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Foreign direct investment and the current environmental situation: Evidence from Binh Duong, Vietnam

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Abstract: The main objective of this study is to investigate what makes the difference in the impact of FDI on environmental pollution according to the effect of the "pollution halo" and "pollution haven" hypotheses, and the current status of FDI and environmental pollution in Binh Duong province. We applied the document analysis, systematic review method of Bryman & Bell (2011), and the descriptive statistical method. The secondary data includes Binh Duong's FDI capital and environmental pollution indicators during the period from 2021 to 2023. The findings indicate that the "pollution halo" effect is primarily influenced by the influx of FDI capital from developed countries and the presence of high-quality FDI capital. Besides, the host country's environmental policy is an important factor in minimizing the environmental pollution. A significant portion of FDI comes from developing countries and a decline in FDI quality is occurring in the study area. Furthermore, the indicators related to environmental pollution are also increasing locally. This is an extremely worrying issue because it has a high potential risk of causing environmental pollution according to the "pollution haven" hypothesis. Governments at all levels should develop appropriate policies to create favorable conditions for the simultaneous development of an industrial structure towards high technology and automation, while promoting a favorable environment for foreign investors.

Keywords: Foreign direct investment, environmental pollution, pollution halo, pollution haven, Vietnam.

1. Introduction

Environmental degradation has certainly proven to be one of the most important problems. Man-made greenhouse gases are an important source of environmental degradation (NOAA, 2023). Carbon (CO2) emissions are known to be the most significant contributor to recent climate change (Cai et al., 2018). Global energy-related carbon emissions increased by 1.7 per cent in 2018, the highest growth rate since 2013 (IEA, 2018). According to the Center for Global Development (2015), developing countries account for 63 per cent of current CO_2 emissions. Abid et al. (2016) and Victor (2017) state that environmental quality is getting worse due to increasing emissions from production and consumption activities.

It is worth noting that numerous countries continue to prioritize economic growth and the attraction of foreign investment (Lan et al., 2012; Solarin et al., 2017). Previous studies have tried to identify the impact of foreign direct investment (FDI) on environmental pollution (Victor, 2017; Wang & Chen, 2014). The issue of FDI in environmental protection remains ambiguous and lacks agreement among scholars (Cole et al., 2006; Cole et al., 2017). The

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"pollution halo" hypothesis states that FDI can contribute to the amelioration of environmental issues (Antweiler et al., 2001; Eskeland & Harrison, 2003). The "pollution haven" hypothesis posits that emerging nations that experience significant FDI inflows will progressively transform into "pollution havens" created by industrialization (Aliyu et al., 2005; An et al., 2021; Wheeler, 2001). So, what about FDI affects environmental pollution according to the "pollution halo" or "pollution haven" effect?

Binh Duong is a Southern Key Economic Region province located in the Southeast region. Binh Duong Province has been one of the leading provinces in Vietnam in terms of attracting FDI (Binh Duong Statistics Department, 2023). However, the process of rapid economic growth in recent times has created significant pressure on the province's environment (Binh Duong People's Committee, 2023). Hence, this study is conducted to examine what makes the difference in the impact of FDI on environmental pollution according to the effect of "pollution halo" and "pollution haven" hypotheses, and the current status of FDI and environmental pollution in Binh Duong. On that basis, the study will make recommendations in choosing FDI capital sources to improve environmental pollution. The research is also a reference for managers and researchers in related fields.

2. Conceptual and analytical framework

2.1. Foreign direct investment (FDI)

The majority of research focuses on analyzing FDI as a crucial factor in determining economic growth and technical advancement (Kok & Ersoy, 2009). According to the IMF (1993) and OECD (1996), FDI refers to the deliberate intention of a resident entity from one economy (referred to as the direct investor) to acquire long-term interests in an enterprise located in another economy (referred to as the direct investment enterprise). A direct investment enterprise is defined as an enterprise in which foreign investors possess 10 per cent or more of common shares or voting rights.

FDI inflows have a significant role in fostering economic growth (Pegkas, 2015). Baharumshah et al. (2017) argue that FDI inflows bring huge potential welfare benefits for host countries. Several studies have indicated that FDI plays a crucial role in stimulating economic growth by supplying the necessary capital, innovation, and technology to developing nations (Iamsiroj, 2016; Keho, 2015; Sunde, 2017).

