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Article

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ENVIRONMENTAL REGULATION AND FOREIGN DIRECT INVESTMENT: THE ROLE OF MODE OF ENTRY

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Introduction

Policymakers in many countries have baulked at toughening up environmental requirements for fear of impairing the international competitiveness of their economy and cutting jobs. A recent example was the 2011 decision by the US president to push for a deferral of new environmental standards for air quality given a weak labor market (White House 2011). Fears of the adverse effects of environmental regulation are also substantiated in academic literature. Theoretical literature on the pollution haven hypothesis (PHH) purports that tightening environmental regulation in one country causes the production of dirty goods to relocate to more lenient locations (and firms to leave that country).³ The watered-down version of the PHH – the so-called pollution haven effect (PHE) – claims that for given levels of trade barriers, weak environmental policy is a source of comparative advantage. Tightening up policy therefore results in reduced net exports or decreased net incoming Foreign Direct Investment (FDI) in the regulated sectors.

As far as the PHH or PHE have empirical relevance, this would not only imply that toughening up environmental policy has negative economic effects like decreased competitiveness, but would also mean that unilateral environmental regulations aimed at global pollutants may be ineffective, as pollution “leaks” from one country to another. Any decrease in CO₂ emissions in a regulating country, for example, would be (partially) offset

by increased emissions in another country, as production (and firms) would flee the regulation and relocate to countries with relatively lenient jurisdictions.

Although theoretical literature on this topic tends to support the existence of pollution havens, empirically there is only mixed evidence that environmental regulation drives out FDI.⁴ A plethora of studies have investigated inflowing and outflowing FDI at both a micro and a macro level in search of patterns consistent with the pollution havens, but no consensus has been reached. While some studies were able to identify substantial deterrence effects of environmental policy on FDI (see, for instance, List and Co 2000; Wagner and Timmins 2009), many studies found no robust support for PHH (Kellenberg 2009; Manderson and Kneller 2011). Yet other papers claim that stringent regulation actually attracts those firms (and industries) that care about corporate social responsibility and cultivate their green image (Poelhekke and van der Ploeg 2015).

How does entry mode matter in the context of environmental regulation?

A possible explanation for these inconclusive results could be the failure of literature on this topic to account sufficiently for the heterogeneity of investment, which may dilute the effect found. When firms invest abroad, they can do so by using one of two possible modes of entry. The merger and acquisition (M&A) mode implies a cross-border merger or acquisition, but the investment is in existing structures. Conversely, a direct investor may start from scratch by building its own facilities (Greenfield mode of entry). The new trade theory, as well as some empirical evidence, suggests that Greenfield investments tend to be carried out by highly productive firms, whereas less productive firms invest abroad in the form of cross-border acquisitions (Nocke and Yeaple 2008). This mode of entry heterogeneity has been ignored in the empirical literature on FDI and environmental regulation to date.



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³ Early contributions to this literature are Siebert (1974) and Pething (1976).

⁴ For studies that look at adverse trade effects of environmental regulation see, for example, Aichele and Felbermayer (2012, 2015).

Vintage differentiation

One possible reason why mode of entry may be relevant is that most environmental laws imply vintage differentiation rules (VDR), which may suggest some sort of grandfathering. VDRs make environmental standards conditional on the date when the regulated unit started to operate. This implies that later vintages (younger units) are faced with more stringent standards, while a grandfathering usually applies to production facilities in operation at the time of the enactment of new regulatory requirements. This means that pre-existing plants are exempted from the new requirements or granted generous transition periods. Such differentiation is justified on the grounds that adjusting operations to new standards is very costly and that general investment uncertainty needs to be minimized. Nevertheless, VDRs give a competitive advantage to the industries, firms and regions where pre-existing plants are located. Besides, it has been argued that environmental regulation may even enhance the profits of existing producers by restricting access to common property and thus creating a scarcity rent (Buchanan and Tullock 1975). Some quantification of the associated “new source bias” was provided by Levinson (1999) based on state variation in toxic air pollution regulation in the US and by Ackerman et al. (1999) for coal-burning power plants.

