

Foreign Direct Investments and Environmental Policies: A Meta-Analysis



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1 Introduction

Over recent times, policy makers are more concerned about the negative effects of ecosystem and the environment as the interdependency between economies have increased in terms of foreign direct investments (FDI) and international trade. Recent advancements in research with regards to international trade have shifted the comparative trade analysis from economics of trade to environmental regulation and trade. Therefore, environmental regulations may become one of the influencing factors in comparative advantage if barrier of trade will fall.

Most of the research hence is in the line of understanding FDI and environmental externalities both at academic and policy levels. Mostly, results between FDI and environmental externalities are contradictory to each other. In examining the relationship between FDI and environmental regulations, three major contributions are made, firstly that flows a pollution haven hypothesis (PHH). This holds two main issues, first inward FDI worsens environmental conditions and second FDI can be a factor of production. In this line of a result, environmental indicators such as energy intensity, emission, trade openness and economic growth have mostly been considered. If inter-jurisdictional differences in the degrees of regulatory stringency are assumed, the PHH suggests that pollution-intensive production activities move to economies that have laxity in environmental rules and regulations through FDI or by increasing market shares of exporting firms. Therefore, it is clear that tougher environmental rulers and regulations will add to the cost of production not only at firm

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level but also at aggregate level. This might bring the locational disadvantage to firms that are investing in the economies that have harder rules related to environmental standards in short run but will be beneficial at a long run in terms of sustainable business environment and sustainable ecosystem. Such costs may be in line of process or product design, R&D or technological shifts. In the absence of these firm characteristics, the decision to invest/locate/relocate the production activities depends solely on the firm to choose between higher/lesser stringent environmental regulations. Therefore, the decisions to reallocate remain one of the important strategies at firm level. The interaction of both country characteristics and firm decision makes the FDI decision to one of the countries either with stronger environmental rules and regulations or otherwise. The number of empirical studies of PHH has expanded steadily since the beginning of the 2000s. The economic rationale of PHH is well established with alternative analysis with the empirical standpoint related to the PHH, hence not reaching to any robust conclusions to establish the relationship between FDI and environmental regulations. As a matter of fact, these arguments have not been tested for a developing countries perspective to our knowledge and particular for the Indian case.

The second area of research brings the concept of pollution halo hypothesis (PhaH), which concludes that FDI results in deteriorating environmental quality in host country. These sets of studies imply that FDI inflows can lead to rapid improvement in energy efficiency and hence result in reducing carbon dioxide emissions. In the case of PhaH, it is important to notice that foreign-funded firms also facilitate development of better technologies for the environmental externalities in the host countries either by technology transfers or by R&D. In this connection, FDI has been presented to be conducive to promoting environmental quality.

One of the reasons for not arriving at a general conclusion on the impact of FDI on environment is classified as differences in research objectives, ideas, methods and timeline. On the one hand, most of the scientific approach of understanding environmental problem is to look at sulphur dioxide, carbon dioxide and other pollution emissions or to look at wastewater, waste dust and soot. Most of the research has focused on pollution instead of waste. Therefore, the effect of FDI on particular pollutants remains identified and these pollutions have strong spatial linkage and higher concentration of the pollutants will have higher spatial correlation with the presence of FDI.

In terms of techniques used, traditional panel data has overlooked the impact of spatial correlation and find out partial or biased estimate in establishing relationship between FDI and environmental consequences. However, the general conclusion on role of FDI is turned out to be an important effect on the host economy in terms of boosting economic activity, major source of external finance/capital and minimising the gap between targeted investment and domestic saving. Further, in the economic development front, FDI helps in reducing gap between foreign exchange requirements and net exports earnings. General conclusions also include direct capital financing, positive externalities for economic development and stimulating economic growth through spillover and technology transfers, productivity gains, and introduction of new process, product and managerial benefits.

These said positive benefits of FDI come at the cost of environment. This is mostly due to laxity in environmental rules and regulations of developing economies and weaker government interventions. These are termed as pollution haven hypothesis (Copeland and Taylor 1994). In this context, industrial flight hypothesis states that firms are more likely to shift production to countries with less stringent environmental regulations to reduce production cost. On the contrary, foreign firms employ better management practices and technology that helps in the production process in terms of reduced environmental hazards. This argument is related to pollution halo hypothesis that does not support the general industrial flight hypothesis but claims that weaker environmental regulations are helpful to firms in locational choice related to resources availability. Particularly, for the energy-intensive sectors, a technological base is tested for this hypothesis in Blackman and Wu (1998).