2.2. The impacts of FDI on the host country's environment

There exist two hypotheses that aim to elucidate the influence of FDI on the environment of the host country.

The "pollution haven" hypothesis posits that developed nations possess more stringent environmental regulations, resulting in elevated pollution control expenses for businesses. Consequently, multinational corporations will relocate to countries with comparatively less stringent environmental regulations, thereby contributing to environmental pollution in these areas (Esty & Dua, 1997). He (2006) also confirms the "pollution haven" hypothesis when studying the relationship between FDI and industrial sulfur dioxide (SO2) emissions in China. In other words, countries with less stringent environmental regulations attract increasing levels of FDI (Waldkirch & Gopinath, 2008), because FDI inflows from countries are positively associated with strict environmental regulations (Aliyu, 2005). The "pollution haven" that occurs due to high FDI growth promotes industrial development, which in turn means more energy consumption and higher environmental pollution rates (Abdouli & Hammami, 2017; Hao et al., 2019).

The "pollution halo" hypothesis suggests that FDI can improve the environment of host countries through technology diffusion, application of production technology or management experience, and environmental standards (Perkins & Neumayer, 2009). The findings of Sitthivanh and Srithilat (2021) revealed that FDI has led to advancements in production technology, resulting in cleaner local practices, and contributing to the overall improvement of the environmental quality in the region. Similarly, Ayamba et al. (2019) argue that FDI is an important technology transfer method that can upgrade industries and improve local pollution problems. Besides, many studies also confirm that FDI significantly reduces environmental emissions (Demena & Afesorgbor, 2020; Xiao et al., 2023).

3. Methodology

We used the document analysis and systematic review method of Bryman & Bell (2011). The research sample includes 50 scientific articles collected through the databases of Google Scholar and Taylor & Francis. Keywords used to search for related articles are "FDI and environmental pollution", "pollution halo", and "pollution haven". Besides, titles of articles are extracted from the reference list of main research articles on the research topic. The contents to be considered include issues that make a difference between the "pollution halo" hypothesis and "pollution haven" hypothesis.

Besides, to clarify the current status of FDI investment capital in Binh Duong, we use the descriptive statistical method. The data utilized is Binh Duong's FDI investment capital during the period from 2021 to 2023, extracted from the database provided by the Department of Planning and Investment of Binh Duong

province. The indicators collected include the value of FDI capital, the country of origin of FDI, and the investment industry of FDI. The FDI capital collected is the capital from foreign investors who have invested in production and service activities in Binh Duong in the period of 2021-2023.

The assessment of FDI as "high quality" or "low quality" is based on a range of criteria beyond just the industry or sector. However, the assessment of FDI in this research is only based on the industry or sector since the main objective of this research is to investigate what makes the difference in the impact of FDI on environmental pollution according to the effect of "pollution halo" and “pollution haven” hypotheses, and the current status of FDI and environmental pollution in Binh Duong province. FDI in sectors with higher value-added potential, such as technology, manufacturing, renewable energy, and advanced services, is often regarded as higher quality due to its potential for innovation, economic diversification, and export growth. Conversely, FDI in extractive and productive industries may be viewed as lower quality if it doesn’t significantly benefit the local economy, particularly if it leads to environmental degradation or operates in an isolated manner.

Developed countries are generally classified based on economic indicators. The first indicator is Gross Domestic Product (GDP) per capita. A high GDP per capita indicates a high average income, often over $12,000 USD (using World Bank classifications for high-income economies). The other indicator is industrialization. A developed country typically has a well-diversified economy with advanced industrial sectors, high productivity, and strong service sectors.

Data on environmental pollution typically covers both production-related pollution and general pollution from various other sources, including transportation, agriculture, waste management, and residential activities. However, the data for this research on environmental pollution is only related to production. This data was collected in industrial zones and the areas polluted mainly due to discharge from industrial zones. Environmental data are collected from monitoring reports of the Department of Natural Resources and Environment of Binh Duong province. Collected indicators include TPS dust concentration, NO2 gas, Benzene in the air, and concentration of substances such as NH4+ N; NO2-_N; PO43-_P, Fe in water…

4. Results and discussion

4.1. Factors that make the difference between the “pollution halo” hypothesis and the “pollution haven” hypothesis

Based on an analysis of empirical studies, it has been seen that FDI can generate two opposite effects on the environment. Firstly, FDI has the potential to exacerbate environmental pollution, as suggested by the “pollution haven” hypothesis. Secondly, FDI can also mitigate environmental pollution, as proposed by the “pollution halo” hypothesis. The primary elements contributing to the difference between the two hypotheses are the source of FDI capital, the quality of FDI capital, and the environmental policies of the receiving country.

