

Kannen, Peter; Semrau, Finn Ole; Steglich, Frauke

**Working Paper**

## Green gifts from abroad? FDI and firms' green management

Kiel Working Paper, No. 2200

**Provided in Cooperation with:**

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

*Suggested Citation:* Kannen, Peter; Semrau, Finn Ole; Steglich, Frauke (2021) : Green gifts from abroad? FDI and firms' green management, Kiel Working Paper, No. 2200, Kiel Institute for the World Economy (IfW), Kiel

This Version is available at:

<https://hdl.handle.net/10419/247705>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# KIEL WORKING PAPER

**Green gifts from  
abroad? FDI and firms'  
green management**



No. 2200 November 2021

*Peter Kannen, Finn Ole Semrau, and Frauke Steglich*

# ABSTRACT

## **GREEN GIFTS FROM ABROAD? FDI AND FIRMS' GREEN MANAGEMENT\***

*Peter Kannen, Finn Ole Semrau, and Frauke Steglich*

Improvements of firms' environmental performance crucially determine the speed of a country's green economic transformation. In this paper, we investigate whether firms with foreign ownership are more likely to adopt 'green' management practices, which determine the capability to monitor and improve a firm's impact on the environment. By using multi-country firm-level data, we show that foreign ownership increases the likelihood of implementing green management practices. Considering country heterogeneity, we reveal that only firms based in more developed economies and in countries with better environmental performance benefit from foreign direct investment, while this is not the case for firms based in less developed economies or countries with weak environmental performance. In addition, we find that the effect is more robust for manufacturing sector firms than for service sector firms. Overall, our results suggest that foreign ownership can contribute towards a country's green economic transformation.

**Keywords:** Foreign direct investment; Green/ environmental management; Green economic transformation; Emerging markets

**JEL classification:** F21; F64; M10; Q56

**Peter Kannen** (Corresponding author)

Helmut Schmidt University Hamburg  
Holstenhofweg 85  
D-22043 Hamburg, Germany

*Email:* [peter.kannen@hsu-hh.de](mailto:peter.kannen@hsu-hh.de)  
[www.hsu-hh.de](http://www.hsu-hh.de)

**Finn Ole Semrau**

Kiel Institute for the World Economy  
Kiellinie 66  
D-24105 Kiel, Germany

*Email:* [finn.ole-semrau@ifw-kiel.de](mailto:finn.ole-semrau@ifw-kiel.de)  
[www.ifw-kiel.de](http://www.ifw-kiel.de)

**Frauke Steglich**

Kiel Institute for the World Economy  
Kiellinie 66  
D-24105 Kiel, Germany

*Email:* [frauke.steglich@ifw-kiel.de](mailto:frauke.steglich@ifw-kiel.de)  
[www.ifw-kiel.de](http://www.ifw-kiel.de)

\*We would like to thank Julian Donaubaauer, Holger Görg, Robert Gold, Dierk Herzer, Rainer Thiele and participants of the SEEDS Annual Workshop 2020 for valuable comments. Semrau acknowledges financial support from the Leibniz Association through the KCG grant no. SAS-2016-Ifw-LWC and Steglich acknowledges financial support from the Research Network Sustainable Global Supply Chains.

*The responsibility for the contents of this publication rests with the author, not the Institute. Since working papers are of a preliminary nature, it may be useful to contact the author of a particular issue about results or caveats before referring to, or quoting, a paper. Any comments should be sent directly to the author.*

# 1 Introduction

Decoupling environmental degradation from economic growth is one of the most urgent challenges of our time. Over the last decades, many countries have been successful in fostering economic growth and achieving widespread economic prosperity among their population. But with economic development the scale of environmental degradation typically increased (Awe, 2012). Therefore, a 'green transformation' of economies is necessary to reduce environmental degradation. This 'green transformation' requires firms to become aware of their environmental footprint and to take consequences of their production on the environment into consideration. To this end, the adoption of good management practices is key. Targeted management practices that focus on a firm's impact on the environment (green management) might have an added value over good general management practices since the latter mainly center on efficiency improvements and cost reduction (Boyd and Curtis, 2014; Grover and Karplus, 2020).

However, implementing green management tools is costly, its necessity might be unknown to a firm and it requires particular knowledge. Foreign direct investment (FDI) is one possibility to overcome these constraints. The intuition behind this is twofold. First, foreign firms face a broader set of stakeholders than domestic firms, which determine a firm's environmental performance (Christmann, 2004; Horbach, 2008). What is more, the set of relevant stakeholders of foreign owned firms includes both domestic and foreign stakeholders (Peñasco, del Río, and Romero-Jordán, 2017). If foreign stakeholders are more environmentally demanding, this can push firms towards more sustainable production (Newman, Rand, Tarp, and Trifkovic, 2018; Hanley and Semrau, 2019). Christmann (2004) shows that multinational companies (MNCs) standardize their environmental conduct and do not necessarily exploit lower environmental regulations abroad. Second, foreign firms may bring capital and, in particular, knowledge and organizational structures to domestic firms that are required to 'green' firms' production. Environmental upgrading is a complex task and often needs certain knowledge (De Marchi, 2012). Particularly firms in less developed countries may lack the required management practices and organizational structures. Even though, to the best of our knowledge, no study so far has explicitly investigated the role of knowledge and management transmission via FDI, it is often suspected that FDI can be a source of knowledge and good management practices (e.g. Javorcik (2004); Arnold and Javorcik (2009); Zhu, Duan, Guo, and Yu (2016); Brucal, Javorcik, and Love (2019)).<sup>1</sup>

In this paper, we explore whether firms with foreign ownership are more likely to introduce management tools targeted at firms' 'green' performance. We use the World Bank Enterprise Survey (WBES) data, covering details on a firm's ownership and green management from 28 countries in Eastern Europe, Asia and North Africa, to empirically analyze if foreign owned firms are more likely to introduce green management tools. We measure green management with the information on whether firms have a strategic objective for environmental or climate change issues (green strategy) or a manager responsible for environmental or climate change issues

---

<sup>1</sup>In this study, we focus on management transmission from a foreign firm to its affiliates and not at FDI spillover effects to other domestic firms like e.g. in the study by Fu (2012).

(green manager). We analyze the relation between green management and foreign ownership by estimating a logit model. In addition, we apply entropy balancing matching to account for potential sources of endogeneity.

Our paper contributes to the understanding of the drivers of a firm's environmental performance by connecting two different strands of literature, namely the literature on FDI and firm's environmental performance and the literature on management and firms' environmental performance.

The first strand of literature focuses on the relation between foreign ownership and environmental performance. Conducting a meta-analysis of macro-level studies, Demena and Afesorgbor (2020) find that environmental emissions are significantly reduced by FDI but only in developed countries. This positive effect of FDI on the environment can be interpreted as a halo effect (Doytch and Uctum, 2016). However, within micro-level studies the relation between FDI and environmental performance is less clear. Using firm-level data, Andonova (2003) shows that the exposure of Central and Eastern European transition economies to international markets increased environmental monitoring in form of internal audits for environmental outcomes and effort to qualify for ISO14000 certifications. The analysis reveals that although export-oriented firms adopt clean technologies faster, foreign investment is not necessarily associated with higher rates of clean technology adoption. Eskeland and Harrison (2003) use a sample of firms from Mexico, Morocco, Côte d'Ivoire and Venezuela to empirically analyze if foreign investors flock into developing countries considered as being pollution havens for dirty industries to exploit low levels of environmental regulations. They only find limited evidence for a pollution haven effect but even find that foreign plants produce significantly more energy efficient. Cole, Elliott, and Strobl (2008) analyze for a sample of Ghanaian firms a mechanism through which a firm's environmental performance is influenced, namely training or experience of a firm's decision maker in a foreign owned firm. They find that training of a firm's decision maker abroad does reduce fuel use, particularly so in foreign owned firms. However, FDI alone does not influence fuel use or total energy use but is found to increase electricity use which is a relatively cleaner input. Cainelli, Mazzanti, and Montresor (2012) analyze the role of foreign ownership in the adoption of green innovation and the adoption of environmental standards in North-East Italy. Similar to Cole, Elliott, and Strobl (2008), they also find no general positive relation between foreign ownership and a firm's environmental performance. Their findings suggest that foreign ownership boosts a firm's environmental innovation adoption only if the firm is embedded in local production systems, e.g. by connections to suppliers or universities. Brucal, Javorcik, and Love (2019) find that Indonesian firms' CO<sub>2</sub> intensity falls with foreign acquisition, even though foreign ownership increases the overall energy usage due to expansion of output. They interpret their findings as being very suggestive that foreign acquisition is associated with improvements in production processes as a result of better management. However, they cannot further verify this mechanism.

The second strand of literature focuses on (environmental) management practices and firms' environmental performance. There is a widespread consensus in the literature that good gen-

eral management practices matter for general firm performance (e.g. Bloom, Eifert, Mahajan, McKenzie, and Roberts (2012); Bloom, Mahajan, McKenzie, and Roberts (2020); Giorcelli (2019); Grover and Karplus (2020)). However, the impact of management on firms' environmental performance is more ambiguous. Bloom, Genakos, Martin, and Sadun (2010) match management data to production and energy usage information for 300 manufacturing firms in the UK and demonstrate that better managed firms are more productive and produce significantly more energy efficient, which leads to fewer CO<sub>2</sub> emissions. Similarly, Grover and Karplus (2020) analyze the link between general management and energy intensity. Using WBES data, they show that good general management practices only reduce the energy expenditure intensity but not physical energy use. Hence, the authors find a difference between an economic benefit and an environmental impact of good management. In addition, they find no supplemental benefit of targeted energy management over general management within their sample. Looking at U.S. manufacturing plants, Boyd and Curtis (2014) find that good general management not necessarily results in better energy efficiency but that rather targeted management is required to lower energy intensity. Martin, Muûls, de Preux, and Wagner (2012) focus on climate friendly management practices and their impact on firm's performance, including green R&D and energy efficiency. For their random sample of 190 manufacturing firms in the UK, they find that firms with climate friendly management practices produce more energy efficient, are more productive and invest higher amounts in green R&D. Additionally, they reveal a strong empirical link between climate friendly management practices and organizational structure. Interestingly, firms are more likely to adopt such climate-related management practices if environmental or energy managers are in charge of climate change issues and not the CEO. Amore and Bennedsen (2016) take the discussion to green patent activities in the US, also covering non-efficiency related environmental innovations in the domains of air or water pollution, hazardous waste prevention, disposal and control, recycling, and alternative energy. They find that worse governed firms show relatively less green innovation activity. They interpret this finding as indication for managers of worse governed firms avoiding cognitively challenging or systematically disruptive activities, which are important characteristics for the development of green innovations.

In this paper, we combine these two literature strands and provide insights on the relationship between foreign owned firms and the adoption of green management tools. Our contribution is threefold. First, we explore an under-investigated potential channel in the FDI-environmental outcome nexus, namely management targeted at greening of firms. Second, by using green management as an outcome, we go beyond the focus on efficiency-related environmental outcomes like energy efficiency or carbon emissions. Third, we provide stylized facts for a large set of heterogeneous developed and developing countries that are often underrepresented. Due to missing data availability many of our covered countries are frequently unconsidered in empirical research, which, so far, mainly covers advanced economies (Chiarvesio, Marchi, and Maria, 2015; Hanley and Semrau, 2019).

We find strong empirical support that foreign owned firms are more likely to have green management tools, which we show to highly correlate with improvements in a firm’s environmental performance. Notably, we show that especially manufacturing sector firms environmentally benefit from FDI, even though we still find some indication for a positive relation for service sector firms. Splitting the sample in accordance with the countries’ economic development level and the countries’ environmental performance, we show that our results are driven by firms in emerging and more advanced countries or countries with stronger environmental performance, while we find no significant relation for firms in less developed countries or countries with weaker environmental performance. The latter finding is of particular interest for upcoming efforts to reduce environmental degradation, because especially emerging countries are the main source of global emissions growth (Copeland, Shapiro, and Taylor, 2021). All in all, the empirical results confirm a direct relation between foreign ownership and adoption of green management tools. We interpret this with an on average higher demand for environmentally friendly production induced by foreign stakeholders. In addition, transfer of organizational structures and knowledge from a firm’s headquarter help firms to introduce green management targeting at improving its environmental performance.

In the next Section, we describe the data and variables used as well as the role of green management tools within a firm’s green transformation. In Section 3 we present the empirical strategy (Section 3.1), the baseline results (Section 3.2) and analyze country heterogeneity (Section 3.3). The robustness of our results is shown in Section 4. Section 5 concludes this paper.

## 2 Data

We use the WBES data based on the most recent survey wave conducted in 2019 and 2020.<sup>2</sup> The WBES data offers a representative sample of firms of an economy’s private sector. We only include countries with more than ten FDI firms in our analysis to ensure some variation in ownership within a country.<sup>3</sup> Thus, our sample consists of over 17,400 firms from 28 countries in East Europe, Central Asia and North Africa (see Table A.2 for the country coverage). This survey wave includes a module on Green Economy, which provides our outcome variables of interest on green management. We rely on the information whether the firm has a ‘green manager’<sup>4</sup> and whether it has a ‘green strategy’.<sup>5</sup> Compared to general management practices, looking particularly at green management has the advantage that management targeted to greening of firms goes beyond firms’ economic performance by also focusing explicitly on firms’ comprehensive impact on the environment. Thus, on the one hand, green management relates

---

<sup>2</sup>Data is available at <https://www.enterprisesurveys.org/en/about-us>.

<sup>3</sup>Following the World Bank, we define a firm as FDI firm if the share of foreign ownership is at least 10%. However, we also show that the results are robust if we take 50% as threshold.

<sup>4</sup>Survey question: “In fiscal year, did this establishment have a manager responsible for environmental and climate change issues?”

<sup>5</sup>Survey question: “In fiscal year, did this firm have strategic objectives that mention environmental or climate change issues?”

to environmental efficiency outcomes, such as energy or CO<sub>2</sub> efficiency, and, on the other hand, to other positive environmental outcomes like environmental innovation (EI) adoption rates.<sup>6</sup> Figure 1 demonstrates that firms with either a green strategy or a green manager do adopt more often and in number more EI measures.<sup>7</sup> For firms without green management tools, the distribution of EI measures is skewed to the right and for firms with green management tools, EI measures are more uniformly distributed. For example, 31.26% of firms without a green strategy do not adopt any EI measure while only 7.16% of firms with a green strategy have no EI measures. In contrast, only 0.63% of firms without a green strategy adopt at least ten EI measures while almost 6% with a green strategy adopt ten EI measures. Similar are the distributions by green manager. This highlights the role these green management tools play in a firm's green orientation.<sup>8</sup>

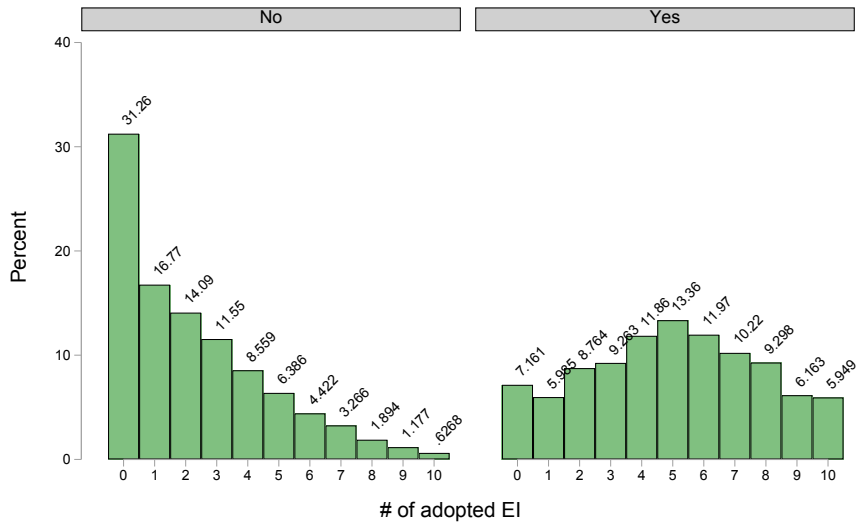
---

<sup>6</sup>Green/eco/environmental innovation includes aspects such as introduction of recycling and waste management or reductions in air and water pollution as well as the replacement of hazardous inputs. For a detailed definition of green innovation see Kemp and Pearson (2007).

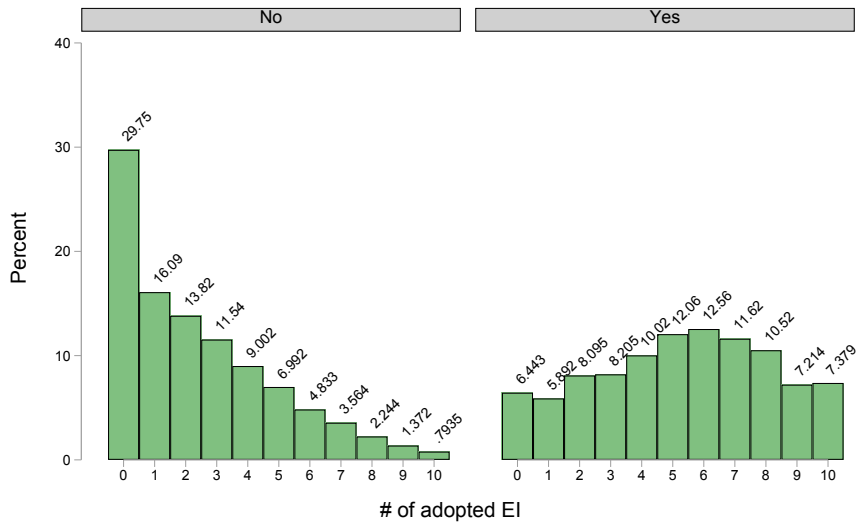
<sup>7</sup>EI measures: heating and cooling improvements; more climate-friendly energy generation; machinery and equipment upgrades; energy management; waste minimization, recycling and waste management; air pollution control measures; water management; upgrades of vehicles; improvements to lighting systems; other pollution control measures.

<sup>8</sup>The distribution for the manufacturing and service sample separately are shown in Figure A.2 and Figure A.3 in the Appendix.





Graphs by Green Strategy



Graphs by Green Manager

Figure 1: Adoption of environmental innovation

Figure 2 shows the distribution of firms by ownership status as well as by green strategy and green manager, respectively.<sup>9</sup> Firms with foreign ownership do more often report having a green strategy or a green manager compared to domestic firms. While only 14.77% of domestic firms have a green strategy, 31.12% of firms with foreign ownership have one. Similarly, 9.18% of domestic firms implement a green manager compared to 23.46% of firms with foreign ownership. Summary statistics of further firm characteristics are presented in Table A.1.

<sup>9</sup>The shares for the manufacturing and service sample separately are shown in Figure A.1 in the Appendix.

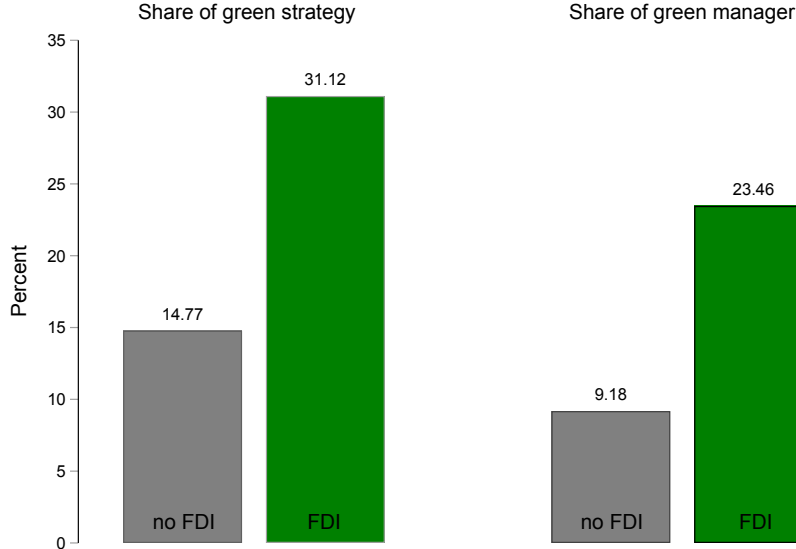


Figure 2: Green strategy & green manager by FDI

A first look at the data reveals a positive relationship between FDI and the adoption of a green strategy or having a green manager. In the next section, we analyze this pattern more rigorously.