The literature on looking at the Environmental Kuznets Curve (EKC) hypothesis concludes that FDI has a positive impact on the growth of an economy and hence on higher energy consumption. If foreign firms adopt advanced technology in production, it can help in reducing energy demand. The existing empirical studies also correlate the increase in per capita income or energy demand due to FDI with CO₂ emissions (Omri and Kahouli 2014). Romer (1993) stated that FDI could be an important source for technology transfer and transfer of business knowledge to the host economy with substantial positive spillover effects. However, according to Boyd and Smith (1992), the domestic regulations also hamper allocation of resources. However, the EKC literature on FDI and environmental regulation explains that initially environmental pollution increases, and after threshold levels, it starts decreasing theoretically (Grossman and Krueger 1995). Researches in line with the EKC hypothesis are being conducted for the environmental regulations, emissions at aggregate and disaggregate levels on various pollutants such as the CO₂ (Stern 2004).

This debate brings out two broad perspectives: One that goes in line with comparative advantage in trade literature, and second deals with neo-technological trade literature. In the first sets of literature, environmental resources as considered as a factor of production and therefore countries with strict environmental regulations will be relatively high cost of production. Hence, these economies cannot have comparative advantage in producing polluting goods that restricts them in not specialising. On the second perspective, if laxity in environmental rules and regulations are followed, it will populate dirty industries in the economy, which is being identified as the technology gap of the economy. Therefore, one the hand, FDI has a positive impact in the environment by transferring knowledge, learning and machine from the developed to the developing economy, and on the other hand, the neo-technology perspective of trade can be analysed by the Porter hypothesis.¹ Few authors such as Palmer et al. (1995) criticise Porter hypothesis as this approach ignores the cost-benefit analysis.

¹The “Porter hypothesis” states that stringent environmental policies encourage producers to innovate and create new environment-friendly technologies and to become net exporters of these new technologies. This is derived from the concept of offsets whether in the form of product or process offsets. Although stringent environmental laws may increase compliance costs, the benefits of environment-friendly, innovative techniques can offset the cost of compliance (Mihci et al. 2005).

In various ways, we can classify the FDI literature from the empirical viewpoint. For example, there are studies that are related to FDI and economic growth; FDI and environment; FDI, economic growth and environment. These studies can also be classified in terms of data in use, for example, either country level and/or cross-country level and/or state level with either cross section/time series or panel data. This paper tries to understand FDI and environmental regulations through a standard literature review, using quantitative techniques such as the meta-analysis to conclude if earlier findings are sensitive to models used, and hence, identifying possible policy implications.

In arriving at better policy implications in economic studies, application of meta-regression/analysis is often used after the seminal work published by Stanley and Jarrell (1989). This paper is similar in the spirit of Mulatu et al. (2004) and Jeppesen et al. (2002)² but departs in terms of focussing empirical literature related to environmental regulations, pollution, ecology and FDI. Nearly, 700 estimates, from 29 studies (list of studies are presented in the appendix) those conducted from 1994 to 2019, are considered as the sample of this work. The sample has firms that are engaged in FDI from various countries including the USA, the UK, France, Germany, Japan, India, other developed economies and the emerging economies. The result of this study suggests that certain aspects of research design are important for the significant of these studies. We further conclude that government environmental expenditure generates higher probability in supporting PHH. This result has similarity in terms of country context either for developing or for the developed economies. In one of the recent studies, it is also found that environmental policies in general and energy and emission efficiencies are found to be stabilizing agent for business cycle synchronisation (Patnaik and Sahu 2017). From both factor endowment and the PHH, it is likely that the capital flow in case of the pollution-intensive industries undergoes diverging experiences. This distinguishes between the market-seeking and efficiency-seeking FDI. Many of the previous studies are unable to differentiate between these two categories. Therefore, we strongly recommend that future works on FDI should make use of disaggregate FDI and bilateral trade data along with the environmental indicators. In sum previous studies are weakly able to differentiate between market-seeking and efficiency-seeking FDI in the context of environmental regulations. Therefore, we believe the future studied should focus on disaggregate FDI and bilateral trade data in analysing relationship between FDI, environmental regulations and nature of FDI.

