



FOREIGN DIRECT INVESTMENT AND ENVIRONMENTAL SUSTAINABILITY IN BOTSWANA

Simon Tumisang Emeldah*, Ge Heping

Simon Tumisang Emeldah is currently pursuing masters degree program in Finance in Nanjing University of Information Science and Technology, China Nanjing 210044. E-mail: tumisangsimon108@gmail.com

Ge Heping is a professor in Nanjing University of Information Science and Technology, China Nanjing 210044. E-mail: 00251@nuist.edu.cn

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ABSTRACT

This article examines the relationship between foreign direct investment (FDI) and environmental sustainability in Botswana, a nation celebrated for its rich diamond reserves and extensive wildlife sanctuaries. As Botswana navigates economic development, the potential environmental costs incurred by FDI pose a critical dilemma. This study is anchored in the Pollution Haven Hypothesis (PHH) framework, exploring whether Botswana's economic allure for FDI might encourage a migration of polluting industries to its jurisdiction. The analysis utilizes an Ordinary Least Squares (OLS) methodology, drawing on data from 1974 to 2020 to assess trends and correlations between CO₂ emissions, FDI inflows, GDP, and population growth. The results reveal a significant positive relationship between FDI and CO₂ emissions, suggesting that increased FDI correlates with heightened environmental impact, largely due to industrial activities. While GDP growth does not show a direct and significant effect on emissions, population growth is associated with an increase in CO₂ emissions, indicating potential demographic challenges to environmental sustainability. The study also finds evidence of a long-term equilibrium relationship among these variables, which supports the possibility of co-integration. Botswana stands at a transformative juncture, seeking to attract non-polluting FDI while bolstering environmental regulations. The findings imply that, while FDI has been a driver of economic diversification, it has not been without environmental repercussions. Botswana must, therefore, forge a strategic path that aligns economic aspirations with ecological preservation, ensuring that the nation's natural wealth sustains future generations. In the broader discourse on sustainable development, Botswana's experience provides valuable insights into the global challenge of achieving economic prosperity without compromising environmental integrity. This study concludes with a call for policies that harmonize economic and environmental objectives, suggesting a future where these goals are balanced and synergistically aligned.

1. INTRODUCTION

Botswana, known for its rich diamond mines and expansive wildlife reserves, stands at a crossroads where economic development goals must be balanced with environmental conservation. The country's approach to foreign direct investment (FDI) has been viewed as a mechanism for economic diversification. However, the environmental implications of such investments have been a growing concern. With its unique positioning as both a biodiversity hot spot and a developing economy, Botswana presents an intriguing case for examining the nexus between FDI and environmental sustainability. Botswana stands as a testament to the transformative power of natural resources in shaping a nation's destiny. Its lucrative diamond mines have historically propelled the country to impressive economic heights and have positioned it as an attractive hub for foreign direct investment (FDI). This influx of FDI has been strategically targeted to stimulate economic diversification, propelling the nation towards sectors that promise sustained growth beyond the finite wealth of its subterranean treasures. The government of Botswana has been at the forefront, courting foreign investors to partake in the nation's growth narrative with the vision of crafting an economy resilient to the volatility of the commodities market.

Yet, as the tides of investment surge, they bring to the fore a critical dilemma: the potential environmental cost of economic growth. Botswana's pristine wilderness and abundant wildlife are not just national treasures but vital cogs in the global biodiversity ecosystem. These natural assets have fostered a thriving eco-tourism sector, which is critical to the country's economic diversification agenda. Consequently, the environmental stewardship of these resources is not merely a local concern but a matter that resonates on the global environmental stage. Amidst this backdrop, Botswana emerges as a compelling study in the pursuit of harmonizing FDI with environmental sustainability. The dual objectives of nurturing economic development and preserving ecological integrity present a complex tableau. On one hand, FDI is seen as a gateway to advanced technologies and practices that can elevate environmental management to new echelons. On the other hand, it carries the specter of increased exploitation of natural resources, pollution, and a strain on the country's delicate ecosystems. The challenge for Botswana, therefore, lies in navigating this intricate landscape where the imperatives of economic progression and environmental custodianship are often seen as opposing forces. This tension is intensified by the global push towards sustainability, with international investors and consumers increasingly aligning their interests with eco-friendly practices. Botswana's policymakers and industry leaders find themselves in a strategic dance, choreographing policies that attract FDI while enforcing regulations that ensure this investment does not come at an unacceptable environmental cost. As Botswana continues to evolve, its journey offers rich insights into the broader discourse on sustainable development. The country's efforts to position itself as a leader in both economic development and environmental conservation reflect a microcosm of the global challenge: how to achieve economic prosperity without compromising the environmental wealth that sustains future generations. This narrative is not unique to Botswana but is echoed across nations grappling with the same dichotomy.