An example of the ubiquity of VDRs comes from the US where, as described by Stavins (2006): “A number of important federal environmental laws make use of VDRs. For example, VDRs appear within the Clean Air Act in its standards for emissions from new versus existing stationary sources, motor vehicle and motor vehicle engines, non-road engines and vehicles, and commercial vehicles; within the Clean Water Act in a wide variety of aspects, including in effluent limits for public treatment plants; within the Safe Drinking Water Act; and within laws affecting the generation and disposal of hazardous and solid waste. State and local environmental laws also make frequent use of VDRs, for stationary and mobile source emissions limits and energy efficiency standards in new construction, among other instances.”

One consequence of vintage conditioning is that different firms operating in the same market may face very different regulation, depending on the day when they went into operation. Greenfield projects obey all of the latest environmental requirements. The local firms targeted in M&As, on the other hand, often only need to adhere to milder regulation. In view of these facts one may expect the Greenfield project to be more “exposed”

to environmental regulation than cross-border acquisitions. If a firm is looking for a location for its Greenfield investment project, it should be more alert to environmental standards, as the costs of meeting them may be substantial.

Capitalization of policy in the acquisition price

The mode of entry may not only be important because of grandfathering. A second argument for M&As having a lower elasticity with respect to regulatory stringency is that the acquisition price may already be a function of the regulation faced by the company. The purchaser of the existing plant is only willing to pay the present discounted value of future profits. Higher regulation, *ceteris paribus*, implies a lower acquisition price that could, at least partially, offset the disadvantages of the regulation for the company. This is hardly possible in the case of Greenfield investment, as the cost of investment (building materials, allowances etc.) is usually determined by fixed prices that are independent of the project conducted.

This conjecture is in line with taxation literature, which suggests that in a high tax country, a portion of the tax burden may be capitalized, reducing the acquisition price. Hebous, Ruf and Weichenrieder (2011) estimate a conditional logit model, including all new outbound FDI projects for the years 2005–2007, and explicitly distinguish between Greenfield and M&A investments. The evidence indicates that the location decisions of M&A investments are less sensitive to differences in statutory corporate income tax rates than the location decisions of Greenfield investments. In a similar vein Huizinga, Voget and Wagner (2012) jointly consider the takeover premium paid for an international target and acquiring-firm excess stock returns. Their findings suggest that additional international taxation in the form of non-resident dividend withholding taxes and home-country corporate income taxation is fully capitalized into takeover premiums.

How do German investors choose the location of their FDI?

To explore whether the sensitivity of FDI towards environmental stringency depends on the mode of entry, we analyzed data on FDI by German investors around the world during the period of 2005–2009 (Bialek and Weichenrieder 2015). The data was obtained from Microdatabase Direct Investment (MiDi) data collected by the Deutsche Bundesbank based on the provisions

of the Foreign Trade and Payments Regulation. MiDi keeps a comprehensive account of all FDI where the balance sheet total of the foreign direct investment exceeds three million EUR and the voting rights obtained are ten percent or higher. We investigated some 6,500 new cross-border projects, of which 37.5 percent took the form of Greenfield investments. Geographically these projects are concentrated in Europe (63 percent) and the Americas (20 percent). The observed location decisions are made by 1,892 different companies. On average, a firm in our sample performs 3.5 different investments.

German investment behavior should be a relevant phenomenon, as Germany is one of the largest economies with ten percent of total world exports and a five to eight percent share of worldwide FDI in the years considered, according to UNCTAD (2015) data.