The paper is organised as follows. Section 2 of the paper discusses estimation strategies and selection of important variable related to this study. Section 3 explains the findings from the meta-regression with the final Sect. 4 presenting the conclusions of this study with the possible policy implications.

²Relationship between environmental regulations and trade flow among economies is analysed by using meta-analysis in the former study. Whereas, the latter uses a similar approach with 11 studies and analyse relationship between environmental regulations and firm definition (new) for the USA.

2 Estimation Strategies and Selection of Variables

The previous section of this study indicates that most of the earlier studies have looked at if stringency of regulations in the context of better environmental indicators affects flow of FDI across jurisdictions in the context of PHH. The most common empirical specification is to model the equation related to the determinants of FDI using standard regression equation. Given the variety in hypothesis in arriving at the determinants of FDI, it is quite difficult to conclude from the standard approach, the existence of either PHH or PhaH. This paper explains the variations in existing estimates on how stringency of environmental regulations, are related/influenced FDI inflows. Information is gathered from earlier literature (without changing the model types) and used in the meta-analysis. In this process, we are not necessarily changing the model type, but able to model the error characteristics in the regression equations. Deviating from a single-estimate-per-study, we adopt multi-approach framework and adopt multiple-estimate-per-study approach for the following reasons:

- (i) Ideally, it is better to use most of the information presented in the earlier paper as against discarding them,
- (ii) In the literature of meta-regression/analysis, there is no clear rule on selecting estimate; and,
- (iii) Recent researches on meta-analysis focus more on addressing issues in multiple-estimate-per-study in meta-analyses.³

Therefore, once the sample of estimates from various studies is gathered, we start understanding the meta-regression by estimating a probit model first. This limited dependent model will explain if results favour PHH both in sign and statistically significant. For the probit model, the definition of the dependent variable is quite important and tricky. This definition varies based on the research question on the one hand. In this case, we will confirm if PHH is validated with FDI inflows, and thereby, we create the dependent variable that takes value one if estimate is statistically significant, zero otherwise.

Further, this is followed by an intercept. The role of this intercept is quite important as these are estimated as the response coefficients that account for the differences between within studies. In general, inter-study comparisons can be made using these coefficients. Hence, these coefficients or factors affect the likelihood of supporting the PHH. On this setup, we can further classify our study based on multiple stages. We bring three major variants of our analysis. These variants are arrived at again from the earlier literature that is discussed in the introduction of this study. The first extension of the analysis is for the estimates that support PHH. The second extension is for those studies that do not validate the PHH and statistically insignificant. One further classification can also be done using the Porter (1991) hypothesis that encourages using a categorical effect size indicator as a dependent variable. Having different types of dependent variables, we can use an ordered probit model as the second models. This is general applied in meta-analysis that has categorical effect size with

³See, Rosenberger and Loomis (2000), Nelson and Kennedy (2009) for detail.

more than two ordered dependent variable. Looking at the results of both probit and ordered probit regressions, we explain that the estimates show direction of change in effect of one of the categories, and hence, only arriving regression coefficients are not enough for a better understanding in this context of research problem, and hence, we have estimated marginal effects.⁴

For the empirical analysis, we use Lipsey and Wilson (2001) as the benchmark study. Following this study, we also obtain the maximum statistical efficiency of the meta-regression. This is done using a weight of inverse of variance. The understanding is that estimates that have smaller degrees of variances are more assumed to be more reliable, and therefore, they should have more weight in the regression, which becomes the rationale of this procedure. In most of the cases, the empirical research papers do not necessarily report a variance; hence, this restricts us not to use variance, and hence, we weight each observation with its sample size.⁵ Further, stratification is done in order to account for the pseudo-panel characteristics of the sample according to each study. Econometrically, we have also computed the adjusted and the robust standard errors of estimates for robustness of the empirical estimations.

