The Critical Review of the Pollution Haven Hypothesis

Fozia Latif Gill*, K. Kuperan Viswanathan, Mohd Zaini Abdul Karim

[1]Othman Yeop Abdullah Graduate School of Business, Universiti Utara Malaysia, Malaysia, [2]Othman Yeop Abdullah Graduate School of Business, Universiti Utara Malaysia, Malaysia, [3]Othman Yeop Abdullah Graduate School of Business, Universiti Utara Malaysia, Malaysia, [4]Othman Yeop Abdullah Graduate School of Business, Universiti Utara Malaysia, Malaysia. *Email: fozialatifgill@gmail.com

ABSTRACT

This paper evaluates the theoretical and empirical basis of the pollution haven hypothesis (PHH) and porter hypothesis (PH). The PHH claims that owing to international trade and foreign direct investment (FDI), the developing countries have become the pollution haven for the advanced countries. The PH portraits an opposite picture than the PHH. According to, the PH, the FDI in home country induce the induction of more advanced and clean technologies that lead to cleaner environment. In the literature, there is mixed support for these opposing hypotheses. This paper therefore, recommends further rigours research that aims at to find out the true link between trade, FDI and environmental degradation.

Keywords: Pollution, Trade, Foreign Direct Investment
JEL Classifications: Q1, Q2, Q4

1. INTRODUCTION

Since 1970s, the issues related to international trade and environment have been extensively debated. The impact of international trade on environment and environment on international trade have been the major focus. The debate on link between environment and trade started in 1970's and become intense in 1990's when trade openness was expanded by different organizations like North American Free Trade Agreement (NAFTA), United Nations Conference on Environment and Development (UNCED), Uruguay Round of the General Agreement on Tariffs and Trade and World Trade Organization (WTO).The worldwide distribution of industrial pollution then became an important subject in the literature of environmental economics. The economists, the researchers, the industrial and political groups become worried about the impact of this increased international trade on the environment (Ederington, 2007; Stonehouse, 2000). Two contradictory views emerged that time about trade and environment link and offered opposite theoretical explanation with the same dynamics. The one extreme was the pollution haven hypothesis (PHH) and other was the porter hypothesis (PH).

The PHH was first postulated by Copeland and Taylor (1994) in the context of North-South trade under NAFTA. It was the first paper that links the environmental regulation stringency and trade patterns with the level of pollution in a country. Under NAFTA the firms operating in highly regulated countries like USA and Canada came in direct competition with the firms operating in poor countries that have lax environmental standards like Mexico. Copeland and Taylor (1994) predicted that NAFTA would become an environmental disaster for Mexico and job disaster for the USA. They further submitted that under the trade liberalization, the firms that produce dirty goods[1] would move from rich countries that have strict environmental regulations to those developing countries that have comparatively weak environmental regulations. Therefore, in open and liberalized trade the developing countries would become pollution haven for the dirty industries of the advanced countries. The PHH predicted an environmental disaster in these developing countries that had comparatively weak environmental regulations.

As stated by the PHH, the migration of the dirty industries from advanced to developing countries takes place through the trade of goods and foreign direct investment (FDI). This

---

1   These are the goods that have most pollution intensive process.

phenomenon is driven by the comparative cost advantage enjoyed by the developing countries due to lower pollution controls. The developing countries tend to specialize and export polluted goods and developed countries tend to specialize and export clean goods. Resultantly, the developing countries are becoming the pollution haven for the dirty industries of the advanced countries.

The critics of trade liberalization also argued that the concentration of pollution-intensive industries in poor and developing countries were due to weak environment standards of these countries. They claim that the consumers of developed world enjoy the pollution-intensive goods at lower prices due to underpricing of environmental resources in developing countries. This phenomenon of the concentration of pollution-intensive industries in poor and developing countries is known as PHH.

The empirical support to the PHH is mixed as (Jaffe et al., 1995; Tobey, 1990) did not find any evidence to claim that stringency of environmental regulation of a country had any impact on the trade of pollution-intensive goods. On the other hand, Mani and Wheeler (1998) found a temporary evidence in favour of the PHH.

Cole (2004) also found that pollution intensive industries grew at rapid speed in developing countries in the periods when environmental regulations in OECD countries had been very stringent. Similarly, Frankel and Rose (2005) also found a support for the PHH from a city-level study of SO_2 concentrations and Cole and Elliott (2005) also supported these results.

Nevertheless, Dinda (2004) rejected the PHH stance. He submitted that the polluting industries that tend to locate in the developing countries, would also raise the income levels of the host country. Resultantly, these host countries would also start imposing the stringent environmental regulations. Therefore, sooner or later there would be no country where polluting industries can be relocated and all countries would be on same playing level.