### 3 Foreign direct investment and green management

#### 3.1 Empirical strategy

In a first step, we apply a logit estimation to further investigate the correlations between FDI and firms' green management tools. Ideally, we would analyze the relation between FDI and green management tools applying panel estimation techniques. Even though several firms are surveyed in consecutive waves and, therefore, exhibit a panel structure, the number of these firms is rather small and the outcome variables of interest are only captured in one survey wave. We thus cannot apply a panel analysis to thoroughly investigate how a change in ownership affects our outcome variables. Hence, we estimate the following equation:

$$green\_management_j = \beta_0 + \beta_1 FDI_j + \beta_2 X_j + \psi + \gamma + \epsilon_j \quad (1)$$

where  $green\_management_j$  is one of our two binary outcome variables *green strategy* or *green manager*. It takes the value of one if firm  $j$  has a green strategy/ a green manager.  $FDI$  is a binary variable equal to one if the firm has 10% or more in foreign ownership and zero otherwise.  $X$  captures different aspects that may influence the likelihood of firms to adopt a green strategy or employ a green manager. It includes both standard firm characteristics as well as external drivers of green management tools. We include firm characteristics like firm size (micro and small, medium, or large enterprises), labor productivity (log of sales over employees), a dummy variable for R&D expenditures, and the export status because internationalization is known to

drive firms' greening. The selection of control variables is based on established findings in the field (e.g. Christmann (2004); Ghisetti, Marzucchi, and Montresor (2015)). We further include variables that capture external drivers of firms' adoption of green management tools. This includes whether a firm acquires external knowledge<sup>10</sup>, whether environmental regulations are seen as an obstacle<sup>11</sup> and whether customers require an environmental certification<sup>12</sup> (Guoyou, Saixing, Chiming, Haitao, and Hailiang, 2013). To control for location specific effects, we include information on whether firms experienced any losses due to extreme weather events<sup>13</sup> or pollution.<sup>14</sup>  $\psi$  and  $\gamma$  are sector and country fixed effects, respectively, that, among other things, capture government or industry pressure. Controlling for sectors is particularly important in our setting as firms in energy-intensive sectors may also be more likely to adopt environmental management.

Furthermore, we consider general differences between firms in the service and in the manufacturing sector because of typically different management structures (Campbell and Verbeke, 1994; Bloom, Iacovone, Pereira-López, and Van Reenen, 2019) and due to the role of headquarters in MNCs (Ciabuschi, Dellestrand, and Holm (2012); Epstein and Roy (2007)). Service firms are generally more skill-intensive and may therefore depend less on external management practices (Bloom, Iacovone, Pereira-López, and Van Reenen, 2019; Zahler, Iacovone, and Mattoo, 2014). The role of MNCs' headquarters is stronger in the manufacturing sector than in the service sector since those firms benefit more from standardization as well as economies of scale and since service sector firms more often locate divisional headquarters abroad (Benito, Lunnan, and Tomassen, 2011). Consequently, the management of foreign firms in the service sector might differ less from the management of domestic firms. What is more, manufacturing sector firms produce more capital and resource intensive compared to service sector firms, which results in a higher local environmental footprint providing more necessity for implementing green management tools. Given these differences between the two sectors, we explore manufacturing and service firms separately throughout the paper.

### 3.2 Baseline results

Table 1 shows the results from the logit estimations for both outcome variables as well as by manufacturing and service sector, respectively. Our first empirical results corroborate the descriptive insights in that foreign ownership is positively correlated with the adoption of a green strategy and a green manager. The odds of having a green strategy are 1.329 times higher for

---

<sup>10</sup>Survey question: "Over the last three years, did this establishment spend on the acquisition of external knowledge? This includes the purchase or licensing of patents and non-patented inventions, know-how, and other types of knowledge from other businesses or organizations."

<sup>11</sup>Survey question: "To what degree are environmental regulations an obstacle to the current operations of this establishment?"

<sup>12</sup>Survey question: "Did any of the establishment's customers require environmental certifications or adherence to certain environmental standards as a condition to do business with this establishment?"

<sup>13</sup>Survey question: "Over the last three years, did this establishment experience monetary losses due to extreme weather events (such as storms, floods, droughts, or landslides)?"

<sup>14</sup>Survey question: "Over the last three years, did this establishment experience monetary losses due to pollution not generated by this establishment (that is, independent of this establishment's activity)?"

firms that receive FDI relative to domestic firms (Column (1)). Analogously, firms with foreign ownership exhibit a 1.234 higher odds of having a green manager relative to domestic firms (Column (2)). As expected, we find differences between the manufacturing and the service sector. The results are mainly driven by manufacturing sector firms (Columns (3) and (4)). For service sector firms we find a statistically significant effect only for FDI on green strategy (Column (5)).

Table 1: Baseline

	(1)	(2)	(3)	(4)	(5)	(6)
	Total sample		Manufact. sample		Service sample	
	Green strategy	Green manager	Green strategy	Green manager	Green strategy	Green manager
FDI (D)	1.329*** (0.101)	1.234** (0.104)	1.331*** (0.124)	1.221** (0.122)	1.296** (0.164)	1.207 (0.197)
Exporter (D)	1.310*** (0.086)	1.516*** (0.106)	1.368*** (0.110)	1.466*** (0.117)	1.216 (0.151)	1.513*** (0.241)
Size = 1, medium	1.589*** (0.102)	2.188*** (0.198)	1.658*** (0.146)	2.578*** (0.328)	1.498*** (0.141)	1.646*** (0.204)
Size = 2, large	2.474*** (0.175)	5.238*** (0.480)	2.492*** (0.231)	6.030*** (0.774)	2.437*** (0.285)	4.338*** (0.569)
R&D (D)	1.697*** (0.108)	1.426*** (0.113)	1.915*** (0.145)	1.405*** (0.135)	1.334** (0.168)	1.527*** (0.226)
log(Labor productivity)	1.062*** (0.020)	1.125*** (0.029)	1.071*** (0.026)	1.168*** (0.037)	1.037 (0.028)	1.048 (0.045)
External knowledge (D)	1.413*** (0.113)	1.384*** (0.127)	1.340*** (0.132)	1.433*** (0.160)	1.592*** (0.218)	1.332* (0.227)
Obstacle: Env. regulation (D)	1.155* (0.094)	1.016 (0.096)	1.361*** (0.141)	1.003 (0.116)	0.828 (0.102)	1.036 (0.162)
Losses: Extreme weather (D)	1.417*** (0.120)	1.329*** (0.140)	1.172 (0.133)	1.366** (0.198)	1.832*** (0.215)	1.250 (0.193)
Losses: Pollution (D)	3.139*** (0.461)	2.699*** (0.499)	3.420*** (0.699)	2.245*** (0.521)	2.822*** (0.599)	3.668*** (1.013)
Env. certification (D)	4.966*** (0.316)	6.260*** (0.482)	4.889*** (0.370)	6.151*** (0.571)	5.223*** (0.602)	6.675*** (0.908)
Observations	17,415	17,441	9,936	9,945	7,479	7,496
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R <sup>2</sup>	0.211	0.279	0.223	0.284	0.177	0.247

*Notes:* Odds ratios. See Table A.9 for marginal effects. Robust standard errors (clustered at the country-sector level) in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Further, we find that the effect is more pronounced for the adoption of a green strategy compared to having a green manager. This finding could be explained in several ways. MNCs usually implement global environmental standards that are centrally controlled (Epstein and Roy, 2007). Setting up a green strategy is relatively easy to implement and clearly visible for firms' stakeholders. In contrast, employing a manager in charge of the firm's green performance is costly and comes along with a shift in control from the headquarter to the affiliate.

The effects of FDI are robust and even stronger if we define a firm as foreign owned with a 50% (instead of 10%) share in foreign ownership (see Table A.14). A placebo type regression, in which we randomly assign FDI to firms, shows for Columns (1) and (2) that it is indeed FDI that drives our results (see Table A.16). Randomly assigned FDI is, as expected, statistically insignificant in both regressions.

In general, firms that are larger are more likely to adopt a green strategy or to have a green manager. Firm size does especially matter for the introduction of a green manager. A green manager is an additional cost factor for a firm that might only be able to be financed by very large companies. Also manufacturing sector firms that are more productive do more often implement green management tools. Being an exporter relates positively to green management tools as well. The same is true for firms which spend on R&D, acquire external knowledge and experienced any losses due to extreme weather or pollution. Manufacturing firms that face environmental regulations as an obstacle do more often implement a green strategy as well. Firms whose customers require an environmental certificate for doing business also do more often have a green strategy or a green manager. Thus, we detect both internal and external drivers of green management tools among which firm size, monetary losses due to external pollution, and the condition of having environmental certifications for doing business have the strongest effects.

### **3.3 Country heterogeneity**

#### **3.3.1 Country heterogeneity - income**

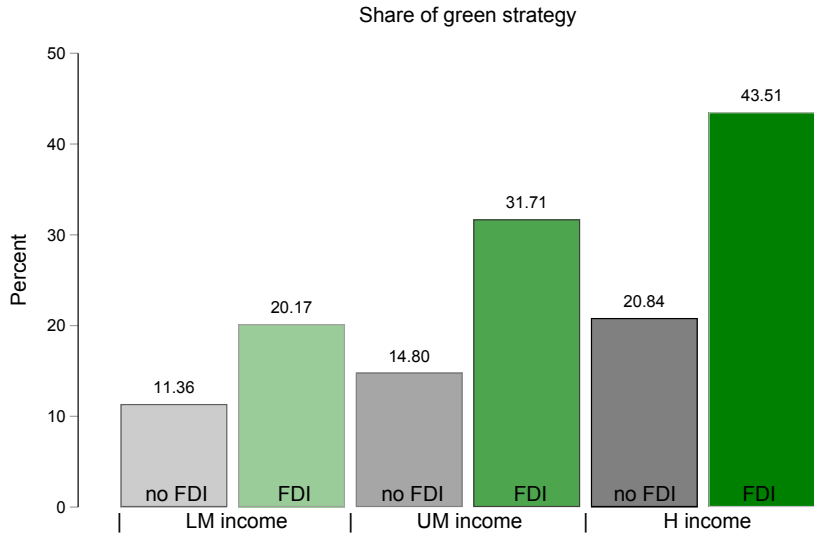
The effects of FDI on firms' green management are not unambiguous and generalizable. On the one hand, firms in developing countries can over-proportionately benefit from foreign ownership induced knowledge and management spillovers because they are further away from the technology frontier and best firm management practices (Gutiérrez and Teshima, 2018). On the other hand, a pollution haven effect and facing lax environmental regulation opposes the positive knowledge and technology spillovers induced by foreign ownership, e.g. discussed by Cole, Elliott, and Strobl (2008).

Given that our sample covers very heterogeneous countries at different stages of economic development, we split the sample in accordance with these differences to explore potential heterogeneous effects across countries. We take the development level into account and split the sample into high income (H), upper-middle income (UM), and lower-middle income countries (LM) based on the Gross National Income (GNI) per capita in 2018.<sup>15</sup> Figure 3 presents the distribution of green strategy and green manager by FDI and income group. The share of foreign owned firms that have a green strategy or a green manager is within all income groups higher than that among domestic firms.

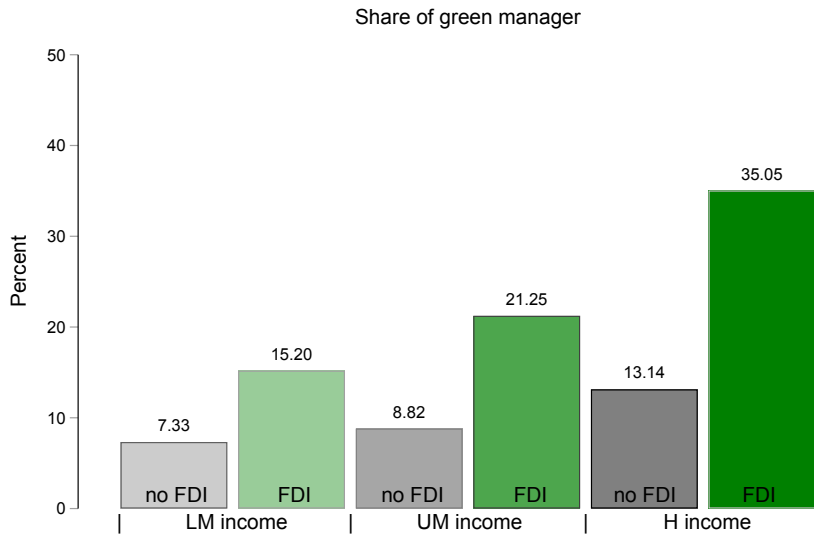
Table 2 shows for the total sample that firms receiving FDI in high and upper-middle income countries are more likely to adopt a green strategy and firms in high income countries are more

---

<sup>15</sup>See <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>.



(a) Green Strategy



(b) Green Manager

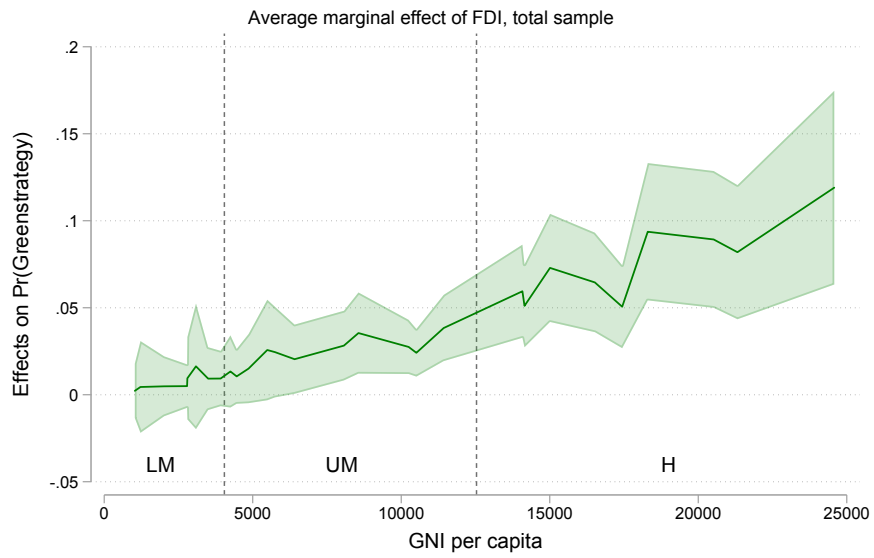
Figure 3: Green strategy & green manager by FDI and income group

likely to implement a green manager. Figure 4 plots the marginal effect of FDI on the respective green management tools by GNI per capita. The marginal effect of FDI on green strategy is close to zero for lower-middle income countries and increases with increasing GNI per capita to over 10% for some high-income countries. The marginal effect of FDI on green manager also increases with income but is only statistically different from zero for high-income countries. When interpreting these results, one has to bear in mind that the high-income countries in our sample are Eastern European EU countries, which mainly attract FDI from other (richer) European countries. These countries benefit with respect to EI from external information sources and technology transfers from Western European countries (Horbach, 2016).

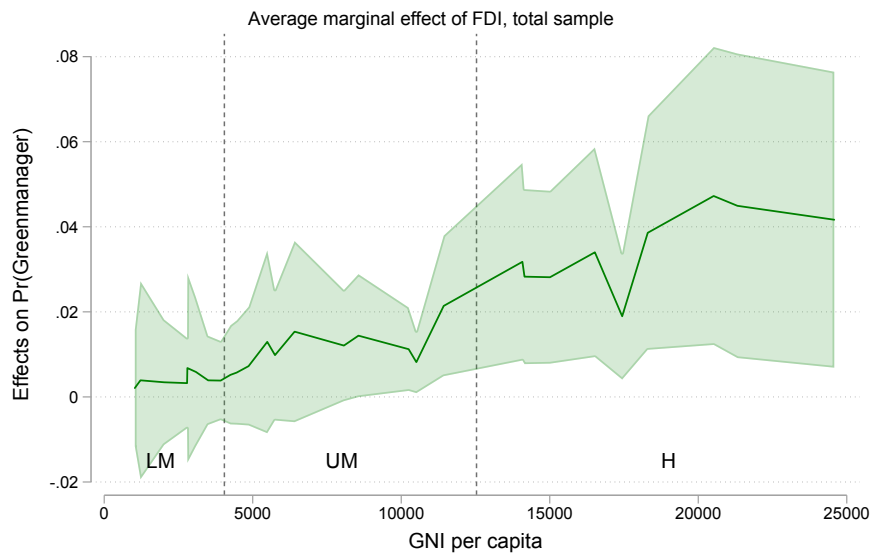
Table 2: Total sample, split by income group

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
FDI (D)	0.840 (0.116)	1.574*** (0.226)	1.596*** (0.184)	1.048 (0.157)	1.143 (0.201)	1.436** (0.212)
Observations	6,839	6,586	3,988	6,838	6,604	3,996
Pseudo R <sup>2</sup>	0.220	0.207	0.189	0.253	0.286	0.299

*Notes:* Odds ratios. Firm controls, sector FE and country FE included. See Table A.4 for the output with control variables and Table A.10 for marginal effects. Robust standard errors (clustered at the country-sector level) in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



(a) Green strategy



(b) Green manager

Figure 4: Marginal effects of FDI by GNI per capita



Splitting the sample into manufacturing and service sector firms. Similarly to the findings of our main specification, we find more pronounced effects for the manufacturing sector and for the adoption of a green strategy. As can be seen in Table 3, for manufacturing sector firms the effect of FDI on green strategy stays statistically highly significant while the effect of FDI on green manager turns statistically insignificant. Again, an explanation for the latter might be that foreign firms in the manufacturing sector do not implement an extra green manager position in their establishments abroad but only might have one in their headquarter. Marginal effects of FDI within the manufacturing sector are shown in Figure A.4 in the Appendix.

Table 3: Manufacturing sample, split by income group

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
FDI (D)	0.858 (0.141)	1.663*** (0.283)	1.557*** (0.231)	1.107 (0.180)	1.216 (0.268)	1.277 (0.233)
Observations	4,219	3,693	2,022	4,222	3,697	2,023
Pseudo R <sup>2</sup>	0.225	0.218	0.197	0.253	0.298	0.291

*Notes:* Odds ratios. Firm controls, sector FE and country FE included. See Table A.5 for the output with control variables and Table A.11 for marginal effects. Robust standard errors (clustered at the country-sector level) in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

For firms in the service sector the effect of FDI on green strategy and green manager is only statistically significant for high income countries (Table 4). Marginal effects of FDI for service firms are shown in Figure A.5 in the Appendix.

For both manufacturing and service sector firms in lower-middle income countries, we find that foreign and domestic firms do not differ in terms of green management. The odds ratios are, even though insignificant, mainly smaller than one, indicating lower environmental awareness of foreign compared to domestic firms. An interpretation of this finding could be that foreign firms exploit lax environmental regulations in less developed economies.

Table 4: Service sample, split by income group

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
FDI (D)	0.692 (0.183)	1.317 (0.318)	1.652** (0.322)	0.612 (0.248)	0.980 (0.281)	1.797** (0.480)
Observations	2,620	2,893	1,966	2,616	2,907	1,973
Pseudo R <sup>2</sup>	0.206	0.175	0.150	0.248	0.262	0.254

*Notes:* Odds ratios. Firm controls, sector FE and country FE included. See Table A.6 for the output with control variables and Table A.12 for marginal effects. Robust standard errors (clustered at the country-sector level) in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### 3.3.2 Country heterogeneity - environmental performance

Income captures countries' general development level. Another dimension that may influence firms' priorities for green management measures is the countries' overall environmental performance. In countries in which sustainable development is an important target, the green transformation of the economy is a more integral policy topic and might also determine whether firms (have to) focus on greening their production. In countries where sustainability is an issue, foreign investments might more easily push firms towards a green transformation with e.g. more capital, advanced management skills, or know-how. We measure a country's state of sustainability by the gap in the score of the environmental performance index (EPI)<sup>16</sup> of each country to the score of the EPI leader.<sup>17</sup> The EPI combines 32 performance indicators in 11 categories like air quality, waste management, biodiversity, pollution emissions, and water resources. Countries' income and their gap to the EPI leader is generally negatively correlated (Figure 5). However, we observe some heterogeneity that we explore in this section.

<sup>16</sup>The EPI is a joint project of the Yale Center for Environmental Law & Policy and The Center for International Earth Science Information Network at Columbia University's Earth Institute. Data available at <https://epi.yale.edu>.

