

THE CHALLENGE OF ANALYSING THE IMPACT OF ENVIRONMENTAL POLICY ON COMPETITIVENESS

1. INTRODUCTION

The link between trade and the environment has drawn a great deal of attention from economists and policy makers. Foremost in their minds is the question of whether stringent environmental policies negatively affect competitiveness, and whether this effect is strong enough to create “pollution havens” in developing countries. This question first arose when the USA decided to allow each state to independently set its environmental regulations, leading to local competition for investments and jobs (De Santis, 2011). Since then, the question has expanded to include international competition and become a crucial factor in the debates over trade and the environment.

Such political debates have motivated many studies on trade and the environment, particularly on the disputed existence of a pollution haven effect (PHE). If domestic environmental regulation can affect trade flow then

“countries might use environmental policy as a secondary trade barrier” (Ederington, 2010).

Furthermore, though countries face pressure to protect the environment, economic integration and trade negotiations have prevented them from implementing traditional trade policy instruments, such as quotas or tariffs. As a result, governments may well use environmental regulation instead (Copeland and Taylor, 2004) and may loosen (tighten) environmental policy in order to decrease (increase) domestic firms’ production costs.

This substitutability between trade and environmental policies has raised concerns regarding the realisation of trade agreements. If weak environmental standards can yield a comparative advantage, then a strategic competition game could arise where the more “attractive” strategy would be to accept more pollution. If all

countries behaved in this way, then this non-cooperative Nash game would lead to a “race to the bottom” in environmental standards, wherein governments would disregard environmental quality and the welfare of their citizens in order to become more competitive (Nader, 1993).

As a result, global environmental degradation would surge while trade fell due to a decrease in market accessibility precipitated by weakening standards for import-competing industries (Copeland and Gulati, 2006). In addition, trade agreements may be undermined.

This has led several scholars to believe that trade negotiations should address environmental policies; this could result in the establishment of binding international environmental standards¹ (Ederington, 2010).

However, this proposed solution could be interpreted as a form of “hidden” protection for developed countries that would prevent developing ones from exploiting a potential comparative advantage. The environment is unlike any other factor endowment:

“Those who ask the same strict environmental regulation everywhere ignore the concept of international division of labour and of the merits of specialisation” (Siebert, 2008).

It is not fair that strong industries should obtain compensation for other countries’ environmental advantages through trade policy measures, such as import duties or product norms. Otherwise, the advantages of international specialisation would disappear.

This debate has raised several political issues, such as whether an international set of environmental regulations should be created, or how trade-policy tools, such as tariffs on imports, should be utilised in order to protect the environment.

In essence, policy makers debate how the rules governing trade should evolve. Many doubt that the PHE exists, and as such they do not believe that the aforementioned “race to the bottom” would occur; thus, they do not believe that international environmental policy negotiations are necessary (Krugman, 1997). However, recent findings in support of the PHE indicate that such negotiations are, in fact, essential.

¹ Others believe that this harmonization of international standards would be inefficient, as it would hamper the relocation of polluting industries to better-suited countries (Pearson, 1987).

For over 40 years, these political debates have hampered studies looking for the existence of a PHE. However, although there is a reasonably strong theoretical case, not all believe in the relationship between environmental regulation and trade patterns. Despite the improvement in empirical techniques, the debate persists over whether environmental stringency can be effectively measured. The focus of this study is to analyse one of the main problems in empirically testing for the PHE: the measurement of regulatory stringency. By studying two Chinese provinces, this study shows that differences in institutional development (and thereby in the enforcement of environmental policies) are not properly captured by the proxies of environmental stringency, which are commonly utilised in applied studies. These results challenge the validity of existing empirical PHE tests.

The rest of this study is organised as follows: Section 2 reviews the principal studies on the subject, focusing on the empirical literature. Section 3 revises the debate on the measurement of environmental stringency and analyses the most commonly used proxies for it. Section 4 empirically tests for a PHE within China (we decided to focus on China because the stringency of environmental regulation varies enormously across different regions). Section 5 concludes this study.

