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Is there a relationship between Environmental Performance and Outwards FDI? A study of Chinese MNEs

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Is there a relationship between Environmental Performance and OFDI? A study of Chinese MNEs.

Abstract

Purpose – In this paper, we aim to examine the question: "How do firm-level, home country and host country Environmental Performance (EP) affect the Outwards Foreign Direct Investment (OFDI) of Chinese multinational enterprises (MNEs)?"

Design/methodology/approach – We examine the relationships between EP and OFDI propensity and between EP and OFDI intensity using a sample of 359 Chinese firms in industries with a significant environmental footprint between 2009 and 2019 (2,002 firm-year observations) and a Heckman two-stage model.

Findings – We show that the propensity of OFDI by Chinese MNEs is significantly and positively related to the firm's prior EP and the country-level EP of China. However, the amount of FDI invested is significantly and positively related to the firm's prior EP and negatively related to the EP of the host country.

Research implications/limitations – Our findings suggest that FDI in a country by an MNE is determined by a combination of firm-level EP, home country EP, and host country EP. We find that the decision to undertake FDI (propensity) and the decision about how much to invest (intensity) are determined by different factors. The propensity for FDI is determined by the home country EP and firm-level EP. However, the intensity of FDI is determined by a combination of the host country EP and firm-level EP. A limitation is that our study only examines MNEs in China, so the findings may not apply to other countries.

Originality – Our paper shows that MNEs' EP is positively related to the propensity and intensity of their OFDI decisions. However, our paper shows that the home country and host country EP may also play an important role in determining the propensity or intensity of OFDI.

Keywords OFDI, Environmental Performance, MNE, China

Paper type Research paper

1. Introduction

The Environmental Performance (EP) of multinational enterprises (MNEs) has become increasingly important as environmental pressures such as climate change have increased in recent years, and the environmental impacts from the global operations of MNEs have come under the spotlight. However, as Linnenluecke (2022) noted in a recent review, the literature on the ESG performance of MNEs, especially those from emerging markets, is limited.

Prior studies have shown that MNEs' internationalization is positively related to their EP. For example, in a recent study of Chinese MNEs, Long *et al*. (2022) investigated how the Outwards FDI (OFDI) of Chinese firms would affect the home country EP. Long *et al*. (2022) argued that MNEs' host country operations improve firms' environmental innovation capabilities and human-embedded environmental skills, which can be transferred back to their home countries via active learning and adapting, and hence improve firms' home country EP. Fewer studies have examined the reverse relationship between EP and OFDI, leaving the impact of the firm-level, home country, and host country EP on their OFDI process largely unexplored (Liu *et al*., 2021). Therefore, in this paper, we address the question: "How do firm-level, home country, and host country EP affect the OFDI of Chinese MNEs?"

We argue that improved firm-level EP positively affects OFDI in two ways. First, it allows domestic firms to maintain competitive advantages by upgrading technology and other capabilities, which enhances their ability to pursue international opportunities outside their home country (Cuervo-Cazurra, 2012). Secondly, improved firm-level EP assists MNEs in overcoming liabilities of foreignness (LOF) (Zaheer, 1995), and equips them to conform to best practices in their target markets, thereby improving their engagement in those markets. In addition, we argue that OFDI is positively related to EP in both the home- and host countries. Stringent home-country environmental regulations positively impact the propensity of Chinese MNEs' OFDI by enhancing their legitimacy and reducing the LOF of Chinese firms in general. Conversely, high EP standards in the host-country negatively correlate with the intensity of Chinese MNEs' OFDI. We

tested our hypotheses using a sample of 369 Chinese firms between 2009 and 2019 (2,002 firm-year observations) using a Heckman two-stage model.

The rest of the paper is structured as follows. In section 2, we review the literature on the determinants of OFDI, in general, and then the determinants of Chinese OFDI, in particular. Next, we derive four hypotheses about the relationship between the firm-level EP, home country EP, host country EP, and the OFDI of Chinese MNEs in pollutive industries. Sections 3 to 5 explain the models we used to test the hypotheses. In section 6, we discuss the results and conclude with a summary of the key findings, theoretical and practical implications.

