In Serbia not only this has been proved but also that the form of industries and size of firms matter too (World Bank Group, 2019). It is important to have in mind that Serbia and the countries in SSA are different countries and this doesn't have to be the case in SSA. It is nonetheless interesting and proof that the effects of FDI can be traced and studied.

3.5 History of corruption in SSA

The history of corruption in SSA dates back the days of colonialism. Colonialism pillaged the continent and stifled local political and economic growth, leaving a legacy that continues to have an impact on the present as shown in the trends of globalization in the twenty-first century (Ocheni & Nwankwo 2012; Heldring and Robinson 2013; Frankema 2015). Since the turn of the millennium, numerous nations on the continent have made notable advancements in the social, political, and economic arenas, while some of these triumphs have not yet been firmly established. This reportedly is being halted to some extent by corruption (Duri, 2020). Corruption undercuts state institutions and monitoring organizations in democracies that are in charge of providing checks and balances on the exercise of power (Pring &Vrushi 2018). As corrupt leaders adopt shady tactics to extend their hold on power and avoid accountability, democracy is delayed in autocratic and weak democracies. These strategies included election tampering and amending the law to increase the number of terms in office. Furthermore, when governmental institutions are politically seized, they can be used by the corrupt elite as coercive means.

There are also several examples from foreign actors having a big role in corruption in the region. Due to claims that he amassed wealth through shady mining and oil dealings in the DRC, the United Nations Department of the Treasury (2017) sanctioned Israeli millionaire Dan Gertler in 2017. In its mining operations in the DRC, Gertler collaborated with Glencore, a British-Swiss multinational commodity trading and mining business. Due to his strong friendship with the late President Joseph Kabila, it's claimed that Gertler functioned as an intermediary for multinational corporations looking to purchase mining rights in the nation. According to the US Treasury, about US$1.36 billion in revenues were lost between 2010 and 2012 alone due to underpricing of mining assets transferred to foreign firms connected to Gertler.

3.6 Environmental Kuznets curve

The theory of the Kuznets curve is interesting since it has empirical evidence. The study "Environmental Kuznets Curve: The Evidence from BSEC Countries" finds evidence of this so-called U shaped figure with income and emissions on each axis. The study concludes that in economic structures with a dominant industrial sector, there is a noticeable rise in environmental pollution (Sarac & Yaglikara, 2017). The authors say that can be attributed to several key factors, including the expanding scale of production driven by the benefits of economies of scale, the escalating utilization of natural resources to meet the growing production demands, and the adverse effects of heightened consumption patterns on the environment. As economies develop, however, the economic structure undergoes a transformation, marked by a shift from the industrial sector to the service sector. Notably, the service sector tends to have a lower impact on the environment due to its reduced reliance on natural resources. Furthermore, as industrialization progresses, concerted efforts are made to combat environmental pollution through the adoption of cleaner technologies, improvements in information processing, the promotion of service-based economic activities, and various environmental enhancement initiatives (Ibid)

3.7 Studies done on corruption and environmental effects

Exactly what the spillover effects and consequences from FDI are is a difficult line to draw and even more difficult to actually measure. This is why this study has narrowed down environmental effects to CO_2 emissions in order to get measurable and reliable data and information to study. This is a suitable measurement to use since the CO_2 emissions relate to many of the environmental issues SSA is facing such as deforestation. The measurement for corruption will be the Corruption Perceptions Index (CPI) and this section provides empirical studies for these specific effects.

3.7.1 CO2 emissions in SSA

Environmental issues have persisted throughout Sub-Saharan Africa, notably in connection to CO_2 emissions. Significant concerns are revealed when the historical trajectory is examined, and the empirical data that supports these issues emphasizes how serious the situation is. An important environmental issue in the area is deforestation. Numerous factors, including the clearing of land for agriculture, the unsustainable logging of lumber, and the growing urbanization of areas, are responsible for this phenomena. In addition to reducing carbon

sinks, the resultant loss of forest cover exacerbates the negative effects of climate change (Agyie, 1998).

Empirical research substantiates the link between deforestation and CO2 emissions in Sub-Saharan Africa. For instance, investigations conducted by Hansen et al. (2013) demonstrate substantial forest loss experienced across the region between 2000 and 2012, leading to significant CO2 emissions. Another significant contributor to CO2 emissions in Sub-Saharan Africa is the energy sector. The region heavily relies on fossil fuels, such as coal, oil, and gas, for meeting its energy demands. Insufficient access to clean and sustainable energy sources exacerbates the reliance on carbon-intensive fuels for power generation, industrial activities, and transportation (US Energy Information Administration, 2018).

3.7.2 Corruption (CPI)

SSA is a corruption plagued region with low CPI scores meaning high reported levels of corruption. The average score is 33 out of 100 and some countries like Somalia report a score below 10 units. 44 of the 49 countries report a CPI below 50 with Covid 19 apparently having a negative effect on the CPI (Transparency International, 2023).