2. LITERATURE REVIEW

Theoretical studies that estimated the impact of environmental regulation on trade patterns mainly focused on comparative advantage theory in terms of differences in environmental policies (i.e. strict or lax (PHE, pollution haven hypothesis (PHH))), in factor endowments, in preferences for environmental quality, and in property rights (Chichilnisky, 1994). Overall, this theoretical literature seems to justify the concern that strict environmental regulation may impair competitiveness² (Pethig, 1976; Siebert, 1977; McGuire, 1982; Copeland and Taylor, 2004).

Based on this theoretical framework, many applied studies have tried to empirically estimate the impact of environmental regulation

² All of these studies utilise many simplistic assumptions, such as the perfect mobility of capital and labour, perfect competition, free trade, and optimal pollution taxes.

by examining foreign direct investment (FDI), plant creation, and exports. In econometric terms:

$$Y_i = \alpha R_i + X_i' \beta_i + \varepsilon_i \quad (1)$$

where:

Y = an economic activity (FDI, trade flow, plant creation)

R = regulatory stringency

X = all other factors that may affect Y .

Despite the fact that the majority of pollution stems from consumption, most studies have focused on production-generated emissions. Regulations on consumption-generated pollution (i.e. product standards) have a different effect on competitiveness than those targeting production (McAusland, 2008); in fact, stricter regulations on consumption-generated pollution may enhance domestic firms' competitiveness (Copeland, 2008). Until 2000, little empirical evidence of the PHE had been found, though some more recent studies have found support for the "green pollution effect", which links FDI to increases in environmental regulation.

It is difficult to draw comparisons between these studies, though, because they differ greatly in terms of hypotheses (they utilise different measures of policy stringency and competitiveness), methods, and data (Dean, 1992). Essentially, the empirical studies on the impact of environmental regulations can be divided into two waves, one before 1997 and one after.

The first wave of studies use cross-sectional data and concluded that a PHE does not exist. Although environmental regulation imposes a significant cost on polluting industries, this cost does not affect trade patterns (Jaffe *et al.*, 1995).

These studies express a country's net exports as a function of factor endowments and use pollution regulation to determine the "environmental endowment".

Tobey (1990), for instance, tests the sources of international comparative advantages. He regresses cross-country data on dirty goods exports, factor endowments, and a dummy variable for environmental stringency. He assumes that stringent policies are correlated with environmental scarcity. The drawback to this approach is that it ignores the fact that countries may enact non-optimal policies, making environmental regulation a poor indicator of environmental endowment (Dean, 1992). He finds that neither the environmental policy variable nor the majority of the factor endowment coefficients are insignificant.

Another approach used in the first wave focuses on variations in net exports across industries rather than countries. In such studies, an industry's trade flow is regressed on industry characteristics (such as labour's, capital's, tariffs' share of cost, measures of environmental stringency, and other control variables). Using US data Kalt (1988) and Grossman and Krueger (1994) find that the cost of pollution abatement does not affect industry-level net trade. Kalt (1988), in particular, finds that stricter environmental regulation is associated with increased net exports. Consequently, many researchers believe that a race to the bottom is implausible given that countries seem unable to negatively affect trade by manipulating environmental regulations.

However, scholars have provided a number of explanations as to why a connection between competitiveness and environmental policy cannot be found. The first problem they cite is a lack of data (on environmental regulatory compliance expenditures), particularly in developing countries. For this reason, the majority of studies use US data (looking for a PHE within the USA), which is not ideal given that we expect environmental policy to affect trade and investment flows between richer and poorer countries (where there is greater variation in the stringency of environmental policies) (Copeland and Gulati, 2006). Therefore, any conclusions regarding the effects of environmental policy on competitiveness within the USA cannot necessarily be applied to the relations between developed and developing countries.

Second, pollution abatement costs (PAC) are, in general, a small fraction of total production cost in most industries; consequently, "traditional determinants of trade" (such as labour and capital cost differentials and energy and raw materials costs) may well outweigh them. However, industries that generate a great deal of pollution face greater abatement costs and as such, stricter policies may well have an effect on trade through them. Empirical studies that estimate the average effect of environmental regulations across multiple industries may obscure the exacerbated effects on these particular industries (Ederington *et al.*, 2005). In addition, it has been found that, because of high transportation costs or existing external economies of scale, industries with the greatest PAC are also the least mobile (footloose) and hence, the least sensitive to differences in regulation. For this reason, the PHE is particularly difficult to detect.