In exploring the nexus between FDI and environmental sustainability in Botswana, this article seeks to dissect the contours of this relationship, probing the strategies, policies, and outcomes that define it. It is a narrative that is both cautionary and hopeful, charting a course for a sustainable future where economic and environmental objectives are not merely balanced but are synergistically aligned.

LITERATURE REVIEW

2.1 The relationship between foreign direct investment and environmental sustainability in Botswana

Foreign direct investment (FDI) in Botswana has exhibited variable trends and patterns over the years, influenced significantly by global economic conditions, commodity prices, and domestic policy changes. The primary focus of FDI has historically been on the mining sector, with diamonds playing a pivotal role in Botswana's economy. However, in recent years, there has been a gradual diversification, with increasing FDI inflows into sectors like services, tourism, and banking. Major sources of this investment include countries from the European Union, South Africa, and the United States, reflecting a global interest in Botswana's economic potential. The impact of FDI on Botswana's economy is multifaceted. It has been a significant contributor to the country's GDP, especially through the mining sector, which remains a cornerstone of its economic output. FDI has also created substantial employment opportunities, both directly and indirectly, across various sectors, contributing to the nation's overall employment and economic stability. Moreover, the influx of FDI has facilitated the transfer of skills and knowledge to the local workforce, promoting skill development and capacity building. Beyond human capital, FDI has played a crucial role in infrastructure development, particularly in

areas directly related to the sectors receiving the most investment, such as mining and tourism. However, the journey of FDI in Botswana is not without its challenges. The economy remains somewhat dependent on diamond mining, making it vulnerable to global market fluctuations in this commodity. This limited diversification underscores the need for a broader spread of FDI across various sectors to ensure economic resilience. Another challenge lies in the skills gap. While FDI has brought in new opportunities, there is a pressing need for more focused skill development programs to fully leverage the potential of FDI. Additionally, the regulatory environment could be improved to enhance the attractiveness of Botswana for diverse foreign investments, thereby bolstering economic growth and sustainability. Parallel to the economic narrative, Botswana faces significant environmental challenges, with issues like land degradation, water scarcity, and threats to biodiversity being particularly prominent. These challenges are exacerbated by climate change and certain agricultural practices. The mining sector, a major recipient of FDI, has substantial environmental impacts, including land degradation and water pollution. Additionally, the burgeoning tourism sector, while having less impact than mining, faces challenges in maintaining ecological balance despite increasing tourist numbers. To address these environmental concerns, the government of Botswana has implemented a series of environmental laws and policies aimed at the conservation and sustainable use of natural resources.

Botswana is also actively participating in various international environmental agreements, showcasing its commitment to global environmental standards.

The relationship between FDI and environmental sustainability in Botswana is complex and multifaceted. On the one hand, FDI is indispensable for economic growth; on the other, its impact on the environment can be significant. In some instances, FDI brings advanced technologies and practices that are environmentally friendly, promoting sustainable development. Additionally, certain foreign investors bring a higher degree of environmental awareness and standards, positively influencing local environmental management practices. However, challenges remain, particularly in ensuring that FDI projects, especially those in resource-intensive industries, do not exacerbate ecological damage. Ensuring compliance with environmental regulations among foreign investors also remains a critical issue.

2.2 Framework: The Pollution Haven Hypothesis

Botswana, a beacon of stability and economic growth in Southern Africa, is widely recognized for its diamond-rich geology and diverse wildlife reserves. As a developing nation, it has positioned foreign direct investment (FDI) as a catalyst for economic diversification. Yet the environmental consequences of such investments are becoming increasingly prominent. This article provides a theoretical framework for a literature review on the complex relationship between FDI and environmental sustainability in Botswana, offering insights into how this interplay affects both economic growth and ecological preservation. The debate around FDI's impact on the environment is not new, and various theories have been postulated to understand this dynamic. At the core of this discourse is the Pollution Haven Hypothesis (PHH), which posits that companies might transfer their polluting activities to countries with lax environmental regulations. This hypothesis is particularly relevant to Botswana, which seeks to balance economic growth derived from FDI with the conservation of its unique biodiversity.

The PHH emerges from the broader Heckscher-Ohlin model, which traditionally examines trade patterns in relation to factor endowments. Copeland and Taylor (1994) extend this model to include environmental regulations as a factor, suggesting that nations with less stringent regulations may attract pollution-intensive industries. Empirical assessments of the PHH present a mixed picture. While early studies found little support for the hypothesis, more recent research indicates that strict environmental regulations might deter pollution-heavy industries. For Botswana, the implication is profound. The country's economic strategy has been largely reliant on the mining sector, an industry fraught with environmental risks. However, Botswana's government has made considerable strides in environmental regulation, potentially reducing the risk of becoming a pollution haven.