<sup>17</sup>In the 2020 EPI ranking Denmark ranks first.

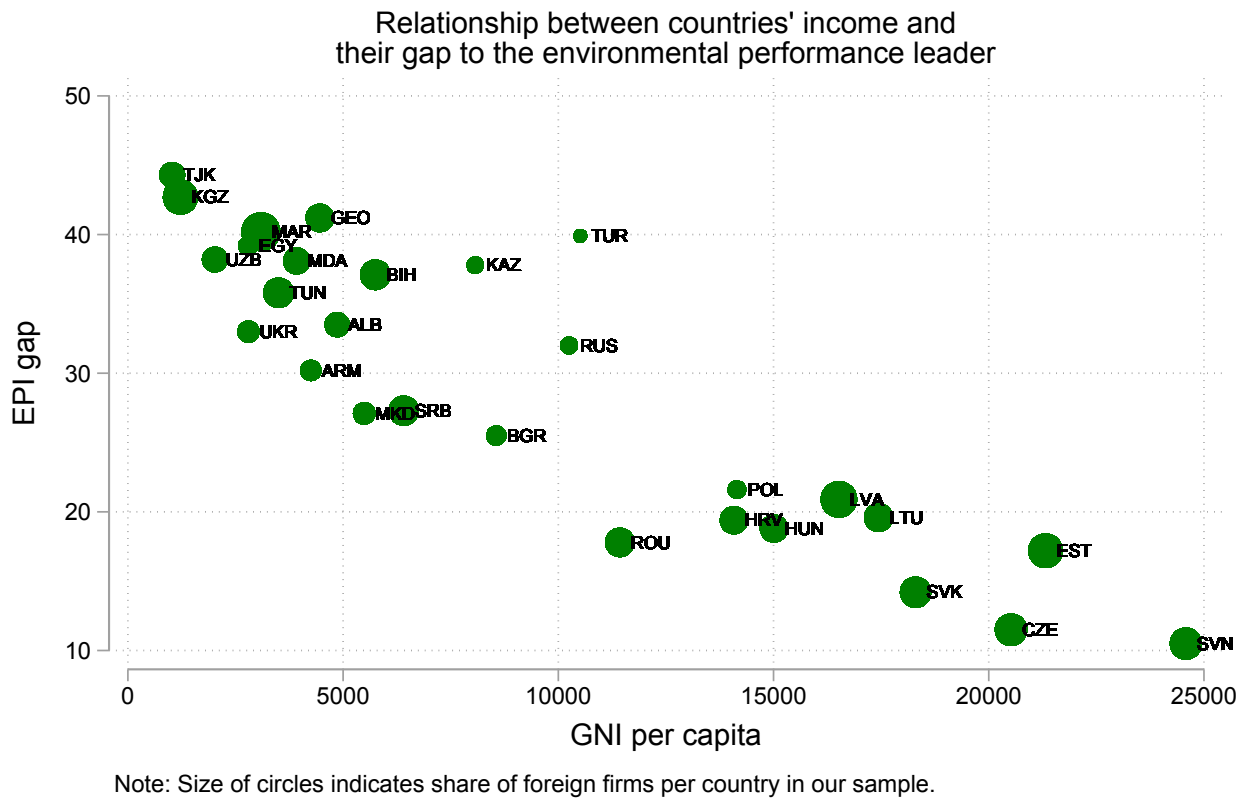
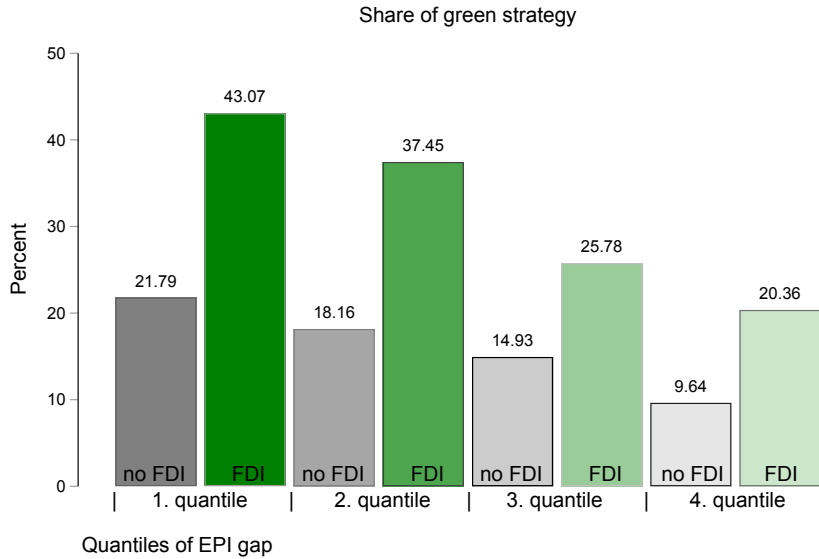
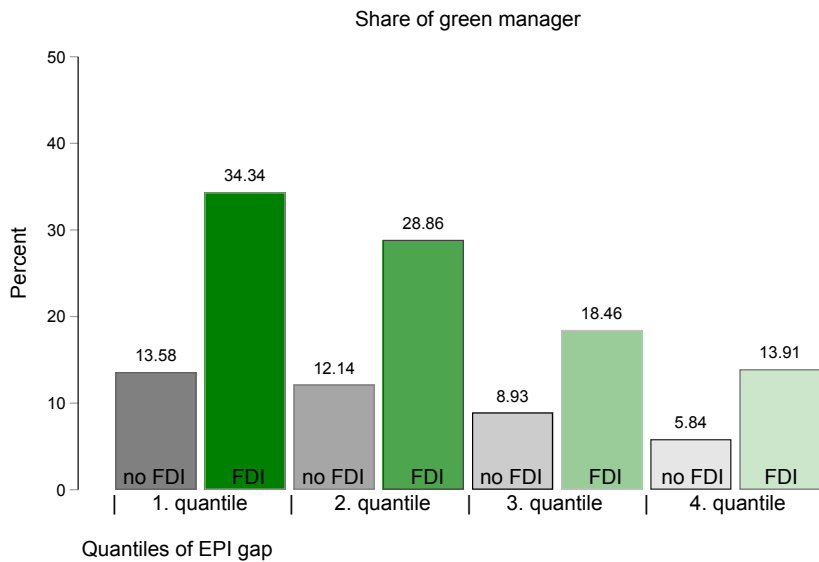


Figure 5: Relationship between countries' income and their gap to the environmental performance leader

Figure 6 presents for the total sample the share of green strategy and green manager by foreign ownership for different quantiles of the EPI gap. As can be seen, the smaller the gap, the higher the share of green strategy and green manager implementation. For all four groups, the difference between foreign and domestic firms is substantial.



(a) Green Strategy



(b) Green Manager

Figure 6: Green strategy & green manager by FDI and EPI gap

As shown in Table 5, we again find a positive correlation between FDI and firms' green management outcomes when controlling for the gap to the EPI leader. However, the effect diminishes with an increasing EPI gap (an odds ratio smaller than one implies a decline). The probability that a foreign firm in the manufacturing sector has a green strategy declines the larger the gap (Column (2)). The insignificant effect of FDI on green manager for manufacturing sector firms (Column (5)) is comparable to the insignificant coefficients we found for different income groups. For firms in the service sector, the positive effect of FDI on green strategy does not depend on the EPI gap (Column (3)) but the effect on green manager decreases with increasing EPI gap (Column (6)). The respective marginal effects are visualized in Figure 7. The marginal effects of FDI on green strategy as well as on green manager are both positive and different from zero for lower gaps of EPI and decrease with increasing EPI gaps. For countries with the smallest EPI gap, the marginal effects of FDI on green strategy and on green manager are about 10%

and 4%, respectively. Figures A.6 and A.7 in the Appendix present the respective marginal effects of FDI by the EPI gap for the two sectors separately. The findings of this exercise complement to previous findings on countries' income heterogeneity. The potential positive effects of FDI only come to fruition with a certain state of development and sustainability awareness in the host country.

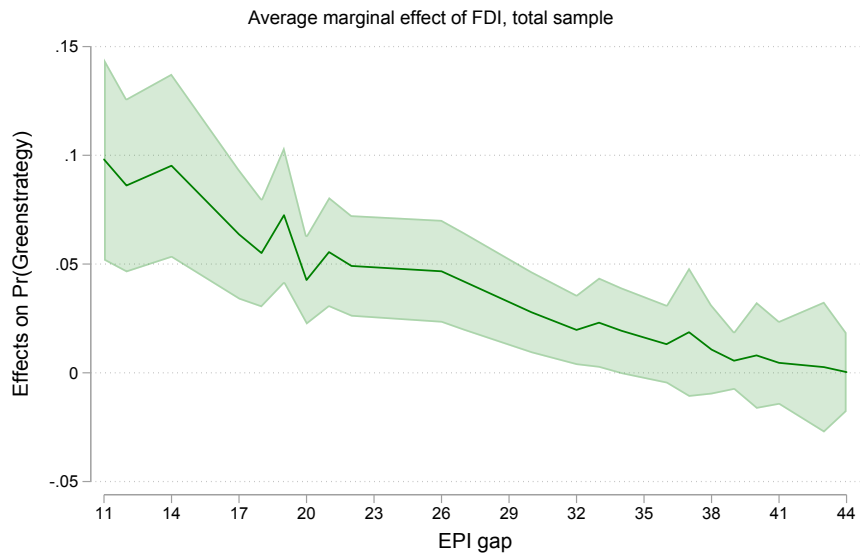
Table 5: Gap to environmental leader

	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Manufact.	Service	Total	Manufact.	Service
	sample	sample	sample	sample	sample	sample
	Green strategy			Green manager		
FDI (D)	2.150***	2.332***	2.066**	1.709**	1.325	2.892**
	(0.412)	(0.565)	(0.627)	(0.401)	(0.375)	(1.229)
EPIgap	0.939	1.004	0.948	1.057	1.170*	0.994
	(0.053)	(0.071)	(0.068)	(0.079)	(0.099)	(0.093)
FDI#EPIgap	0.983***	0.980**	0.983	0.988	0.997	0.968**
	(0.006)	(0.008)	(0.010)	(0.008)	(0.010)	(0.014)
Observations	17,415	9,936	7,479	17,441	9,945	7,496
Pseudo R <sup>2</sup>	0.211	0.224	0.177	0.280	0.284	0.248

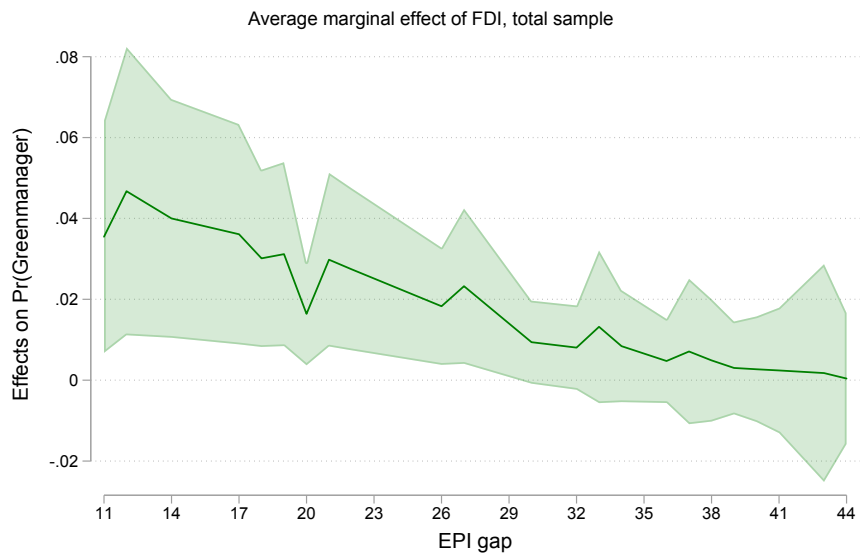
*Notes:* Odds ratios. Firm controls, sector FE and country FE included. See Table A.7 for the output with control variables. Robust standard errors (clustered at the country-sector level) in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

So far, our results confirm partially the so called halo effect, which states that foreign ownership is accompanied by higher levels of environmental awareness (Doytch and Uctum, 2016). We find this only to be true for more developed host economies. For firms based in less developed economies, we cautiously interpret the pattern in line with the well-known pollution haven effect. In general, the pollution haven effect describes the reallocation of dirty production to countries with lax environmental regulations and lower levels of environmental awareness (Eskeland and Harrison, 2003). In our sample, foreign owned firms do not differ from domestic firms in terms of green management in less developed countries.



(a) Green strategy



(b) Green manager

Figure 7: Marginal effects of FDI by environmental performance gap

## 4 Robustness

Up to this point, our results reveal a positive link between FDI and the implementation of green management tools for certain income groups and EPI gaps. However, there could be endogeneity concerns in our setting so far. First, it might be that FDI is not exogenous but rather driven by the possibility of foreign investors to pick better, and 'greener', governed domestic firms in the first place. Our results would suffer from an omitted variable bias in case we do not observe the factors that determine the choice of firms. In order to tackle this, we control for general management practices, which have been shown to explain part of firms' productivity and, thus, are likely to be considered by foreign investors. Second, we apply a matching approach to further reduce potential omitted variable biases, selection biases and model dependency.

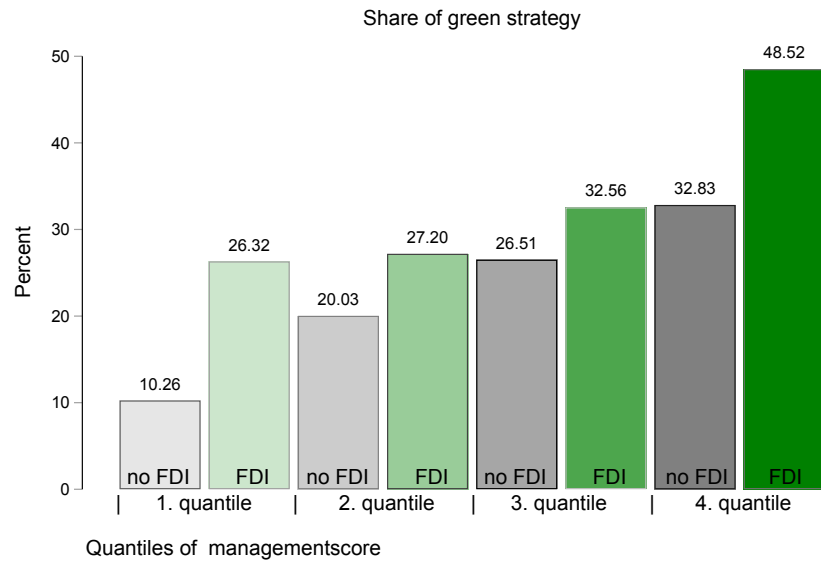
### 4.1 Controlling for general management practices

To evaluate a firm's general management practice we follow Bloom and Van Reenen (2007) or rather the implementation of their approach to the WBES by Grover and Karplus (2020). The WBES includes 11 questions on management practices, which cover the areas operations, monitoring, targets and incentives. The score of each practice evaluation is normalized with a zero mean and a standard deviation of one. Then, the average across all practices' z-scores is taken to define the general management score. Figure 8 shows that firms with better management scores do more often implement a green strategy or a green manager and both more often in foreign owned firms in the total sample.<sup>18</sup>

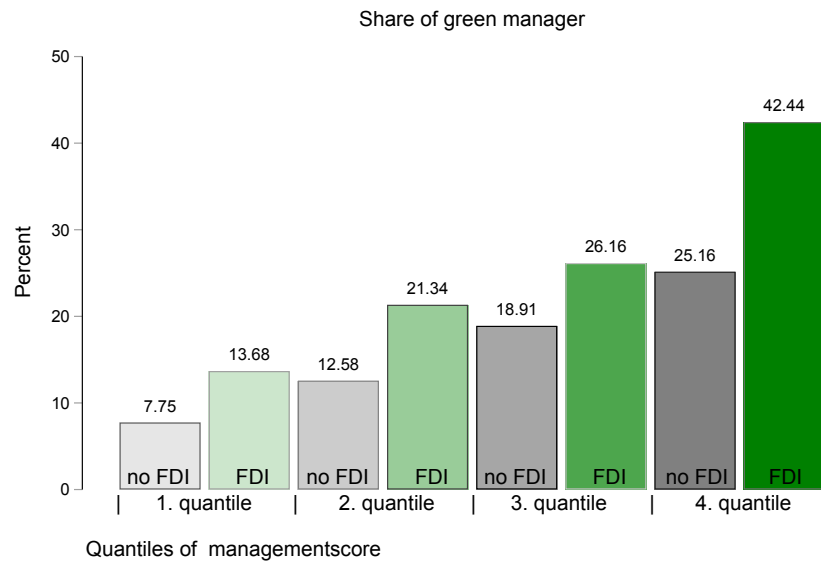
Given that general management practices might directly influence the implementation of a green management tool, we control for firm's management scores in Table 6. Indeed, the effect of FDI on green strategy and green manager becomes slightly smaller when we control for general management but stays statistically significant for the manufacturing sector sample. For firms in the service sector the effect of FDI turns insignificant. Overall, higher general management scores are positively linked to green management. It has to be noted that data to calculate the general management score is only available for larger firms such that all small and many medium size firms are not included in the regressions controlling for general management. Thus, our sample becomes considerably smaller. Because of this fact, we estimate for each sub-sample also the effect of FDI without controlling for general management in order to rule out that the results are driven by the different sample composition. For service sector firms, the effect of FDI on green management disappears even without the inclusion of the general management score (Columns (10,12)). It seems that there is no difference between larger foreign and larger domestic service firms in terms of green management. This gives some indication that our baseline result for the service sector is driven by smaller foreign firms. Since we find that for service sector firms the FDI effect on green management is driven by firms in high income

---

<sup>18</sup>Summary statistics for general management score and the green management variables by FDI and firm size are presented in Table A.3.



(a) Green Strategy



(b) Green Manager

Figure 8: Green strategy and green manager by FDI and management score

countries (cf. Table 4, Columns (3,6)), we further subdivide this sample by firms' size. Indeed, as shown in Table 7, for service sector firms in high income countries the effect of foreign ownership on green management tools is strongly driven by small firms for which we don't have data to calculate the general management score.



Table 6: Controlling for general management score

	(1)	(2)	(3)	(4)
	Total sample			
	Green strategy		Green manager	
FDI (D)	1.231**	1.294***	1.193*	1.241**
	(0.106)	(0.112)	(0.110)	(0.116)
managementscore	2.107***		1.906***	
	(0.177)		(0.182)	
Observations	8,293	8,293	8,316	8,316
Pseudo R <sup>2</sup>	0.208	0.197	0.248	0.241
	(5)	(6)	(7)	(8)
	Manufacturing sample			
	Green strategy		Green manager	
FDI (D)	1.302**	1.360***	1.212*	1.258**
	(0.134)	(0.141)	(0.131)	(0.137)
managementscore	2.134***		1.854***	
	(0.213)		(0.218)	
Observations	5,401	5,401	5,413	5,413
Pseudo R <sup>2</sup>	0.206	0.195	0.242	0.236
	(9)	(10)	(11)	(12)
	Service sample			
	Green strategy		Green manager	
FDI (D)	1.038	1.106	1.103	1.152
	(0.157)	(0.168)	(0.202)	(0.217)
managementscore	2.045***		2.049***	
	(0.317)		(0.356)	
Observations	2,892	2,892	2,903	2,903
Pseudo R <sup>2</sup>	0.213	0.203	0.248	0.239

*Notes:* Odds ratios. Firm controls, sector FE and country FE included. See Table A.8 for the output with control variables and Table A.13 for marginal effects. Robust standard errors (clustered at the country-sector level) in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 7: Service sample in high-income countries: firm size split

	(1)	(2)	(3)	(4)	(5)	(6)
	small	medium	large	small	medium	large
	Green strategy			Green manager		
FDI (D)	3.804*** (1.409)	1.071 (0.317)	1.376 (0.438)	4.346** (2.713)	1.243 (0.563)	1.779 (0.784)
Observations	1,160	543	263	1,163	518	265
Pseudo R <sup>2</sup>	0.101	0.154	0.194	0.161	0.159	0.273

*Notes:* Odds ratios. Firm controls, sector FE and country FE included. Robust standard errors (clustered at the country-sector level) in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 4.2 Matching

Finally, we apply a matching technique to estimate the FDI effect on green management tools. Matching is one approach to reduce endogeneity problems that might result from a selection bias as treated firms are only compared with non-treated firms with similar observable firm characteristics.<sup>19</sup> Hence, conditional on observable firm characteristics our outcome variables are supposed to be independent of the treatment. We cannot rule out other sources of endogeneity like omitted variable bias due to unobservable variables, reverse causality or simultaneity but we think that they are not a major issue in this study since our outcome variables are not a (typical) determinant of FDI and since we control for the most relevant determinants of FDI. Given that we use cross-section observational data, we apply entropy balancing matching (Hainmueller, 2012). This data re-weighting process imitates randomization more closely such that the treatment variable (FDI) becomes more independent of firm characteristics (Hainmueller, 2012; Athey and Imbens, 2017). To evaluate the effect of FDI, we estimate the average treatment effect on the treated (ATT) by:

$$\beta_{ATT} = E[Y(1)|D = 1] - E[Y(0)|D = 1], \quad (2)$$

with  $D$  being the binary treatment indicator (FDI). The counterfactual mean is estimated by:

$$E[Y(\widehat{0})|D = 1] = \left( \frac{\sum_{\{j|D=0\}} Y_j w_j}{\sum_{\{j|D=0\}} w_j} \right) \quad (3)$$

where  $w_j$  is the weight chosen for the control group units (Hainmueller, 2012). Thus, ATT gives the average effect of FDI over all firms that receive FDI.