The theoretical framework of our model is derived from the standard location model for firms establishing a new affiliate in a host country. Such firms aim to make an investment in a sector of their choice with the entry mode that best suits them. They select the country for the location of their investment. The only criterion applicable to decision-making is expected profit; and it is assumed that firms will locate their affiliates where they expect profits to be highest. Environmental regulation affects profits but, as argued above, to a possibly different extent for Greenfields and M&As. Moreover, the sensitivity of profits to environmental stringency should depend on how polluting the sector is in which the firm operates.

To make quantitative statements about the influence of environmental regulation on investments, one needs to measure its stringency across countries and years. How to compare and capture the level of regulation has been a contentious issue in literature on this topic. Apart from the pure data collection problem (lack of measures for less developed countries), Brunel and Levinson (2013) point to some fundamental conceptual obstacles related to capturing the stringency (multi-dimensionality of the policy, endogeneity and the issues with capital-vintage). However, since the publication of Kellenberg (2009) there seems to

be a consensus on the use of indices from the Executive Opinion Survey published annually by the World Economic Forum (WEF) in the studies comparing different countries as possible locations. Environmental stringency is generated from responses by the Forum's partner institutes (recognized research institutes, universities, business organizations, and in some cases, survey consultancies) to the following questions:

- How would you assess the stringency of your country's environmental regulations?
- How would you assess the enforcement of environmental regulation in your country?

Both questions can be answered on a seven point scale [1=very lax; 7=among the world's most rigorous]. The WEF data captures what is of interest to researchers investigating PHH, namely the perception of managers (who are responsible for the FDI decisions) of the environmental policy pursued by the respective countries.

Figure 1 plots the number of FDIs conducted against the values of WEF environmental index. For reference, the 2009 environmental index of some countries was plotted on the horizontal axis. In all of the years analyzed Germany was among the highest scoring countries, while many of the developing countries (Albania, Algeria, Burundi, Côte d'Ivoire, Kyrgyz Republic, Mongolia etc.) consistently obtained very low scores.

Figure 1

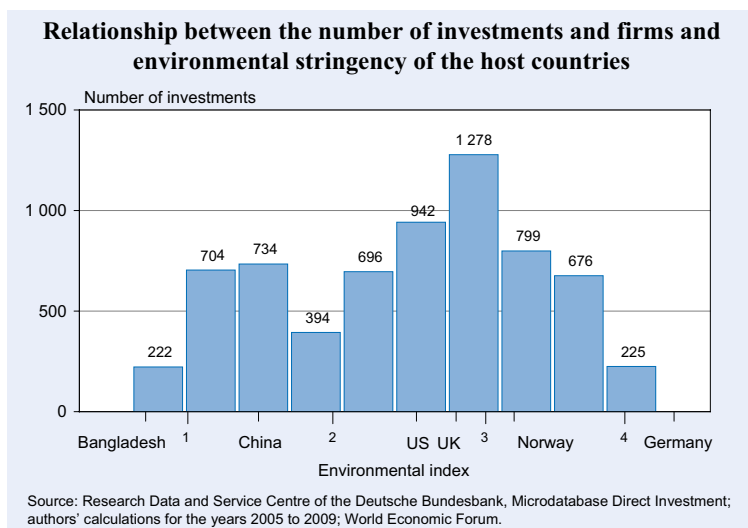
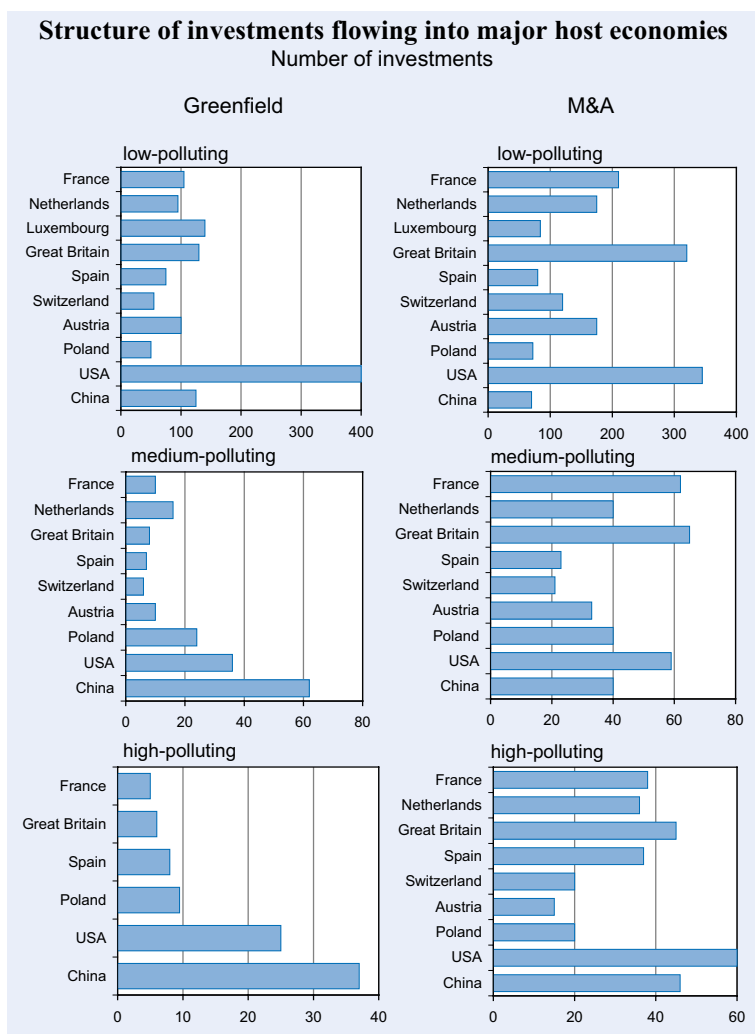