Third, there is little difference between US regulations and those of its major trade-partners. The majority of trade occurs between

developed countries that have similar environmental regulations; therefore, aggregating trade flows across different countries may fail to fully capture the effect on trade between developed and developing nations. Based on the idea that there is heterogeneity in the correlation between environmental policy and competitiveness, Ederington *et al.* (2005) find that PAC have an important effect on imports from polluting (high share of PAC in total costs) and footloose industries in developing countries.

Finally, it seems that global ties lead many firms to standardise their pollution controls in accordance with those of the most stringent countries (Christmann and Taylor (2001) support this with evidence from China). In particular, rich countries often invest (FDI) in new production techniques utilised in countries with weak environmental regulations. If firms produce export goods in developed countries, then using dirtier techniques may make exporting more difficult and expensive (Dean *et al.*, 2009). Therefore, international statutory differences in pollution controls may not affect competitiveness.

The second wave of studies highlight the econometric problems in the previous wave. In particular, the assumption that pollution policy is endogenous, unobserved heterogeneity between countries or regions, and environmental stringency measurement errors may well have biased the previous results. In addition, two-way causality may be causing endogeneity, and imports and environmental regulation could be linked through the political process (Copeland and Gulati, 2006). If trade liberalisation leads to a decrease in tariffs on dirty imports (and thus an increase in imports), import-competing industries will lobby for protection in the form of weaker environmental regulation³. Consequently, the positive association between policy stringency and imports would be weakened. However, if the polluting industry is politically weak, then environmental regulation may tighten rather than loosen (Copeland and Taylor, 2004).

“If environmentalists are sufficiently strong relative to industry groups, then pollution policy may be more stringent than the Samuelson rule requires” (Conconi, 2001).

In the context of investments, Fredriksson *et al.* (2003) show that (conditional upon the host country’s political institutions) FDI affects environmental stringency. In particular, an increase in FDI inflows

³ Environmental policy can be used as a secondary means of protection (see Introduction).

can increase the efficacy of industrial lobbies, and thus decrease the stringency of regulations if there are few legislative units⁴. Another possibility is that the anticipation of low FDI inflows may simply induce governments to decrease their stringency (Millimet and Roy, 2015).

The previous literature has been unsuccessful in controlling for unobserved heterogeneity, especially in models of FDI flow. Since FDI decisions are far more complex than trade decisions, they involve a wider range of country and industry characteristics (Chung, 2014). A location's unobservable features, such as tax breaks, the stringency of other regulations (such as occupational safety standards), corruption, local political activism, political institutions, and infrastructure, may be correlated with both environmental regulations and investments, leading to omitted variable biases (Dean *et al.*, 2009).

Once the problems of endogeneity and unobserved heterogeneity are corrected by using panel data and instrumental variables, results supporting the PHE become more common. However when the PHE is tested for within particular sectors (such as machines, electronics and automotive, and transportation and communication), it is found that more stringent and better-enforced environmental policies seem to attract more FDI (this may stem from firms' desire for a more conscientious reputation). This may be termed a *green haven* effect (Poelhekke and Van der Ploeg, 2014).

3. MEASURING THE STRINGENCY OF ENVIRONMENTAL REGULATION

Despite the improvements in empirical techniques, there is still debate as to whether environmental stringency can be measured effectively. This section analyses the various proxies for environmental stringency which have previously been employed, particularly in relation to the importance of institutional structures.

Environmental regulation is complex and multidimensional, therefore

“merely conceiving of data that would represent the environmental stringency is difficult” (Levinson, 2008).

⁴ Cole *et al.* (2006) arrives at a similar conclusion: that the impact of FDI on environmental stringency depends on the degree of corruptibility in the government. If the government is (not) highly corrupted, the FDI leads to (stringent) lenient regulations.

This is because

“different regulations cover different pollutants (air, water and solid waste), regulation exists at multiple levels (national and local) and monitoring and enforcement are imperfect” (Millimet and Roy, 2015).