Furthermore, there are also other arguments against the theory, assumptions and implications of the PHH. These arguments are as follows;

a. It is argued that firms while shifting to a country that has lax environmental regulations, also consider that pollution reduces the productivity of the labour force that may raise the labour cost of the firm.
b. Second, the firms also consider the huge sunk cost[2] when they decide to shift the production operation to another country.
c. Third, the countries with lax environmental regulations, usually have a weak legal system and ill-defined commercial laws. Whereas, the investors from developed countries prefer the countries that have clear regulations and effective enforcement of laws. Therefore, they are likely to avoid investing in those countries that have lax environmental regulations.
d. Fourth, it is also argued that trade and investment flows are driven by the factor endowment, especially those that

flow from North to South[3] (Ethier, 1982; Helpman, 1984; Markusen, 1984). The factor endowment theory stated that capital-intensive firm tends to invest in labor-abundant countries while labour intensive firms tend to invest in the capital-abundant country. Nevertheless, the capital-intensive sector is considered a typical pollution intensive sector and capital abundant countries are those that have most stringent environmental regulations. Therefore, capital-labour hypothesis (KLH) seems to produce the trade and investment patterns that are opposite to the PHH. The KLH implies that capital abundant North will specialize and export capital-intensive goods that are also pollution intensive and labour abundant South will specialize and export labor-intensive goods that are less pollution-intensive.

e. Fifth, The PH by (Porter and Van der Linde, 1995) is another argument against the PHH. As stated in this hypothesis, most stringent environmental regulations in home country induce the induction of more clean and efficient technologies. These clean and efficient technologies reduce the marginal cost and raise the productivity of the firms resultantly, the firms become more competitive.
f. Sixth, according to Letchumanan and Kodama (2000), the most of the work on the PHH is rooted in neo classical theory of comparative advantage that treats the environment as another factor that entails comparative cost advantage. The neo classical theory of comparative advantage does not consider dynamic factors such as innovation, technology, market access and strategic partnership that exert a more significant effect on the competitiveness of the export than the comparative cost advantages factors. There are very few empirical studies that have been based on these dynamic factors. He also criticised the assumption of the PHH that industries are perfectly mobile to take locational advantages of pollution haven.
g. Finally, the green haven hypothesis (GHH) states that capital and pollution intensive industries are also concerned with their corporate social responsibility. They also follow the triple bottom line (people, profit, and the planet) and maintain their green reputation, therefore, contribute to minimize the ecological footprints (Herzig and Schaltegger, 2006; Willis, 2003).

These opposing arguments explain why empirical literature on the PHH has mixed outcome. Therefore, there has been a constant motivation for the researchers in environmental economics to search empirical evidence against or in the support of the PHH. In this backdrop, this research study aims to appraise the empirical literature on different aspects of the PHH.

2. LITERATURE REVIEW

The PHH has been studied theoretically and empirically all over the world. It has been empirically examined in all parts of the

---

2 In economics and business, a sunk cost is a cost that has already been incurred and cannot be recovered.

3 "The North–South divide is broadly considered a socio-economic and political divide. Generally, definitions of the Global North include the United States, Canada, Western Europe, and developed parts of Asia, as well as Australia and New Zealand, which are not actually located in the Northern Hemisphere but share similar economic and cultural characteristics as other northern countries. The Global South is made up of Africa, Latin America, and developing Asia including the Middle East."

world with different specification, with different functional form, with different variables, with different estimation methods and with different dataset. Nevertheless, the results are mixed at best, as no conclusive conjecture on the existence of the PHH can be established. The empirical literature about the PHH can be divided into following three categories.

2.1. The PHH and Environment Regulation

From the PHH stand point, the stringent environmental regulations in developed countries lead to relocate of the polluting industries from developed to developing countries and cause pollution to rise in developing countries. While on the other hand, PH holds that, stringent environment regulations prompt advanced technologies and innovations that reduce relocation of the industries, improve the competitiveness of the industries and thus improve the environment. The empirical studies reveal that environmental regulations play a different role in different perspective. AS in one of the early studies on trade in polluting industries, Low and Yeats (1992) found that stringency of environmental regulation had increased the net imports of 11 toxins in developed countries. They further observed that developing countries had a comparative advantage in pollution-intensive goods. Similarly, the critics of the EKC hypothesis like Selden and Song (1994) also pointed out that the EKC is the result of the relocating of dirty manufacturing industries from rich countries that have strict environmental regulations to those developing countries that have cheaper production costs and lax environmental regulations. They further stated that in some ways these lax environmental standards act as a form of comparative advantage for developing countries.

Mani and Wheeler (1998) observed that the pollution haven effects are expected to be transient, as pollution intensity has an elastic response to income growth in rich countries and some countries tend to lag in pollution control efforts, thereby perpetuating environmental degradation. Similarly, List and Co (2000) and Cole and Elliott (2005) also found a significant role of environmental regulations to determine the US outbound FDI to Mexico and Brazil.

Levinson and Taylor (2008) observed the increase of the imports of those industries of the USA whose abatement cost had increased following the environmental regulations. This increased import was from Latin America, Mexico and from other developing countries of the world.

On the contrary, Van Beers and van den Bergh (1997) did not find any significant impact of environment stringency on the trade of dirty goods in 21 OECD countries. Similarly, Xu (2000) examined the effect of environment stringency on the competitiveness of environmentally sensitive goods of 25 OECD countries excluding Turkey, Iceland, Hungry and East Asian countries. Their results revealed no systematic change in trade patrons of these countries despite the implementation of more stringent environmental policies. They, therefore, rejected the PHH stance and suggested an insignificant role of environmental regulations in determining the trade flows.