Figure 2



Source: Research Data and Service Centre of the Deutsche Bundesbank, Microdatabase Direct Investment; authors' calculations for the years 2005 to 2009.

Figure 2 displays the top ten locations for German affiliates abroad in 2005–2009. As we expect that in the context of PHH both mode of entry and the sector should matter, we split the investments accordingly. The visual analysis of the figure already seems to reveal some interesting patterns. For instance, while China receives only a small share of clean projects, it is a major host for dirty investments, especially of the Greenfield variety.

However, the pattern observed may just be a coincidence stemming from a specific distribution of country characteristics. Therefore our analysis controls for other factors that were found to be important for firms' location decisions: GDP per capita, population, distance to Germany, freedom from corruption, flexibility of the labor market, the statutory corporate tax rate

and openness measured as ratio of summed imports and exports over the country's GDP. We also use the stock of inward FDI for a given country to capture agglomeration effects.

Pollution havens and green havens

By applying mixed logit regressions, we were able to confirm that the reaction to environmental policy is indeed strongly heterogeneous. It depends on how polluting the sector is, in which the firm invests, but also on the mode of entry. To make our findings more accessible, we computed the individual marginal effects (ME) of environmental policies – the change in the probability that a particular investment will be conducted in a particular country if that country marginally toughens up its environmental regulation. The Average Marginal Effect (AME) was constructed as an average over all marginal effects. We also computed something we call, a bit loosely, "Conditional Marginal Effects" (CME) – an average over ME for individual types of investments.

As a result, we obtain CME for Greenfield investments in low polluting sectors, CME for Greenfields in medium polluting sectors etc. CMEs capture the essence of our findings in a neat way.

Evidence of a pollution haven effect was found in the form of a negative CME for Greenfield investments in medium and highly-polluting sectors. For such projects, a unit increase in the environmental index lowers the probability of investment by one percentage point on average. However, the effects for individual countries may be much higher. For example, the probability that a given dirty Greenfield investment will locate in China is 8.7 percent. Should China decide to increase its environmental stringency to match that of the United States, the chances of attracting such an investment would shrink to 3.5 percent according to our predictions.