There is evidence which shows that FDI inflows can cause corruption. A study by Wei (2002) shows just this, however the study is on 45 chosen countries and not SSA. Though the evidence is not overwhelming it is enough to point towards some interesting finds that could be made. A study by Li & Resnick (2003) states that the information found on corruption and FDI are susceptible to some flaws in research since there's evidence that point towards that corruption scares away foreign investors. In this case the effects from FDI's might be harder to notice if they cancel eachother out. To even further complicate the issue it seems that the effects from FDI are not that straightforward in general. For example, in SSA it is documented that FDI can have different effects depending on the sector and the effects on corruption vary.

It is important for policymakers to carefully consider the potential risks and benefits of FDI in relation to corruption, and to implement measures to mitigate the negative effects of corruption. This is why it is a great opportunity to further research the topic and get more clarity.

4. Data

4.1 The data set

The data we are using is being set up in a panel data before performing the analyses. It is set up for 44 countries with data being collected from 1990-2021 which is in order with the Central Limit Theorems requirement of 30 observations to get statistically sound results (Ross, 2021). It is collected from The World Data Bank and Transpancy.org and can be interpreted as how the FDI net inflows as % of GDP affects CPI and CO2 emissions, our dependent variables. Doing this in a panel data, and using different control variables will provide context and room for interpretation and comparison between the different variables.

So two different panel data with two different dependent variables will be tested against the net inflows of FDI as % of GDP to see whether anything can be extracted from the data.

The primary limitation of the thesis is its data. The available data concerning countries in SSA has been criticized for being inaccurate, full of error, incomplete and inconsistent (Jerven, 2013). However, it is the best data available at the moment, but the consequence is that the results should be treated with some degree of caution. With that being said, again, this is the data available and that goes for all studies being done in the region, it is not exclusive for this paper but something that should be considered when doing any type of research in SSA. This is certainly a limitation for panel data analysis in general since it's very hard to find data points for every single country, every year and for every variable (Hsiao, 2007).

4.2 The dependent variables

Since it's near impossible to see the full effects of FDI in a country let alone in a region it has been decided to narrow down the effects that should be tested to get reasonable results. This has been done to confine the study to get a more deep understanding of FDI and how they might be affecting the environment and corruption. Both the variables have relevant history in SSA and empirical evidence that can be examined (See 3.7).

4.2.1 Environmental effects (CO2 emissions)

Environmental effects for a whole region is not a suitable measurement since it's not clearly defined and hard to measure. But CO2 effects are easier to measure and have more consistent results for most of the countries in SSA. CO2 is a greenhouse gas which causes global warming, acidification and much more. It is also a good metric to use to see deforestation (Nunez, 2022). This variable is measured in CO2 emissions in kg per 2015 US$ of GDP. This to account for the different sizes of GDP for the countries.

4.2.2 Corruption perceptions index (CPI)

The Corruption Perceptions Index, or CPI, is an index that is cut out to measure corruption on a scale from 0 (highly corrupt) to 100 (very clean). CPI takes in 13 different surveys and assessments form 12 different institutions to come up with their results. One of the institutions is the World Bank (Transparency International, 2021). It has been pointed out that the CPI is strongly correlated to two other proxies for corruption, black market activity and overabundance of regulation. All of these metrics are also correlated to the real GDP per capita. And standing out is the CPI explaining over three quarters of the variance. (Paul, 2002). The CPI is a very suitable variable to use to measure corruption.

4.3 The Independent variable

The independent variable of this study is as stated before FDI's. More specifically it's net inflows of FDI as a % share of GDP. This variable is collected from The World Data Bank (2023) from 1990-2019. FDI as a % GDP serves the purpose of also considering the size of GDP for the respective countries. This variable is present in both panel dataset as our independent variable which means that this variable is used to explain the changes in our dependent variables from a statistical standpoint.

4.4 Control variables

To determine if the independent variable is indeed to blame for the observed variation in the dependent variable, control variables are used. Since there may be no causal relationship between two variables when they rise or fall together, extra variables are included in the regression to prevent being fooled by this correlation (Dougherty, 2001)

4.5 For corruption

Control of corruption estimate

The estimate is provided by the World Data Bank (2023) and gives the country's score on the aggregate indicator, in units of a standard normal distribution, ranging from approximately -2.5 to 2.5. This variable is self explanatory to include, it should correlate with the score of CPI.

Regulatory quality

Regulatory quality measures how well the public believes the government can create and carry out sensible laws and rules that support and encourage the growth of the private sector. This variable is measured on the public so it can be perceived as an indicator of trust also. This is an index also spanding form -2.5-2.5.

GDP per capita

Studies have shown that GDP per capita decreases with increases in corruption and therefore this is a good control variable. The argument behind it is that countries with higher GDP per capita generally are more educated and also stronger institutions. It might also be a reverse casualty of corruption causing lower GDP per capita but they do seem to have a negative relationship (Gründler & Potrafke, 2019).

4.6 For environment (CO2 emissions)

Population

Population is a suitable control variable since environmental effects depend heavily on population. This is shown in "Population and Environment: A Complex Relationship " (Hunter, 2000) where population size and distribution is argued as major reasons for environmental issues. Also affirmed by the study, the majority of the world's population growth is mainly happening in Asia and Africa and hence important to include. The data is the total growth in population annually (World data bank, 2023).