The matching results are presented in Table 8 and corroborate the results presented before. Matching is based on the assumption that all relevant variables are observed, which is why we also include general management score. The results are robust for manufacturing firms but not for service sector firms when we additionally control for general management score in the matching process (Table 9). However, the samples become considerably smaller as it includes only larger firms as discussed before.

In Figure 9 we show the balancing graph for the estimation in Column (1) of Table 8 and in Figure 10 we show the balancing graph for the estimation in Column (2) of Table 8. The covariate balancing conditions are fulfilled for both samples since the standardized mean difference is close to zero and the variance ratio close to one. Respective graphs for the cumulative probabilities are shown in Figures A.8 and A.9.<sup>20</sup>

Given that the effect of FDI differs across income groups, Table 10 and Table 11 show the matching results by sector for the different income groups. Again, these results corroborate

<sup>19</sup>Please note that given our cross-sectional data structure we are not able to use pretreatment covariates.

<sup>20</sup>Balancing and cumulative probability graphs by sector (Columns (3)-(6)) of Table 8 are shown in Figures A.10 - A.17.

Table 8: Matching

	(1)	(2)	(3)	(4)	(5)	(6)
	Total sample		Manufact. sample		Service sample	
	Green strategy	Green manager	Green strategy	Green manager	Green strategy	Green manager
ATT	0.050*** (0.013)	0.031*** (0.011)	0.060*** (0.017)	0.036** (0.015)	0.033* (0.019)	0.020 (0.015)
Observations	14,887	14,904	8,612	8,614	6,275	6,290

*Notes:* Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 9: Matching with general management score

	(1)	(2)	(3)	(4)	(5)	(6)
	Total sample		Manufact. sample		Service sample	
	Green strategy	Green manager	Green strategy	Green manager	Green strategy	Green manager
ATT	0.045*** (0.016)	0.030** (0.015)	0.063*** (0.020)	0.035* (0.019)	0.010 (0.024)	0.017 (0.020)
Observations	7,022	7,037	4,753	4,759	2,269	2,278

*Notes:* Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

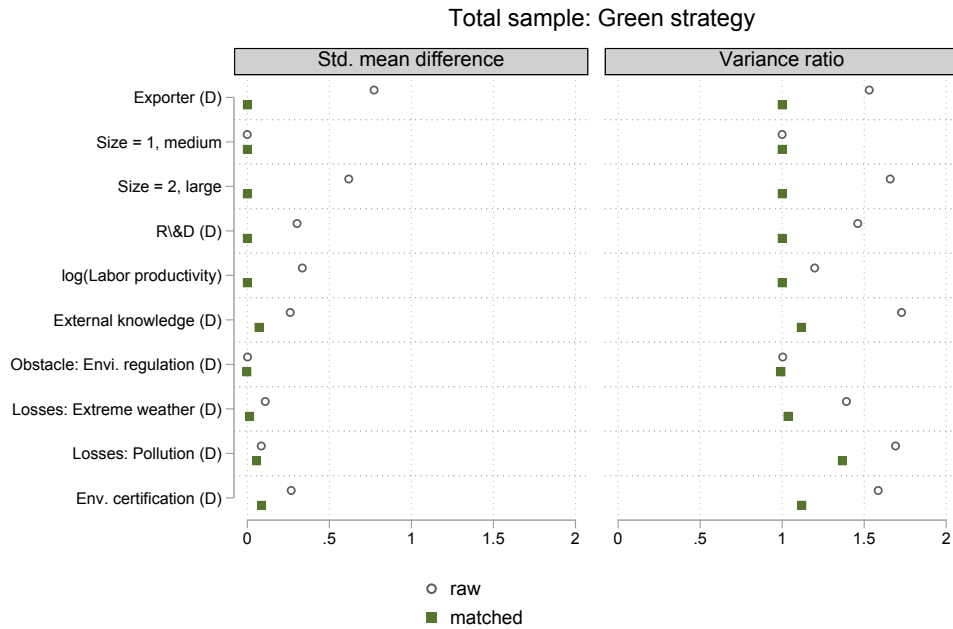


Figure 9: Balance graph for green strategy

our findings shown above. For the manufacturing sample, we find a positive and statistically significant relation between FDI and the adoption of a green strategy in upper-middle and

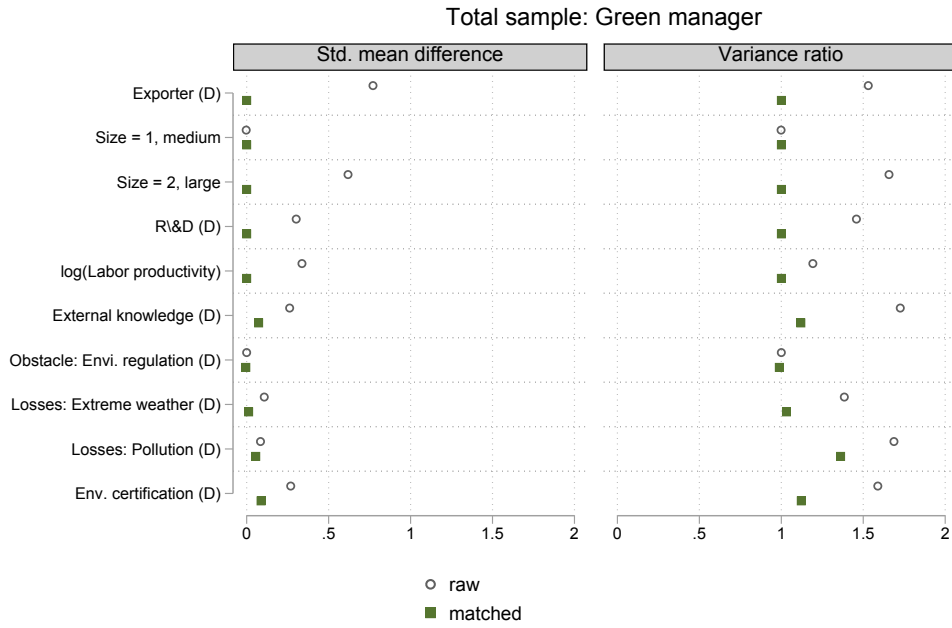


Figure 10: Balance graph for green manager

high-income countries. For the service sector, we find a positive relation between FDI and both the adoption of a green strategy and a green manager for high-income host countries.

Table 10: Matching, sample split by income group - manufacturing sample

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
ATT	-0.006 (0.024)	0.095*** (0.032)	0.064* (0.034)	0.018 (0.018)	0.041 (0.030)	0.000 (0.031)
Observations	3,897	2,821	1,681	3,894	2,825	1,682

Notes: Robust standard errors in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Table 11: Matching, sample split by income group - service sample

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
ATT	-0.031 (0.026)	0.042 (0.033)	0.083** (0.034)	-0.017 (0.020)	-0.008 (0.022)	0.069** (0.033)
Observations	2,235	2,134	1,566	2,231	2,146	1,572

Notes: Poland excluded. Robust standard errors in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## 5 Conclusion

In this paper, we shed light on the relation between FDI and the implementation of green management tools, which are crucial for firms' ability to manage their environmental footprint. We find that foreign firms are more likely to have green management tools compared to domestic firms. This effect is mainly driven by the manufacturing sector, which exhibits higher pollution compared to the service sector and at the same time more possibilities to reduce firms' environmental footprints. Furthermore, the effect is more pronounced for the adoption of a green strategy as for having a green manager. This could be driven by the fact that employing a green manager is more costly for firms and managers are usually based in the headquarter. In contrast, setting up a green strategy is relatively easier to implement and is clearly visible for firms' stakeholders. Considering country heterogeneity, we find that the effect of FDI only holds for more developed economies and countries with better environmental performance. For less developed economies, we do not detect a significant effect of FDI on the adoption of green management tools. Our results confirm the so called halo effect for more developed economies because foreign ownership is accompanied by higher levels of environmental awareness. For firms based in less developed economies, we cautiously interpret the pattern in line with the well-known pollution haven effect, which describes the reallocation of dirty production to countries with lax environmental regulations and lower levels of environmental awareness. The latter result indicates that a significant lack in domestic demand for environmental awareness of firms opposes the positive effect induced by FDI.

We contribute to the understanding of firms' internationalization and environmental performance in several ways. We explore the importance of the transmission of management tools through FDI. In doing so, we provide evidence for the in the literature often suggested channel by which foreign ownership affects firms' environmental performance. Furthermore, by using green management as an outcome, we go beyond the focus in the literature on efficiency-related environmental outcomes. Finally, we provide stylized facts for a large set of heterogeneous developed and developing countries. Having the information on firms' green management tools for a large sample of heterogeneous countries is unique. However, our analysis faces several constraints due to data limitations. Given the cross-sectional structure of the data, we are not able to explore time variation and, for instance, the effect of changes in foreign ownership on green management outcomes. Unfortunately, we also have no information on foreign companies' home country, which would allow the analysis of heterogeneity regarding the origin of FDI.

The relevance of our findings for policy makers is multi-fold. FDI is likely to boost the green transformation of firms by encouraging green management practices, which, in turn, relate to firms' green outcomes. Accordingly, FDI inflows provide an economic and environmental dividend not only for the firm but also contribute to countries' green economic transformation necessary to cope with environmental degradation. Countries willing to attract foreign investors should target investments from countries with relatively high environmental standards. Further, strong environment-related institutions are crucial for FDI to positively impact domestic firms' green management.

## References

- AMORE, M. D., AND M. BENNEDSEN (2016): “Corporate governance and green innovation,” *Journal of Environmental Economics and Management*, 75(C), 54–72.
- ANDONOVA, L. B. (2003): “Openness and the environment in Central and Eastern Europe: Can trade and foreign investment stimulate better environmental management in enterprises?,” *The Journal of Environment & Development*, 12(2), 177–204.
- ARNOLD, J. M., AND B. S. JAVORCIK (2009): “Gifted kids or pushy parents? Foreign direct investment and plant productivity in Indonesia,” *Journal of International Economics*, 79(1), 42–53.
- ATHEY, S., AND G. W. IMBENS (2017): “The state of applied econometrics: Causality and policy evaluation,” *Journal of Economic Perspectives*, 31(2), 3–32.
- AWE, Y. A. (2012): “Toward a green, clean, and resilient world for all: a World Bank Group environment strategy 2012-2022,” Discussion paper, The World Bank.
- BENITO, G. R., R. LUNNAN, AND S. TOMASSEN (2011): “Distant encounters of the third kind: Multinational companies locating divisional headquarters abroad,” *Journal of Management Studies*, 48(2), 373–394.
- BLOOM, N., B. EIFERT, A. MAHAJAN, D. MCKENZIE, AND J. ROBERTS (2012): “Does Management Matter? Evidence from India,” *The Quarterly Journal of Economics*, 128(1), 1–51.
- BLOOM, N., C. GENAKOS, R. MARTIN, AND R. SADUN (2010): “Modern Management: Good for the Environment or Just Hot Air?,” *The Economic Journal*, 120(544), 551–572.
- BLOOM, N., L. IACOVONE, M. PEREIRA-LÓPEZ, AND J. VAN REENEN (2019): “Management in Mexico: Market Size, Frictions and Misallocation,” Discussion paper, Stanford University, Stanford, CA.
- BLOOM, N., A. MAHAJAN, D. MCKENZIE, AND J. ROBERTS (2020): “Do Management Interventions Last? Evidence from India,” *American Economic Journal: Applied Economics*, 12(2), 198–219.
- BLOOM, N., AND J. VAN REENEN (2007): “Measuring and explaining management practices across firms and countries,” *The Quarterly Journal of Economics*, 122(4), 1351–1408.
- BOYD, G. A., AND E. M. CURTIS (2014): “Evidence of an ‘Energy-Management Gap’ in U.S. manufacturing: Spillovers from firm management practices to energy efficiency,” *Journal of Environmental Economics and Management*, 68(3), 463–479.

- BRUCAL, A., B. JAVORCIK, AND I. LOVE (2019): “Good for the environment, good for business: Foreign acquisitions and energy intensity,” *Journal of International Economics*, 121(C).
- CAINELLI, G., M. MAZZANTI, AND S. MONTRESOR (2012): “Environmental Innovations, Local Networks and Internationalization,” *Industry and Innovation*, 19(8), 697–734.
- CAMPBELL, A. J., AND A. VERBEKE (1994): “The globalization of service multinationals,” *Long Range Planning*, 27(2), 95–102.
- CHIARVESIO, M., V. D. MARCHI, AND E. D. MARIA (2015): “Environmental innovations and internationalization: Theory and practices,” *Business Strategy and the Environment*, 24(8), 790–801.
- CHRISTMANN, P. (2004): “Multinational companies and the natural environment: Determinants of global environmental policy,” *Academy of Management Journal*, 47(5), 747–760.
- CIABUSCHI, F., H. DELLESTRAND, AND U. HOLM (2012): “The role of headquarters in the contemporary MNC,” *Journal of International Management*, 18(3), 213–223.
- COLE, M. A., R. J. ELLIOTT, AND E. STROBL (2008): “The environmental performance of firms: The role of foreign ownership, training, and experience,” *Ecological Economics*, 65(3), 538 – 546.
- COPELAND, B. R., J. S. SHAPIRO, AND M. S. TAYLOR (2021): “Globalization and the Environment,” *NBER Working Paper*, 28797.
- DE MARCHI, V. (2012): “Environmental innovation and R&D cooperation: Empirical evidence from Spanish manufacturing firms,” *Research Policy*, 41(3), 614 – 623.
- DEMENA, B. A., AND S. K. AFESORGBOR (2020): “The effect of FDI on environmental emissions: Evidence from a meta-analysis,” *Energy Policy*, 138, 111192.
- DOYTCH, N., AND M. UCTUM (2016): “Globalization and the environmental impact of sectoral FDI,” *Economic Systems*, 40(4), 582–594.
- EPSTEIN, M. J., AND M.-J. ROY (2007): “Implementing a corporate environmental strategy: Establishing coordination and control within multinational companies,” *Business Strategy and the Environment*, 16(6), 389–403.
- ESKELAND, G. S., AND A. E. HARRISON (2003): “Moving to greener pastures? Multinationals and the pollution haven hypothesis,” *Journal of Development Economics*, 70(1), 1–23.
- FU, X. (2012): “Foreign direct investment and managerial knowledge spillovers through the diffusion of management practices,” *Journal of Management Studies*, 49(5), 970–999.



- GHISETTI, C., A. MARZUCCHI, AND S. MONTRESOR (2015): “The open eco-innovation mode. An empirical investigation of eleven European countries,” *Research Policy*, 44(5), 1080 – 1093.
- GIORCELLI, M. (2019): “The Long-Term Effects of Management and Technology Transfers,” *American Economic Review*, 109(1), 121–52.
- GROVER, A. G., AND V. J. KARPLUS (2020): “The Energy-Management Nexus in Firms: Which Practices Matter, How Much and for Whom?,” Policy Research Working Paper 9397, The World Bank.
- GUOYOU, Q., Z. SAIXING, T. CHIMING, Y. HAITAO, AND Z. HAILIANG (2013): “Stakeholders’ influences on corporate green innovation strategy: a case study of manufacturing firms in China,” *Corporate Social Responsibility and Environmental Management*, 20(1), 1–14.
- GUTIÉRREZ, E., AND K. TESHIMA (2018): “Abatement expenditures, technology choice, and environmental performance: Evidence from firm responses to import competition in Mexico,” *Journal of Development Economics*, 133, 264–274.
- HAINMUELLER, J. (2012): “Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies,” *Political Analysis*, 20(1), 25–46.
- HANLEY, A., AND F. SEMRAU (2019): “Stepping up to the mark? Firm’s export orientation and environmental innovation in 14 European countries,” *Beiträge zur Jahrestagung des Vereins für Socialpolitik 2019*.
- HORBACH, J. (2008): “Determinants of environmental innovation - New evidence from German panel data sources,” *Research Policy*, 37(1), 163 – 173.
- (2016): “Empirical determinants of eco-innovation in European countries using the community innovation survey,” *Environmental Innovation and Societal Transitions*, 19, 1 – 14.
- JAVORCIK, B. (2004): “Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages,” *American Economic Review*, 94(3), 605–627.
- KEMP, R., AND P. PEARSON (2007): “Final report MEI project about measuring eco-innovation,” *UM Merit, Maastricht*, 10.
- MARTIN, R., M. MUÛLS, L. DE PREUX, AND U. WAGNER (2012): “Anatomy of a paradox: Management practices, organizational structure and energy efficiency,” *Journal of Environmental Economics and Management*, 63(2), 208–223.
- NEWMAN, C., J. RAND, F. TARP, AND N. TRIFKOVIC (2018): “The transmission of socially responsible behaviour through international trade,” *European Economic Review*, 101, 250–267.

- PEÑASCO, C., P. DEL RÍO, AND D. ROMERO-JORDÁN (2017): “Analysing the role of international drivers for eco-innovators,” *Journal of International Management*, 23(1), 56–71.
- ZAHLER, A., L. IACOVONE, AND A. MATTOO (2014): “Trade and Innovation in Services: Evidence from a Developing Economy,” *The World Economy*, 37(7), 953–979.
- ZHU, H., L. DUAN, Y. GUO, AND K. YU (2016): “The effects of FDI, economic growth and energy consumption on carbon emissions in ASEAN-5: Evidence from panel quantile regression,” *Economic Modelling*, 58, 237–248.