Each plant has to face a myriad of air, water, and solid waste regulations and as such, it is difficult to estimate the effect of these regulations. For this reason, many studies elect to focus on a particular form of pollution Dean *et al.* (2009) and Fan (2012) focus on water pollution, Becker and Henderson (2001) and Lu *et al.* (2012) study air pollution, and Levinson (1999) examines hazardous waste). However, the relationship between environmental policy and competitiveness may vary depending on the asset it is trying to protect. As a result, the conclusions of studies that focus on a particular regulation should not be generalised.

Many recent empirical studies in support of the PHE, such as Keller and Levinson (2002) or Levinson and Taylor (2004), use PAC⁵ as a proxy for environmental stringency. This measure has the advantage of conveying the total cost of complying with all environmental regulations.

On the other hand, the data may be inaccurate as it is obtained from firm-level surveys, and firms may have an incentive to misrepresent these costs if they believe the data will influence future environmental regulations. Firms may also face difficulty in distinguishing abatement costs from other production costs, especially when environmental regulations influence the very design of the production facility (Copeland, 2008). In addition, a region or country's average pollution abatement cost is affected by local production technologies, factors prices, and industry concentration (Dean *et al.*, 2009).

Others (Greenstone, 2002; Becker and Henderson, 2001) use compliance with the national air quality standard⁶ as a proxy for

⁵ Each study constructs the measure slightly differently, but all use data from the US Census Bureau's Pollution Abatement Costs and Expenditures (PACE) database, which documents how much individual plants spend in order to comply with environmental regulations. As states that attract more polluting industries have greater PAC, regardless of the stringency of their regulations, researchers usually account for states' industrial composition in their measurement of state-level regulations (Levinson, 1996).

⁶ US Clean Air Act states that every states in the US has to achieve the same minimum level of air quality.

stringency, because plants in non-compliant areas will face stricter regulations. However, this measure only applies to air regulation and it is a “zero/one” measure of stringency, making the interpretation of its effect on FDI flows or new plant creation difficult (Shadbegian and Wolverton, 2010).

The level of pollution is also used as a proxy for environmental stringency, based on the argument that lax regulations lead to greater pollution (Xing and Kolstad, 2002). However, this measure is problematic because while high pollution can be a consequence of lax regulation, it can also stem from jurisdiction issues (i.e. the inability to enforce stringent regulations) (Levinson, 2008).

Therefore, each of these proxies is incapable of fully capturing the stringency of environmental regulations and as such, their use may lead to errors in the estimation of the PHE.

4. EMPIRICAL TEST OF THE POLLUTION HAVEN EFFECT WITHIN CHINA

After it liberalized trade in 1992, China began to receive a large inflow of FDI from all over the world, so much so that it became the number one recipient. It should be noted, though, that FDI is not uniformly distributed among the regions and as such, many researches have investigated the factors that determine this distribution (Wei *et al.*, 1999; Fung *et al.*, 2002).

China is home to 16 of the world’s 20 most polluted cities, and it is the world’s largest emitter of SO₂ (Pandey, 2005). The effective implementation and enforcement of Chinese environmental laws has been largely criticised, as these laws seem to exist only on paper. Additionally, as citizens vary greatly from region to region in their participation in local government and awareness, the stringency of environmental regulation varies enormously as well (Zhang, 2008). For all these reasons, China is an ideal subject for our analysis of the PHE.

Dean *et al.* (2009) analyse the factors that determine the localization of manufacturing equity joint ventures across China and finds a relationship between the type of country that makes the investment, the pollution intensity of the industry, and the behaviour of the pollution haven.

In this study, total collected pollution levies and wastewater are factored into the official water-pollution-tax formula in order to create a *de facto* measurement of the stringency of environmental

regulations⁷. The differences in effective provincial pollution tax rates stem from differences in concentration standards (a province has tighter regulations if it imposes a lower concentration standard), differences in industrial concentrations⁸, and differences in enforcement capacities (more effective enforcement increases the collected water pollution levies). He shows that lax environmental regulations attract investment from ethnically Chinese countries in highly polluting industries, while non-ethnically Chinese countries are inclined to invest in areas with lenient environmental regulation, regardless of the pollution intensity of the industry. He justifies this heterogeneity by citing the source countries' differences in technological advancement⁹.