4.1.1. Origin of FDI

The origin of FDI is an important factor that can increase or decrease environmental pollution. Some studies show that FDI capital from developed countries helps reduce the possibility of environmental pollution (Zugraveu-Soilita, 2017). Eskeland and Harrison (2003) find that US outbound investments in developing countries have more energy efficient technologies and use significantly more clean energy than domestic firms of host countries. Hao et al. (2020) also confirms that new technology from developed countries contributes to reducing sulfur dioxide and dust emissions. Singhania and Saini (2021) state that capital flows from developed countries seek to increase environmental and social sustainability to achieve sustainable business goals.

On the contrary, some studies also confirm that FDI from developing countries can increase the level of environmental degradation. Sattar et al. (2022) confirm that FDI from the BRI has a significant impact on environmental degradation. Similarly, Aung et al. (2020) state that underdeveloped nations frequently reduce environmental management regulations in order to establish a more advantageous business climate for international investors. Additionally, Tracy et al. (2017) argue that China is moving towards more stringent environmental regulations to reduce environmental pollution. Domestic capital flows may move abroad to avoid regulations on environmental pollution, which makes increased pollution in the receiving country.

4.1.2. Quality of FDI capital

FDI quality mainly refers to the production spillover effects of FDI, the strength of FDI's technological management, the technological level of FDI and the host country's willingness to transfer technology (Wang & Luo, 2020). Particularly, low quality FDI exacerbates environmental pollution, while high quality FDI has a beneficial effect on reducing environmental pollution (Wang & Luo, 2020). Choosing high quality FDI capital sources plays a particularly important role, following Yu and Ly (2020). FDI stocks with clean technology levels will create a “pollution halo” effect of

reducing environmental pollution (Demena & Afesorgbor, 2020).

Additionally, through technology transfer, foreign companies will probably transfer their green technology to domestic companies, thereby leading to an overall reduction in emissions (Golub et al., 2011; Lee, 2013). According to Mert and Bölük (2016), FDI capital serves as a catalyst for economic growth by facilitating the utilization of managerial expertise, production methodologies, enhanced productivity, and the transfer of technology.

Based on the above review, it is clear that the origin of FDI capital and the quality of FDI capital are intricately linked and play a significant role in shaping the economic and developmental impact of FDI on the host country. The origin of FDI capital can play a significant role in determining the quality of that capital, which, in turn, affects the overall impact on the host country's economy.

The origin often affects the technology transfer, managerial practices, labor standards, and environmental regulations associated with FDI projects. FDI originating from developed countries often brings higher-quality capital in terms of advanced technology and managerial practices. Investors from developed countries typically possess and transfer high-value technologies, which can significantly enhance productivity in the host country. This can lead to a boost in local innovation and skill development. In contrast, FDI from less developed origins may bring lower quality capital if it lacks the same levels of technology, corporate standards, or long-term focus.

For host countries, understanding the origin of FDI is essential for implementing policies that attract high-quality capital, maximize the benefits of FDI, and mitigate potential downsides associated with less responsible investment.

4.1.3. Environmental policy of the host country

According to Kim and Rhee (2019), the "Race to the Bottom" hypothesis states that in the face of intense market competition, many countries will engage in rivalry to reduce environmental laws to attract FDI capital flows in order to attain a competitive advantage. Naughton (2014) finds that host country regulations reduce returns on capital and stimulate capital flows to regions where environmental management standards are lower.

In contrast to the above views, Elliott and Zhou (2013) state that FDI has the potential to generate spillover effects of green technology, hence increasing environmental performance inside nations. Asghari (2013) concludes that the cost of compliance with environmental regulatory policies for multinational enterprises is relatively low because they possess abundant capital and advanced technology.