Urbanization

It is argued that urbanization is good for the environment for several reasons. Property values are higher and space is used more effectively in urban areas. Therefore, compared to rural

areas, there are more people living on a square mile of land. Cities have less carbon emissions per person than rural places, which is another environmental benefit (Tupy, 2015). Hence low urbanization can be a liability for the environment. This variable is the % of the population living in an urban area. Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects (World data bank, 2023).

Natural resources

Theory states that countries with large natural resource endowments could face environmental deterioration from the energy costing act of extraction. Since this is a region with many natural resources with many being minerals and metals, extracting and working with these materials can be costful from an environmental standpoint. Especially if the tools, equipment and labor force is not up to date in technology or jurisdiction (University of Berkeley, 2023). All of this ties well into our research with corruption and technology spillovers. This specific variable is Total natural resources rents (% of GDP).

4.7 Previous studies and motivation for variables

The previous empirical studies used for this research puts emphasis on the growth of FDI inflows (UNCTAD, 2021)as well on its positive relationship with economic growth (Jugurnath, Chuckun & Fauzel, 2016). This prompts this study to also include economic growth into the picture. So the variables included are chosen with this in mind. When looking at CO_2 emissions the variable chosen is weighted to the own size of the country in terms of 2015 US dollars per capita to not skew the results since larger countries of course will have more CO_2 emissions. This is also the reason why the independent variable, FDI, is weighted with GDP.

As reported by OECD (2012), FDI does cause an increase in productivity. It is crucial to point out that this is not the same thing as efficiency. Productivity measures the capacity for, in this case a country, to produce. Efficiency means the ability to minimize waste which in this case relates to the CO_2 emissions. More production will always cause some form of waste/emissions. Looking at the US for example, industry and transportation stand for more than 51% of all greenhouse gas emissions (EPA, 2022). Efficiency can minimize the waste (Lumen Learning, 2022). This study more so aims to see whether the effects from FDI can make SSA more efficient with their emissions rather than to see if their production creates

CO2 emissions. Corruption enters the picture here. A Yale case study of Asian-pacific countries showed that corruption can to some extent prevent countries from improving their CO2 emissions. "Corruption can directly affect a country's CO2 emissions. For example, embezzlement and bribery may erode public funding for environmental programs and leave fewer checks on carbon dioxide emissions." (YI, 2017) Indirectly, corruption renders an economy less efficient, causing more damage to the environment. This study thus aims to see if FDI can have any impact on corruption or the environment, tying back into the fact that the SSA are pursuing changes to attract FDI.

Table Containing all variables descriptions and sources

Variable	Description	Source
CO2 emissions per GDP	CO2 emissions in kg divided by the GDP in US dollars 2015	World Data Bank
CPI	Corruptions perceptions index, score between 0-100	Transparency International
FDI net inflows	Net inflows from FDI anually	World Data Bank
Control of corruption	An estimate between -2.5-2.5 showing the capability to control corruption in a country	World Data Bank
Regualtory quality	Estimate between -2.5-2.5 showing the quality and capability for countries to cultivate regualtions	World Data Bank
GDP per Capita	GDP of country divied by population	World Data Bank
Urbanization	% of population living in Urban Area	World Data Bank
Population	The total increase in population anually	World Data Bank
Natural resources	Total natural resources rents (% of GDP)	World Data Bank
FDI net inflows as % of GDP	Net inflows from FDI anually divided by the countrys GDP	World Data Bank

5. Method

As mentioned the data has been set up in two different panel data models with CPI and CO2 emissions as the dependent variables. For each of the panels control variables have been selected before the analysis. The analysis for corruption is more susceptible to less accurate results since the data for CPI only was available from 2012-2019 while the data for CO2 emissions was available from 1990-2019. The foundation for the analysis and methods will be presented in this section.

5.1 Missing data

In this chapter all the missing countries and the missing data will be regarded for. Some of the data is missing depending on country, year or variable. If 2 data points of either of these are missing the section of that data has been removed completely. For example, Burundi was missing 2 years of data in CO2 outages from 1996-98 so all the data from those years were removed for the country of Burundi. Even if one datapoint is missing the section has been removed to ensure the best possible results. Below are all the data points or entire countries missing from the study.

Corruption: Liberia, Mauritius, Guinea, Djibouti, Eritrea, Somalia 2012-13.

Environment: Eswatini, Sudan, Djibouti, Burkina Faso, mauritius
Burundi 1996-98, 2002-2003, Equatorial Guinea 2000-2005, Eritrea 1990-1995, 2012-2019, Ethiopia 1990-1992, Liberia 1990-1999, Mali 1998-1999, Mozambique 1990, Sao Tome and Principe 1990-2000, Somalia 1991-2012.

This is certainly a limitation for panel data analysis since it's very hard to find data points for every single country, every year and for every variable (Hsiao, 2007).