Cole and Elliott (2003) also did not find either of the environment measure effective to influence the trade of dirty goods. They rather

found that export of steel and iron industries that are considered most polluted industries was highest in capital intensive countries. Similarly, they also found the export of paper and pulp industries and of non-ferrous metals were highest in mineral and forest abundant countries. They, therefore, concluded that it was the factor endowment rather than environmental regulations that determine the specialization patrons of a country. Millimet and List (2004) highlighted that relocation decisions of a firm depend not only on the degree of environmental regulation but also on a host of other factors, such as labour costs and proximity to the markets and so on. Therefore, to determine the existence of the PHH, environmental regulations should be isolated from the variety of other determining factors.

Nevertheless, Smarzynska and Wei (2004) found an interesting result. They observed an opposite phenomenon than the predictions of the PHH. They found that the firms were migrating to those regions that had stricter environmental regulations. Similarly, Cole et al. (2010) also found limited support for the PHH from the disaggregated firm level data of Japan. They found that the effects of environmental regulation on trade were dependent on the mobility of the industry. Lanoie et al. (2011) also found in OECD countries that strict regulations partially offset the production cost of the firms. Furthermore, Minghua and Yongzhong (2011) found a positive role of regulations to improve the competitiveness and environment-friendly products in three different regions of China.

On the same footing, Costantini and Mazzanti (2012) from a large panel data of world countries, found the evidence to support PH that environmental regulations increase international competitiveness and technological innovations. They claimed that environmental regulations were not always harmful to the production activities, especially environment taxes and energy regulations both increase the export competitiveness. The producers in competition would produce environmentally beneficial and quality goods.

Rezza (2013) again found that Norwegian MNCs moved towards less stringent countries. They also found that MNCs that seek vertical efficiency, likely to stay in stringent environmental regulations and MNCs that seek horizontal efficiency tend to move to the countries that have less stringent environmental regulation. The vertical motives of the firm are in line with comparative advantage theory while horizontal motive is in line with the PHH. Lastly, From state level data of the USA for the period 1977–1994 Millimet and Roy (2015) found that pollution intensive industries like chemical, chemical products, environmental tend to move to states where environmental regulations were weak. Solarin *et al*. (2017) investigate the PHH in Ghana utilizing dioxide carbon (CO_2) emission as an indicator of air pollution for the period of 1980–2012. The outcome of this research revealed cointegration which indicates the existence of long run relationship between the variables. Moreover, gross domestic product (GDP), FDI, urban population, financial development and international trade have positive impact on CO_2 emission, while institutional quality decreases emissions in Ghana. This indicates that PHH does exist in Ghana. Keho (2017) uses quantile regression to reexamine the effect of economic growth and energy consumption on CO_2 emissions for five panels of 59 countries. The results reveal that

energy consumption increases CO_2 emissions in all panels, the effect being larger in low pollution countries. They also provide evidence supporting the EKC hypothesis for Sub-Saharan, American and European countries at all quantiles, and for Asian and MENA countries at lower levels of CO_2 emissions. These findings suggest that economic growth is not everywhere and always the cause and the cure of pollution. Therefore, environmental control policies should be tailored differently across low and high pollution countries. Rosado and Sanchez (2017) investigate the influence of electric consumption (ELC) and economic growth on CO_2 emissions in 10 selected South American countries using the period of 1980–2012. The Pedroni cointegration results indicated that CO_2 emissions, per capita GDP, and electricity power consumption were cointegrated. The fully modified ordinary least squares and dynamic ordinary least-squares results revealed that GDP growth and ELC increase CO_2 emissions in the long run. The vector error correction model Granger causality test show the causal flows from energy consumption, electricity consumption and economic growth to CO_2 emissions in South America both short and long-run. Policy recommendations were provided for the South American countries.

2.2. The PHH and International Trade

The proponents of international trade hold that open trade brings new technologies, innovations and environmental improvement in developing countries. Nevertheless, the PHH portraits a different picture of international trade for developing countries. According to the PHH, following international trade, the developing countries have become the pollution haven for advanced countries. Which stance is more advocated, it can be scrutinised by following empirical work.

Yang (2001) provided a strong support to the PHH by examining the environmental impact of WTO membership on Taiwan economy. He found that CO_2 emission in Taiwan has increased after the trade liberalization and production structure of the economy also have changed towards most polluting industries. Iwami (2001) also found that trade and industrialization in South East countries had aggravated the problem of environmental degradation. Similarly, Takeda and Matsuura (2006) found that environmental degradation has increased in East Asian countries following their export of polluting industries to developed world. This export might have increased the employment, income nevertheless, it also has contributed to the environmental problem in these countries.

Azhar and Elliott (2007) investigated the existence of PHH and the capital-labour hypothesis (KLH) in the context of North-south trade. They also found the evidence of PHH in the case of USA-Asia and USA-Latin America trade while for KLH, they found it for Japan-Asia and UK-Asia trade. Chao and Eden (2007), examined the effects of trade liberalization on firm ownership and environment. They found that trade liberalization has shifted the ownership of firms from local to foreigners that resulted in more pollution in host countries and from the examination of the export patterns of developing countries between 1994 and 1997, Akbostanci et al. (2007) also found that export of polluting industries of the developing countries had increased.