Botswana's approach to attracting FDI has been multifaceted. The government has actively sought to diversify the economy through FDI, promoting sectors that promise growth beyond the extractive industries. This strategy has included offering incentives for renewable energy projects and sustainable tourism, which align with global trends towards green investment. The literature review highlights a common theme: the delicate balance between economic development and environmental conservation. For Botswana, the challenge is to leverage its natural resource wealth to attract FDI while implementing policies that safeguard the environment. This balancing act is complicated by the economic benefits of FDI and the global urgency of environmental

sustainability.

Sustainability and Policy Recommendation: The theoretical framework suggests that Botswana could benefit from a nuanced policy approach that incentivizes green technology and sustainable business practices among foreign investors. By strengthening institutional frameworks and enforcing environmental regulations, Botswana can mitigate the negative impacts of FDI while fostering economic growth. As Botswana continues to court foreign investors, its journey provides valuable insights into the broader narrative of sustainable development. The country exemplifies the challenge faced by many developing nations: to harness the economic benefits of FDI without undermining environmental sustainability. The theoretical framework outlined in this literature review serves as a basis for understanding the intricate dynamics between FDI and environmental sustainability in Botswana, offering a lens through which policymakers and scholars can evaluate future strategies and outcomes.

2.3 Empirical Review

Idoko, Idachaba, and Emmanuel (2016) emphasize the potential of FDI in driving sustainable development in Nigeria while simultaneously highlighting that the benefits are not automatic. They underscore the necessity of a robust infrastructure and a stable macroeconomic framework to maximize the positive impacts of FDI. This perspective suggests that the effectiveness of FDI in fostering sustainability is significantly contingent upon the domestic policy environment and infrastructural support, implying that without these elements, FDI's potential may remain unrealized. Khan and Agha (2017), through their use of Augmented Dickey-Fuller (ADF) and Granger Causality tests, delve into the nuances of the relationship between FDI, GDP growth, and CO₂ emissions. Their findings reveal no direct causality between GDP growth and FDI but emphasize the critical role of policy in ensuring FDI's contribution to environmentally sustainable practices. This study asserts that while FDI may not directly drive GDP growth, its role in environmental sustainability depends significantly on the regulatory and policy framework.

Riti and Kamah (2018) further explore the complexities inherent in the relationship between FDI, trade liberalization, and environmental quality. Their research indicates that FDI and trade openness, while beneficial for economic growth in Nigeria, adversely impact environmental quality, primarily due to industrialization and increased resource extraction activities. They advocate for stringent environmental policies to mitigate these negative effects, thus promoting sustainable economic growth. Imoughele and Ismaila (2019) focus on the effects of FDI in Nigeria's mining and agriculture sectors. Their findings suggest that FDI in these areas significantly bolsters economic growth without necessarily leading to environmental degradation, especially in non-extractive sectors. This insight is particularly relevant for Botswana, suggesting that strategically directed FDI into sectors with lower environmental impact can foster economic growth without compromising environmental sustainability. Danladi and Akomolafe (2020) investigate the direct impact of FDI on environmental degradation in Nigeria. They conclude that there is a unidirectional causality from FDI growth to increased pollution, underscoring the need for environmental safeguards in the context of FDI. This finding implies that, without appropriate regulatory frameworks, FDI can exacerbate environmental challenges, necessitating a balance between economic incentives and environmental protection.

Anfom, Gambo, and Suleiman (2021), and Mojekwu and Ogege (2022) both observe the positive correlation between FDI and economic performance in Nigeria, particularly highlighting the role of effective policy frameworks. These studies suggest that FDI, when guided by sound policies, can be a driver of sustainable economic performance without adversely affecting the environment. They emphasize the importance of integrating environmental considerations into FDI strategies, involving assessments, sustainable resource management, and compliance with environmental regulations. Tenuche (2023) provides a critique of international investment in Nigeria's steel sector, focusing on the role of government oversight in managing FDI. The study underscores that while FDI brought technological and economic benefits, it also raised sustainability concerns due to inadequate government oversight, leading to environmental degradation. This emphasizes the essential role of government control in steering FDI towards sustainable outcomes.

The literature presents a complex picture of the impact of FDI on environmental sustainability. While FDI can contribute to economic growth, its effects on the environment can be detrimental without robust policy frameworks and enforcement mechanisms. For Botswana, the challenge will be to attract clean FDI that aligns with its development goals while enhancing its environmental regulations to prevent the degradation of its unique natural heritage.