5.2 Regression model with fixed effects

Two panel datasets have been set up in order to properly analyze and interpret the results. A panel data is a collection of both cross-sectional and time-series data. This implies that data is gathered over a longer period of time for various countries for many variables. From an econometrics standpoint a panel data can be visualized like this:

$$Y\text{it} = \beta_0 + \beta_1 \text{xit} + \varepsilon\text{it}$$

This is a panel data model where Y is our dependent variable, and β_1 is our independent variable. In this case, one of the panel data's Y will be CPI and for the other Y will be CO2 emissions but β_1 will always be FDI. The ϵ is the error competent of the regression. It is appropriate to keep in mind that there might be time- and country-specific effects when comparing different nations. If this is the case, the error term might look like this:

$$\varepsilon it = ai + uit$$

Here ε is a factor containing two variables. The first *a* which is the country specific component which differs between countries but stays constant over time. (Dougherty, 2001) So Country A will for example always have 100 sunny days and country B will always have 80 sunny days. *u* on the other hand is the time specific component which varies over time but stays the same for all the countries. For example all the countries experience the same water levels in the oceans which vary over time. This is what you call fixed effects model. Where there are some fixed effects for each of the countries. In regions such as Sub-Saharan Africa, it is common for unique preferences to exist that are not simply the result of random variation in each country. Therefore, the most appropriate estimation method is fixed-effect regression, which accounts for individual heterogeneity over time (Dougherty, 2001). In this instance, the term "*uit*" refers to the outcome of a predictor, in this case the countries, that is thought to have an impact on all subgroups. Stated by Wooldridge (2012), an unobserved random component, also known as an unobserved effect, is only included in the analysis if it is not linked with the independent variable. This is done with a Hausmann test which will be performed later on.

After adding the individual effects the model can be visualized like this:

$$Y_{it} = \beta_0 + \beta_1 x_{it} + a_i + \varepsilon_{it}$$

Where a_i is the individual effects for each country i.

When doing a fixed effects regression a constant is included in the regression. The constant can be described as a starting point or baseline value for the dependent variable we are studying. It represents the average value of the dependent variable when all the other factors we are looking at are zero or at their reference points. In simpler terms, no matter the individual differences for all the countries in the dependent variable, the constant helps us see how the dependent variable varies across individuals, taking into account their unique qualities that don't change over time (Huntington-Klein, 2022).

5.3 Regression diagnostics

This section outlines the tests that were carried out to evaluate the characteristics of the variables and, consequently, the accuracy of the models.

5.3.1 Hausmann test and endogeneity

The Hausmann test seeks to identify endogeneity. Endogeneity is that the regression model is correlated to the error term which will cause the test results to become biased. As earlier stated this test will also provide us with information on whether the fixed effects model or the random effects model is the most accurate when is comes to running the regression. The FE estimator is consistent even under endogeneity, but the RE estimator is only consistent on the assumption of exogeneity, according to the underlying premise of the Hausman test. As a result, if the test results show a large difference between the FE and RE estimators, endogeneity may be present and the FE estimator should be used (Baltagi, 2014).

When conducting the Hausmann test for both variables FE was chosen as the most appropriate effect to run the tests with. The low p-values declares that null hypothesis of the RE being consisting.

Hausman test - CPI

 Null hypothesis: GLS estimates are consistent

Asymptotic test statistic: Chi-square(4) = 404.841

with p-value = 2.50247e-86

Hausman test - CO2 emissions

Null hypothesis: GLS estimates are consistent

Asymptotic test statistic: Chi-square(4) = 22.4086

with p-value = 0.000166166

5.3.2 Multicollinearity

When using several regressors to explain a dependent variable one is at risk for multicollinearity (Dougherty, 2001). This is when the variables used to explain the dependent variable themselves are correlated which is especially usual in time series analysis. When the data is made up of a number of observations made over a number of time periods a strong time trend in two or more of the explanatory variables will make them strongly correlated, which could lead to multicollinearity. For example heavy rainfall will impact both traffic accidents and agricultural crops growing, causing correlation even though the two might be completely uncorrelated.

To test this one can do a correlation matrix of all the independent variables to see if any of the variables correlate with each other. A correlation of >0.8 is considered like multicollinearity (Rekha, 2019).

The correlation matrix for CO2 emissions shows little to no correlation. However the correlation matrix for CPI shows a high correlation between the corruption control estimate and the regulatory quality (See appendix 8.1). The correlation is 0.8 which is high. This can partly be explained since the indexes are both between the intervals -2.5-2.5 but nonetheless there could be some multicollinearity. To combat the test will be run two times, one with the variable of regulatory quality and one without to see the differences. Multicollinearity only affects p-values and coefficient but not other metrics like goodness of fit (Dougherty, 2001).

5.3.3 Heteroskedasticity

Heteroscedasticity is a statistical term that describes a situation where the variance of the error term in a regression model is not constant across all observations. In other words, the error term's variability is different for different values of the independent variable(s). This violates

the assumption of homoscedasticity, which assumes that the error term's variance is constant across all observations. Heteroscedasticity can lead to biased and inconsistent estimates of the regression coefficients, as well as inflated standard errors, which can affect the statistical significance of the results (Ibid). To address heteroscedasticity, various methods such as weighted least squares or robust standard errors can be used.

The Wald test was employed to test for heteroscedasticity in the models. The null hypothesis of homoscedasticity has been rejected for both CO2 emissions and for CPI.