Levinson and Taylor (2008) measured the impact of pollution abatement cost on US net imports of manufacturing sectors from Mexico and Canada over the period from 1977 to 1989. As Mexico is a developing country, therefore, the analysis of US-Mexico trade provided a valid testing ground for PHH. They found that the pollution abatement cost in the USA was a significant determining factor of US trade with Mexico and Canada. Guo et al. (2010) provided another support to PHH. They examined the impact of inter-sectoral trade of 47 Chinese sectors and 67 sectors of the USA on national and global CO_2 emissions. They found that the USA imports had decreased the emission of polluted gases in the USA nevertheless, global emission in same period remained increasing. The same scenario they observed in the case of USA trade with China.

Atici (2012) also found that export of dirty goods was the main determinant of CO_2 emission in the ASEAN countries for the period of 1970-200. Moreover, he also found that imports of Japan from ASEAN do not cause pollution in ASEAN countries while the imports of China stimulate the pollution per capita in these countries. López et al. (2013) again confirmed a strong evidence for the support of the PHH from the analysis of bilateral trade between Spain and China. They found that China has become pollution haven for energy intensive industries of Spain. Similarly, Gani (2013) also found that trade and industrial activities have a strong impact on pollution in Arab states. Chakraborty and Mukherjee (2013) also supported the PHH from the analysis of trade and environment nexus in 114 countries for the period of 2000–2011. They used environment performance index as a measure of pollution. They also found that export of primary and manufactured goods of developing countries has caused environmental degradation in these countries.

From a panel dataset of 187 countries, Kanemoto et al. (2014) found that embodied CO_2 emissions had been on rising in developed and developing countries during the sample period of the study. They claimed that 72% of embodied flows of CO_2 were being generated from outside Kyoto Annex B[4] signatory that indicated the existence of PHH type trade flows. They recommended that world pollution can be controlled only by reducing consumption of embodied emission. They further submitted that the major emitter of GHH have applied aggressive environmental legislation, yet the net global air pollution was on the rise because these countries had been shifting the burden.

Similarly, from the US-India trade between the period of 1991– and 2010 Sawhney and Rastogi (2015) concluded that decade of trade liberalization had made India a pollution haven for some polluting industries of the USA like chemical, steel, and iron. Furthermore, Ibrahim et al. (2015) found that trade has environmentally degrading effects in South-East Asian countries. Whilst, in another study on the trade, flows of 28 toxic chemicals

---

4   "Annex B Countries/Parties are the signatory nations to the Kyoto protocol that are subject to caps on their emissions of GHGs and committed to reduction targets–countries with developed economies. Annex B is an adjusted list of the countries identified under the more recent Kyoto Protocol. Annex B countries have their reduction targets formally stated." Source: United Nations Framework Convention on Climate Change.

from the US to the countries that have less stringent countries Tang (2015) also provided a strong support to the PHH. He found that the import of toxic chemicals of the USA has increased during the study period 1989–2006. The empirical work of Kiuila (2015) also indicated that trade had a negative effect on the environment of developing countries.

Aller et al. (2015) highlighted that as result of increasing trend in international trade there is a shifting of the industries from most developed countries to less developed countries. This global industrialization has certain implications for environmental quality of the developing countries. This trend has a negative as well as positive effect on the environment of less developed countries. On the same footing, McCollough et al. (2016) also, proved the existence of PHH. They found that pollution intensive industries like the tyre industry of US shifted their production operations offshore that lead to decrease emission in the USA. This study was a strong empirical support to the PHH stance that advanced countries are shifting the burden of the pollution to the developing the world.

On the other contrary, Cole and Elliott (2003) found a relatively small role of pollution haven effects as compared to other explanatory variables in explaining the pollution. They investigated the extent to which the PPH phenomena can influence the EKC of developing countries. They used a detailed data of North–South trade flows of pollution-intensive products and investigated the possible impact of these trade flows on water and air pollutants in South countries. In another study on China, Xiqin et al. (2006) analysed the effect of international trade on the environment. Although, they did not find any clear evidence of PHH, yet they found that trade has certain consequences for the environment. Poelhekke and Ploeg (2015) analysed the PHH from the data set of 188 countries for the period 1996–2003.They also did not find support for the PHH on aggregated level data but found little support for the PHH at the sector level data. Similarly, the empirics like (Jaffe et al., 1995; Jänicke and Weidner, 1997; Tobey, 1990) did not support the PHH from the analysis of inter-industry trade between developed and developing countries.

Becker and Henderson (2000) also, pointed out that most polluting sectors also had comparative advantages in other costs of production like labour productivity. Therefore, these advantages also affect the relocation decision of the firms. Smarzynska and Wei (2001) believed that past research had found weak evidence in the support of the PHH. Because previous studies had overlooked some important determinant of pollution, therefore, did not correctly specified the models to investigate the existence of the PHH. They included some more variables in their model like the level of corruption and did not find any robust support in favour of the PHH.

Cole (2004) and He and Wang (2012) also explained a different role of international trade than theorized by the PHH. According to them, trade liberalization usually leads to more economic growth and wealth accumulation. Then this accumulated wealth raises the awareness about the environmental standards. International trade also transfers modern and more advanced technologies from developed to developing countries. These modern technologies are more efficient and clean than traditional technologies of developing countries, therefore, in long run, international trade makes production processes clean and curtail pollution in developing countries.