As our data is from the earlier literature on FDI and environmental policies, we have collected papers that are published in English language from SIC/Scopus listed journal. In addition to this, these papers are also listed in EconLit. For the papers that are based on Indian economy, we have got papers from international conferences that include papers presented in Forum for Global Knowledge Sharing.⁶ A number of research papers considered in this analysis are 29 that directly deal with FDI and PHH literature with focus on environmental policies. Out of 29 papers, 21 papers are published in academic journals, seven working papers and conference papers and one book chapter published by Springer publication. Six papers of this study focus on the US economy that deals with FDI and PHH, which refers to the behaviour of the developed economy. Other studies relatively look at the similar context of emerging and low/medium income economies. Such studies are concentrated on the African and Asian economics. In the context of the developed economies, we have also selected papers that are related to the European economies or any group economies. In the emerging economy context, we have also selected papers that are related to the Indian economy. When we classify papers based on the data in use, we can see that papers that are published relatively early in this area use cross-sectional data and the recent ones use data that is classified as panel structure. Out of 29 papers, one paper has used Bayesian analysis along with 3SLS estimates.

⁴Based on the multiple estimates from single study, precision of meta-analysis may not be arrived at due to the reason that change in the variance will create a comparative relation across study.

⁵Meta-analysis studies in environmental economics that have used this approach include Brons et al. (2005) and Van Houtven et al. (2007).

⁶Forum for Global Knowledge Sharing (Knowledge Forum) is a specialised, interdisciplinary global forum. It deals with science, technology and economy interface. It aims at providing a platform for scholars belonging to different institutions, universities, countries and disciplines to interact, exchange their research findings and undertake joint research studies. It is designed for persons who have been contributing to R&D and publishing their' research findings in professional journals. Detail of this forum can be found at <http://fgks.in>.

From the sample of studies, it is evident that most of the studies (18) have looked at the first stand of testing of the hypothesis, namely examining role of stringent jurisdictions in attracting higher FDI. On the second issue of concern, some studies also look at if pollution-intensive industries/firms are more likely to decide for outward FDI. This is where we are able to classify the FDI behaviour in the context of environmental rules and regulation with inward and outward FDI. There are four such studies that look at the pollution-intensive firms/industries in the contest of outward FDI. One study is focused on productivity and emission at aggregate country level. Interestingly, six studies accommodated buy the stands. Looking at the proxies used for the analysis of environmental regulations, most of the studies selected in this paper focus on using one proxy, few of them use more than one proxy. The combination of all such studies and estimates we arrive at 700 estimates, of which 248 support the PHH. A clear look at the estimate gives us the understanding that 452 reject PHH; however, only 68 out of 452 accept the Porter hypothesis. The conclusion of such 68 estimates concludes that higher degree of environmental rules and regulations attract higher FDI. From the sample of estimates, 435 estimates were obtained from regression analysis employing a proxy for environmental regulations and one through Bayesian method of analysis. Next step on the analysis front is to generate the independent variable of interest. As these studies can be further sub-grouped, we created eight dimensions from the sample studies. They are described in Table 1. For one of the groups identified in Table 1, we further represent them in Table 2 in detail.

3 Results and Discussion

Consistencies in approach across studies are arrived from the result of our study. In all cases, the prediction capability of the model has turned out significant for the select variable. In this case, a positive result indicates the correctness of the model used and selection of the variable is robust. We present the definition of variables in Table 3.

The empirical estimation and results are presented in Table 4. This includes results obtained by probit and ordered probit estimations. As evidenced by the results presented in Table 4, if studies have used establishment definition of new firms, they arraign results in support of PHH. This result is also because of the use of panel data as against cross-sectional data and reducing other control variables. It should be noted that these set of studies have also used government environmental spending as a proxy to represent stringency of environmental regulations.