CPI:
Distribution free Wald test for heteroskedasticity:
 Chi-square(39) = 775.302, with p-value = 1.28789e-137

CO2 emissions:
Distribution free Wald test for heteroskedasticity:
 Chi-square(37) = 773212, with p-value = 0

The conclusion is that there is evidence of heteroscedasticity in the regression model. This suggests that the variance of the errors is not constant across the range of values of the independent variables. Therefore, the standard errors and hypothesis tests based on them may not be reliable, and the alternative method of robust standard errors will be used for both regressions.

6. Results

6.1 CO2 emissions

This regression aims to see how FDI inflows could affect the CO2 emissions in SSA. According to theory the FDI could have an impact on the CO2 emissions for several reasons (See 2.4). For one FDI from MNEs or countries most likely are thinking of making a profitable investment rather than thinking of how it could affect the environment. The pollution haven theory could be a real phenomenon where countries exploit the regulations in the region since the empirical evidence points towards increasing CO2 emissions and other environmental deterioration (See 3.7). But, spillover effects from operations from MNE could impact the CO2 emissions positively and improve efficiency on the other hand. Though the expectation for FDI to have a negative impact on the CO2 emissions, meaning a positive coefficient.

In the results of the regression model, the coefficient estimate for FDI was 0.0470517, indicating a positive relationship between FDI inflows as a percentage of GDP and CO2 emissions. The corresponding standard error of 0.0204929 suggests a relatively precise estimation of the coefficient. The t-ratio of 2.296 implies that the coefficient is statistically significant at the conventional significance level of 0.05. This means that we can confidently conclude that FDI has a significant explanatory power over CO2 emissions in the given model. A brief review of the control variables is noteworthy, even if this thesis does not address their impact, because the values obtained in the regressions support the validity of the data collected. Urbanization was the only control variable that exhibited a positive impact on CO2 emissions, although the p-value of 0.0649 falls slightly above the 0.05 threshold, indicating a weaker level of statistical significance. However, it's still close enough to be worth pointing out (See Appendix 8.3).

The joint test on the named regressors resulted in a test statistic of $F(4, 36) = 3.31251$, with a p-value of 0.0207364. This indicates that overall the independent variable and control variables were statistically significant. Additionally, the robust test for differing group intercepts yielded a test statistic of Welch $F(36, 374.3) = 17.7106$, with a p-value of 1.59767e-60. This result suggests that there are variations in the baseline level of CO2 emissions among the different groups or entities represented in the data. This does not mean

that there is anything wrong in the data setup since these variations could be attributed to factors specific to each group, such as geographical location, socio-economic characteristics, policy differences, or other relevant factors that differentiate them.

6.2 Corruption

This regression aimed to see how FDI could impact corruption, or more specifically CPI. Looking at the CPI, SSA has a very low score across the region with the mean being 33. This indicates high levels of corruption that reasonably has to be caused by something. Theory gives several examples on what might be the case and what can be a cause for corruption (See 2.5). Reasons like regulatory quality, culture and dependency on foreign countries are all theoretical possibilities. Previous evidence shows that FDI can cause corruption (Wei, 2002) and that is also what is expected to see here.

The test for corruption was conducted with FE and showed a high R-squared (0.977002) but a low R-squared within (0.144467). This indicates that a great deal of other factors explain the values of CPI. The F-test however revealed a p-value of 7.11059e-05 which is very low. This means that at least one of the variables in the test har explanatory power, making the model statistically significant. The test in regards to FDI came back as not significant with a p-value of 0.2836. The corruption control estimate showed high explanatory value over CPI and a negative relationship which makes perfect sense since the estimate is used to measure corruption just as CPI is. The p value was measured <0.0001 and the coefficient -6.67794 (See Appendix 8.4)

The test was done with the other data for FDI as net inflows instead of as % of GDP and this time. FDI was shown to have a significant explanatory power over the CPI (See appendix 8.5). This time the test showed signs of a spurious regression with the rule of thumb of having a higher Durbin Watson than R-squared (Granger & Newbold, 1974). This rule of thumb was therefore tested further to confirm if this was an appropriate regression. To examine this an Augmented dickey fuller test was performed with choi meta test scores giving it a Inverse chi-square(76) = 45.4592 [0.9979] with a p-value close to 1, indicating little evidence the reject the null hypothesis test of a unit root (See Appendix 8.6). This means that this is likely a spurious regression. Hence, the results from using FDI net inflows for this panel regression should be avoided to get accurate results. The high explanatory power displayed should be

taken with great precaution. This is probably because these data points are mainly increasing over time and are very large in proportion to the CPI scores.

The test was run again without regulatory quality to avoid multicollinearity (See Appendix 8.7) Multicollinearity does not affect the goodness of fit so the coefficients and p-values are the only interesting differences to delve into (Dougherty, 2001). There were no big changes identified. FDI displays a coefficient of -0.0279240, p value 0.2617, indicating no statistically significant relationship with CPI. As opposed to previous results with a potential multicollinear model, displaying a coefficient of -0.0251917 p-value 0.2836, there is not much of a difference. The corruption control estimate still showed a high explanatory power with a low p value and a negative coefficient of -6.93076.