Dietzenbacher and Mukhopadhyay (2007) also did not find any evidence in favour of the PHH. They examined the impact of import and export on various environmental indicators in India. Kearsley and Riddel (2010) examined the EKC and the PHH from the bilateral trade of 100 developing countries with 27 OECD countries. They investigated the impact of bilateral trade and GDP per capita on seven local and global emissions like CO_2, nitrous oxide, Sulphur oxide, volatile organic compound, and carbon mono oxide and, suspended particle matter. They found weak evidence for the role of PHH in shaping the EKC, therefore, they rejected the PHH. Similarly, Beladi and Oladi (2011) also concluded that global emissions can be decreased by the openness of trade. They examined the impact of trade liberalization on CO_2 emission by using duopoly model of home and a foreign firm.

Tan et al. (2013) also found a very robust support against the PHH. They examined the effect of bilateral trade on CO_2 emission between China and Australia for a period 2002–2010. As per their results, embodied CO_2 emission in trade scenario was lower than the non-trade scenario and trade between Australia and China contributed to the reduction of global CO_2 emission. Thus, these results were quite opposite to the PHH trade patterns. Moreover, Jebli et al. (2016) also found that more international trade reduces global CO_2 emission. They investigated the causal relationships between per capita CO_2 emissions, GDP, and international trade for 25 OECD countries. Mahmood and Alkhateeb (2017) investiagte the impacts of trade and income level on the carbon dioxide emissions (CDE) in Saudi Arabia by using a period 1970–2016. Unit root and cointegration tests have been utilized for data analysis. In the long run, income is found responsible for increasing CDE but its square term is showing a negative impact on CDE. Therefore, this study has inveterate the environmental Kuznets curve hypothesis. Further, trade has negative impact on CDE. Therefore, trade has been remained helpful in reducing pollution levels in Saudi Arabia. The income, its square and trade have same directions of relationships in short run as in long run. Based on findings, this study recommends the Saudi government to liberalize trade policy to protect environment.

2.3. The PHH and FDI
There are opposing arguments and empirical findings about the effect of FDI on the environment of a country. The PHH claims the dirty industries of advanced countries are shifting towards the developing countries in the form of FDI and making the environment of these countries worse. While the critics of the PHH hold that FDI provides new technologies, management skills and financial resources that eventually lead to the improvement of the environment. In literature, there is diverse empirical output about the link between FDI and environment.

According to Winslow (2005), trade and FDI had aggravated the environmental conditions in China. He (2006) examined the

effect of FDI on SO_2 emission in 29 Chinese provinces for the period 199–2001. He also found a negative impact of FDI on SO_2 emission in these Chines states thus, supported the PHH. MacDermott (2008) also, found that FDI was flowing from 26 OECD countries to those developing countries that were with the higher level of pollution.

Ren et al. (2014) conducted a study to investigate the presence of PHH in 18 industries of China for the period 2000–2011. They applied two-step GMM model to check the impact of FDI, international trade, export and import on embodied CO_2 emission. As per their results, trade surplus and inward FDI were the main reason of environmental degradation in China. They further submitted that China has become pollution haven because of its foreign consumers. They recommended that China should promote clean FDI and should focus on energy efficient services to be a low carbon economy.

Aller et al. (2015) investigated the presence of PHH for the period 1996–2010 in 177 countries. They also found a support for the PHH. Tai et al. (2015) also, had the same conclusion. They found that FDI and pollution are positively related and FDI-led host country to the PHH effect but this effect can be reduced by reducing the share of aid on pollution abatement.

From the study of 27 selected developing countries for the time period of 2002–2008, Neequaye and Oladi (2015) also found that FDI flows deteriorated environment while environmental aid decreased the emission in these countries. They recommended that developing countries should choose clean FDI and should focus on stringent environmental regulations.

Seker et al. (2015) examined the impact of FDI on CO_2 emission in Turkey for the period of 1974–2010. They used autoregressive distributed lag to test the long run relation between the variables. The long run results showed the positive effect of FDI on CO_2 emission thus supported to the PHH. They recommended that Turkey should allow only those FDI flows that were with clean technologies.

Riti et al. (2016) conducted an empirical investigation in Nigeria for the period 1980–2013 to examine the link between of manufacturing export, FDI and pollution. From Ganger causality test and bound cointegration test, they found a positive impact of manufacturing export and FDI on CO_2 emissions.

On contrary, Haisheng et al. (2005) stated that there was no certain impact of trade and FDI on the environment. They found that FDI had a positive impact on economic growth and help to invent new technologies to reduce pollution. This study was a support to the stance of PH. Honglei et al. (2011) also, generated the arguments against the PHH effects. They examined the effect of a set of variables like FDI economic growth, foreign trade on environmental pollution in 30 regions of China. They found that FDI was not destructive for the local environment. From simultaneous equation model, they concluded that China was not a pollution haven of the advanced countries. They further submitted that China's huge economy and cheap labour are the

main determinants of FDI inflows rather than lax environment regulation Similarly, Al-Mulali and Tang (2013) found that FDI has a negative effect on the CO_2 emission in those countries that have the well-developed infrastructure. They found that FDI had brought energy efficient technologies to the host countries. Furthermore, Xiao (2016) concluded that FDI was mainly attracted by infrastructure and technology rather than lax environmental conditions.They examined the impact of environmental stringency on FDI in 30 regional states of China. They found that the PHH held to some extent in the western region of China. They also found that the coastal region with stringent regulations also attracted the FDI. Therefore, they did not find any robust support for the PHH.