# Appendix

## A.1 Descriptive statistics

Table A.1: Summary statistics of control variables by FDI (survey wave 2019/20)

	count	mean	sd	min	max
FDI = 0					
Green strategy (D)	15892	.148	.355	0	1
Green manager (D)	15867	.092	.289	0	1
Exporter (D)	15892	.197	.398	0	1
Size	15892	.687	.756	0	2
R&D (D)	15892	.173	.379	0	1
log(Labor productivity)	15892	10.122	1.488	.948	18.102
External knowledge (D)	15892	.102	.302	0	1
Obstacle: Env. regulation (D)	15892	.118	.323	0	1
Losses: Extreme weather (D)	15892	.071	.258	0	1
Losses: Pollution (D)	15892	.019	.135	0	1
Env. certification (D)	15892	.129	.335	0	1
FDI = 1					
Green strategy (D)	1523	.311	.463	0	1
Green manager (D)	1522	.235	.424	0	1
Exporter (D)	1523	.556	.497	0	1
Size	1523	1.259	.775	0	2
R&D (D)	1523	.307	.461	0	1
log(Labor productivity)	1523	10.652	1.629	2.071	16.857
External knowledge (D)	1523	.194	.396	0	1
Obstacle: Env. regulation (D)	1523	.116	.320	0	1
Losses: Extreme weather (D)	1523	.100	.301	0	1
Losses: Pollution (D)	1523	.033	.178	0	1
Env. certification (D)	1523	.232	.422	0	1

Table A.2: Country coverage

High Income	Upper-middle Income	Lower-middle Income
Croatia	Albania	Egypt, Arab Rep.
Czech Republic	Armenia	Kyrgyz Republic
Estonia	Bosnia and Herzegovina	Moldova
Hungary	Bulgaria	Morocco
Latvia	Georgia	Tajikistan
Lithuania	Kazakhstan	Tunisia
Poland	Macedonia, FYR	Ukraine
Slovak Republic	Romania	Uzbekistan
Slovenia	Russian Federation	
	Serbia	
	Turkey	

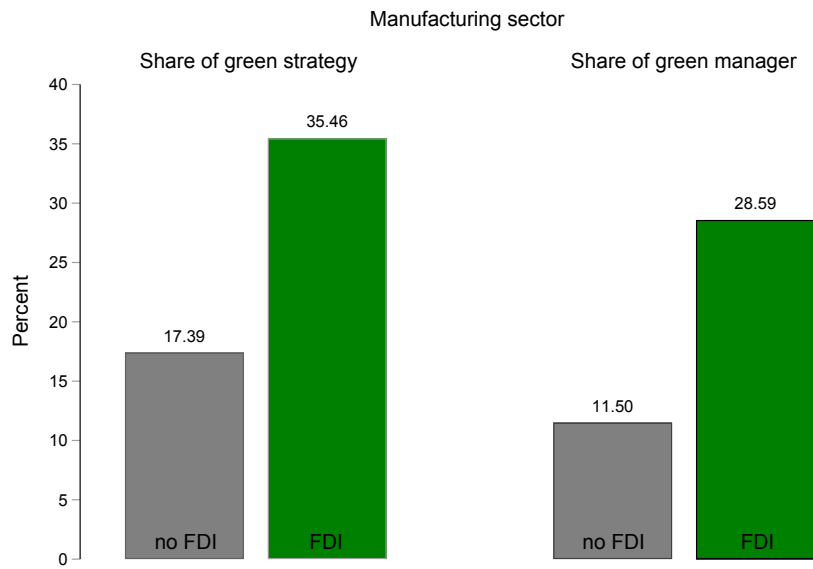
*Note:* World Bank classification based on per capita GNI in 2018

Table A.3: Summary statistics general management score by FDI and firm size

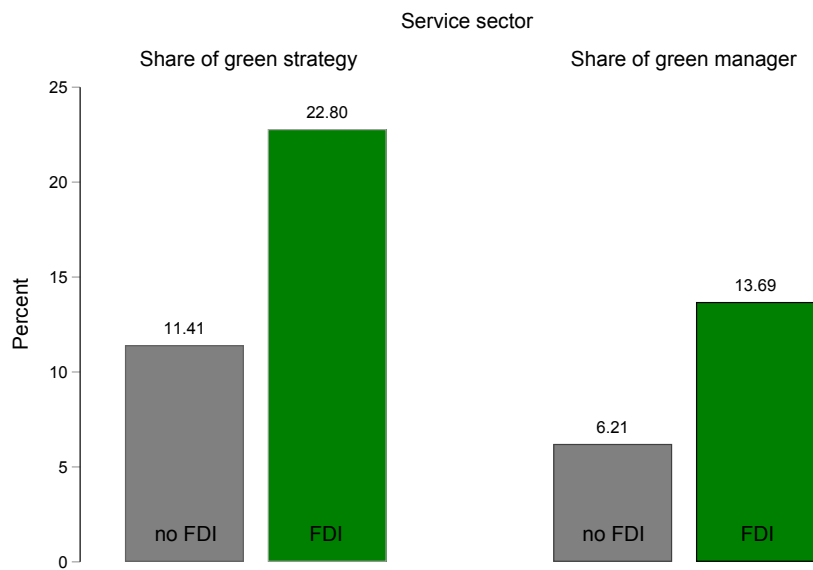
	count	mean	sd	min	max
FDI = 0, firm size: medium					
Green strategy (D)	4531	.183	.386	0	1
Green manager (D)	4526	.107	.309	0	1
Management score	4531	-.072	.458	-1.469	1.231
FDI = 1, firm size: medium					
Green strategy (D)	459	.268	.443	0	1
Green manager (D)	459	.159	.366	0	1
Management score	459	.069	.452	-1.469	1.111
FDI = 0, firm size: large					
Green strategy (D)	2626	.286	.452	0	1
Green manager (D)	2620	.247	.431	0	1
Management score	2626	.083	.451	-1.469	1.245
FDI = 1, firm size: large					
Green strategy (D)	677	.424	.495	0	1
Green manager (D)	676	.377	.485	0	1
Management score	677	.205	.455	-1.126	1.231

*Note:* Based on the sample of Column (1) in Table 6.

## A.2 Additional graphs

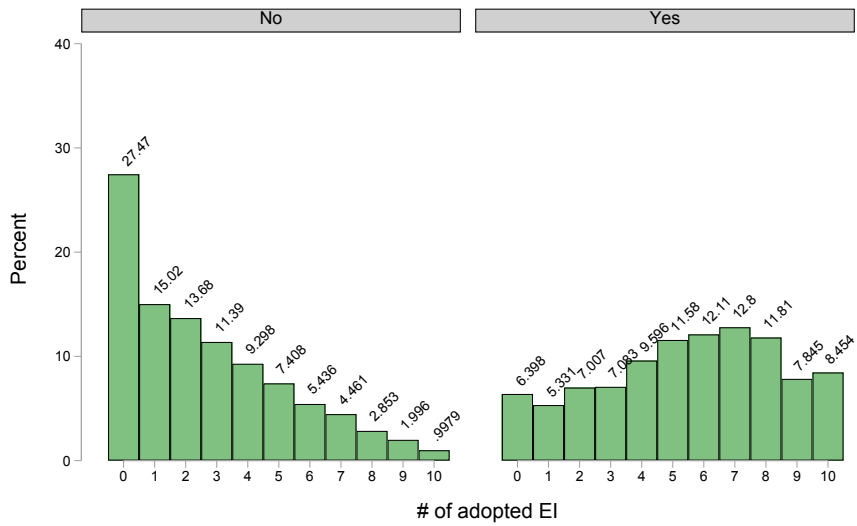


(a) Manufacturing sector

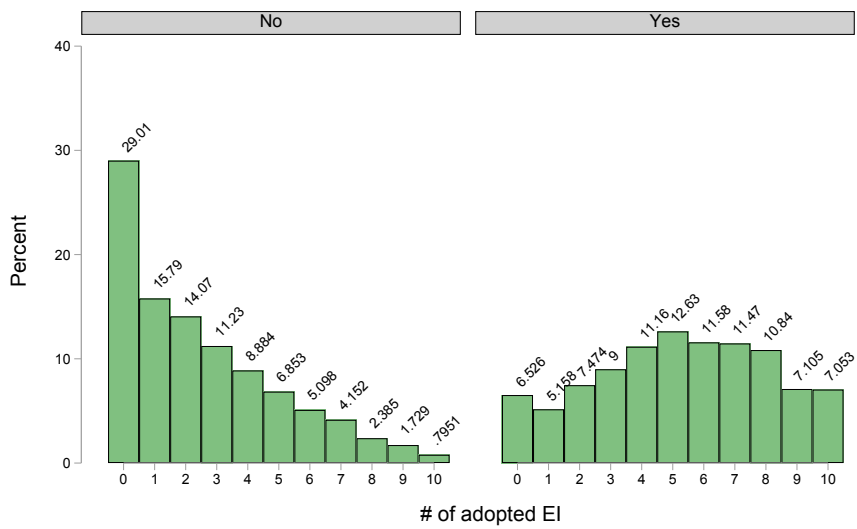


(b) Service sector

Figure A.1: Green strategy & green manager by FDI

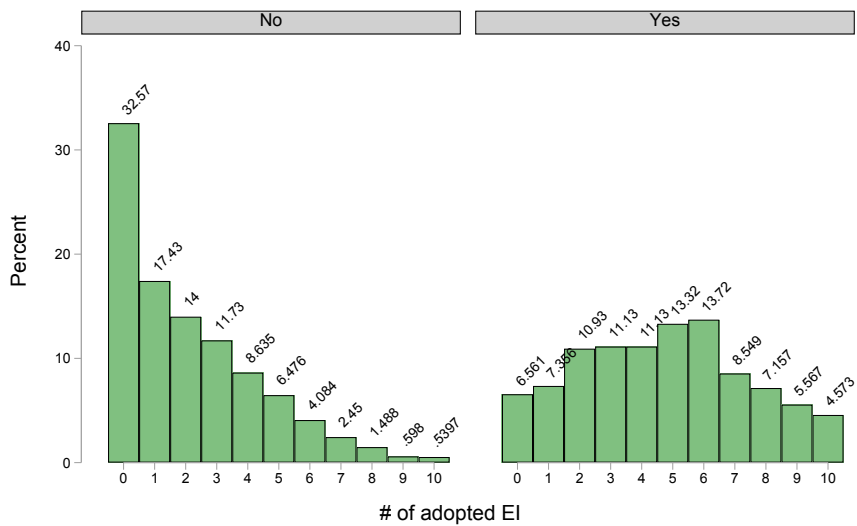


Graphs by Green Manager

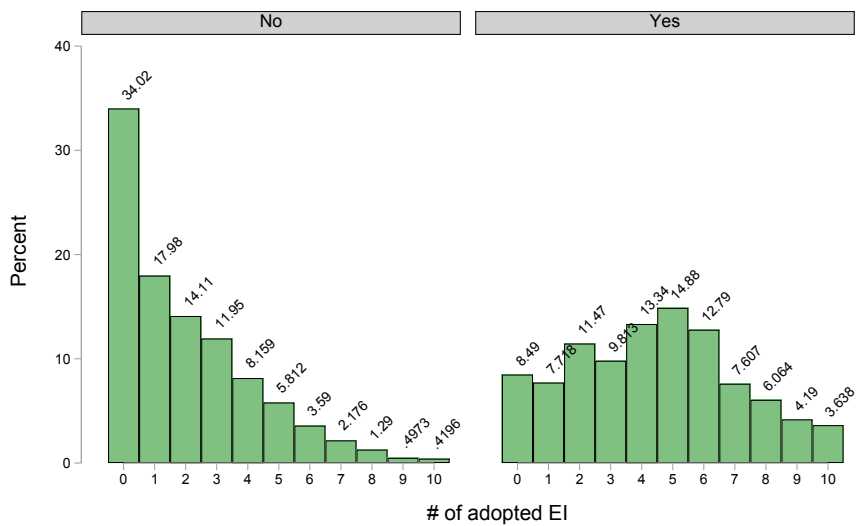


Graphs by Green Strategy

Figure A.2: Adoption of environmental innovation in manufacturing sector

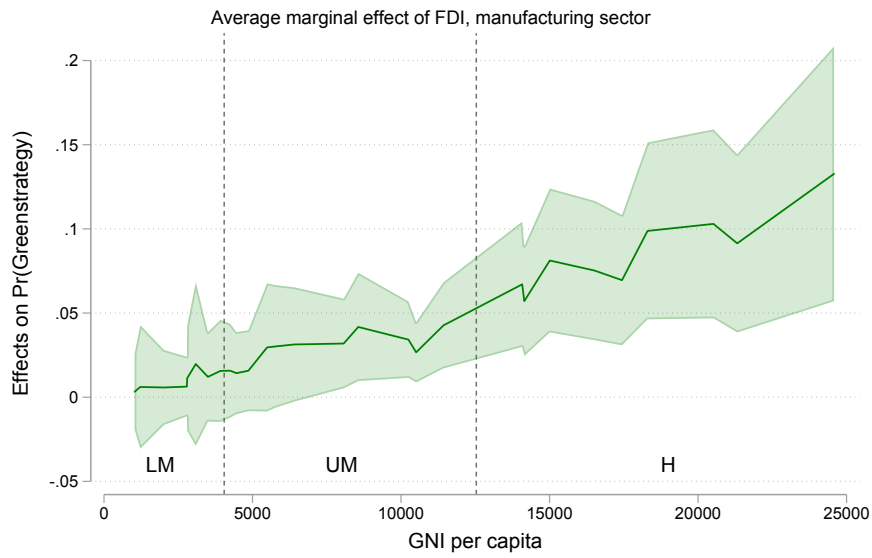


Graphs by Green Manager

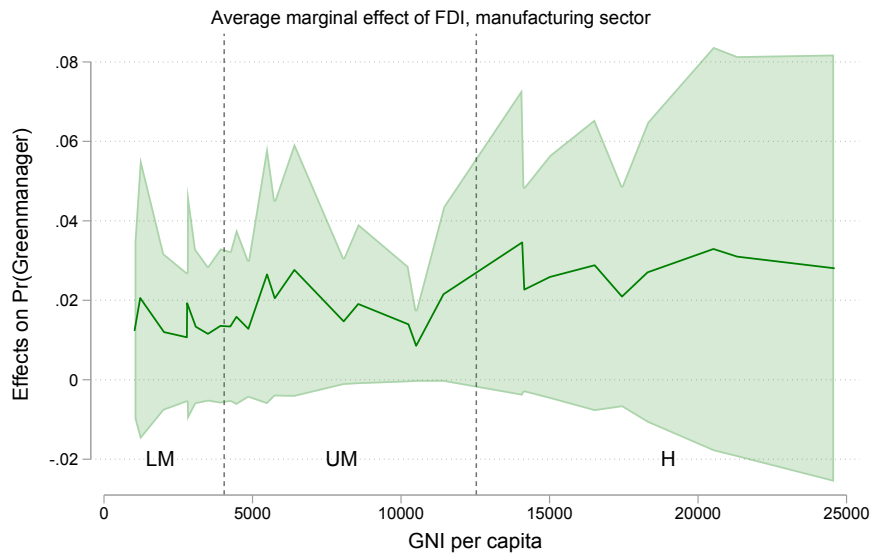


Graphs by Green Strategy

Figure A.3: Adoption of environmental innovation in service sector



(a) Green strategy



(b) Green manager

Figure A.4: Marginal effects of FDI by GNI per capita in manufacturing sector



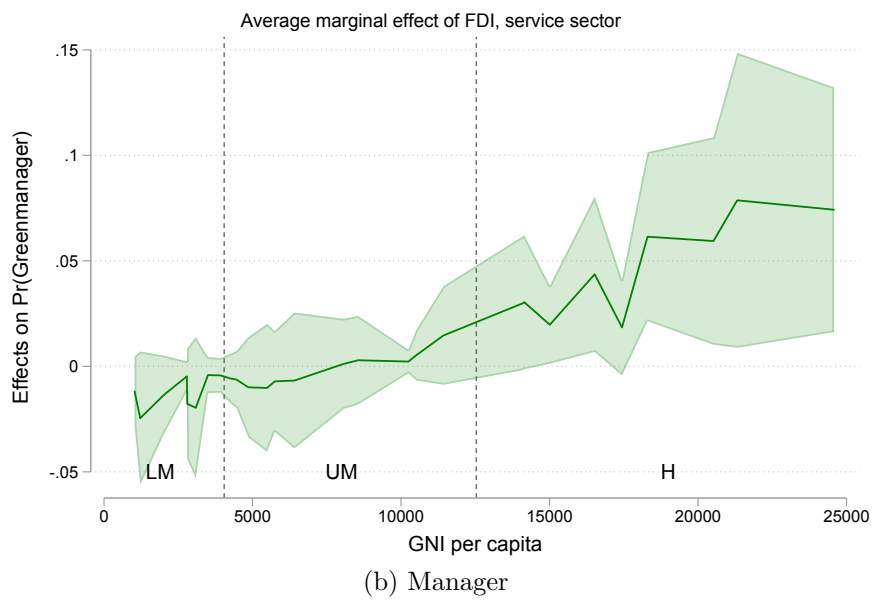
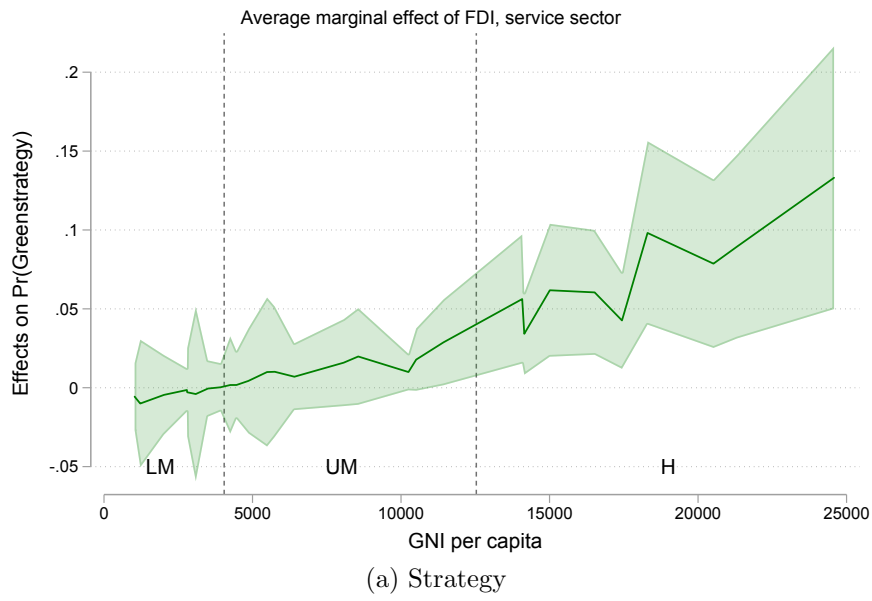
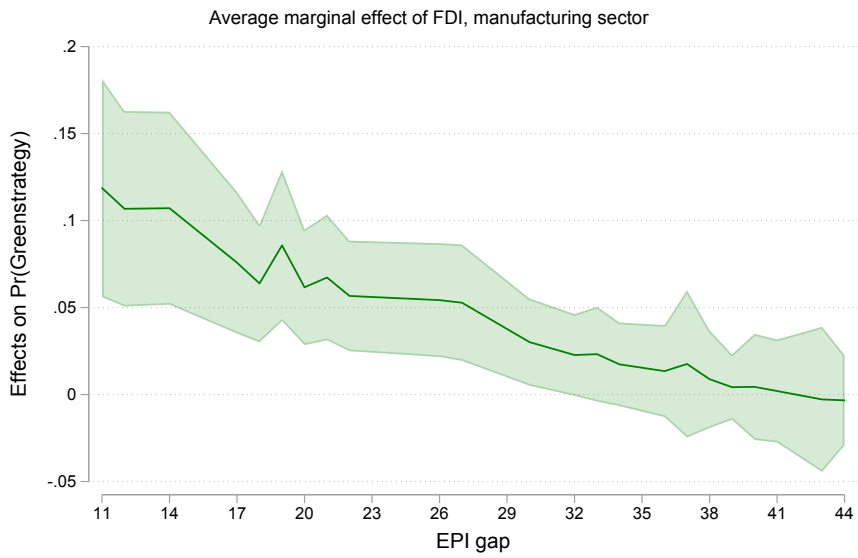
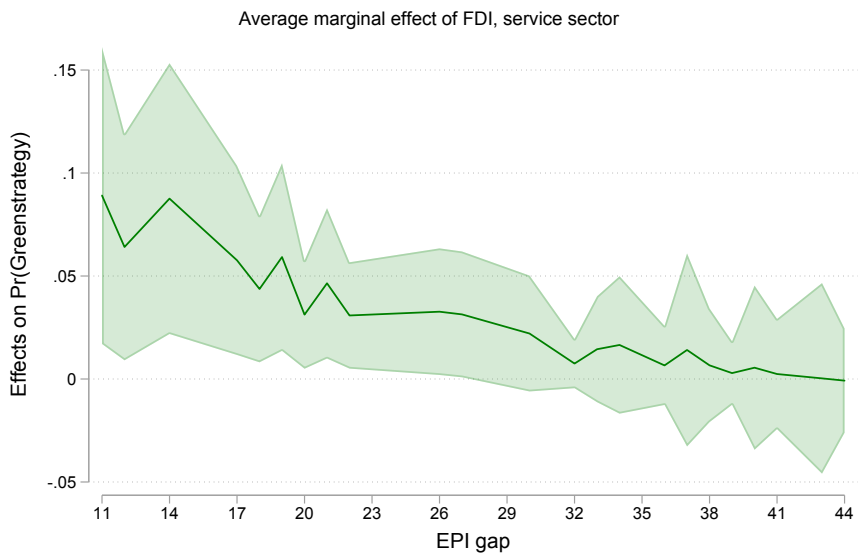