So in conclusion, the tests for both regressions CO_2 emissions and CPI, were satisfactory in terms of explaining their dependent variables, with both showing that in their F-statistics. The independent variable of FDI showed no significant explanatory over the CPI but did for CO_2 emissions. Both indicated negative coefficients suggesting a counterintuitive relationship. The tests should be looked at with FDI as a % of GDP otherwise the risk of getting inaccurate results from a spurious regression gets too big.

7. Discussion

7.1 CO2 emissions and the environment

A not so surprising result was that FDI showed a positive coefficient in relation to CO2 emissions, looking at the empirical evidence of increasing emissions in the region as well as some increasing FDI inflows. The expectation was to have a positive coefficient which we got. This seemed like the most logical turnout, especially with the factor of economic growth tying in to it as well. It is hard to see how a region could experience economic growth without some increase in CO2 emissions. The production has to have some environmental footprint. The results go against the theory of the pollution haven and from just this perspective the regulations in the region seem to be met by the industries actively receiving FDI, however more research would have to be done to draw that conclusion. This could be explained by the effects like the environmental Kuznets curve (See 2.5.4). The Kuznets curve is theoretically applicable to developing countries where the technology and other reasons stand as factors to the degradation of the environment until a certain point where the degradation starts to slow down. With SSA having a GDP per capita of 1820 US dollars as compared to South America having 9310 (IMF, 2022) it is safe to assume they would be at the lower end of this curve where the environment worsens. One of these reasons could also be the fact that MEN are gaining power in the SSA and get more of a say in the operations, policies and industries. One clear example of this is China's investments in the region and with real cases like the one in DRC in the mining industry this is a possibility. These companies act on their own needs and are more likely to seek maximization to their returns rather than the environment. This is exactly what is theorized as the pollution haven theory (See 2.5.3). The SSA has a lot cheaper regulations to meet and also not as of an attentive regulatory quality (Eric Fosu Oteng-Abeyie, Gideon Mensah, Emmanuel Duode, 2022). It has also been shown that regulatory quality has had an effect on the environment in the region to a great extent (Ibid).

An interesting finding was that urbanization had a pretty significant explanatory power, although not under 0.05 p-value, still enough to mention. Surprisingly it indicated a positive relationship. It is surprising since most of the research that was done on urbanization before it

was included as a control variable pointed towards a negative relationship, i.e urbanization is more CO2 efficient than living in the countryside (Guanghua Wan, 2023).

7.2 Corruption

The returns from the tests for CPI were more surprising than those for CO2 emissions with a negative coefficient with an insignificant explanatory power. The regression analysis aimed to examine the impact of FDI on corruption, specifically measured by the CPI. The CPI score in SSA is 33, indicating high levels of corruption. For reference Sweden's CPI score is 83 (Transparency Internaitonal, 2023). The theoretical framework explored several theoretical explanations for corruption, including regulatory quality, culture, and dependency on foreign countries. One of these theories is the dependency theory, which with a negative coefficient returned for the test is maybe far fetched. The theory argues that the host country may feel pressure to accommodate the demands of foreign investors, even if it is not in their best interest. Branches and extensions of MNEs may focus on maximizing returns rather than the host country's well-being, potentially using corruption to secure favorable deals. This theory highlights the potential negative consequences of dependence on foreign investment (Barton & Fisher). With real evidence of countries, like Nigeria which is a part of this study, showing signs of suffering from dependency on western countries, creating an "exclusive relationship" (Oyetunde, 2022).

The coefficient for FDI was negative, suggesting a counterintuitive relationship. But again, with an insignificant explanatory power so the results for FDI affecting CPI should be viewed cautiously. The corruption control estimate turned out to have a very high explanatory power with a negative coefficient of -6.67794. This makes perfect sense, with high corruption control leading to lower CPI. It is also worth noting that this could be a reverse causality, meaning that a low CPI probably would indicate a good/high corruption control estimate. This control variable is in reality very insipid since it very likely would have a high explanatory power and a negative coefficient. But it serves a purpose of legitimizing the setup of data and the regression in general and validating the other results. If this variable was shown insignificant the results would be hard to trust. The constant for this model also has significant explanatory power and a coefficient of 27.8221. Meaning that when all other variables har held at 0, the CPI on average stands at 27.8221. This essentially means that quite a bit of the CPI cannot be explained by our variables chosen.

When the test was run again without regulatory quality as a control variable to avoid multicollinearity nothing much changed. Comparing the two models, it can be observed that the inclusion or exclusion of regulatory quality as an independent variable does not substantially alter the significance or relationships of other variables. Specifically, the constant term remains highly significant in both models, implying its important role in explaining CPI variation. Moreover, corruption control consistently demonstrates a statistically significant association with CPI, indicating that efforts to curb corruption are associated with lower CPI values. These findings emphasize the need to consider multiple factors when examining CPI dynamics. While corruption control emerges as a critical factor influencing CPI, other unaccounted factors may also play a significant role. Future research could explore additional variables or alternative models to better understand the complex dynamics of CPI and its determinants.