Similarly, Fan (2012) uses data on collected water pollution levies and wastewater from each province in China in order to create a *de facto* measurement of provincial environmental stringency. However, his results show that FDI is not deterred by stringent environmental regulation. Lu *et al.*, (2012), on the other hand, reach just the opposite conclusion. They assume that cities under the Two Control Zone (TCZ)¹⁰ policy will have stricter regulations. This measure of stringency eliminates the problem of endogeneity, but it is too simplistic as cities just above or below the threshold are labelled as having completely different regulations (lenient or stringent,

⁷ The water discharge levy depends on the concentration of pollutants (set jointly at the provincial and national level) and volume of emissions.

R_j is the national tax rate on the pollutant(j)-specific discharge factor (P_{ij}). P_{ij} depends on the total amount of discharged wastewater (D_i), and the degree to which the pollutant concentration (C_{sj}) exceeds the concentration standard (C_{ij}).

$$P_{ij} = D_i \frac{C_{ij} - C_{sj}}{C_{sj}}$$

⁸ This is Dean *et al.*'s (2009) method of controlling for the endogeneity that arises from industrial concentration.

⁹ Poor countries typically have older technologies. Consequently, it is reasonable to believe that investors from developing countries would be more affected by higher compliance costs than those from developed ones (Dean *et al.*, 2009).

¹⁰ The TCZ policy was introduced in 1998 to decrease SO₂ pollution and acid rain. If a city exceeds certain standards (as established by the government), it is designated as an acid rain or SO₂ pollution control zone. New firms opening in TCZ cities have to install specific equipment, while the existing firms have to take measures to reduce SO₂ emissions.

respectively). They compare the change in FDI in TCZ cities with that in non-TCZ cities before and after 1998 (i.e. when the TCZ policy was implemented). They find that TCZ cities have a lower inflow of FDI compared to non-TCZ cities as such, they confirm the existence of a PHE within China.

Zhang (2008) uses three proxies for environmental stringency; the proportion of industrial pollution treatment investment to total innovation investments, the normalised number of citations filed by environmental authorities, and the pollution emission charge (normalised by the number of firms that pay the charge). He finds evidence of the PHE as well.

4.1 Enforcement of Environmental Regulations in China

Because of China's high degree of administrative decentralisation, "environmental policy is influenced by local government behaviour" (Zhang, 2008).

The Environmental Protection Law (EPL) states that local and national regulators must jointly decide upon environmental standards. In fact, the national regulators establish the level and structure of the pollution levy, while the local regulators determine and collect the levies, thus deciding the effective implementation of the environmental laws and regulations. The Environmental Protection Board (EPB), which is represented in every level of local government, is legally responsible for enforcing environmental policies, but it has limited power and resources. Therefore, many polluters are able to escape punishment; in fact, the *de facto* stringency of each province's environmental regulations (effective fines collected or the number of punished polluters) is the result of a negotiation and bargaining process between the polluters and the local EPB (Wang *et al.*, 2003). Therefore, each province's level of enforcement will be different, depending on its institutional distortions.

The factors which determine the enforcement of environmental regulations vary greatly as well. In addition to formal regulations on pollution, informal regulations also play a crucial role in determining where foreign countries choose to invest¹¹. An example of informal policy control is citizen activism, which can be measured by the

¹¹ Mani and Wheeler (1998) found that complaints translate into pressure for cleaner production processes. They show that high collective action deters new plant creation in India.

public's propensity to complain, vote, or join public interests. Citizen complaints can supplement formal environmental regulations and improve enforcement. The geographic distribution of citizen complaints is not random; in fact, education and income levels seem to positively affect the propensity to complain (Dasgupta *et al.*, 2002).

Imperfect information is the key impediment to effective environmental regulation; local regulators are ill informed about pollution problems. The levy system in China relies on universal self-reporting¹² and verification inspections by local environmental authorities. However, this monitoring is costly, particularly for developing regions where resources are scarce. Consequently, local authorities rely on citizen complaints to inform them of transgressions. Therefore, regions with a higher propensity to complain are subject to more inspections and thus better enforcement, whereas "silent regions" (i.e. those with low citizen awareness and participation) will have fewer inspections and consequently ineffective enforcement.