There is growing evidence that increased environmental regulation does not hinder FDI entry (Yang & Song, 2019; Kim & Rhee, 2019). Cai et al. (2016) also confirm that more stringent environmental restrictions primarily impede the growth of companies with high levels of pollution, while clean industries see comparatively less impact. Muhammad & Khan (2019) point out that strengthening environmental regulatory policies can promote the development of industries using clean energy and new technology. Kim & Rhee (2019) find that strict environmental regulations can enhance domestic production efficiency, thereby attracting foreign multinationals. Additionally, Yu et al. (2020) also conclude that environmental regulations play an important role in filtering FDI capital flows.

4.2. Current status of FDI in Binh Duong Province

With data on FDI into Binh Duong for three years, we have grouped it according to the origin of FDI capital from developed countries and other countries. The analysis results show that the percentage of FDI capital originating from developed nations is at 55.1 per cent (equivalent to 7.1 billion USD), while the proportion of FDI capital originating from other countries is 44.9 per cent (equivalent to 5.8 billion USD).

Besides, the results of analysis of changes in the origin of FDI capital over the years show that the proportion of FDI capital of developed countries tends to decrease sharply over the years. Specifically, this proportion decreases sharply from 90.7 per cent in 2021 to 25.9 per cent in 2023; On the contrary, the proportion of FDI capital originating from developing countries increased dramatically, from 9.3 per cent (2021) to 74.1 per cent in 2023.

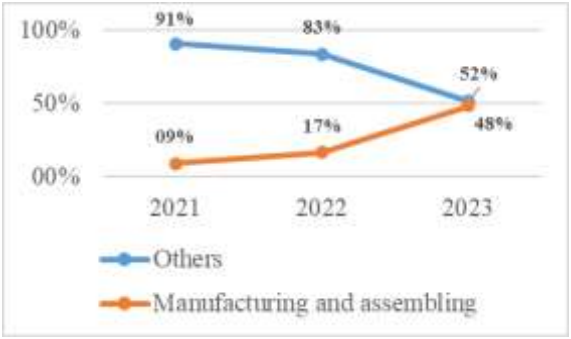

Figure 1: FDI quality over the years

In addition, to better understand the quality of FDI capital, we divide investment fields and capital sources flow into fields such as the production of products related to garments, the field of processing, and the production of other products (wood products, plastics, fibers, fabrics, etc.) are grouped with low FDI quality and have a high risk of causing pollution. The findings depicted in Figure 1 indicate the proportion of low FDI capital has increased sharply in recent years, from 9.3 per cent (2021)

to 48.3 per cent (2023), which also means that high quality FDI capital tends to decrease sharply from 90.7 per cent in 2021 to 51.7 per cent in 2023.

4.3. Current status of environmental pollution in Binh Duong Province

The analysis results indicate an increasing trend in air pollution in industrial regions in Binh Duong, as measured by the ratio of dust and NO2 gas in the air. Despite the fact that the average TSP dust threshold per year remains significantly lower than Vietnam's standard threshold (as per QCVN 05:2023/BTNMT, which specifies a dangerous threshold of 300 µg/Nm^3). However, it is worth noting that on a local scale, certain areas in the industrial zone 3 located in Tan Uyen City experienced TSP levels exceeding the allowable threshold during the period from December to March. These levels ranged from 326 µg/Nm3 to 374 µg/Nm3 (Figure 2).

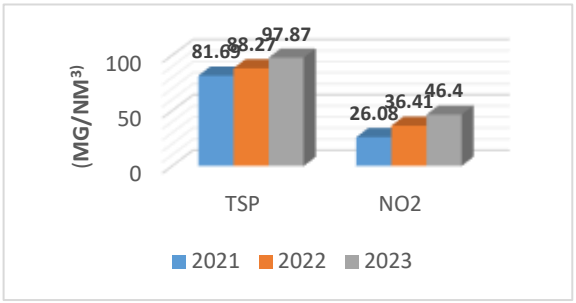

Figure 2: Increase in some air pollution measurement indicators

According to reports from environmental monitoring stations in Binh Duong, in some areas, benzene content exceeding allowed standards was also determined. For example, the Ong Cu temple area in January, February, March, April, October, December 2023 exceeds 1.2 ÷ 2.4 times; Ong Bo bridge area in January, March, September and November 2023 was 2.9 times, 1.9 times, 1.6 times and 1.4 times higher than the standard.