Figure A.5: Marginal effects of FDI by GNI per capita in service sector

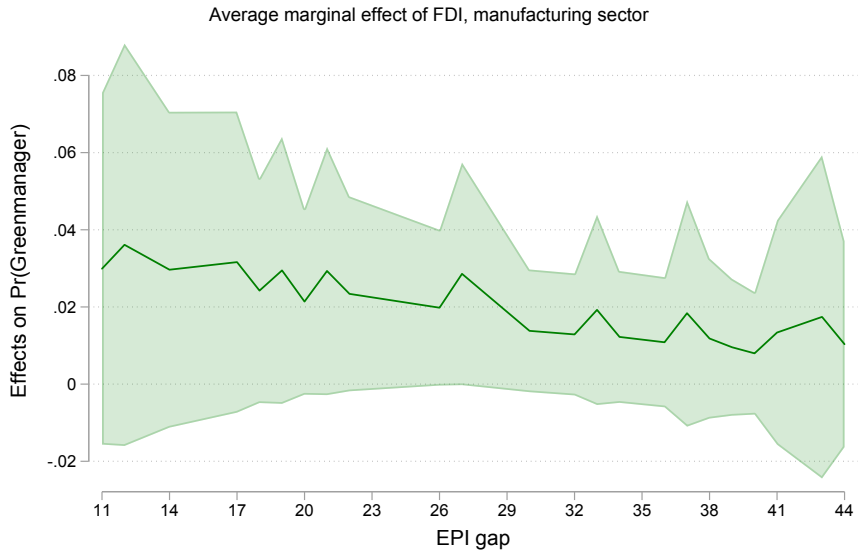


(a) Manufacturing

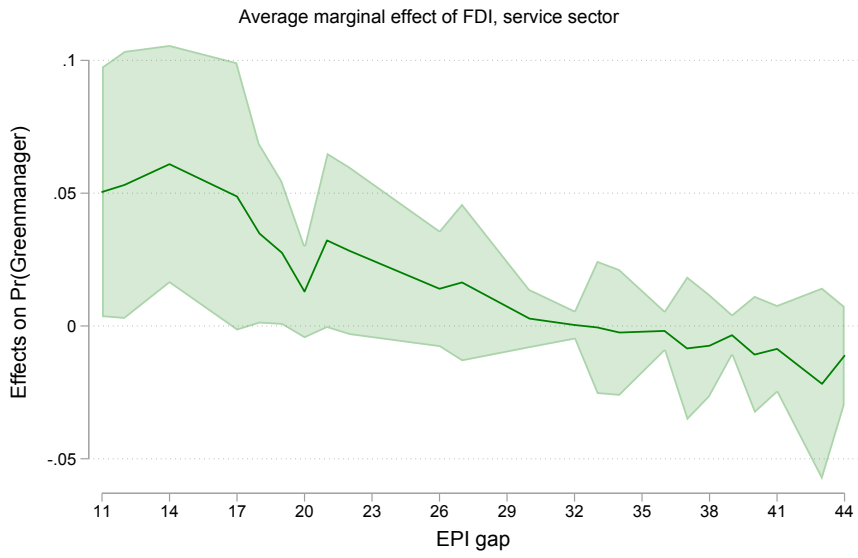


(b) Service

Figure A.6: Marginal effects of FDI on green strategy by environmental performance



(a) Manufacturing



(b) Service

Figure A.7: Marginal effects of FDI on green manager by environmental performance