Results from both probit and ordered probit explain that studies that have used either pollution intensity or firm-level environmental spending have barely significant effect(s) on supporting PHH. However, use of government expenditure on environmental-related measures gives result in favour of PHH. Hence, macro-level interventions on environment-related issues are more important as compared to the

Table 1 Design parameters: eight dimensions

Sl. No.	Variable	Issues
1	Stringency of environmental regulations	More generalised classification of this variable is presented in Table 2. This is one of the critical variables as many times it is unclear from the researcher viewpoint in defining this variable
2	Number of proxies uses	An unclear but accepted argument, in this case, is higher the number of proxies used better the results in explaining the PHH in the context of FDI inflow
3	Definition of FDI	1. New plant establishment ^a 2. We have also used capital flow/capital stock/employment to explain the FDI definition apart from the first definition in terms of new firm ^b
4	Level of pollution at firm level	Aggregation versus disaggregation
5	Host country's level of development	1. International monetary fund 2. The World Bank
6	Data type	We look at data both at cross section and panel structure
7	Endogeneity	FDI and pollution(s) may be determined simultaneously ^c
8	Other controls	Other control variables used include wage rates, tax or the effect of agglomeration

^aFriedman et al. (1992) and List (2001) have used this definition

^bRecent studies have used this definition(s)

^cEndogeneity problem may also exist if environmental regulations are set strategically to attract inflows of FDI (Fredriksson et al. 2003; Cole and Fredriksson 2009)

micro-level interventions at firm/industry level. Therefore, policies related to environmental suitability and FDI should be top-down approach. Levinson and Taylor (2008) explain that level of data aggregation is quite relevant to the PHH literature. In this work, we find that studies that use new plant establishment as a definition of FDI have a favourable result for PHH as against those used capital flow definition. One possible explanation of this result is that as effect of the environmental rules and regulations on FDI is mostly a microeconomic phenomenon at firm level, studies that use unit-level/firm-level information are able to support the argument in favour of PHH compared to those use aggregate and country-level data in validating PHH. This finding also correlates with the earlier finding of environmental regulations must be top-down approach.

Data availability and a structured panel type increase the understanding of the estimates and the direction of FDI and pollution. A research on select industry type may not possibly increase the results in support of PHH. Hence, for a policy analysis, researchers/policy makers must use data of a panel type. One more important

Table 2 Five subcategories for proxies used

Sl. No.	Category	Example(s)	Deficiency
1	Pollution abatement spending at firm level	In general, few firms invest in acquiring environment-friendly equipment and technologies that help firm in upgrading their production technology; however, these spending are considered as additional environmental tax expenses at firm level	One of the problems of this category is for all economies, researcher may not get data annually
2	Environmental spending of the government	In enforcing the environmental regulations, economics spend on pollution abatement or on the enforcing agencies	It may ignore the economies of scale of the regulators
3	Pollution intensity	At firm level, this indicator uses information on level of particular matter such as CO ₂ , NO _x , SO _x , for air pollution of BoD/CoD for the water pollution	Data at firm level may not be directly observed
4	Index	Categories identified above can be clubbed in an index number that defines are combination of one or more activities at firm or at economy level	Information may not be available for every country
5	Opinion survey by competent authorities	For example, Global Competitiveness Report measures overall stringency of environmental regulations using a scale from 1 to 7. In this case, 1 stands for the economies that have most laxity in environmental rules and regulation and higher than 1 have stricter regulation related to environmental issues ^a	Sample selection and bias in survey may be one of the concerns

^aThis *construct* is used by Wagner and Timmins (2009)

Table 3 Definitions of explanatory variables

Sl. No.	Variable	Definition
1	Data type	1. 1 if panel data is used; 0 if otherwise
2	Aggregation	1. In this case, we have created a variable for the dirty industry, value one is assigned if the study is carried out for a dirty industry, else this variable takes value zero 2. Similarly, for the clean industries, value takes one if study is attempted for the clean industries else zero
3	Stringency of environmental regulations	1. If a firm spends on environmental expenditure, the value is assigned as one, else zero 2. For the second case, if government spending is reported, this variable takes a value one, else zero 3. For the third case, if pollution intensity is used as a variable, this takes one, else zero 4. In the fourth case, if the study has used an index, this value of the variable is one, else zero
4	Level of development in the recipient country	1. This case, we classify studies based on economic development, and value one is assigned if the study is undertaken for a developed economy, else zero 2. Similarly, the other definition is if study is undertaken for a developing economy, the variable value takes one, else zero
5	The definition of FDI	1. If new plant definition in terms of establishment is considered, the value takes one, else zero 2. If capital flow is used in defining FDI, the value of this variable takes value one else zero
6	Other variables	1. 1 if endogeneity of environmental regulation is taken into account; 0 if otherwise 2. 1 if study includes a variable on wage, else 0 3. 1 if study has taken agglomeration effect, else 0 4. 1 if study has used tax as one of the variable, else 0 5. 1 if study has used bilateral data for FDI and emissions, else 0