In addition, according to a report from the Center for Technical Monitoring of Environmental Resources, water pollution also occurs in canal areas in the province. Specifically, the water discharged into the Saigon River has an NH4+_N index that exceeds the allowable limit by 2.6 ÷ 12 times; NO2-_N parameter exceeds the allowable limit 2.7 ÷ 4.2 times. For canals draining into Dong Nai River, the NH4+_N index exceeds the allowable limit by 2.9 ÷ 9.7 times; The NO2-_N parameter exceeds the allowable limit by 1.2 ÷ 1.6 times in the canals draining into the middle of the river, the Fe parameter exceeds the allowable limit by 1.2 ÷ 2.1 times.

In addition, we also analyze the correlation between the origin of foreign direct investment (FDI), the quality of FDI, and the levels of total suspended particulate (TSP) dust concentration and nitrogen dioxide (NO2) concentration. The analytical results depicted in Figure 3 indicate a negative correlation between foreign direct investment (FDI) originating from developing nations, and the concentrations of total suspended particulates (TSP) and nitrogen dioxide (NO2). If the percentage of FDI capital coming from developed nations rises, there will be a corresponding fall in the levels of total suspended particulates (TSP) and nitrogen dioxide (NO2) in the atmosphere.

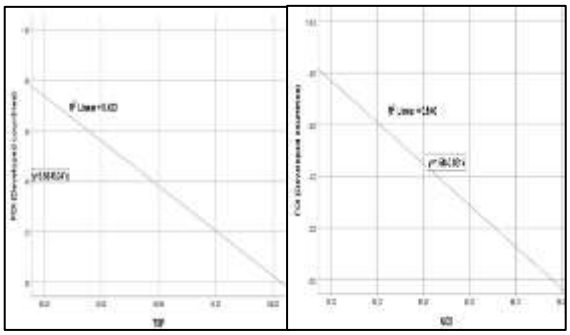

Figure 3: Relationship between FDI origin and environmental pollution

Similarly, the analysis results show that the proportion of low-quality FDI capital (processing sector) has a positive relationship with TSP and NO2 dust concentrations. This means that when the proportion of FDI capital invested in low-quality FDI (processing sectors) increases, environmental pollution will increase.

5. Conclusion and recommendations

Our research results show that the origin of FDI capital from developed countries and high quality of FDI capital are two main factors creating the "pollution halo" effect, because this FDI capital has cleaner, energy-saving technology. At the same time, technology transfer with the host country creates a spillover effect that encourages local businesses to seek and use new greener and cleaner technology to increase their competitiveness with foreign businesses. Besides, the host country's environmental management policy is an important factor in minimizing the environmental pollution created by FDI. Strict environmental policies play a role in screening and selecting high-quality FDI capital sources and eliminating low-quality FDI capital without reducing the level of FDI investment.

The research results show that the proportion of FDI originating from developing countries accounts for a relatively large proportion and has increased sharply in the last three years, along with FDI capital. Together with the increase in FDI from developing countries, low-quality FDI capital has also tended to increase substantially in the past three years. Furthermore, the findings of the study indicate an upward trend in

indicators pertaining to environmental pollution. Although the majority of these indicators fall below the permissible level, it is worth mentioning that localized contamination has been observed in many regions, with surface water pollution and air pollution being particularly prevalent. The matter at hand is of significant concern because of its substantial potential to induce environmental pollution, as posited by the "pollution haven" hypothesis.

Based on the research results, we make the following recommendations:

FDI presently has a substantial impact on mitigating environmental pollution. When assessing FDI, it is imperative for local governments to enhance the assessment of emissions associated with foreign-invested enterprises. This can be achieved by including emission indicators into the FDI evaluation system and implementing strict controls on the admission of such enterprises.

On the other hand, local authorities need to encourage businesses to actively choose advanced technology, energy saving, and emission reduction technology to ensure cleaner production and maximize the structure of FDI effects and technology spillover effect. This is to promote industrial structural transformation and improve local production technology. On that basis, the goal of reducing pollution and improving local environmental protection standards is achieved.

In addition, local authorities also added indicators on the level of technology transfer of FDI capital to the basic standards for selecting foreign investors. Local authorities should gradually reduce the selection of FDI capital in product processing fields, fields that create many sources of environmental pollution. In the process of transforming industrial structure, governments at all levels need to develop appropriate policies to promote the synchronous development of industrial structure towards high technology and automation. At the same time, governments at all levels need to provide a good policy environment and development space for strategic emerging industries and modern service industries, thereby promoting the continuous upgrading process of these industries and reducing pollution emissions.

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