3. METHODOLOGY

For this research, the Ordinary Least Squares (OLS) method, a widely-used econometric approach, has been utilized. The analysis is based on time-series secondary data spanning from 1974 to 2020. This data has been sourced from the World Bank Statistics, specifically focusing on estimates related to Botswana. To enhance the robustness of the study, the long-term data set allows for a comprehensive analysis of trends and patterns over several decades, providing valuable insights into the economic and environmental dynamics of Botswana during this period. The use of OLS, a standard technique in econometrics, is expected to yield reliable estimates by minimizing the sum of the squares of the differences between observed and predicted values.

Model Specification

The model can be represented in a functional form as follows:

$$CO2_t = f(FDI_t, GDP_t, POP_t)$$

$CO2_t$: Carbon Dioxide Emissions at Time t (measured in metric tons.)

FDI: foreign direct investment at time t (measured in millions)

GDP: Gross Domestic Product at time t (measured in millions)

POP: Population at time t (measured in millions).

Including an error term to account for random disturbances and other unexplained variations, the model in its stochastic form is presented as:

$$CO2_t = \beta_0 + \beta_1 \times FDI_t + \beta_2 \times GDP_t + \beta_3 \times POP_t + \varepsilon_t$$

Where:

β_0 is the intercept term.

$\beta_1, \beta_2, \beta_3$ are the parameters (coefficients) to be estimated for FDI, GDP, and POP, respectively.

ε_t being the error term at time t

DATA ANALYSIS

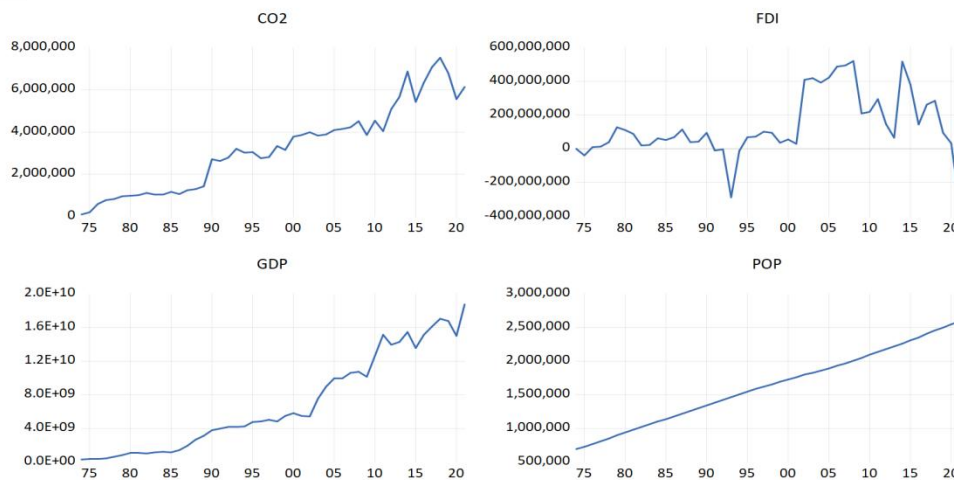
The graphical data for Botswana, as presented, illustrates trends across four key indicators: carbon dioxide (CO₂) emissions, foreign direct investment (FDI), gross domestic product (GDP), and population (POP) from approximately 1975 to 2020.

Table 1: Variable Description

Variables	Definition	Description	Source
CO2	Carbon emission	Measured in metric tons.	World Bank
FDI	Foreign direct investment	In millions (US\$)	World Bank
GDP	Economic growth	In millions(US\$)	World Bank
POP	Population	The total number of people at time t, measured in millions.	World Bank

CO2 Emissions: The CO2 emissions graph shows a general increase over the 45-year period, with some fluctuations, indicating that environmental impact in terms of CO2 emissions has been rising. The trend suggests a correlation between economic activity and environmental impact, with the highest emissions possibly reflecting periods of peak industrial activity. If we were to follow the analytical approach used for Nigeria, we would look for years with maximum and minimum emissions to infer the levels of industrial activity and associated environmental risks. The peak points could suggest years of high industrial output and, consequently, greater environmental stress.

Figure 1: Graphical Trend of Variables



Source: E-views Output, 2023.

FDI: The FDI graph shows a highly volatile trend. There are periods where FDI spikes dramatically, as well as periods of sharp decline, even falling below zero, which could indicate net disinvestment in some years. The reasons behind these fluctuations could range from global economic conditions to changes in Botswana's investment policies or economic environment. The years with the highest FDI could indicate strong investor confidence and economic incentives, whereas the dips, particularly those below zero, might reflect periods of economic downturn, policy shifts, or global economic crises that led to disinvestment.

GDP: The third graph shows a steady and relatively smooth increase in GDP, with a notable upward trajectory that suggests Botswana's economy has been expanding consistently over the years. The slope of the GDP line seems to have become steeper after the 2000s, pointing to accelerated economic growth during this period.