2. Literature review

Most research on determinants of FDI in the international business literature follows Dunning's (1980) eclectic paradigm in which he suggested three primary motivations for FDI — market seeking, efficiency, and resource seeking — and he identified the decision to undertake FDI as being determined by ownership, location, and internalization (OLI) factors. According to Dunning (1980), MNEs may seek access to abundant natural resources and rapidly growing markets with lower-cost operational locations. This is supported by the statistic that over 87% of the total accumulated Chinese OFDI amount is directed toward developing countries (Ministry of Commerce, 2019). While Dunning (1980) focused on the role of the firm and host country advantages in determining FDI, other researchers (e.g., Rugman, 2010) have highlighted the important contribution that home-country-specific advantages can make in international competition. These include reputation as well as more tangible advantages such as access to financial capital (Cuervo-Cazurra *et al*., 2018). Other researchers (e.g., Peng *et al.*, 2008) have also argued for the need to integrate institutional factors in international business strategic decisions, especially in less-developed countries. A central premise of institutional theory is that organizations are embedded in and must adapt to their institutional environment to attain legitimacy (Zukin and DiMaggio, 1990). Thus, it is argued MNEs are motivated to enhance their legitimacy by becoming isomorphic with their environment (Yiu and Makino,

2002). Incorporating an institution-based view into FDI theory is even more important in the case of MNEs from emerging economies where there are "institutional voids" (Khanna and Palepu, 2000) and when these MNEs enter foreign markets with different institutional environments. Thus, both the home- and host country institutional environments need to be considered.

2.1 Home-country institutional environment

The importance of considering the home country's institutional environment is especially important in the case of MNEs from China, which has an economy underpinned by a political system that is quite different from developed economies and other emerging economies (Alon, 2010; Kang and Jiang, 2012; Wang *et al.*, 2012). Since 1979 when OFDI was formally permitted under the "Open Door" policies, the internationalization of Chinese firms has been strongly subject to influences of the Chinese state, either directly or indirectly (Buckley *et al*., 2007). Outward investment accelerated following the government-led "go global" initiative in 1999, which aimed to promote the international competitiveness of Chinese firms by reducing or eliminating foreign exchange-related, fiscal, and administrative obstacles to international investment. The increased pressures by the Chinese government on Chinese firms to improve their economic performance has knock-on effects in terms of upgrading technology, innovation, and other capabilities, which can further boost their ability to compete in international markets (Rui and Yip, 2008).

2.2 Host-country institutional environment

Institutional pressures can also influence the OFDI attractiveness of destination countries (Bailey, 2018). For instance, a strict rule of law can reduce uncertainty and promote foreign competition by addressing market failure, making a country more attractive for FDI. This is particularly crucial in developing countries, which require higher legitimacy to attract FDI. On the other hand, Kolstad and Wiig (2012) found that Chinese OFDI flows were attracted to countries with a combination of large natural resources and poor

institutions and argued that Chinese firms are different since their experience with managing the poor institutional environment at home gives them an advantage compared to firms from developed countries.

3. Impact of EP on OFDI

Based on the above theoretical perspectives on FDI, we developed four hypotheses regarding the specific effects of firm-level, home country, and host country EP on the OFDI of Chinese MNEs, as shown in Figure 1.

Figure 1 here

3.1 Firm-level EP

Improved EP by MNEs can help them overcome LOF (Zaheer, 1995) in foreign markets by providing environmental legitimacy. Higher environmental legitimacy enables firms to comply with local institutional expectations, gain better access to resources, and shield themselves from scrutiny (Bansal and Clelland, 2004). Consequently, this grants them a distinct competitive advantage (Porter and van der Linde, 1995). In addition, many industry associations often promote and share information on global "best practices" to protect the legitimacy of their focal industry; thus, MNEs have to adopt these "best practices" to reduce the consequences of an environmental mishap (Bansal and Clelland, 2004). MNEs have to engage in "do good" to gain enough local respect (Crilly *et al*., 2016) and MNEs with better EP are better equipped to conform to the best practices in their target markets and, hence, gain more access to that market. We expect such pressures to gain environmental legitimacy to be especially significant for overseas ventures of Chinese MNEs (Tan and Yang, 2021) as they strive to move up the value chain by acquiring proprietary technology, brand names, and other resources to maintain competitive advantages (Luo and Tung, 2018). Upgrading their technology, innovation, and other capabilities can enhance their ability to pursue international opportunities (Cuervo-Cazurra, 2012). Therefore, we hypothesize that,