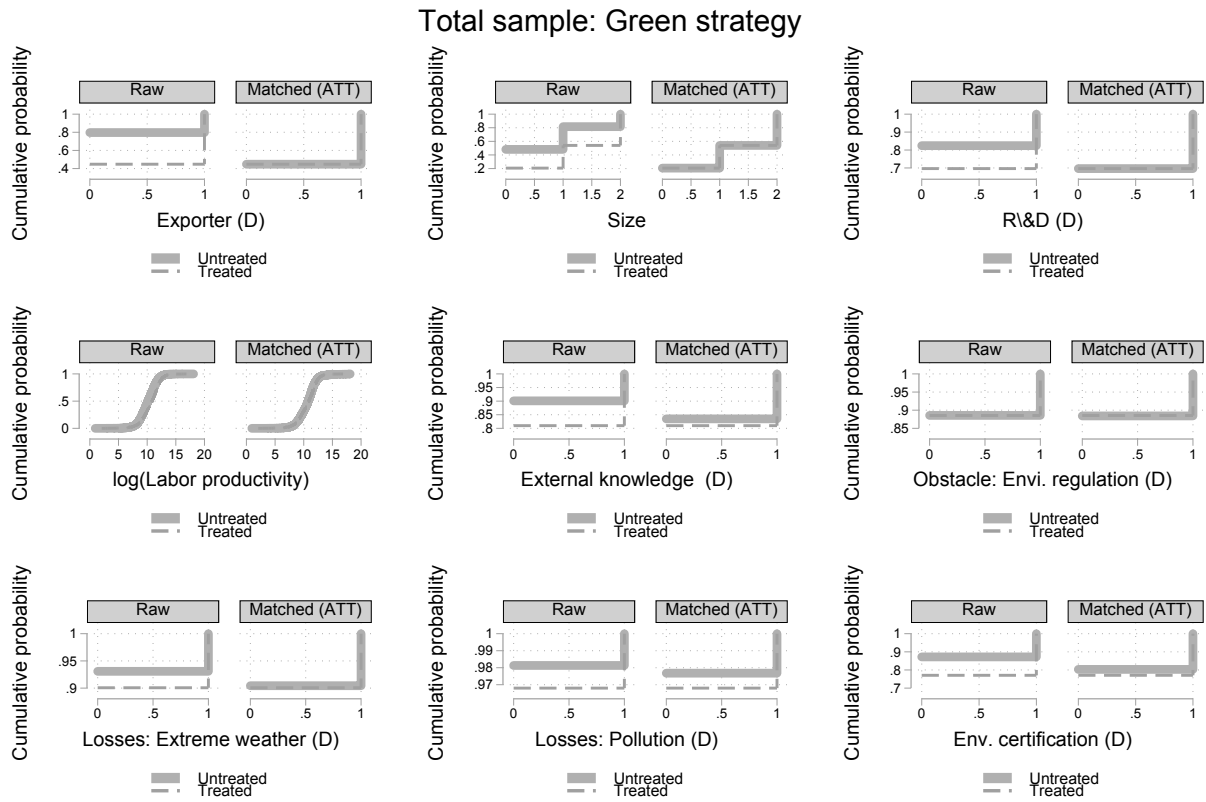


Figure A.8: Cumulative probability for green strategy in total sample

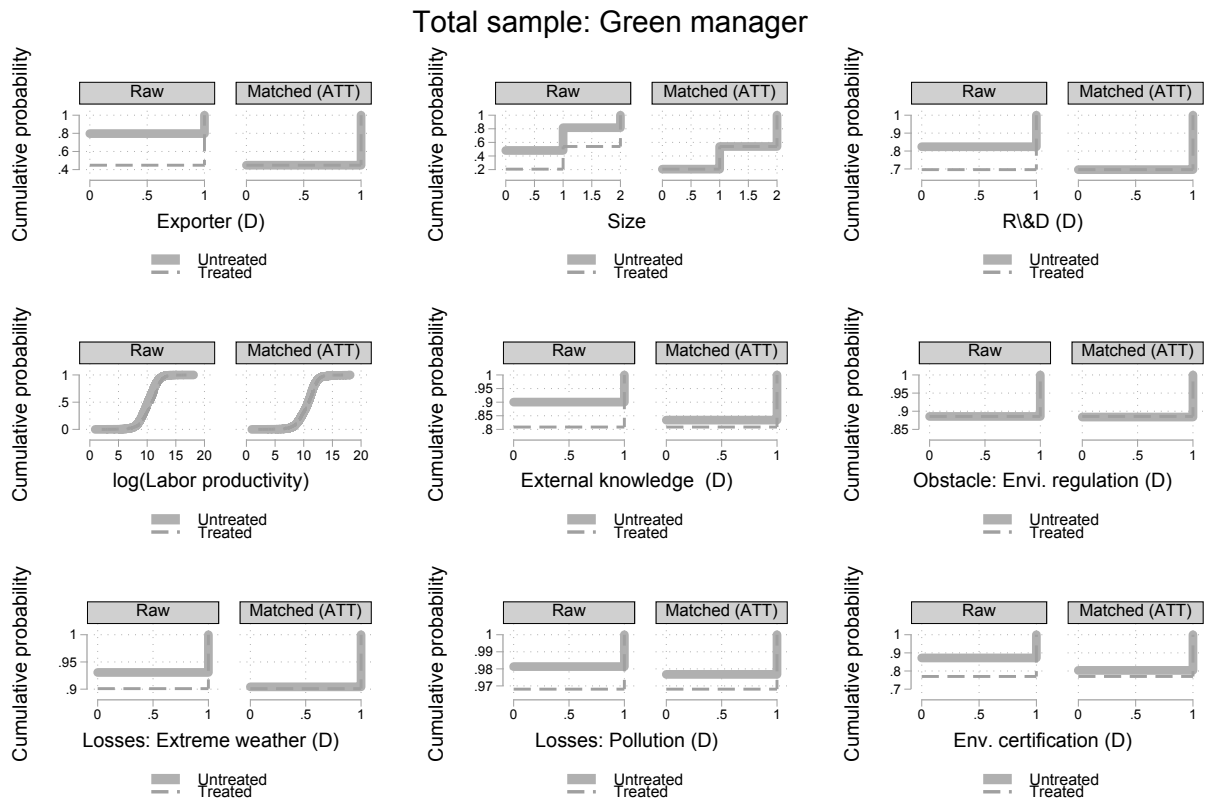


Figure A.9: Cumulative probability for green manager in total sample

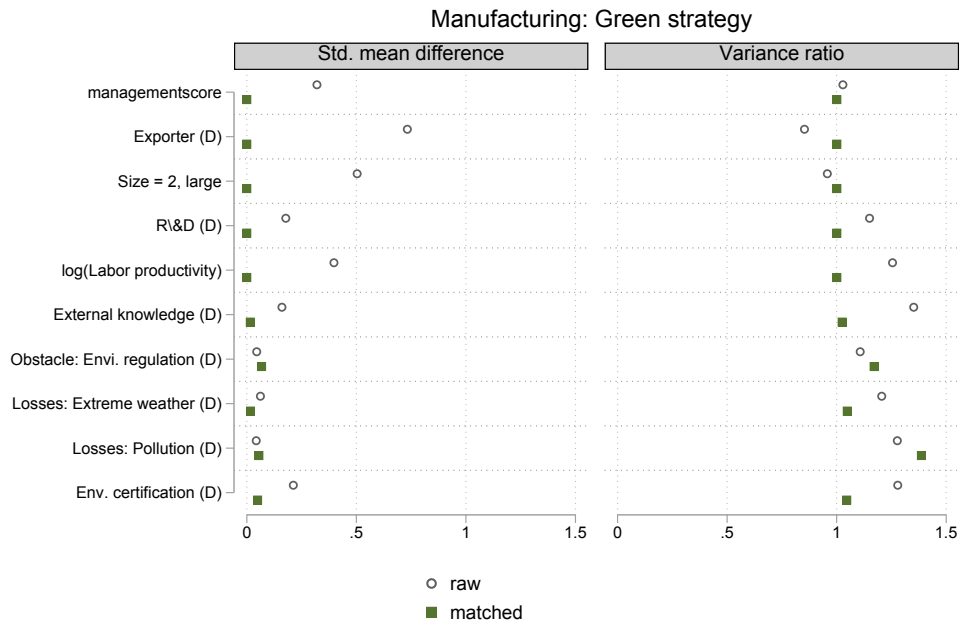


Figure A.10: Balance graph for green strategy in manufacturing sector

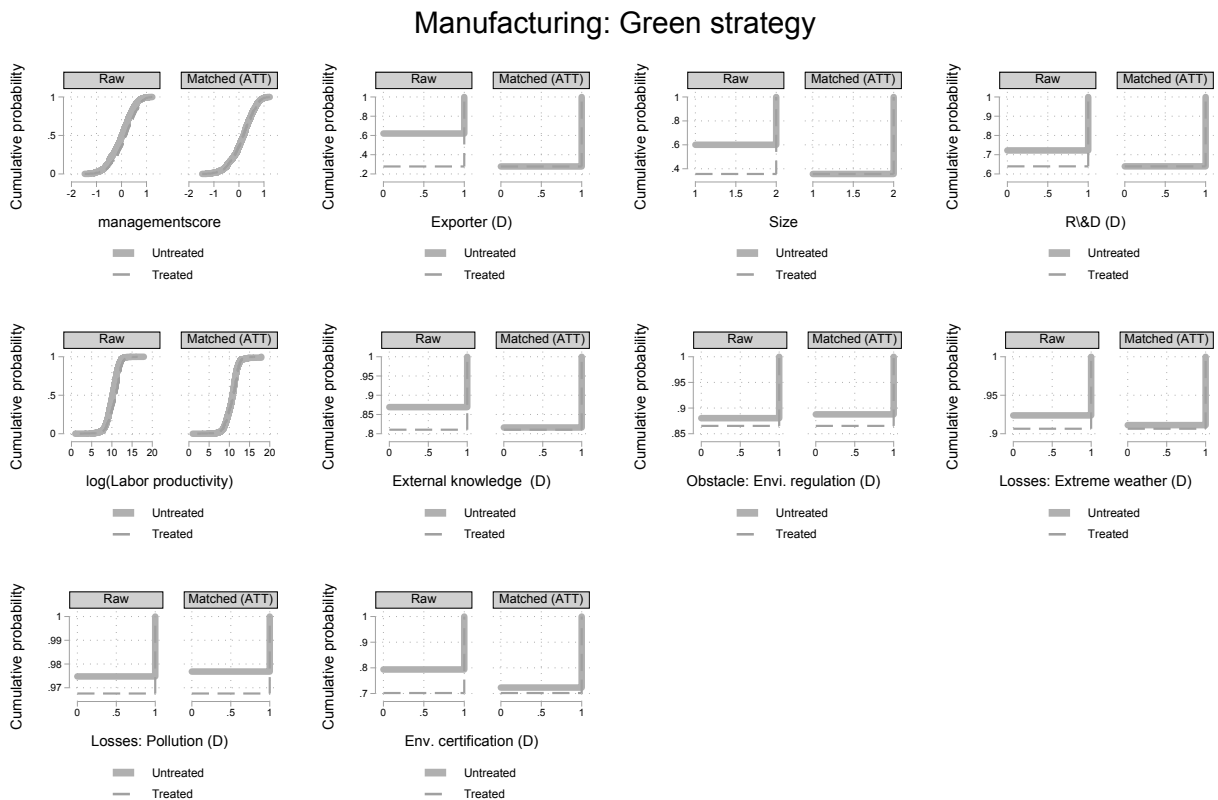


Figure A.11: Cumulative probability for green strategy in manufacturing sector

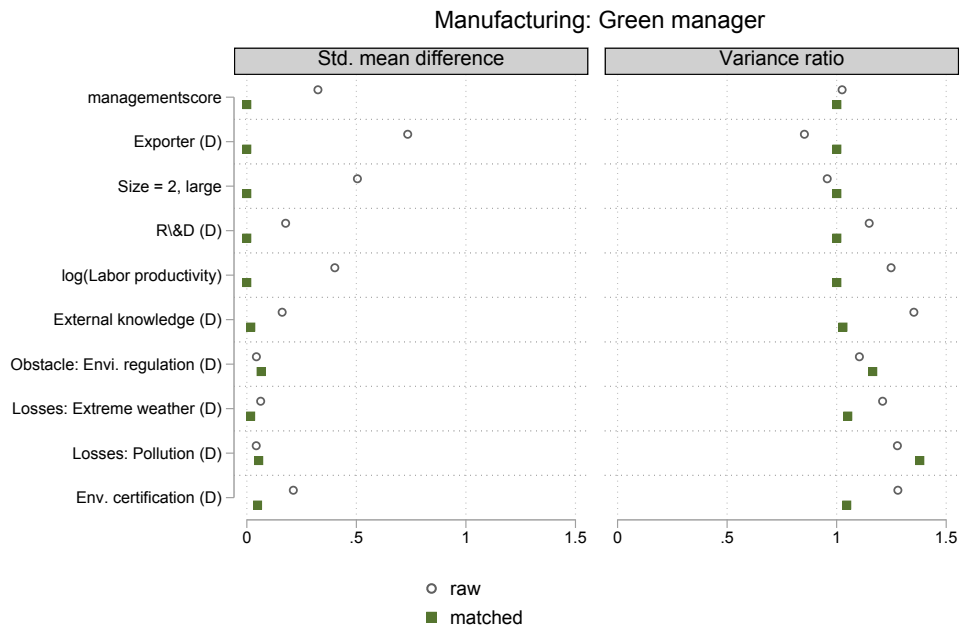


Figure A.12: Balance graph for green manager in manufacturing sector

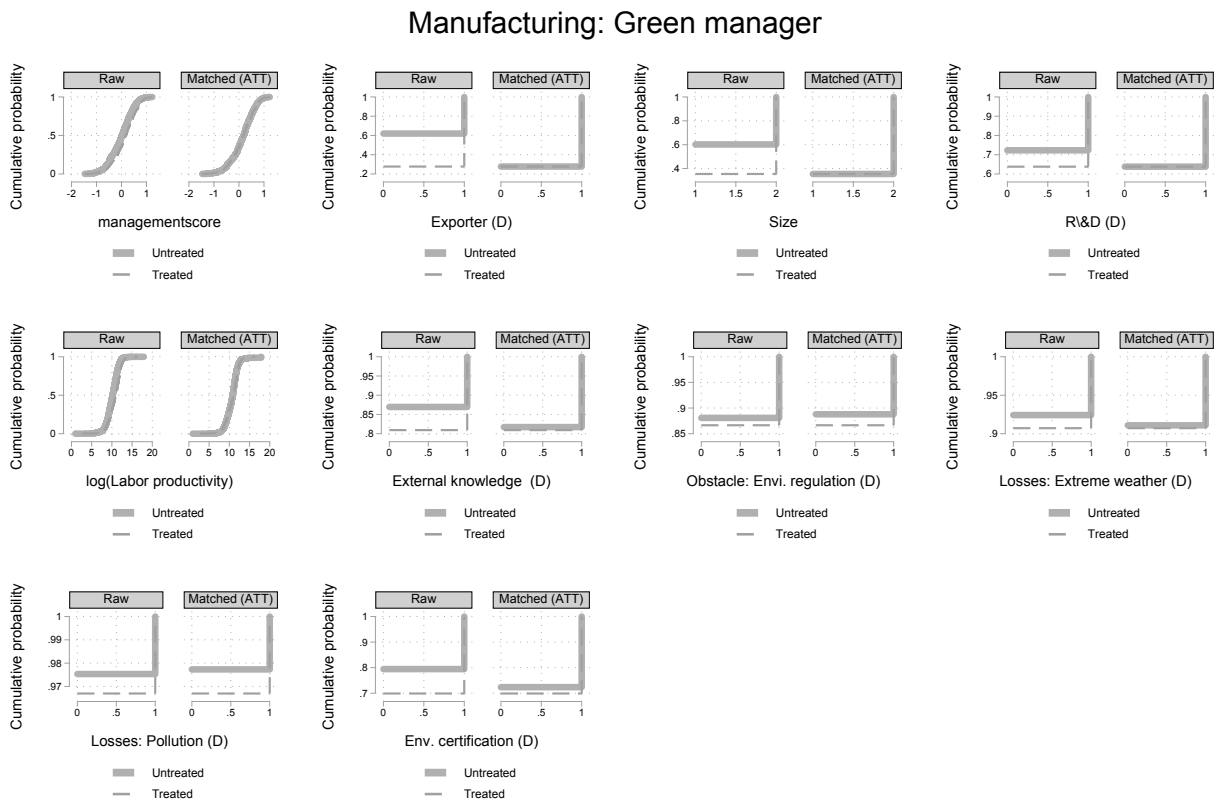


Figure A.13: Cumulative probability for green manager in manufacturing sector

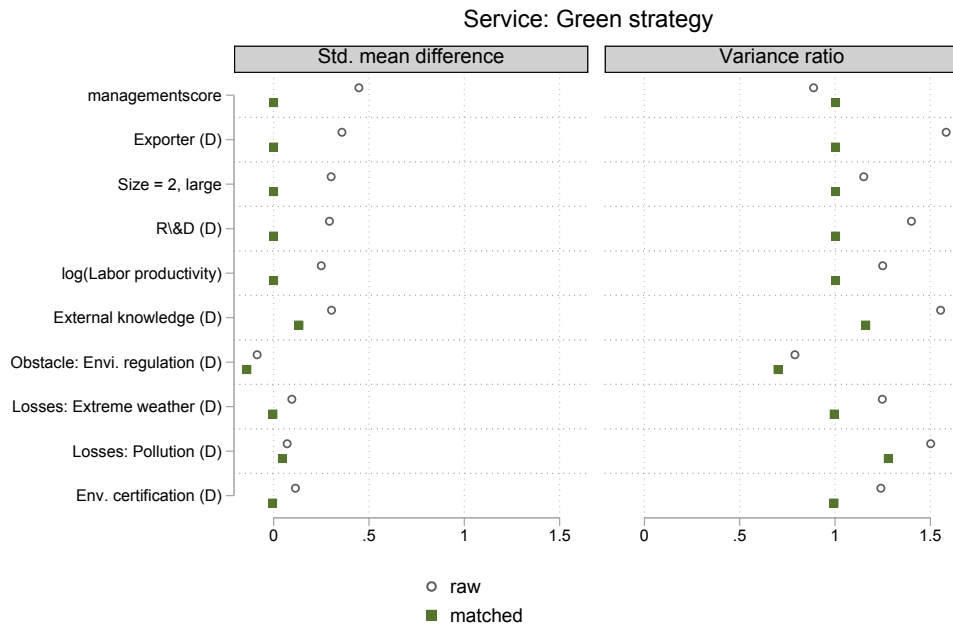


Figure A.14: Balance graph for green strategy in service sector

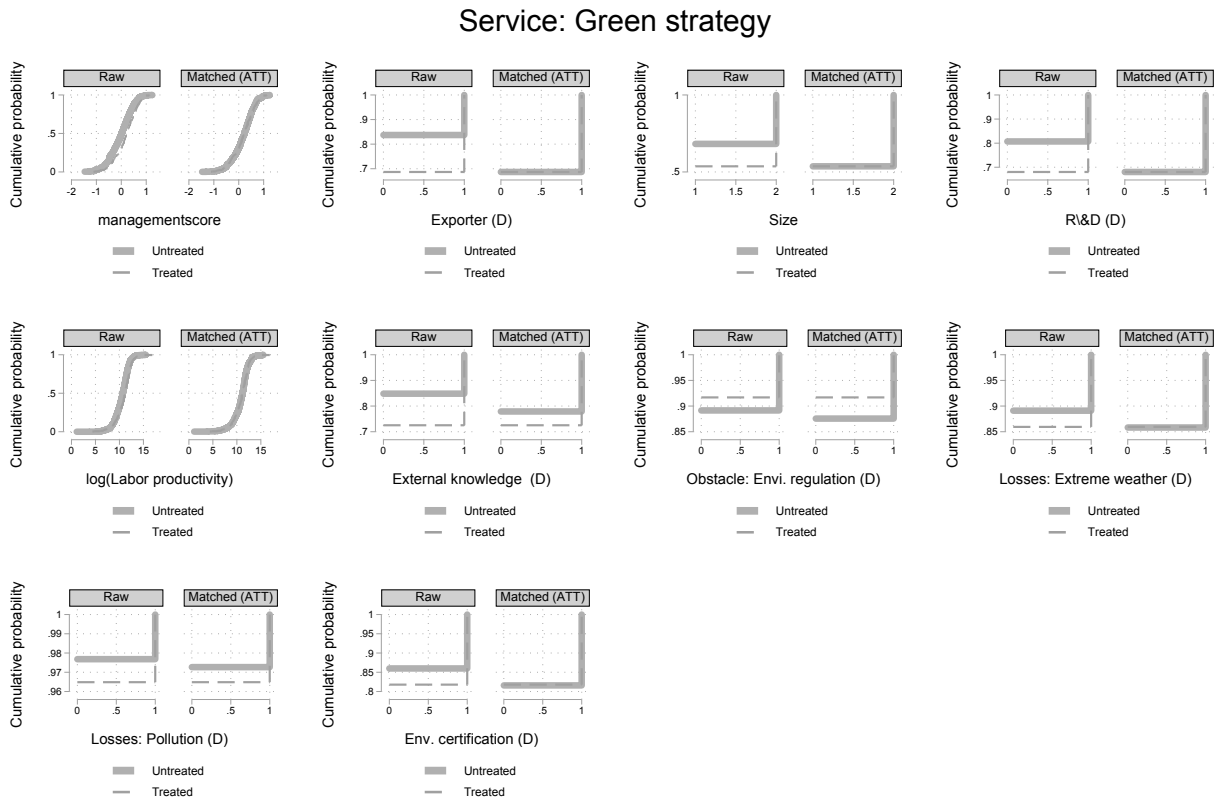


Figure A.15: Cumulative probability for green strategy in service sector



Figure A.16: Balance graph for green manager in service sector

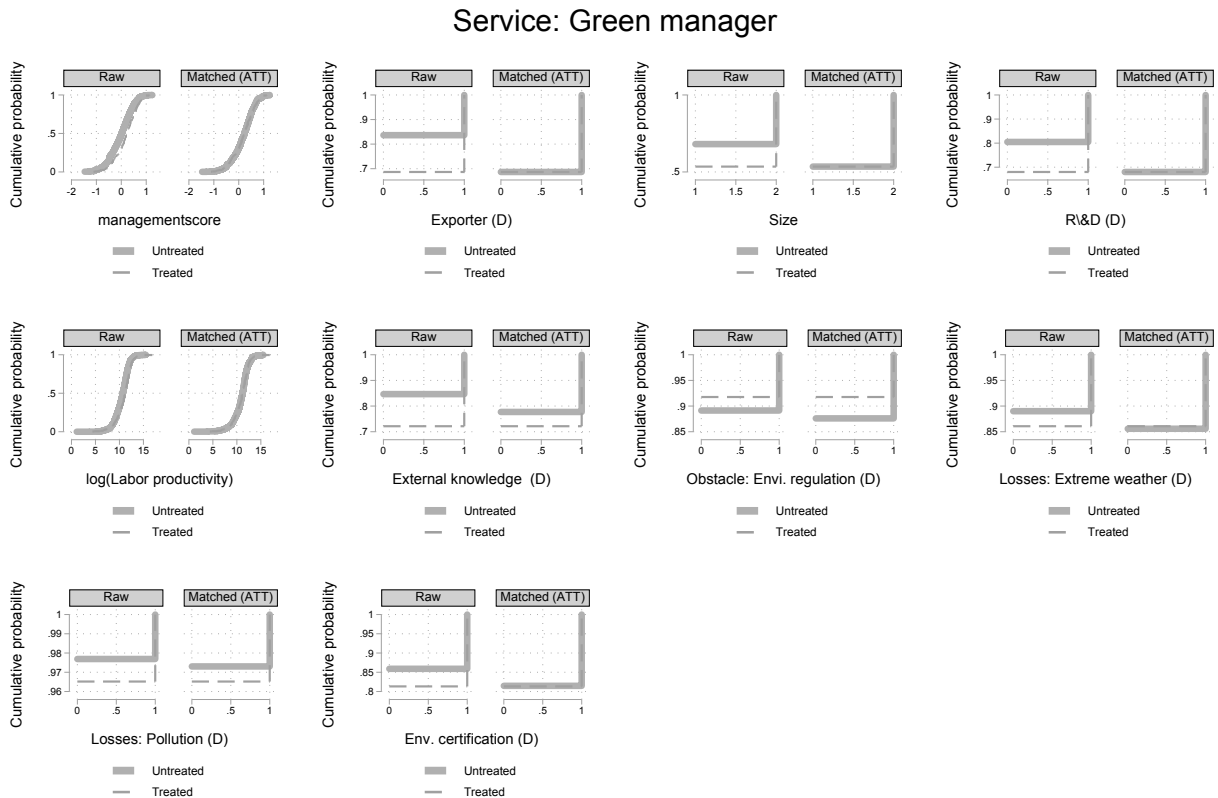


Figure A.17: Cumulative probability for green manager in service sector



## A.3 Additional empirical results

### A.3.1 Logistic regression results with control variables

Table A.4: Total sample, split by income group

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
FDI (D)	0.840 (0.116)	1.574*** (0.226)	1.596*** (0.184)	1.048 (0.157)	1.143 (0.201)	1.436** (0.212)
Exporter (D)	1.716*** (0.185)	1.493*** (0.149)	0.911 (0.115)	1.789*** (0.210)	1.683*** (0.211)	1.125 (0.144)
Size = 1, medium	1.820*** (0.201)	1.327*** (0.125)	1.778*** (0.221)	2.891*** (0.541)	1.861*** (0.254)	2.099*** (0.293)
Size = 2, large	2.689*** (0.336)	1.857*** (0.212)	3.274*** (0.375)	6.293*** (1.179)	3.722*** (0.533)	6.717*** (0.921)
R&D (D)	1.535*** (0.194)	1.860*** (0.176)	1.735*** (0.200)	1.238 (0.215)	1.594*** (0.191)	1.508*** (0.176)
log(Labor productivity)	1.018 (0.031)	1.079*** (0.027)	1.116** (0.051)	1.152*** (0.043)	1.054 (0.045)	1.137** (0.067)
External knowledge (D)	1.541*** (0.253)	1.263* (0.156)	1.447*** (0.198)	1.368 (0.264)	1.512*** (0.199)	1.250 (0.213)
Obstacle: Env. regulation (D)	1.291** (0.165)	1.012 (0.147)	1.224 (0.190)	0.846 (0.121)	1.277 (0.206)	1.084 (0.181)
Losses: Extreme weather (D)	1.565*** (0.258)	1.316* (0.192)	1.497*** (0.206)	1.484 (0.365)	1.229 (0.201)	1.318* (0.216)
Losses: Pollution (D)	2.758*** (0.645)	3.164*** (0.812)	3.559*** (1.025)	1.793* (0.607)	4.569*** (1.277)	2.553*** (0.892)
Env. certification (D)	5.313*** (0.553)	5.513*** (0.610)	3.943*** (0.443)	5.502*** (0.797)	6.924*** (0.798)	6.506*** (0.917)
Observations	6,839	6,586	3,988	6,838	6,604	3,996
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R <sup>2</sup>	0.220	0.207	0.189	0.253	0.286	0.299

*Notes:* Odds ratios. Robust standard errors (clustered at the country-sector level) in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A.5: Manufacturing sample, split by income group

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
FDI (D)	0.858 (0.141)	1.663*** (0.283)	1.557*** (0.231)	1.107 (0.180)	1.216 (0.268)	1.277 (0.233)
Exporter (D)	1.553*** (0.190)	1.570*** (0.188)	0.945 (0.170)	1.563*** (0.192)	1.789*** (0.254)	1.036 (0.164)
Size = 1, medium	2.087*** (0.295)	1.246* (0.150)	1.951*** (0.355)	3.940*** (1.056)	1.980*** (0.354)	2.654*** (0.527)
Size = 2, large	2.973*** (0.466)	1.804*** (0.246)	3.262*** (0.554)	9.099*** (2.341)	3.858*** (0.751)	7.858*** (1.581)
R&D (D)	1.723*** (0.255)	2.050*** (0.242)	1.960*** (0.252)	1.203 (0.232)	1.548*** (0.230)	1.533*** (0.211)
log(Labor productivity)	1.040 (0.042)	1.068** (0.034)	1.191*** (0.072)	1.241*** (0.056)	1.027 (0.050)	1.225** (0.100)
External knowledge (D)	1.592** (0.318)	1.277 (0.191)	1.210 (0.196)	1.310 (0.313)	1.720*** (0.264)	1.229 (0.248)
Obstacle: Env. regulation (D)	1.624*** (0.267)	1.152 (0.221)	1.414 (0.312)	0.920 (0.148)	1.316 (0.260)	1.048 (0.243)
Losses: Extreme weather (D)	1.137 (0.216)	1.080 (0.234)	1.347 (0.248)	1.280 (0.404)	1.644** (0.347)	1.127 (0.253)
Losses: Pollution (D)	3.015*** (0.871)	4.198*** (1.694)	2.930*** (1.199)	1.444 (0.549)	4.484*** (1.718)	1.606 (0.763)
Env. certification (D)	4.925*** (0.597)	5.225*** (0.663)	4.284*** (0.640)	4.833*** (0.775)	7.085*** (0.951)	6.810*** (1.284)
Observations	4,219	3,693	2,022	4,222	3,697	2,023
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R <sup>2</sup>	0.225	0.218	0.197	0.253	0.298	0.291

*Notes:* Odds ratios. Robust standard errors (clustered at the country-sector level) in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A.6: Service sample, split by income group

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
FDI (D)	0.692 (0.183)	1.317 (0.318)	1.652** (0.322)	0.612 (0.248)	0.980 (0.281)	1.797** (0.480)
Exporter (D)	2.325*** (0.547)	1.418* (0.277)	0.886 (0.176)	2.714*** (0.976)	1.585* (0.440)	1.164 (0.257)
Size = 1, medium	1.497** (0.258)	1.477*** (0.221)	1.564*** (0.265)	1.917*** (0.414)	1.680** (0.373)	1.495** (0.299)
Size = 2, large	2.472*** (0.529)	1.859*** (0.400)	3.296*** (0.532)	3.805*** (1.076)	3.680*** (0.745)	6.285*** (1.269)
R&D (D)	1.124 (0.290)	1.524** (0.250)	1.448 (0.373)	1.489 (0.544)	1.797*** (0.371)	1.427 (0.338)
log(Labor productivity)	0.987 (0.039)	1.072* (0.043)	1.027 (0.082)	0.957 (0.055)	1.093 (0.085)	1.024 (0.095)
External knowledge (D)	1.612 (0.479)	1.310 (0.273)	1.796** (0.429)	1.383 (0.461)	1.158 (0.295)	1.342 (0.418)
Obstacle: Env. regulation (D)	0.739 (0.140)	0.784 (0.165)	1.047 (0.230)	0.796 (0.228)	1.300 (0.360)	1.118 (0.256)
Losses: Extreme weather (D)	2.846*** (0.634)	1.633*** (0.299)	1.643** (0.328)	1.908* (0.683)	0.767 (0.196)	1.655** (0.422)
Losses: Pollution (D)	2.364** (0.845)	2.160** (0.796)	3.967*** (1.501)	2.510 (1.463)	4.357*** (2.033)	3.698*** (1.578)
Env. certification (D)	6.317*** (1.363)	6.266*** (1.246)	3.673*** (0.677)	7.385*** (2.285)	7.149*** (1.586)	6.798*** (1.455)
Observations	2,620	2,893	1,966	2,616	2,907	1,973
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R <sup>2</sup>	0.206	0.175	0.150	0.248	0.262	0.254

*Notes:* Odds ratios. Robust standard errors (clustered at the country-sector level) in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A.7: Gap to environmental leader

	(1)	(2)	(3)	(4)	(5)	(6)
	Total sample	Manufact. sample	Service sample	Total sample	Manufact. sample	Service sample
	Green strategy			Green manager		
FDI (D)	2.150*** (0.412)	2.332*** (0.565)	2.066** (0.627)	1.709** (0.401)	1.325 (0.375)	2.892** (1.229)
EPIgap	0.939 (0.053)	1.004 (0.071)	0.948 (0.068)	1.057 (0.079)	1.170* (0.099)	0.994 (0.093)
FDI#EPIgap	0.983*** (0.006)	0.980** (0.008)	0.983 (0.010)	0.988 (0.008)	0.997 (0.010)	0.968** (0.014)
Exporter (D)	1.314*** (0.087)	1.374*** (0.111)	1.219 (0.151)	1.521*** (0.106)	1.468*** (0.118)	1.523*** (0.243)
Size = 1, medium	1.584*** (0.101)	1.654*** (0.145)	1.495*** (0.141)	2.181*** (0.198)	2.578*** (0.328)	1.632*** (0.203)
Size = 2, large	2.458*** (0.173)	2.476*** (0.229)	2.419*** (0.281)	5.206*** (0.481)	6.023*** (0.775)	4.265*** (0.566)
R&D (D)	1.702*** (0.109)	1.922*** (0.146)	1.339** (0.170)	1.430*** (0.114)	1.406*** (0.135)	1.540*** (0.228)
log(Labor productivity)	1.061*** (0.020)	1.070*** (0.027)	1.035 (0.028)	1.124*** (0.029)	1.168*** (0.037)	1.044 (0.046)
External knowledge (D)	1.413*** (0.113)	1.339*** (0.133)	1.595*** (0.218)	1.384*** (0.127)	1.432*** (0.160)	1.334* (0.227)
Obstacle: Env. regulation (D)	1.158* (0.094)	1.370*** (0.142)	0.826 (0.102)	1.018 (0.096)	1.004 (0.117)	1.032 (0.161)
Losses: Extreme weather (D)	1.419*** (0.121)	1.171 (0.134)	1.839*** (0.216)	1.331*** (0.140)	1.367** (0.198)	1.262 (0.195)
Losses: Pollution (D)	3.139*** (0.463)	3.419*** (0.704)	2.820*** (0.601)	2.706*** (0.500)	2.246*** (0.521)	3.705*** (1.022)
Env. certification (D)	4.972*** (0.316)	4.892*** (0.370)	5.228*** (0.605)	6.267*** (0.486)	6.152*** (0.572)	6.710*** (0.920)
Observations	17,415	9,936	7,479	17,441	9,945	7,496
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R <sup>2</sup>	0.211	0.224	0.177	0.280	0.284	0.248

Notes: Odds ratios. Robust standard errors (clustered at the country-sector level) in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A.8: Controlling for general management score

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total sample				Manufacturing sample				Service sample			
	Green strategy		Green manager		Green strategy		Green manager		Green strategy		Green manager	
FDI (D)	1.231**	1.294***	1.193*	1.241**	1.302**	1.360***	1.212*	1.258**	1.038	1.106	1.103	1.152
	(0.106)	(0.112)	(0.110)	(0.116)	(0.134)	(0.141)	(0.131)	(0.137)	(0.157)	(0.168)	(0.202)	(0.217)
managementscore	2.107***		1.906***		2.134***		1.854***		2.045***		2.049***	
	(0.177)		(0.182)		(0.213)		(0.218)		(0.317)		(0.356)	
Exporter (D)	1.241***	1.316***	1.426***	1.501***	1.266***	1.371***	1.447***	1.539***	1.261	1.273	1.379	1.402*
	(0.095)	(0.100)	(0.112)	(0.118)	(0.108)	(0.116)	(0.128)	(0.135)	(0.219)	(0.221)	(0.277)	(0.283)
Size = 2, large	1.419***	1.531***	2.238***	2.383***	1.344***	1.441***	2.178***	2.304***	1.545***	1.686***	2.389***	2.593***
	(0.101)	(0.107)	(0.175)	(0.182)	(0.119)	(0.127)	(0.206)	(0.214)	(0.182)	(0.187)	(0.326)	(0.348)
R&D (D)	1.437***	1.579***	1.300***	1.407***	1.597***	1.743***	1.258**	1.354***	1.130	1.258	1.490**	1.654**
	(0.112)	(0.121)	(0.118)	(0.125)	(0.143)	(0.153)	(0.133)	(0.139)	(0.192)	(0.218)	(0.290)	(0.324)
log(Labor productivity)	1.025	1.053**	1.115***	1.143***	1.031	1.057*	1.148***	1.173***	0.992	1.026	1.030	1.061
	(0.024)	(0.024)	(0.034)	(0.034)	(0.029)	(0.030)	(0.041)	(0.041)	(0.042)	(0.042)	(0.057)	(0.058)
External knowledge (D)	1.295***	1.388***	1.197*	1.275**	1.362***	1.462***	1.346**	1.428***	1.292	1.373*	0.929	0.992
	(0.122)	(0.128)	(0.126)	(0.134)	(0.146)	(0.152)	(0.163)	(0.173)	(0.242)	(0.255)	(0.201)	(0.217)
Obstacle: Env. regulation (D)	1.150	1.112	1.018	0.987	1.306**	1.266**	0.981	0.956	0.801	0.772	1.134	1.083
	(0.113)	(0.109)	(0.117)	(0.112)	(0.153)	(0.150)	(0.136)	(0.131)	(0.143)	(0.137)	(0.210)	(0.204)
Losses: Extreme weather (D)	1.497***	1.483***	1.364**	1.348**	1.171	1.151	1.319*	1.296	2.170***	2.164***	1.376*	1.358
	(0.158)	(0.156)	(0.168)	(0.166)	(0.154)	(0.148)	(0.217)	(0.212)	(0.360)	(0.358)	(0.256)	(0.256)
Losses: Pollution (D)	3.189***	3.112***	2.340***	2.270***	3.274***	3.235***	2.001***	1.963***	3.342***	3.167***	3.679***	3.459***
	(0.572)	(0.555)	(0.459)	(0.454)	(0.765)	(0.757)	(0.471)	(0.472)	(0.929)	(0.868)	(1.221)	(1.139)
Env. certification (D)	4.505***	4.856***	5.558***	5.921***	4.281***	4.623***	5.496***	5.845***	5.289***	5.705***	5.833***	6.257***
	(0.338)	(0.354)	(0.476)	(0.497)	(0.373)	(0.389)	(0.578)	(0.596)	(0.728)	(0.782)	(0.858)	(0.934)
Observations	8,293	8,293	8,316	8,316	5,401	5,401	5,413	5,413	2,892	2,892	2,903	2,903
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R <sup>2</sup>	0.208	0.197	0.248	0.241	0.206	0.195	0.242	0.236	0.213	0.203	0.248	0.239
P-value for model test	0	0	0	0	0	0	0	0	0	0	0	0
Log Pseudol.	-3618	-3667	-2908	-2936	-2499	-2533	-2091	-2109	-1088	-1102	-794.9	-803.9