Population: The population exhibits a steady increase, suggesting a growing consumer base and workforce and, potentially, a rise in domestic demand for goods and services. A rising population might lead to increased CO2 emissions due to higher energy consumption, transportation needs, and overall economic activity.

From these observations, it can be inferred that Botswana's economy has been growing alongside its population. However, this economic growth may be coupled with increasing CO2 emissions, pointing towards a potentially growing environmental challenge. The volatility in FDI suggests that while Botswana has been able to attract foreign investments, these inflows have not been consistent and may be subject to external factors that cause them to fluctuate. The steady increase in population is a typical trend for many countries and is expected to increase the demand for goods and services, potentially contributing to both GDP growth and higher CO2 emissions. In summary, these graphs suggest that Botswana has experienced economic growth and development, but this progress comes with increased environmental costs. Further analysis would be necessary to understand the direct correlations and causation between these variables, which could inform policy decisions to balance economic development with environmental sustainability.

When linking these trends to reality, we have come to the discovery that foreign direct investment (FDI) can be a vital source of capital for developing countries. When FDI enters Botswana, it brings in not just money but also technology, expertise, and access to new markets. This influx can stimulate economic activity by creating jobs, boosting productivity, and increasing the overall output, which is reflected in the Gross Domestic Product (GDP). The periods of high FDI inflows aligning with GDP growth affirm this positive influence. However, the variability in FDI—sharp rises and falls—suggests that Botswana's economy might be vulnerable to global economic trends, investor sentiment, and international market dynamics. Such volatility can lead to economic instability, which might affect long-term planning and sustainable development. Investments are not sector-agnostic; they often target specific industries. In many developing nations, sectors that attract FDI are those that require significant energy inputs, such as mining, manufacturing, and infrastructure development. These sectors tend to be carbon-intensive, hence the positive correlation between FDI and CO2 emissions. While FDI is beneficial for economic expansion, without proper environmental regulations and sustainable practices, it can exacerbate ecological degradation. Botswana, therefore, faces the challenge of attracting "green" FDI that supports economic growth without compromising its environmental commitments, such as investments in renewable energy or eco-friendly tourism.

On the other hand, economic growth often comes with an increase in production and consumption, which typically requires more energy, often from carbon-based sources like coal, oil, and natural gas. The parallel rise in GDP and CO2 emissions in Botswana implies that the country's economic growth is partly fueled by activities that increase carbon emissions. This presents a sustainability dilemma: how to continue growing economically while reducing the carbon footprint. Transitioning to a green economy, improving energy efficiency, and adopting cleaner technologies are potential strategies to decouple economic growth from environmental degradation. Furthermore, a growing population can be a double-edged sword. On one hand, it means a larger workforce and potentially a larger internal market, both of which can drive economic growth. On the other hand, it leads to greater demand for resources, more waste, and higher carbon emissions. In Botswana, the steady population increase could be exerting pressure on the environment through the need for more housing, increased energy consumption, and greater use of transportation. Managing this growth sustainably involves urban planning that incorporates green spaces, investment in public transport, promotion of energy-efficient buildings, and provision of renewable energy sources.

4.2 Result and Discussion

TABLE 1: UNIT ROOT TEST

Variables	ADF test statistics	1% Critical Value	5% Critical Value	10% Critical Value	Prob.	Order of Integration
CO2	-8.382776	-4.170583	-3.510740	-3.185512	0.0000	I(1)
FDI	-7.474000	-4.170583	-3.510740	-3.185512	0.0000	I(1)
GDP	-7.118262	-4.205004	-3.526609	-3.194611	0.0000	I(1)
POP	-3.711307	-2.618579	-1.948495	-1.812135	0.0004	I(1)

Source: Eviews9 Output, 2023.

The ADF test statistics for all variables are more negative than the critical values at the 1%, 5%, and 10% levels, indicating that we can reject the null hypothesis of a unit root for each series at the 1% level of significance. This implies that each time series is stationary after the first difference (indicated by the order of integration I(1)). The probabilities close to zero reinforce the test results, suggesting that the findings are statistically significant. The fact that CO2 emissions are stationary after differencing indicates that the environmental impact of economic activities is somewhat predictable over time. This predictability is vital for environmental policy-making because it suggests that the government can implement measures to reduce emissions, and these measures are likely to have a lasting impact, as CO2 levels will not just drift upwards indefinitely. Botswana can use this information to align its environmental policies with the Sustainable Development Goals (SDGs), particularly those related to climate action. The stationery suggests that policies aimed at reducing CO2 emissions can be effective over the long term. The government could leverage the information to attract investment in clean and renewable energy projects, knowing that such investments could contribute to a stable reduction in CO2 emissions.