3. CONCLUSION

Although, the PHH has been theoretical and empirically reviewed in various previous studies with different specification and with different data set, yet no conclusive results can be drawn about the existence of the PHH. The PHH claims that as a result of trade and investment liberalizing the developing countries have become pollution haven of dirty industries of the developed countries. The advanced countries are clean because they have shifted their pollution-intensive industries to the developing countries. As a result, the developed countries tend to specialize in clean goods while developing countries tend to specialize and export pollution-intensive goods. The world pollution is still on the rise and it has only changed its location.The PHH claims that the world pollution can be curtailed only if the advanced countries control the consumption of the pollution-intensive goods.

Contrastingly, PH offers different argument. According to this hypothesis, trade and Investment have a beneficial impact for the environmen in the developing countries. Trade openness has contributed to increase the market access of the developing countries resultantly, they are reaping the advantage of specialization and large scale production. Trade and investment liberalization policies have also brought new and updated energy efficient technologies to the developing countries. Therefore, the long run impact of these policies would be beneficial for wealth generation, sustainable development and for the environment.

The previous empirical literature reveals inconclusive findings about the both above-mentioned hypothesis. The critics of the PHH explain some of the arguments that have not been focused on the analysis of the PHH. They argued that most of the analysis about the PHH is based on neo classical trade theory of comparative advantage. The neo-classical trade theory ignores the dynamic factors like technology and market access that are the most important determinants of the location of any industry. Furthermore, it is also argued that pollution -intensive sectors are also capital intensive and advanced countries are capital abundant countries. Moreover, most of the analysts ignored the cost of mobility of translocation of these industries in case of the PHH.

In addition to this, several previous empirical studies indicate that trade and FDI contribute to employment generation, income growth and technological up- gradation in the developing countries. These changes may contribute to bring improvement

in the environment. Similarly, there is also an empirical support to the stance that stringent environment regulations prompt environment-friendly technologies rather than only to contribute the relocation of the industries.

REFERENCES

Akbostanci, E., Tunc, G.I., Türüt-Asik, S. (2007), Pollution haven hypothesis and the role of dirty industries in Turkey's exports. Environment and Development Economics, 12(2), 297-322.

Al-Mulali, U., Tang, C.F. (2013), Investigating the validity of pollution haven hypothesis in the gulf cooperation council (GCC) countries. Energy Policy, 60, 813-819.

Aller, C., Ductor, L., Herrerias, M.J. (2015), The world trade network and the environment. Energy Economics, 52, 55-68.

Atici, C. (2012), Carbon emissions, trade liberalization, and the Japan–ASEAN interaction: A group-wise examination. Journal of the Japanese and International Economies, 26(1), 167-178.

Azhar, A., Elliott, R.J. (2007), Trade and specialisation in pollution intensive industries: North–South evidence. International Economic Journal, 21(3), 361-380.

Becker, R., Henderson, V. (2000), Effects of air quality regulations on polluting indust$_r$ies. Journal of political Economy, 108(2), 379-421.

Beladi, H., Oladi, R. (2011), Does trade liberalization increase global pollution? Resource and Energy Economics, 33(1), 172-178.

Chakraborty, D., Mukherjee, S. (2013), How do trade and investment flows affect environmental sustainability? Evidence from panel data. Environmental Development, 6, 34-47.

Chao, C.C., Eden, S. (2007), Trade liberalization, foreign ownership, and the environment in a small open economy. International Review of Economics and Finance, 16(4), 471-477.

Cole, M.A. (2004), Trade, the pollution haven hypothesis and the environmental Kuznets curve: Examining the linkages. Ecological Economics, 48(1), 71-81.

Cole, M.A., Elliott, R.J. (2003), Determining the trade–environment composition effect: The role of capital, labor and environmental regulations. Journal of Environmental Economics and Management, 46(3), 363-383.

Cole, M.A., Elliott, R.J. (2005), FDI and the capital intensity of "dirty" sectors: A missing piece of the pollution haven puzzle. Review of Development Economics, 9(4), 530-548.

Cole, M.A., Elliott, R.J., Okubo, T. (2010), Trade, environmental regulations and industrial mobility: An industry-level study of Japan. Ecological Economics, 69(10), 1995-2002.

Copeland, B.R., Taylor, M.S. (1994), North-South trade and the environment. The Quarterly Journal of Economics, 109, 755-787.

Costantini, V., Mazzanti, M. (2012), On the green and innovative side of trade competitiveness? The impact of environmental policies and innovation on EU exports. Research Policy, 41(1), 132-153.

Dietzenbacher, E., Mukhopadhyay, K. (2007), An empirical examination of the pollution haven hypothesis for India: Towards a green leontief paradox? Environmental and Resource Economics, 36(4), 427-449.

Dinda, S. (2004), Environmental kuznets curve hypothesis: A survey. Ecological Economics, 49(4), 431-455.

Ederington, J. (2007), NAFTA and the pollution haven hypothesis. Policy Studies Journal, 35(2), 239-244.