One aspect to take into account when studying corruption is the potential to not get accurate results at all since corruption might be very hard to identify. Corruption in most forms is illegal and definitely not something that is looked keen upon. So MNE, countries or people engaging in corruption would most certainly try to keep it behind closed doors. Plus, one form of corruption could be countries reporting false numbers to avoid tax, regulations or such. For example, deforestation in parts of Romania are rapidly rising right now through illegal logging in national parks. Romania's government has welcomed international timber companies to these regions where they plunder the woods completely illegally. The cut wood must still be certified on site in Romania, provided with so-called logging certificates which they do not have (Markus Pohlmann & Banshina, 2023). WWF estimates in 2022 that 26% of all timber shipments they identified were illegal and did not have a Sumal code or permit. Another 31% had an overload of up to 10%.

Summary

To summarize the study, the results and the discussion one can begin to say that the study has fulfilled its purpose. It was stated in the purpose:

"This thesis purpose intends to provide important context to the very complex different consequences that could arise from FDI. Could FDI be a cause for environmental degradation and could FDI be a cause for corruption?

The conclusion can be drawn that FDI does have an impact on CO2 emissions however not on corruption. The CO2 emission results were displayed as significant leading to the statement that this thesis has fulfilled its purpose. And the answer to the question: Could FDI be a cause for environmental degradation? According to this study it could. The study cannot to a great extreme explain the cause for the high corruption in SSA. This can be because of many reasons. One being that the variables chosen for this study may not be appropriate to examine corruption. One other can be that it is very hard to measure what causes corruption because of the risk of false numbers and data.
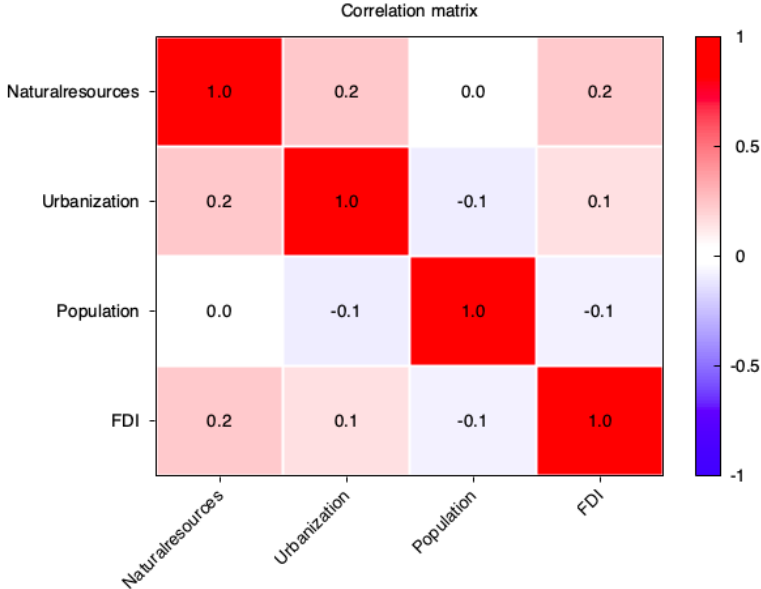
8. Appendix

This section will include all the numbers, tests and regressions performed in this study.

8.1 Correlation matrix for CPI

Correlation matrix
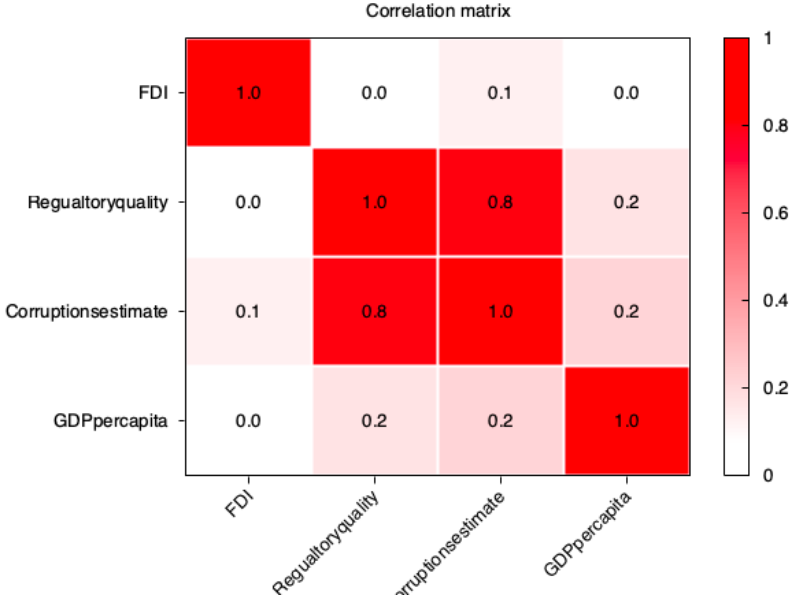
8.2 Correlation matrix variables for CO2 emissions

Correlation matrix

8.3 Regression results with CO2 emissions in kg per 2015 US$ of GDP

Model 2: Fixed-effects, using 1103 observations

Included 37 cross-sectional units

Time-series length: minimum 26, maximum 30

Dependent variable: CO2

Robust (HAC) standard errors

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	−5.55539	4.23898	−1.311	0.1983	
FDI	0.0470517	0.0204929	2.296	0.0276	**
Population	−6.25819e-08	9.75178e-08	−0.6417	0.5251	
Urbanization	0.251427	0.132022	1.904	0.0649	*
Natural Resources	0.0608519	0.0394278	1.543	0.1315	