Foreign Direct Investment (FDI): Stationary FDI after differencing suggests that while FDI can fluctuate, it tends to return to a baseline level over time. This can be reassuring for both policymakers and investors, indicating that the investment climate in Botswana is fundamentally stable. Knowing that FDI levels will not perpetually increase or decrease can help Botswana formulate long-term economic policies that aim to create a conducive environment for sustainable FDI. To make the most of FDI without becoming too dependent on it, Botswana may look to diversify its economy to reduce the potential negative impacts of FDI volatility.

Gross domestic product (GDP) suggests that economic planning can be conducted with a degree of confidence regarding the country's long-term growth trajectory. Policymakers can anticipate economic cycles and potentially smooth out the volatility through fiscal and monetary policies. The stable trend in GDP growth also provides a platform for considering how to make growth more sustainable, balancing economic advancement with environmental and social factors. Additionally, both the public and private sectors can use the predictability of GDP growth to plan long-term investments, infrastructure development, and human capital development programs. With a stable population growth trend, urban planners and policymakers can forecast future needs for housing, transportation, and other critical infrastructure, investing in sustainable urban development projects accordingly. Predictable population growth allows for better management of natural resources, ensuring that consumption patterns do not exceed the carrying capacity of the environment. Healthcare and Education: Stable population growth patterns enable the government to plan effectively for healthcare and education services, ensuring that these critical services can keep pace with the population's needs.

TABLE 2: CO INTEGRATION TEST

Test Type	Test Statistic	Critical Value at 1%	Critical Value at 2.5%	Critical Value at 5%	Critical Value at 10%	Result
F-statistic	7.704747	3.42	2.87	2.45	2.01	Reject Null
t-statistic	-5.746333	-3.97	-3.64	-3.33	-1.62	Reject Null

Source: E-views Output, 2023.

The calculated F-statistic (7.704747) is higher than the upper bound critical value at the 1% significance level (4.84), which is the most stringent level provided. Since the F-statistic is above the critical values at all conventional significance levels (10%, 5%, 2.5%, and 1%), you can reject the null hypothesis of no co-integration with a high degree of confidence. This implies that there is robust evidence of a long-term equilibrium relationship among the variables in question. In other words, while the variables may fluctuate in the short term, they tend to move together in the long term. The variable k indicates the number of independent variables included in the co-integration analysis. Here, k is 3, which means three independent variables were tested against the dependent variable for a co-integrating relationship.

The absolute value of the t-statistic (-5.746333) is larger than the absolute values of the critical bounds across all the given significance levels (10%, 5%, 2.5%, 1%). This means that the null hypothesis can be rejected at the 1% level, which is the most stringent level indicated in the test. The rejection is even more robust at the 10%, 5%, and 2.5% levels. Rejecting the null hypothesis at these levels indicates there is strong evidence against the notion that there is no level of relationship. In other words, it suggests that there is co-integration among the variables being tested, implying that there is a long-term equilibrium relationship between them. Since the t-statistic is used to confirm the results of the F-statistic in an ARDL bounds test, these results reinforce the findings from the F-statistic that may have been provided elsewhere, which also suggests co-integration if the F-statistic value exceeds the upper bound of its critical values.

Economic and Environmental Linkage: The results suggest that FDI, GDP, CO2 emissions, and population growth are all linked in the long run. This indicates that changes in one of these variables are likely to be associated with long-term changes in the others. For example, an increase in FDI may lead to growth in GDP, which in turn could lead to increased CO2 emissions and population growth due to economic expansion. **Policy Implications:** The co-integration of these variables highlights the need for integrated policies that consider the implications of FDI on economic growth and its environmental impact. It suggests that Botswana's policymakers should consider the environmental impacts when designing FDI policies and aim to attract investments that support sustainable development. **Sustainable Investment:** The discovery of a sustained correlation between these factors may encourage Botswana to encourage foreign direct investment (FDI) in sustainable development-related fields, such as renewable energy, in order to prevent damage to the environment accompanying GDP growth.

Strategic Planning: The co-integration result implies that FDI could be used strategically to foster economic growth while also promoting environmental sustainability. For instance, Botswana could leverage FDI to build green infrastructure or to develop industries that have a lower carbon footprint. Recognizing the long-term connection between economic indicators and environmental impact can help Botswana balance its objectives for economic growth with its goals for environmental sustainability. This might involve initiatives such as carbon pricing, investment in clean technologies, and the development of green industries. In summary, the co-integration test results imply that there is a stable long-term relationship between FDI, economic growth, and environmental indicators in Botswana. This underscores the importance of considering the environmental

sustainability aspect in economic planning and FDI strategies to ensure that the country's development path remains sustainable over the long term.