Ethier, W.J. (1982), National and international returns to scale in the modern theory of international trade. The American Economic Review, 72(3), 389-405.

Frankel, J.A., Rose, A.K. (2005), Is trade good or bad for the environment? Sorting out the causality. Review of Economics and Statistics, 87(1), 85-91.

Gani, A. (2013), The effect of trade and institutions on pollution in the Arab countries. Journal of International Trade Law and Policy, 12(2), 154-168.

Guo, J., Zou, L.L., Wei, Y.M. (2010), Impact of inter-sectoral trade on national and global CO2 emissions: An empirical analysis of China and US. Energy Policy, 38(3), 1389-1397.

Haisheng, Y., Jia, J., Yongzhang, Z., Shugong, W. (2005), The impact on environmental kuznets curve by trade and foreign direct investment in China. Chinese Journal of Population Resources and Environment, 3(2), 14-19.

He, J. (2006), Pollution haven hypothesis and environmental impacts of foreign direct investment: The case of industrial emission of sulfur dioxide (SO2) in Chinese provinces. Ecological Economics, 60(1), 228-245.

He, J., Wang, H. (2012), Economic structure, development policy and environmental quality: An empirical analysis of environmental Kuznets curves with Chinese municipal data. Ecological Economics, 76, 49-59.

Helpman, E. (1984), A simple theory of international trade with multinational corporations. The Journal of Political Economy, 93, 451-471.

Herzig, C., Schaltegger, S. (2006), Corporate sustainability reporting. An overview. Sustainability Accounting and Reporting. Netherlands: Springer. p301-324.

Honglei, C., Xiaorong, Z., Qiufeng, C. (2011), Export-oriented economy and environmental pollution in China: The empirical study by simultaneous equation model. Energy Procedia, 5, 884-889.

Ibrahim, M.H., Rizvi, S.A.R., Leal-Filho, W., Seixas, J. (2015), Emissions and trade in Southeast and East Asian countries: A panel co-integration analysis. International Journal of Climate Change Strategies and Management, 7(4): 460-475.

Iwami, T. (2001), Economic development and environment in Southeast Asia: An introductory note. International Journal of Social Economics, 28(8), 605-622.

Jaffe, A.B., Peterson, S.R., Portney, P.R., Stavins, R.N. (1995), Environmental regulation and the competitiveness of US manufacturing: What does the evidence tell us? Journal of Economic Literature, 50, 132-163.

Jänicke, M., Weidner, H. (1997), National Environmental Policies: A Comparative Study of Capacity-Building. Berlin: Springer-Verlag.

Jebli, M.B., Youssef, S.B., Ozturk, I. (2016), Testing environmental Kuznets curve hypothesis: The role of renewable and non-renewable energy consumption and trade in OECD countries. Ecological Indicators, 60, 824-831.

Kanemoto, K., Moran, D., Lenzen, M., Geschke, A. (2014), International trade undermines national emission reduction targets: New evidence from air pollution. Global Environmental Change, 24, 52-59.

Kearsley, A., Riddel, M. (2010), A further inquiry into the pollution haven hypothesis and the environmental kuznets curve. Ecological Economics, 69(4), 905-919.

Keho, Y. (2017), Revisiting the income, energy consumption and carbon emissions nexus: New evidence from quantile regression for different country groups. International Journal of Energy Economics and Policy, 7(3), 356-363.

Kiuila, O. (2015), Interactions between trade and environmental policies in the czech republic. The Journal of International Trade and Economic Development, 24(7), 1014-1035.

Lanoie, P., Laurent☐Lucchetti, J., Johnstone, N., Ambec, S. (2011), Environmental policy, innovation and performance: New insights on the Porter hypothesis. Journal of Economics and Management Strategy, 20(3), 803-842.

Letchumanan, R., Kodama, F. (2000), Reconciling the conflict between thepollution-haven'hypothesis and an emerging trajectory of

international technology transfer. Research Policy, 29(1), 59-79.

Levinson, A., Taylor, M.S. (2008), Unmasking the pollution haven effect. International Economic Review, 49(1), 223-254.

Levinson, A., Taylor, M.S. (2008), Unmasking the pollution haven effect. International Economic Review, 49(1), 223-254.

List, J.A., Co, C.Y. (2000), The effects of environmental regulations on foreign direct investment. Journal of Environmental Economics and Management, 40(1), 1-20.

Low, P., Yeats, A. (1992), Do Dirty Industries Migrate? World Bank Discussion Papers [World Bank Discussion Paper].

López, L.A., Arce, G., Zafrilla, J.E. (2013), Parcelling virtual carbon in the pollution haven hypothesis. Energy Economics, 39, 177-186.

MacDermott, R.J. (2008), Environmental Regulations and the Flow of Foreign Direct Investment: A Review of the Pollution Haven Hypothesis. Foreign Direct Investment.

Mahmood, H., Alkhateeb, T.T.Y. (2017), Trade and environment nexus in Saudi Arabia: An environmental kuznets curve hypothesis. International Journal of Energy Economics and Policy, 7(5), 291-295.

Mani, M., Wheeler, D. (1998), In search of pollution havens? Dirty industry in the world economy, 1960 to 1995. The Journal of Environment and Development, 7(3), 215-247.