Mean dependent var	3.531858	S.D. dependent var	7.976497
Sum squared resid	55501.49	S.E. of regression	7.229197
LSDV R-squared	0.208413	Within R-squared	0.024487
Log-likelihood	−3726.074	Akaike criterion	7534.147
Schwarz criterion	7739.385	Hannan-Quinn	7611.780
rho	0.409755	Durbin-Watson	1.166994

Joint test on named regressors -

Test statistic: $F(4, 36) = 3.31251$

with p-value = $P(F(4, 36) > 3.31251) = 0.0207364$

Robust test for differing group intercepts -

Null hypothesis: The groups have a common intercept

Test statistic: Welch $F(36, 374.3) = 17.7106$

with p-value = $P(F(36, 374.3) > 17.7106) = 1.59767e-60$

8.4 Regression results for CPI with FDIs as a % of GDP

Fixed-effects, using 310 observations

Included 39 cross-sectional units

Time-series length: minimum 6, maximum 8

Dependent variable: CPI

Robust (HAC) standard errors

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	27.7603	1.55103	17.90	<0.0001	***
FDI	−0.0251917	0.0231611	−1.088	0.2836	
Regulatory Quality	−1.77301	2.02922	−0.8737	0.3877	

Corruption control	−6.67794	1.20870	−5.525	<0.0001	***
GDP per capita	−0.0199667	0.0334468	−0.5970	0.5541	

Mean dependent var	33.02581	S.D. dependent var	12.75025
Sum squared resid	1155.290	S.E. of regression	2.080127
LSDV R-squared	0.977002	Within R-squared	0.144467
Log-likelihood	−643.7788	Akaike criterion	1373.558
Schwarz criterion	1534.230	Hannan-Quinn	1437.788
rho	0.433486	Durbin-Watson	0.974386

Joint test on named regressors -

 Test statistic: F(4, 38) = 8.21062

 with p-value = P(F(4, 38) > 8.21062) = 7.11059e-05

Robust test for differing group intercepts -

 Null hypothesis: The groups have a common intercept

 Test statistic: Welch F(38, 95.0) = 7.10161

8.5 Regression results for CPI with FDI net inflows

Model 1: Fixed-effects, using 302 observations

Included 38 cross-sectional units

Time-series length: minimum 6, maximum 8

Dependent variable: CPI

Robust (HAC) standard errors

	Coefficient	Std. Error	t-ratio	p-value	
const	27.8221	1.57371	17.68	<0.0001	***
FDI	−2.23271e-10	1.29760e-11	−17.21	<0.0001	***
Regulatory Quality	−1.31237	2.13493	−0.6147	0.5393	
Corruption Control	−6.81607	1.29890	−5.248	<0.0001	***
GDP per capita	−0.0156980	0.0321244	−0.4887	0.6255	

Mean dependent var	32.85762	S.D. dependent var	12.87364
Sum squared resid	1130.779	S.E. of regression	2.085461
LSDV R-squared	0.977332	Within R-squared	0.151386
Log-likelihood	−627.8749	Akaike criterion	1339.750
Schwarz criterion	1495.588	Hannan-Quinn	1402.102

rho	0.431978		Durbin-Watson	0.980973

Robust test for differing group intercepts -

 Null hypothesis: The groups have a common intercept

 Test statistic: Welch $F(37, 92.7) = 7.27089$

 with p-value = $P(F(37, 92.7) > 7.27089) = 5.3997\text{e-}15$

8.6 Choi meta-tests:

   Inverse chi-square(76) = 45.4592 [0.9979]

   Inverse normal test = 2.71952 [0.9967]

   Logit test: $t(194) = 2.95501$ [0.9982]

8.7 Regression results for CPI without regulatory quality

Model 3: Fixed-effects, using 310 observations

Included 39 cross-sectional units

Time-series length: minimum 6, maximum 8

Dependent variable: CPI

Robust (HAC) standard errors

	Coefficient	Std. Error	t-ratio	p-value	
const	28.8236	0.753892	38.23	<0.0001	***
FDI	−0.0279240	0.0245119	−1.139	0.2617	
GDP per capita	−0.0193103	0.0324011	−0.5960	0.5547	
Corruption Control	−6.93076	1.25353	−5.529	<0.0001	***

Mean dependent var	33.02581	S.D. dependent var	12.75025
Sum squared resid	1163.808	S.E. of regression	2.083883
LSDV R-squared	0.976832	Within R-squared	0.138159
Log-likelihood	−644.9174	Akaike criterion	1373.835
Schwarz criterion	1530.771	Hannan-Quinn	1436.571
rho	0.440257	Durbin-Watson	0.969820

Joint test on named regressors -

 Test statistic: $F(3, 38) = 10.6854$

 with p-value = $P(F(3, 38) > 10.6854) = 3.12792\text{e-}05$

Robust test for differing group intercepts -

 Null hypothesis: The groups have a common intercept

 Test statistic: Welch $F(38, 95.0) = 11.0406$

 with p-value = $P(F(38, 95.0) > 11.0406) = 2.27293\text{e-}21$

9. Sources

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