Corruption is another important factor in the determination of enforcement. Svensson (2005) defines corruption as

"the misuse of public office for private gains".

Many studies report that corruption may deter FDI, but more importantly, it also affects the enforcement of environmental regulations. If local officials are highly corrupt, then polluters would find lobbying for more favourable environmental regulations quite easy. Therefore, enforcement will be more lax in provinces with more corruption.

Wang *et al.* (2003) empirically examine the factors which determine the enforcement of China's pollution levy system. As enforcement depends on the bargaining process between polluters and the EPB, the enforcement of environmental regulations will be less effective if the industrial sector is more powerful. As such, the question then becomes "what determines a firm's relative bargaining power"? Wang *et al.* (2003) document the variation in enforcement among different types of firms. Firms in poor financial situations have greater bargaining power because environmental regulators can put an upper bound on their levies. Privately-owned enterprises, on the other hand, have less power (Wang and Wheeler, 2005). In addition, the greater the social impact of a firm's emissions (precipitating more complaints) the lower its bargaining power will be.

¹² Therefore, firms have an incentive to under-report their pollution in order to pay a lower compliance fee.

4.2 Comparing two Provinces: Tianjin and Zhenjiang

We will analyse differences in provinces' enforcement of environmental regulations. It is reasonable to believe that provinces with a higher percentage of state-owned enterprises will have more lax environmental policies, because local authorities tend to discriminate in their favour¹³. Regions with highly active citizens may well have more stringent enforcement, while those with more corruption, inefficient governance, or a high percentage of firms in bad financial situations may have more lax enforcement.

We will compare Tianjin and Zhejiang, two provinces on China's east coast. Almost all of the cities in these provinces were designated as TCZs in 2002. Therefore, both provinces could be said to have strict regulations (Lu *et al.*, 2012; Hering and Poncet, 2012). Conversely, using the number of citations as a proxy for regulatory stringency, these two provinces have the same *de facto* leniency as others. The normalised number of pollution emissions charges, by contrast, suggests that Tianjin (8907 yuan per organisation) has stronger regulations than Zhejiang (3839 yuan per organisation). Therefore, each measure of environmental stringency (see Table 1) yields different results, casting doubt on the reliability of these proxies.

TABLE 1 - *Measures of Regulation Stringency*

Measure of Regulation Stringency (2002)	TIANJIN	ZHEJIANG
TCZ measure	TCZ city (strong)	TCZ city (strong)
Citations	256 cases/1000 firm (lenient)	268 cases/1000 firms (lenient)
Pollution emissions charges	8907 yuan/organisation (strong)	3839 yuan/organisation (lenient)

Source: Chinese Environmental Yearbook (various years); Chinese City Statistical Yearbook (various years).

¹³ Hering and Poncet (2012) also show that there is heterogeneity in firms' responses to environmental policies: state-owned enterprises are less affected by stringent environmental policies because of their greater bargaining power and greater ability to absorb cost shocks.

We use the normalised number of registered corruption cases (based on procuratorates' investigations) as a proxy for the provinces' efforts to control corruption. Tianjing has made significant efforts to curb corruption with an average of 6 cases per 100000 persons (on average, the greatest in China) between 1999 and 2003, whereas Zhenjiang had an average of only 3 cases (ranking 17th out of 30 provinces). The efficiency of governance is also greater in Tianjin (ranked 4th) than in Zhenjiang (ranked 7th)¹⁴.

Per capita GRP is higher in Tianjin (12045 yuan) and the illiteracy rate is lower (6.7%) compared to Zhejiang (9062 yuan and 13.5%, respectively). Given that income and education positively affect citizen activism, we would expect it to be greater in Tianjin, and thereby we would expect Tianjin to more effectively enforce its environmental regulations.

In conclusion, we hypothesize that, as Tianjin has less corruption and greater governmental efficiency and citizen activism, it should more stringently enforce its environmental regulations (see Table 2).