Markusen, J.R. (1984), Multinationals, multi-plant economies, and the gains from trade. Journal of International Economics, 16(3), 205-226.

McCollough, J., He, M., Bayramoglu, A.T. (2016), Pollution havens and their relationship to the environmental kuznets curve: The case of the us tyre industry. Economic Affairs, 36(3) 258-272.

Millimet, D.L., List, J.A. (2004), The case of the missing pollution haven hypothesis. Journal of Regulatory Economics, 26(3), 239-262.

Millimet, D.L., Roy, J. (2015), Empirical tests of the pollution haven hypothesis when environmental regulation is endogenous. Journal of Applied Econometrics, 31(1), 652-677.

Minghua', L., Yongzhong, Y. (2011), Environmental regulation and technology innovation: Evidence from China. Energy Procedia, 5, 572-576.

Neequaye, N.A., Oladi, R. (2015), Environment, growth, and FDI revisited. International Review of Economics and Finance, 39, 47-56.

Poelhekke, S., Ploeg, F. (2015), Green havens and pollution havens. The World Economy, 38(7), 1159-1178.

Porter, M.E., Van der Linde, C. (1995), Toward a new conception of the environment-competitiveness relationship. The Journal of Economic Perspectives, 9(4), 97-118.

Ren, S., Yuan, B., Ma, X., Chen, X. (2014), International trade, FDI (foreign direct investment) and embodied CO_2 emissions: A case study of Chinas industrial sectors. China Economic Review, 28, 123-134.

Rezza, A.A. (2013), FDI and pollution havens: Evidence from the Norwegian manufacturing sector. Ecological Economics, 90, 140-149.

Riti, J.S., Sentanu, I.G.E., Cai, A., Sheikh, S. (2016), Foreign direct investment, manufacturing export and the environment in Nigeria: A test of pollution haven hypothesis. NIDA Development Journal, 56(2), 73-98.

Rosado, J.A., Sánchez, M.I.A. (2017), The influence of economic growth and electric consumption on pollution in South America countries.

International Journal of Energy Economics and Policy, 7(3), 121-126.

Sawhney, A., Rastogi, R. (2015), Is India specialising in polluting industries? Evidence from US–India bilateral trade. The World Economy, 38(2), 360-378.

Seker, F., Ertugrul, H.M., Cetin, M. (2015), The impact of foreign direct investment on environmental quality: A bounds testing and causality analysis for Turkey. Renewable and Sustainable Energy Reviews, 52, 347-356.

Selden, T.M., Song, D. (1994), Environmental quality and development: Is there a kuznets curve for air pollution emissions? Journal of Environmental Economics and Management, 27(2), 147-162.

Smarzynska, B.J., Wei, S.J. (2004), Pollution havens and foreign direct investment: Dirty secret or popular myth? The B.E. Journal of Economic Analysis and Policy, 2, 8.

Smarzynska, B.K., Wei, S.J. (2001), Pollution havens and foreign direct investment: Dirty secret or popular myth? Available from: http://www.nber.org/papers/w8465.

Solarin, S.A., Al-Mulali, U., Musah, I., Ozturk, I. (2017), Investigating the pollution haven hypothesis in Ghana: An empirical investigation. Energy, 124, 706-719.

Stonehouse, D.P. (2000), A review of WTO and environmental issues. Journal of Agricultural and Environmental Ethics, 13(1), 121-144.

Tai, M.Y., Chao, C.C., Hu, S.W. (2015), Pollution, health and economic growth. The North American Journal of Economics and Finance, 32, 155-161.

Takeda, F., Matsuura, K. (2006), Trade and the environment in East Asia. Korea and the World Economy, 7(1), 33-56.

Tan, H., Sun, A., Lau, H. (2013), CO2 embodiment in China–Australia trade: The drivers and implications. Energy Policy, 61, 1212-1220.

Tang, J.P. (2015), Pollution havens and the trade in toxic chemicals: Evidence from US trade flows. Ecological Economics, 112, 150-160.

Tobey, J.A. (1990), The effects of domestic environmental policies on patterns of world trade: An empirical test. Kyklos, 43(2), 191-209.

Van Beers, C., Van Den Bergh, J.C. (1997), An empirical multi-country analysis of the impact of environmental regulations on foreign trade flows. Kyklos, 50(1), 29-46.

Willis, A. (2003), The role of the global reporting initiative's sustainability reporting guidelines in the social screening of investments. Journal of Business Ethics, 43(3), 233-237.

Winslow, M. (2005), The Environmental Kuznets Curve Revisited Once Again. Paper Presented at the Forum for Social Economics.

Xiqin, H., Hai, Z., Li, Y. (2006), Resolving trade and environment conflicts: A focus on sustainable trade in China. Chinese Journal of Population Resources and Environment, 4(2), 55-60.

Xu, X. (2000), International trade and environmental regulation: Time series evidence and cross section test. Environmental and Resource Economics, 17(3), 233-257.

Yang, H.Y. (2001), Trade liberalization and pollution: A general equilibrium analysis of carbon dioxide emissions in Taiwan. Economic Modelling, 18(3), 435-454.

Zhang, C., Zhou, X. (2016), Does foreign direct investment lead to lower CO2 emissions? Evidence from a regional analysis in China. Renewable and Sustainable Energy Reviews, 58, 943-951.