On the other hand, we found the CME for M&A in clean sectors to be positive, implying that highly regulated locations tend to attract such investments. There are several potential explanations for that finding:

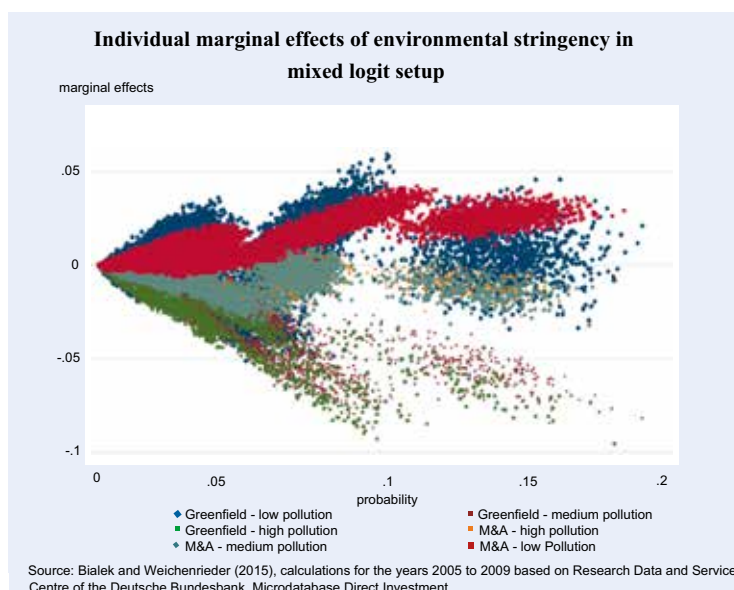
- According to the “green haven effect” reported by Poelhekke et al. (2015), some firms that attach great importance to their sustainable management image and corporate social responsibility may want to avoid settling in poorly regulated regions to prevent potential reputation losses. As their expenses for complying with regulation are probably low (they are in the low polluting sector), this image boosting does not come at a high cost.
- Competition for input factors may also lead to spillover effects across industries. High regulatory standards put polluting industries at a competitive disadvantage and may potentially deter them from the market. This, in turn, implies less competition for inputs, such as land and workers, for low polluting industries.
- In the case of M&As, capital-vintage rules may imply that the relevant degree of stringency may be much lower than that reported by the WEF. Moreover, investors do not have to fear the instantaneous influence of increased environmental requirements on their operating processes. The changed regulation will, however, apply to all those companies freshly entering the market, driving a cost wedge between new units and existing ones. The impact of allurements is especially visible for low polluting industries, as the need for adjustments to comply with the altered regulations in the long run prevails over the advantages for more pollution intensive sectors. Finally, the capitalization of environmental policy into purchase prizes may level off the negative impact of stringent regulation on profits.

This positive effect of tighter regulation on clean industries is relatively small in magnitude. In the case of China, for example, the increase in the probability of such investments would be 0.9 percent. Yet, it suggests that environmental policy does have a bearing on the composition of inflowing FDI from the perspective of the host country.

The CME for polluting cross-border acquisitions and for Greenfield investments in clean industries were not statistically different from zero, implying that such investments do not respond to environmental regulation. For M&As this could again be due to capital-vintage rules that protect investments from high regulation and capitalization of the policy into the acquisition price. In the case of clean Greenfield investments, the costs of environmental regulation may be too small to significantly affect the location decision for non-polluting sectors compared to other costs. However, it could also be that different clean Greenfields respond very differently to environmental regulation, with some “enjoying” their green status, as documented in Poelhekke et al. (2015) and others seeing themselves as negatively affected by the regulation. The mixed logit model that we estimated enables us to make statements about heterogeneity in the responses of firms. Indeed, considerable variability in tastes can still be observed for the Greenfield projects in clean industries. Some firms are deeply attracted to highly regulated jurisdictions, while environmental requirements constitute a strong deterring factor for others.