Hypothesis 1: Increased EP of Chinese MNEs increases their propensity to conduct OFDI and

Hypothesis 2: Increased EP of Chinese MNEs increases the intensity of their OFDI (as measured by the amount of investment).

3.2 Home-country EP

At the same time, over the past forty years, China has gradually ramped up its environmental policies and regulations. These include an increasing emphasis on EP in consecutive Five-Year Plans — the major policy documents that guide the economic and social development of the country. For example, the 2006-2010 five-year plan included energy and water intensity targets, industrial solid waste generation and reuse, and industrial water reuse. Specific policies that support the improvement of the EP of the country include, for example, the Circular Economy Promotion Law introduced in 2008, which provided a framework and motivation for a circular economic model to promote "ecological civilization" and "harmonious development" (Naustdalslid, 2014). More recently, an emphasis has been placed on the enforcement of these environment-related regulations and policies through mechanisms such as central environmental inspections (Kostka and Goron, 2021) and the introduction of online monitoring and surveillance systems for key enterprises (Xie and Chen, 2021).

The pressures from a growing level of stringency in the country's environmental policies are reflected in the EP of Chinese firms at the micro-level. Figure 2 illustrates the average EP of Chinese firms from 2009 to 2019. The data shows that, apart from a temporary drop in 2017, Chinese firms' average EP increased steadily from 21.4% to 31.5% over the period.

Figure 2 here

Chinese firms may also expand abroad due to home-country constraints, as engaging in OFDI allows them to exit unfavorable domestic markets (Boisot and Meyer, 2008; Lewin and Witt, 2007). The introduction of a series of environmental regulations in recent years, such as the Circular Economy Promotion Law, together with the increasing enforcement of existing policies and laws, may have made the domestic market less attractive to some firms, especially those in pollution-intensive industries, by affecting their competitive landscapes and input availability. In this case, firms may transfer their pollutive operations overseas via OFDI (Bu and Huo, 2014). Furthermore, more stringent environmental regulations can act as a driving force for firms to innovate environmentally (Porter and van der Linde, 1995), which in turn can enhance their competitive advantage in the face of technological reform and production process optimization (Liu *et al*., 2022). As a result, improving EP at the country level may help firms from that country be better equipped financially and technologically to engage in OFDI. Therefore, we hypothesize that,

Hypothesis 3: Increased home-country EP increases the propensity of Chinese firms' OFDI.

3.3 Host-country EP

Environmental standards in the host country may also affect OFDI. Meeting higher environmental standards in the host country may necessitate a higher level of EP by MNEs. This can result in higher operational costs in the host country and an increase in LOF from MNEs. Environmental regulations and policies in host countries are increasingly regarded as important determinants of FDI, particularly in the case of industries with a significant environmental footprint, given the increasingly stringent environmental regulations worldwide.

The "pollution halo hypothesis" posits that MNEs contribute to a reduction in pollution in host countries by transferring new production processes, management skills, and greener technologies to the host country. More recent studies find that the effects of FDI may be sector-specific, with capital-intensive, pollution-

intensive industries more likely to display the effects (Poelhekke and van der Ploeg, 2015). Other studies have found the effects of FDI vary depending on the intuitional development of the host country. For example, Solarin *et al*. (2017) conducted research on the connection between FDI, institutional quality and carbon dioxide emissions in Ghana spanning 1980-2012. Their findings demonstrated that institutional quality is crucial in decreasing carbon emissions in Ghana, emphasizing the significance of institutions in the host country. Similarly, Singhania and Saini (2021) examined 21 developing and developed countries from 1990 to 2016 and found a substantial positive correlation between FDI and environmental degradation, especially in developing countries.