TABLE 2 - *Proxies for Enforcement of Environmental Regulation*

	TIANJIN	ZHEJIANG
GRP <i>per capita</i> (2002)	12045 yuan	9062 yuan
Illiteracy rate (2002)	6.7%	13.5%
Average provincial anti-corruption effort (1999-2003)	6 cases/ 100000 persons	3 cases/ 100000 persons
Average of governmental efficiency STD value result (1999-2003)	0.276	0.198

Source: authors' elaborations from Zhang (2008).

Looking at the number of citations as a proxy for environmental stringency, these two provinces have the same *de facto* lenient regulations. However, we have just illustrated that these two provinces vary widely in institutional development. The *de facto* lenient regulations in Zhenjiang are a consequence of weaker enforcement; thus, the effect on FDI will be different.

¹⁴ Data from Zhang (2008).

Our analysis shows the potential weaknesses of regulatory stringency measures previously used in empirical PHE tests. In particular, *de facto* measures of regulatory stringency (collected levies, number of polluters punished, etc.) depend heavily on enforcement, which varies from province to province. Two provinces with the same *de facto* stringency but different degrees of enforcement will attract FDI differently. Therefore, empirical studies that do not consider differences in enforcement may well reach incorrect conclusions. As such, our study contributes to the PHE discussion by pointing out the hidden risks related to the *de facto* measurements of regulatory stringency that have been systematically underestimated in applied studies.

5. CONCLUSION

Further research must be conducted before significant policy conclusions can be drawn (such as whether to allow governments flexibility in deciding environmental policies or to limit them in order to avoid trade agreement loopholes). Despite strong theoretical support, the empirical evidence of the PHE is still inconclusive due to three main problems; unobserved heterogeneity, endogeneity, and regulatory stringency measurement errors. Our study sheds light on the potential drawbacks of the proxies used for environmental regulation stringency. Comparing two provinces in China, we highlight how measures of stringency fail to capture clear differences in institutional development. In addition, the prior studies have highlighted the heterogeneous effects of environmental regulations on competitiveness. Dean *et al.* (2009), for instance, emphasized the FDI source country as source of heterogeneity, while Ederington *et al.* (2005) studied the import source country, the pollution intensity, and the mobility of the industrial sector. Therefore, in order to fully understand the link between environmental and trade policies, further studies are necessary to test whether there is still heterogeneity when a better proxy for environmental regulations is used.

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ABSTRACT

Despite almost forty years of studies, the debate persists over whether stringent environmental policies negatively affect competitiveness, and whether this effect is strong enough to create "pollution havens" in developing countries. In this paper, some of the policy issues that inspired much of the literature on environmental regulation and competitiveness are described and the main empirical studies are examined. The focus of this paper is to analyse one of the main problem in the empirical testing of the disputed existence of a pollution haven effect (PHE): the measurement of environmental regulatory stringency. By analysing two Chinese provinces, this study shows that differences in institutional development (and thereby in the enforcement of environmental policies) are not properly captured by the proxies of environmental stringency, which are commonly utilised in applied studies. These results challenge the validity of existing empirical PHE tests.

Keywords: Environmental Regulation, Competitiveness, Pollution Haven
JEL Classification: Q56

RIASSUNTO

L'analisi dell'impatto della politica ambientale sulla competitività: una sfida ancora aperta

Nonostante quasi quaranta anni di studi, persiste il dibattito circa l'ipotesi che politiche ambientali rigorose influenzino negativamente la competitività e se questo effetto sia abbastanza forte da creare "paradisi dell'inquinamento" nei paesi in via di sviluppo. In questo lavoro sono presentati alcuni dei temi di politica ambientale ed economica che hanno ispirato gran parte della letteratura sul legame tra normativa ambientale e competitività e vengono analizzati i principali studi empirici sul tema.

L'obiettivo consiste nel valutare uno degli aspetti più rilevanti e controversi tra quelli che caratterizzano la verifica empirica dell'esistenza di "paradisi dell'inquinamento" (PHE): la misura del rigore della normativa ambientale. Analizzando due province cinesi, questo studio dimostra che le differenze di sviluppo istituzionale (e quindi di applicazione delle politiche ambientali) non sono adeguatamente descritte dalle variabili comunemente utilizzate negli studi empirici per rappresentare il rigore della normativa ambientale. Questi risultati mettono in discussione la validità delle prove empiriche che confermano l'esistenza di PHE.