Table 4 Marginal effects from probit and ordered probit regression

Category	Variable	Ordered probit model estimates			
		(1)	(2)	(3)	(4)
Data	<i>Panel data</i>	0.28*** (0.05)	$M = -1$	$M = 0$	$M = 1$
Aggregation	<i>Dirty firms</i>	0.19 (0.25)	-0.25** (0.11)	-0.25*** (0.07)	0.11*** (0.05)
	<i>Clean firms</i>	-0.16 (0.16)	0.01 (0.05)	0.02 (0.05)	0.27** (0.15)
	<i>Developed</i>	-0.56** (0.25)	0.11 (0.06)	0.18* (0.10)	-0.05 (0.05)
Development level of the recipient country	<i>Developing</i>	-0.89** (0.26)	-0.05 (0.25)	-0.05 (0.08)	0.09* (0.05)
	<i>Government spending</i>	0.84** (0.24)	-0.48** (0.25)	-0.55** (0.28)	0.63** (0.33)
Proxy of stringency of environmental regulation	<i>Firm spending</i>	0.59** (0.21)	-0.11* (0.06)	-0.15 (0.09)	0.31 (0.21)
	<i>Pollution intensity</i>	0.21** (0.11)	-0.07 (0.06)	-0.017 (0.09)	0.28 (0.26)
The definition of FDI	<i>Establishment definition</i>	0.58*** (0.18)	-0.3*** (0.04)	-0.67*** (0.11)	0.79*** (0.18)
	<i>Capital flow definition</i>	0.01 (0.25)	-0.04 (0.03)	-0.09 (0.18)	0.19 (0.14)
Other variables	<i>Endogeneity</i>	-0.25 (0.22)	0.01 (0.05)	0.01 (0.04)	-0.02 (0.06)
	<i>Wage</i>	-0.17 (0.12)	0.08** (0.03)	0.17* (0.09)	-0.22** (0.12)
	<i>Agglomeration</i>	0.02 (0.12)	0.09 (0.06)	0.03* (0.02)	-0.20 (0.15)
	<i>Tax</i>	0.29*** (0.11)	-0.14 (0.09)	-0.41* (0.22)	0.27** (0.16)
Sample size	<i>Sample size</i>	0.05 (0.25)	0.01 (0.01)	0.01 (0.01)	0.01 (0.12)
	<i>Bilateral trade data</i>	-0.25 (0.18)	0.01 (0.01)	0.01 (0.01)	0.01 (0.18)
Observations		476	476	476	476
Studies		29	29	29	29

Notes *, **, ***Refers to statistical significance at 0.1, 0.05 and 0.01 levels of significant, respectively. Standard errors are presented in the parentheses. Marginal effects are estimated at sample mean of the respective independent variables. For the model that uses ordered probit, evidence of PHH is given in column 4, under $Y = 1$. All regressions are estimated with cluster robust estimates by study

econometric issue that comes is using more than one proxy that explains stringency in environmental policy does not influence the likelihood in favour of PHH. A closer look at the economies that are developed explains that these economies are capital-abundant typically, and hence, they specialise in capital-intensive industries, and in the absence of better technological support either from the production or energy demand, they turnout to be emission/pollution intensives too. Therefore, in such cases, PHH predicts that these economies will relocate to economies with lesser regulated economies on environment where they can possibly maximise profit. These two arguments do not converge, and hence, they may cancel out as competing pressures in the regression estimations. The result that we have arrived at further indicates that endogeneity does not change the probability of supporting PHH; rather, this is one of the standard econometric analyses for academic gains in understanding data and methods, not necessarily for the policy analysis.