4.2.1 Effect of Foreign Direct Investment on Environmental Sustainability-table

Table 3: REGRESSION RESULTS

VARIABLES	COEFFICIENT	Std. ERROR	T-Statistics	Prob.
C	-19.13792	5.414009	-3.534888	0.0011
LNFDI	0.170447	0.030718	5.548736	0.0000
LN GDP	-0.175518	0.227222	-0.772450	0.4446
LN POP	2.429356	0.716783	3.389249	0.0016

Source: Eviews9 Output, 2023.

The regression analysis examines the impact of foreign direct investment (FDI) and other factors on environmental sustainability in Botswana, as measured by CO2 emissions. The results suggest that FDI has a significant positive relationship with CO2 emissions. Specifically, a 1% increase in FDI is associated with an approximately 0.17% increase in CO2 emissions, which is statistically significant with a t-statistic of 5.548736 and a P-value of 0.0000. This implies that as Botswana receives more FDI, its CO2 emissions tend to increase, potentially indicating that incoming investments are not entirely aligned with environmentally sustainable practices.

Conversely, GDP growth appears to have a negative but statistically insignificant relationship with CO2 emissions. The coefficient of -0.175518, with a t-statistic of -0.772450 and a P-value of 0.4446, suggests that higher GDP does not necessarily lead to increased emissions, although the lack of statistical significance means this finding is not reliable and could be due to chance. Population growth has a notably high and statistically significant positive effect on CO2 emissions. A 1% rise in population is associated with a 2.43% increase in emissions, with a t-statistic of 3.389249 and a P-value of 0.0016. This indicates that demographic pressures may be contributing to environmental challenges in Botswana.

Lastly, the constant term of the regression is significant and negative, indicating that when all independent variables are at zero, CO2 emissions would be lower, which may reflect a base level of emissions inherent to the country's infrastructure or natural environment. Overall, the high R-squared value of over 94% suggests that the model explains a large proportion of the variance in CO2 emissions. However, the results highlight the need for Botswana to carefully consider environmental sustainability in its development strategy, particularly in managing FDI and population growth to mitigate their impact on CO2 emissions.

The positive coefficient for FDI indicates that an increase in FDI is associated with an increase in CO2 emissions. This could be due to FDI being directed towards industries that are not environmentally friendly, such as those that rely heavily on fossil fuels. For Botswana, this suggests that while FDI is beneficial for economic growth, it may also contribute to environmental degradation if it is not channeled into sustainable sectors. To counteract this, Botswana might need to implement policies that encourage green investment and ensure that foreign investors follow environmental regulations. This could include tax incentives for sustainable practices or stricter environmental impact assessments for new projects. The negative coefficient for GDP, though statistically insignificant, suggests that an increase in GDP does not necessarily lead to an increase in CO2 emissions. In reality, this could mean that Botswana's economic growth may come from sectors that are not significantly carbon-intensive, or it could indicate that the country is becoming more efficient in its production. However, since this relationship is not statistically significant, one cannot reliably assert that economic growth in Botswana has a diminishing effect on emissions without further investigation. The significant positive coefficient for population growth indicates a strong link between population increases and CO2 emissions. This can be attributed to the higher demand for energy, increased use of transportation, and

greater consumption of goods and services as the population grows. For Botswana, this means that population growth could be a major factor driving environmental challenges. Addressing this could involve investing in sustainable urban planning, promoting energy efficiency, and increasing public awareness about sustainable practices.

The constant term being significantly negative might reflect a baseline level of emissions that could exist without any economic activities, possibly tied to the natural environment or subsistence-level human activities. These results indicate that while FDI and population growth are contributing to economic development in Botswana, they are also linked to increased environmental pressures, particularly in terms of CO₂ emissions. Botswana may need to reassess its approach to attracting and managing FDI to ensure that it aligns with the country's environmental sustainability goals. This could involve promoting sectors that have lower emissions or creating joint ventures where foreign investors can bring in not just capital but also technology that can help reduce CO₂ emissions. The impact of population growth on emissions underscores the importance of integrating family planning, education, and sustainable lifestyle practices into national development programs. Overall, the high explanatory power of the regression model (as indicated by the high R-squared value) implies that the factors included are highly relevant to CO₂ emissions in Botswana. However, it's crucial to approach development strategically to balance economic benefits with environmental sustainability. The results highlight the complexities involved in developing policies that simultaneously promote economic growth and protect the environment. For Botswana, it is clear that environmental considerations need to be at the forefront of economic planning and policy-making, especially in relation to FDI and demographic changes.

CONCLUSION

The methodology section presents a comprehensive analysis of Botswana's economic and environmental data from 1975 to 2020, focusing on CO₂ emissions, foreign direct investment (FDI), gross domestic product (GDP), and population growth (POP). The graphical representation indicates a steady rise in CO₂ emissions over the past 45 years, with surges aligning with economic activities, suggesting a link between industrialization and environmental impact. The FDI trend is characterized by significant fluctuations, showing investor confidence and economic challenges during various periods. GDP showcases sustained growth, particularly after the 2000s, while the population trend reflects steady growth, hinting at increased domestic demand.