Notes: Odds ratios. Robust standard errors (clustered at the country-sector level) in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### A.3.2 Logistic regression results with marginal effects

Table A.9: Baseline: Marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Total sample		Manufact. sample		Service sample	
	Green strategy	Green manager	Green strategy	Green manager	Green strategy	Green manager
FDI (D)	0.032*** (0.009)	0.015** (0.006)	0.035*** (0.012)	0.017* (0.009)	0.025* (0.013)	0.010 (0.009)
Exporter (D)	0.030*** (0.007)	0.030*** (0.005)	0.038*** (0.010)	0.033*** (0.007)	0.018 (0.012)	0.023** (0.009)
Size = 1, medium	0.046*** (0.006)	0.045*** (0.005)	0.056*** (0.010)	0.063*** (0.008)	0.035*** (0.008)	0.022*** (0.006)
Size = 2, large	0.102*** (0.009)	0.127*** (0.007)	0.111*** (0.012)	0.155*** (0.011)	0.089*** (0.013)	0.091*** (0.010)
R&D (D)	0.061*** (0.008)	0.026*** (0.006)	0.084*** (0.011)	0.029*** (0.009)	0.027** (0.013)	0.023*** (0.009)
log(Labor productivity)	0.006*** (0.002)	0.008*** (0.002)	0.008*** (0.003)	0.013*** (0.003)	0.003 (0.002)	0.002 (0.002)
External knowledge (D)	0.039*** (0.010)	0.024*** (0.007)	0.036*** (0.013)	0.032*** (0.011)	0.046*** (0.015)	0.015 (0.010)
Obstacle: Env. regulation (D)	0.016* (0.009)	0.001 (0.007)	0.038*** (0.013)	0.000 (0.010)	-0.016 (0.010)	0.002 (0.008)
Losses: Extreme weather (D)	0.040*** (0.010)	0.021** (0.008)	0.019 (0.014)	0.028** (0.014)	0.062*** (0.014)	0.012 (0.009)
Losses: Pollution (D)	0.156*** (0.025)	0.088*** (0.020)	0.182*** (0.036)	0.080*** (0.027)	0.123*** (0.032)	0.096*** (0.028)
Env. certification (D)	0.235*** (0.011)	0.187*** (0.010)	0.248*** (0.013)	0.210*** (0.014)	0.220*** (0.020)	0.157*** (0.016)
Observations	17,415	17,441	9,936	9,945	7,479	7,496
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* Robust standard errors (clustered at the country-sector level) in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Table A.10: Total sample, split by income group: Marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
FDI (D)	-0.014 (0.011)	0.052*** (0.018)	0.071*** (0.019)	0.003 (0.009)	0.009 (0.012)	0.035** (0.015)
Exporter (D)	0.050*** (0.011)	0.045*** (0.012)	-0.013 (0.018)	0.037*** (0.008)	0.036*** (0.009)	0.011 (0.012)
Size = 1, medium	0.046*** (0.009)	0.028*** (0.009)	0.079*** (0.018)	0.048*** (0.008)	0.034*** (0.007)	0.060*** (0.011)
Size = 2, large	0.087*** (0.012)	0.067*** (0.013)	0.186*** (0.020)	0.113*** (0.012)	0.090*** (0.010)	0.212*** (0.016)
R&D (D)	0.039*** (0.013)	0.071*** (0.012)	0.085*** (0.019)	0.013 (0.011)	0.032*** (0.009)	0.040*** (0.012)
log(Labor productivity)	0.001 (0.003)	0.008*** (0.003)	0.015** (0.006)	0.008*** (0.002)	0.003 (0.003)	0.012** (0.005)
External knowledge (D)	0.040** (0.017)	0.025* (0.014)	0.055** (0.021)	0.020 (0.013)	0.029*** (0.010)	0.021 (0.017)
Obstacle: Env. regulation (D)	0.023* (0.012)	0.001 (0.015)	0.029 (0.023)	-0.009 (0.008)	0.016 (0.012)	0.008 (0.016)
Losses: Extreme weather (D)	0.042** (0.017)	0.030* (0.017)	0.061*** (0.022)	0.025 (0.017)	0.014 (0.011)	0.027 (0.017)
Losses: Pollution (D)	0.111*** (0.032)	0.157*** (0.043)	0.219*** (0.057)	0.040 (0.027)	0.143*** (0.034)	0.104** (0.046)
Env. certification (D)	0.204*** (0.016)	0.257*** (0.020)	0.243*** (0.022)	0.146*** (0.017)	0.189*** (0.015)	0.244*** (0.021)
Observations	6,839	6,586	3,988	6,838	6,604	3,996
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* Robust standard errors (clustered at the country-sector level) in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A.11: Manufacturing sample, split by income group: Marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
FDI (D)	-0.014 (0.014)	0.066*** (0.025)	0.074*** (0.026)	0.007 (0.012)	0.015 (0.018)	0.030 (0.023)
Exporter (D)	0.044*** (0.013)	0.056*** (0.015)	-0.009 (0.029)	0.033*** (0.010)	0.046*** (0.012)	0.004 (0.019)
Size = 1, medium	0.063*** (0.012)	0.025* (0.014)	0.103*** (0.028)	0.068*** (0.011)	0.043*** (0.011)	0.099*** (0.019)
Size = 2, large	0.103*** (0.017)	0.072*** (0.017)	0.198*** (0.030)	0.151*** (0.016)	0.103*** (0.015)	0.271*** (0.025)
R&D (D)	0.057*** (0.017)	0.093*** (0.017)	0.115*** (0.023)	0.013 (0.014)	0.034*** (0.012)	0.052*** (0.018)
log(Labor productivity)	0.004 (0.004)	0.008** (0.004)	0.028*** (0.009)	0.015*** (0.003)	0.002 (0.004)	0.024** (0.009)
External knowledge (D)	0.049** (0.023)	0.030 (0.019)	0.031 (0.027)	0.020 (0.019)	0.044*** (0.014)	0.025 (0.025)
Obstacle: Env. regulation (D)	0.050*** (0.019)	0.017 (0.024)	0.057 (0.037)	-0.006 (0.011)	0.021 (0.016)	0.006 (0.028)
Losses: Extreme weather (D)	0.012 (0.019)	0.009 (0.026)	0.049 (0.032)	0.018 (0.025)	0.041** (0.019)	0.014 (0.027)
Losses: Pollution (D)	0.135*** (0.044)	0.223*** (0.075)	0.193** (0.080)	0.028 (0.032)	0.157*** (0.051)	0.060 (0.065)
Env. certification (D)	0.207*** (0.019)	0.266*** (0.023)	0.280*** (0.030)	0.152*** (0.021)	0.210*** (0.018)	0.302*** (0.031)
Observations	4,219	3,693	2,022	4,222	3,697	2,023
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* Robust standard errors (clustered at the country-sector level) in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



Table A.12: Service sample, split by income group: Marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)
	LM	UM	H	LM	UM	H
	Green strategy			Green manager		
FDI (D)	-0.022 (0.014)	0.025 (0.024)	0.068** (0.029)	-0.016 (0.011)	-0.001 (0.014)	0.043* (0.022)
Exporter (D)	0.069*** (0.023)	0.032* (0.019)	-0.015 (0.023)	0.050** (0.023)	0.025 (0.017)	0.010 (0.015)
Size = 1, medium	0.025** (0.011)	0.032*** (0.012)	0.053** (0.021)	0.021*** (0.008)	0.022** (0.010)	0.022** (0.011)
Size = 2, large	0.067*** (0.019)	0.056*** (0.021)	0.173*** (0.027)	0.058*** (0.015)	0.075*** (0.013)	0.164*** (0.021)
R&D (D)	0.008 (0.018)	0.039** (0.016)	0.049 (0.037)	0.016 (0.016)	0.033** (0.013)	0.024 (0.018)
log(Labor productivity)	-0.001 (0.003)	0.006* (0.003)	0.003 (0.010)	-0.002 (0.002)	0.004 (0.004)	0.001 (0.006)
External knowledge (D)	0.035 (0.025)	0.024 (0.020)	0.079** (0.036)	0.013 (0.015)	0.008 (0.013)	0.020 (0.022)
Obstacle: Env. regulation (D)	-0.018* (0.010)	-0.020 (0.016)	0.006 (0.027)	-0.008 (0.009)	0.014 (0.016)	0.007 (0.015)
Losses: Extreme weather (D)	0.091*** (0.025)	0.047** (0.020)	0.067** (0.030)	0.029 (0.019)	-0.012 (0.011)	0.036* (0.020)
Losses: Pollution (D)	0.073* (0.038)	0.082* (0.048)	0.226*** (0.075)	0.046 (0.038)	0.114** (0.050)	0.119** (0.052)
Env. certification (D)	0.199*** (0.032)	0.251*** (0.035)	0.206*** (0.033)	0.131*** (0.027)	0.165*** (0.026)	0.192*** (0.028)
Observations	2,620	2,893	1,966	2,616	2,907	1,973
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* Robust standard errors (clustered at the country-sector level) in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A.13: Controlling for general management: Marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Total sample				Manufacturing sample				Service sample			
	Green strategy		Green manager		Green strategy		Green manager		Green strategy		Green manager	
FDI (D)	0.030** (0.013)	0.038*** (0.013)	0.019* (0.010)	0.024** (0.011)	0.041** (0.016)	0.048*** (0.017)	0.024* (0.014)	0.029** (0.014)	0.004 (0.018)	0.012 (0.019)	0.008 (0.015)	0.012 (0.016)
managementscore	0.103*** (0.011)		0.069*** (0.010)		0.113*** (0.014)		0.074*** (0.014)		0.083*** (0.018)		0.057*** (0.014)	
Exporter (D)	0.031*** (0.011)	0.040*** (0.011)	0.039*** (0.009)	0.045*** (0.009)	0.036*** (0.013)	0.049*** (0.013)	0.045*** (0.011)	0.053*** (0.011)	0.028 (0.022)	0.029 (0.022)	0.027 (0.018)	0.029 (0.018)
Size = 2, large	0.050*** (0.010)	0.061*** (0.010)	0.090*** (0.009)	0.098*** (0.009)	0.045*** (0.014)	0.056*** (0.014)	0.097*** (0.012)	0.106*** (0.012)	0.052*** (0.015)	0.064*** (0.014)	0.074*** (0.012)	0.082*** (0.012)
R&D (D)	0.053*** (0.012)	0.068*** (0.012)	0.029*** (0.010)	0.038*** (0.010)	0.074*** (0.015)	0.089*** (0.015)	0.028** (0.013)	0.038*** (0.013)	0.014 (0.020)	0.028 (0.022)	0.034* (0.018)	0.044** (0.018)
log(Labor productivity)	0.003 (0.003)	0.007** (0.003)	0.012*** (0.003)	0.014*** (0.003)	0.005 (0.004)	0.008* (0.004)	0.017*** (0.004)	0.019*** (0.004)	-0.001 (0.005)	0.003 (0.005)	0.002 (0.004)	0.005 (0.004)
External knowledge (D)	0.037*** (0.014)	0.048*** (0.014)	0.020* (0.012)	0.027** (0.012)	0.048*** (0.018)	0.061*** (0.018)	0.038** (0.016)	0.046*** (0.017)	0.031 (0.023)	0.039 (0.024)	-0.006 (0.017)	-0.001 (0.017)
Obstacle: Env. regulation (D)	0.020 (0.014)	0.015 (0.014)	0.002 (0.012)	-0.001 (0.012)	0.041** (0.019)	0.037* (0.019)	-0.002 (0.017)	-0.005 (0.016)	-0.025 (0.019)	-0.029 (0.019)	0.010 (0.015)	0.006 (0.016)
Losses: Extreme weather (D)	0.060*** (0.017)	0.059*** (0.017)	0.035** (0.015)	0.034** (0.015)	0.024 (0.021)	0.022 (0.020)	0.035 (0.022)	0.033 (0.022)	0.104*** (0.025)	0.105*** (0.025)	0.027 (0.017)	0.026 (0.017)
Losses: Pollution (D)	0.193*** (0.034)	0.192*** (0.034)	0.107*** (0.028)	0.104*** (0.029)	0.207*** (0.045)	0.208*** (0.046)	0.094*** (0.036)	0.092** (0.037)	0.177*** (0.048)	0.171*** (0.048)	0.143*** (0.046)	0.136*** (0.046)
Env. certification (D)	0.263*** (0.014)	0.283*** (0.014)	0.245*** (0.014)	0.260*** (0.013)	0.265*** (0.017)	0.286*** (0.017)	0.265*** (0.018)	0.280*** (0.017)	0.260*** (0.024)	0.279*** (0.024)	0.204*** (0.022)	0.219*** (0.022)
Observations	8,293	8,293	8,316	8,316	5,401	5,401	5,413	5,413	2,892	2,892	2,903	2,903
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors (clustered at the country-sector level) in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### A.3.3 Additional robustness checks

Table A.14: Baseline with 50% FDI

	(1)	(2)	(3)	(4)	(5)	(6)
	Total sample		Manufact. sample		Service sample	
	Green strategy	Green manager	Green strategy	Green manager	Green strategy	Green manager
FDI (50%) (D)	1.377*** (0.116)	1.308*** (0.119)	1.378*** (0.144)	1.271** (0.138)	1.365** (0.186)	1.306 (0.229)
Exporter (D)	1.316*** (0.087)	1.517*** (0.105)	1.373*** (0.110)	1.467*** (0.116)	1.224 (0.151)	1.518*** (0.240)
Size = 1, medium	1.590*** (0.102)	2.187*** (0.198)	1.660*** (0.146)	2.581*** (0.328)	1.499*** (0.141)	1.643*** (0.204)
Size = 2, large	2.477*** (0.174)	5.221*** (0.482)	2.498*** (0.231)	6.028*** (0.779)	2.433*** (0.281)	4.310*** (0.570)
R&D (D)	1.702*** (0.108)	1.432*** (0.114)	1.922*** (0.146)	1.410*** (0.135)	1.336** (0.168)	1.530*** (0.226)
log(Labor productivity)	1.063*** (0.019)	1.125*** (0.029)	1.072*** (0.026)	1.168*** (0.037)	1.036 (0.028)	1.047 (0.045)
External knowledge (D)	1.407*** (0.112)	1.379*** (0.127)	1.332*** (0.132)	1.427*** (0.160)	1.591*** (0.218)	1.330* (0.226)
Obstacle: Env. regulation (D)	1.162* (0.094)	1.021 (0.096)	1.370*** (0.141)	1.007 (0.116)	0.831 (0.103)	1.041 (0.163)
Losses: Extreme weather (D)	1.421*** (0.120)	1.334*** (0.140)	1.177 (0.133)	1.373** (0.198)	1.838*** (0.215)	1.253 (0.193)
Losses: Pollution (D)	3.151*** (0.465)	2.709*** (0.502)	3.434*** (0.707)	2.252*** (0.524)	2.830*** (0.603)	3.677*** (1.019)
Env. certification (D)	4.970*** (0.315)	6.264*** (0.483)	4.893*** (0.369)	6.155*** (0.572)	5.227*** (0.604)	6.677*** (0.910)
Observations	17,415	17,441	9,936	9,945	7,479	7,496
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R <sup>2</sup>	0.211	0.280	0.223	0.284	0.177	0.247

*Notes:* Odds ratios. See Table A.15 for marginal effects. Robust standard errors (clustered at the country-sector level) in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A.15: Baseline with 50% FDI: Marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Total sample		Manufact. sample		Service sample	
	Green strategy	Green manager	Green strategy	Green manager	Green strategy	Green manager
FDI (50%) (D)	0.036*** (0.010)	0.020*** (0.007)	0.040*** (0.014)	0.021** (0.010)	0.030** (0.014)	0.014 (0.010)
Exporter (D)	0.030*** (0.007)	0.030*** (0.005)	0.038*** (0.010)	0.033*** (0.007)	0.019 (0.012)	0.023** (0.009)
Size = 1, medium	0.046*** (0.006)	0.045*** (0.005)	0.056*** (0.010)	0.063*** (0.008)	0.035*** (0.008)	0.021*** (0.006)
Size = 2, large	0.102*** (0.009)	0.126*** (0.008)	0.111*** (0.012)	0.155*** (0.011)	0.089*** (0.013)	0.090*** (0.010)
R&D (D)	0.062*** (0.008)	0.026*** (0.006)	0.084*** (0.011)	0.030*** (0.009)	0.027** (0.013)	0.023*** (0.009)
log(Labor productivity)	0.006*** (0.002)	0.008*** (0.002)	0.008*** (0.003)	0.013*** (0.003)	0.003 (0.002)	0.002 (0.002)
External knowledge (D)	0.039*** (0.010)	0.024*** (0.007)	0.036*** (0.013)	0.031*** (0.011)	0.046*** (0.015)	0.015 (0.010)
Obstacle: Env. regulation (D)	0.016* (0.009)	0.001 (0.007)	0.039*** (0.013)	0.001 (0.010)	-0.016 (0.010)	0.002 (0.008)
Losses: Extreme weather (D)	0.040*** (0.010)	0.021*** (0.008)	0.020 (0.014)	0.028** (0.013)	0.063*** (0.014)	0.012 (0.009)
Losses: Pollution (D)	0.157*** (0.025)	0.088*** (0.020)	0.183*** (0.036)	0.080*** (0.027)	0.123*** (0.032)	0.097*** (0.028)
Env. certification (D)	0.236*** (0.011)	0.187*** (0.010)	0.248*** (0.013)	0.210*** (0.014)	0.220*** (0.020)	0.157*** (0.016)
Observations	17,415	17,441	9,936	9,945	7,479	7,496
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors (clustered at the country-sector level) in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A.16: Robustness, randomized FDI

	(1) Green strategy	(2) Green manager
random FDI (D)	1.063 (0.047)	1.042 (0.061)
Exporter (D)	1.350*** (0.088)	1.550*** (0.108)
Size = 1, medium	1.604*** (0.102)	2.202*** (0.198)
Size = 2, large	2.570*** (0.179)	5.384*** (0.492)
R&D (D)	1.694*** (0.108)	1.424*** (0.113)
log(Labor productivity)	1.069*** (0.020)	1.132*** (0.029)
External knowledge (D)	1.422*** (0.114)	1.392*** (0.128)
Obstacle: Env. regulation (D)	1.156* (0.094)	1.016 (0.095)
Losses: Extreme weather (D)	1.414*** (0.119)	1.327*** (0.139)
Losses: Pollution (D)	3.147*** (0.464)	2.719*** (0.503)
Env. certification (D)	4.977*** (0.316)	6.270*** (0.483)
Observations	17,415	17,441
Sector FE	Yes	Yes
Country FE	Yes	Yes
Pseudo R <sup>2</sup>	0.210	0.279

*Notes:* Odds ratios. Robust standard errors (clustered at the country-sector level) in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1