The heterogeneity of responses in various groups is illustrated by Figure 3, which plots individual marginal effects versus the probability of investment (for mixed logit model). It is particularly worth noting the wide spread in the marginal effects of regulation for Greenfield projects in low polluting sectors (blue dots), which is consistent with the discussion above. The pos-

Figure 3



itive impact of regulation on clean M&A projects (red points) and its negative impact on polluting Greenfields (dark green and dark red colour) is also clearly visible.

Is environmental policy endogenous?

Many have expressed their concern over the endogeneity of environmental policy. It is conceivable that environmental policy does not represent *ex ante* preferences, but responses to the pollution created, among others, by FDI. Therefore, there could be a simultaneity problem and the macro studies that deal with the FDI stock are highly prone to this problem. In the case of our study, which relies on microdata, simultaneity does not seem to pose a major threat to the unbiasedness of the estimates. However, should the environmental regulation be correlated with some factor influencing the decision where to invest that we do not control for, an omitted variable bias would arise.

To deal with potential endogeneity, we developed an instrument using what we consider to be “external pressure on environmental regulation”. We construct it as a weighted average of the regulation level in the countries that import the goods produced by a given country (lagged one year). The weights correspond to the shares of the partner countries in total exports. This reflects the supposition that the partner countries exert pressure on exporters if the exporters’ environmental regulation is lenient compared to the regulation of the importing partner. The pressure could come from consumer groups, importing companies protecting their “responsible” image or from legislation imposing certain requirements on the imported goods.

When we instrument environmental stringency using a control function approach, the positive effect of regulation on clean cross-border acquisitions becomes insignificant. If it was a result of some endogeneity problems, this would suggest that the unobserved variables conceal some of the negative effects of the regulation, i.e. the true effect of environmental stringency may be more negative than that reported in the previous discussion. Nevertheless, the effect of environmental regulation on clean mergers and acquisitions is never negative and the main object of our interest – the difference between M&A and Greenfield is preserved.

However, the regression results suggest that endogeneity may not be a problem in our study in the first place. Using a control function approach, one may directly test

for endogeneity by looking at the significance of the residual from the first stage as a predictor in the second stage. In our study, the residual comes out insignificant, thus corroborating our previous findings.

Conclusions

A review of the empirical literature on how environmental regulation affects the location of FDI yields mixed results. Against this background, we suggest that mode of entry heterogeneity may be a confounding factor. As we have argued, there are several reasons why M&As may be affected much less by strong environmental regulation than Greenfield investment. As M&As usually account for the majority of FDI, this is a potentially important issue. In this contribution we have reported on our recent empirical study that, to our best knowledge, is the first to explicitly differentiate between M&A and Greenfield when looking at the location effects of environmental policies. Our findings, which analyze investment decisions by German multinationals, reveal that tightened environmental stringency is an important deterrent of FDI inflow in the case of polluting Greenfield projects. At the same time, an increased restrictiveness of regulation even seems to have a positive effect on the decision of clean M&As to locate in the respective jurisdiction. This could be due to competitiveness effects associated with vintage differentiated regulation, the “green image” that German firms are trying to keep or other factors. The pollution haven effects seem to be an issue for polluting Greenfield investment, but not for other cross-border projects. As a result, the mixed results in the existing literature on pollution havens could be, at least partly, attributable to the varying composition of the investments in the datasets used. In cases where cross-border acquisitions are prevalent and researchers do not control for mode of entry, we would expect to obtain positive or insignificant estimates of environmental regulation. If Greenfield projects account for a substantial share of observations, by contrast, significant, negative coefficients may result.

Different sensitivities to environmental stringency should imply that regulation has a bearing on the composition of inflowing FDI. This may be a useful message for policymakers, who are concerned that M&As and Greenfield investments differ in terms of the associated know-how spillovers and employment effects.

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