The Augmented Dickey-Fuller (ADF) test confirms that all variables are stationary after the first difference, as their test statistics are well below the critical values at conventional significance levels, implying the data is suitable for further time series analysis. The co-integration test reveals strong evidence of a long-term equilibrium relationship among the variables, with both F-statistic and t-statistic significantly exceeding their respective critical values, suggesting these economic and environmental factors move together over time.

A detailed regression analysis explores the impact of FDI on environmental sustainability in Botswana. It reveals a significant positive correlation between FDI and CO₂ emissions, indicating that increased FDI is associated with rising emissions. In contrast, GDP growth does not show a statistically significant relationship with emissions. Population growth exhibits a strong positive effect on CO₂ emissions, indicating that demographic growth is linked to environmental strain.

The constant in the regression analysis is significant and negative, suggesting a baseline level of emissions inherent to Botswana's environment. The model's high R-squared value indicates that it explains a substantial proportion of the variance in CO₂ emissions, pointing to the effectiveness of the chosen variables in predicting environmental impact. Overall, the analysis suggests that Botswana's economic development comes with environmental costs, particularly in terms of CO₂ emissions. The findings underscore the importance of incorporating environmental considerations into the country's development strategy, especially concerning FDI

and population growth, to foster sustainable progress. Further analysis is needed to determine direct causation and inform policy decisions aimed at balancing economic growth with environmental preservation.

Limitations of the Study

Given the time series nature of the data, there is a risk of auto-correlation, where error terms could be correlated with each other, violating OLS assumptions and leading to inefficient estimates. If the variables used in the regression are not stationary, which means their mean, variance, and covariance are not constant over time, OLS estimates could be spurious.

Omitted Variable Bias: If important variables that affect CO₂ emissions are omitted from the model, the OLS estimates of the included variables could be biased. If the independent variables are correlated with the error term, perhaps through reverse causality or omitted variables, OLS estimates will be biased and inconsistent.

Measurement Error: If the data has measurement errors, OLS estimates could be biased and inconsistent.

Despite these potential problems, we chose to use OLS because of the following reasons:

Simplicity and Familiarity: OLS is a basic and well-understood econometric technique, making it a practical first approach to analysis.

Preliminary Analysis: OLS can be used for an initial exploration of the data to inform more complex models.

Robustness Under Certain Conditions: If the data meets the OLS assumptions (which could be checked using diagnostic tests), then OLS estimates are BLUE—the best linear unbiased estimators.

Availability of Remedies: Many of the problems with OLS can be addressed with statistical techniques like Cochrane-Orcutt for auto-correlation or co-integration analysis for non-stationary.

Widespread Acceptance: OLS is widely recognized and accepted in academic literature, making the study's findings more accessible to a broader audience.

RECOMMENDATIONS

1. **Developing a Green FDI Strategy:** Botswana should formulate a clear strategy for attracting FDI into sectors that are environmentally sustainable. This includes incentives' investments in renewable energy, sustainable agriculture, and ecotourism, which align with the country's natural resource endowments and biodiversity.
2. **Strengthening Environmental Regulations:** Enhance environmental regulatory frameworks to ensure that incoming FDI complies with stringent environmental standards. This would involve regular environmental impact assessments and stringent monitoring of industrial activities.
3. **Capacity Building for Environmental Stewardship:** Invest in building local capacities for environmental management and monitoring. This includes training programs for government officials and local communities in environmental conservation and sustainable practices.
4. **Promoting Sustainable Practices in Existing Industries:** Encourage and support existing industries, especially mining, to adopt more sustainable practices. This can be achieved through tax incentives for environmentally friendly technologies and penalizing non-compliance with environmental standards.
5. **Fostering Public-Private Partnerships (PPPs):** Establish PPPs to fund environmental conservation projects. This approach can leverage private sector efficiencies and innovation while ensuring public sector oversight and alignment with national conservation goals.

6. Leveraging Eco-tourism: Further develop the ecotourism sector as a sustainable economic activity that capitalizes on Botswana's unique biodiversity. This includes creating more protected areas and promoting community-based tourism initiatives.
7. Community Engagement and Inclusive: Ensure that local communities are actively engaged in decision-making processes regarding FDI projects. This will ensure that development projects are aligned with local needs and environmental conservation efforts.
8. International Collaboration: Seek international collaborations and partnerships to gain access to technical expertise, funding, and best practices in environmental sustainability.
9. Monitoring and Evaluation Systems: Establish robust monitoring and evaluation systems to assess the environmental impact of FDI projects continually. This will help in making data-driven decisions and policy adjustments as needed.

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