Now, discussing the issues related to the multinational corporation related to the PHH, we must understand that these corporations undertake market-seeking FDI or more specifically horizontal FDIs. This allows the multinational corporations to gain advantage in supplying to the local or the domestic market. In other lines of research, the vertical FDI mostly happens between dissimilar economies for gaining in factor-price differences at the time when cost of trade is low. Hence, the sensitivity of FDI to host economies will vary according to the locational choice or the destination of production. Going by the theory of comparative advantage, both from the theory and empirical viewpoint, PHH is relevant in the context of FDI that is vertical in nature. Our study, however, made no attempt to distinguish between these two types of FDI. Except one study in our sample, others do not explain this classification of FDI. Therefore, we are not been able to capture this phenomenon in the meta-regression. Also, only one of the papers used in this analysis uses bilateral FDI and pollution data; hence, it is not possible to come up with robust policy related to FDI and pollution. This is one of such areas of research that researcher has to pay more attention. The understanding from the results of the meta-analysis as presented in this paper is one of the rare attempts to understand the empirical stand between FDI and environmental policies. Our results are encouraging enough in pushing for a better climate negotiation policy, if it is believed that FDI generates externalities in terms of pollution and waste. From the understanding of carbon footprint and carbon tax evidence are there in the context of a developed economy. However, such initiatives are rare in the context of an emerging economy. When most of the developing and emerging depend on FDI for positive spillover either in terms of employment or technology support in production and participation in export market, understanding ecosystem and cleaner production remains a challenge. In parallel to the above objectives in attracting FDIs, if emerging economies can design appropriate carbon tax at both local and regional scale, this will increase global welfare and target for sustainable development.

4 Conclusion

From the empirical literature on FDI, it is quite accepted argument that FDI can fuel economic development with positive spillovers from technology development to labour management. However, if the environmental rules and regulations are not stricter from the host country viewpoint that would result in inefficient and irreversible environmental destruction, there is a possibility that it may decline the welfare of the host economy. Hence, it is very important for the host country viewpoint in selecting the FDI in specific sector where it is likely to create environmental problems both at short and long run. The findings from meta-regression can be summarised in the following points along with international best practices for better environmental policies and FDI.

While going for a solution to the impacts of FDI, policy makers must look at the costs and benefits of such projects. These solutions in terms of policies should be focused on institution with the capacity to change in the short run before environmental damage happens. Therefore, building capacity in the host economies governments to manage FDI and maintain environmental standard is equally important and hence can be considered as longer-term process. In the short to medium-term solutions, standards must be raised through other policy instruments such as involvement of civil society, non-governmental organisations and conduct of the investors. With the support of the international agreements, these mechanisms will build capacity in the host economy especially for lesser developed/remote/conflict areas. In using voluntary codes for environmental safety and regulations, different sectors such as the forestry, fisheries and tourism sectors can be identified where eco-labelling can be made mandatory. There is equally a need to reform the existing and the planned investors' protection agreements so that they do not undermine the environmental rules and regulations. If international coordination and regulations can be built in ensuring FDI, it will promote sustainable development by preventing destructive competition, increasing economic benefits to host economies and protecting the rights of local communities and domestic industries.

To arrive at the maximum contribution of FDI in minimising negative impact, it is important to have practical solutions at all institutional levels including national/regional and international levels. However, in promoting higher environmental quality and sustainable use of natural resources, it is also important to have voluntary, market based and regulatory components as well. In fact, as there is no magic bullet in ensuring sustainability in a globalised economy, a diverse set of complementary approach is required to balance between growing economic pressure and sustainable development. Table 5 summarises the available and modified policy linkages that can foster FDI and sustainable development through environmental regulations and policies.

These regulatory policies can be implemented through various institutions at national or regional or international levels. Or the governments can also choose a balance evolution of these instruments to get the maximum benefit from FDI on the sustainable development.

Table 5 Summary of specific policy linkages

Sl. No.	Policy	Advantage
1	Eco-labelling	Importance should be given to consumer-sensitive natural resource sectors
2	International agreements	Focus should be on the national sovereignty and international regulations
3	Investor protection and promotion agreements	Subordinates investor rights to legitimate national sovereignty and the achievement of sustainable development
4	Detailed agreements on environmental standards	Importance should be given to minerals, fossil fuels, basic agricultural commodities and bulk chemicals
5	No-lowering of standards	Ensure revenue collections from natural resources
6	Support environmental best practice	Minimise or eliminate costly and inefficient competition based on lowering or freezing environmental standards

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Appendix: Select Studies for Meta Analysis

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