In contrast, the "pollution haven hypothesis" (Taylor, 2005) predicts that MNEs tend to relocate production to countries with less stringent environmental policies to take advantage of the lower production costs associated with these policies. Following this logic, Chinese MNEs may choose to physically relocate some of their more environmentally-polluting operations to less-developed economies with weaker environmental regulations following the "pollution haven hypothesis" (Zhang and Fu, 2008; Singhania and Saini, 2021) as they face less EP pressures in these economies (Long *et al*., 2022; Bu and Huo, 2014). In this context, Chinese MNEs may find less-developed host countries with lower country-level EP more favorable for their OFDI. Therefore, we hypothesize that,

Hypothesis 4: The EP of the host country is negatively related to the intensity of Chinese MNEs' OFDI in that market.

4. Data and methodology

4.1 Sample

We constructed a sample of Chinese firms to test the proposed hypotheses by combining data from the REFINITIV EIKON and the fdiMarkets databases. REFINITIV EIKON provides firm-level data such as

EP, market value, revenue, and return on assets (ROA), while fdiMarkets provides information on firms' OFDI host countries and investment amounts in each country.

As the earliest year for which we have data in the fdiMarkets database is 2009 and figures after 2019 are distorted by the impact of the COVID-19 pandemic, we sampled firms over the ten years between 2009 and 2019. We excluded firms from less pollution-intensive industries, such as banking, holding companies, investment banking, insurance, real estate operation, and software & IT, as their OFDI has less environmental impact. Furthermore, financially oriented OFDIs may be driven by tax considerations (Lu *et al*., 2014; Hampton and Christensen, 2002). For example, Ahmed *et al*. (2020) discovered a significant positive correlation between the use of tax havens and FDI in countries with low economic development and excessive levels of capital flight. Finally, we dropped firms with any missing values in our models. Our final sample consists of 359 Chinese firms over the period 2009 to 2019 (2,002 firm-year observations) in the first stage of our model, which examines the propensity of OFDI. Of the 359 firms, 96 have at least one overseas OFDI activity, providing us with 569 firm-year observations of FDI amounts in the second stage of our model, which examines the intensity of OFDI. Table I shows the number of firms and observations by industry sector.

Table I here

4.2 Stage 1: Propensity of OFDI

4.2.1. Dependent variable

To measure OFDI propensity, we created an OFDI dummy variable set to 1 if a sampled firm engaged in an OFDI during the observed year and 0 otherwise.

4.2.2 Independent variables

The firms' EP was sourced from the widely used REFINITIV EIKON database (formerly known as Thomson Reuters ASSET4), which provides ESG scores for firms (e.g., Ioannou and Serafeim, 2012; Pollard *et al*., 2018; Bhaskaran *et al*., 2020). The EP score is a percentile rank score, which is calculated from the firms' emission (i.e., emissions, waste, biodiversity, and environmental management systems), innovation (i.e., product innovation, environmental R&D and capital expenditures), and resource use (i.e., water, energy, sustainable packaging, environmental supply chain) performance relative to the industry median. We lagged the EP variable by one year to reduce the risk of reverse causality effects of OFDI on EP. To measure the country-level EP of China, we used the Environmental Performance Index (EPI) developed by Yale University. This data-driven ranking system summarises the sustainability of 180 countries, with scores ranging from 0% to 100% (Hsu and Zomer, 2014).

4.2.3 Control variables

As larger firms and those with higher profitability tend to have more resources for OFDI (Dowell and Killaly, 2009), we also controlled for firm size and profitability. We used market value and revenues to measure the firm size and ROA to measure the firm's profitability. Additionally, we controlled for state ownership, year, and industry in our model. To mitigate endogeneity issues that could arise from the reverse effect of OFDI propensity on the independent and control variables, we lagged the time-varying firm-level variables by one year, such as EP_{t-1}, Market $Value_{t-1}$, $Revenues_{t-1}$, and ROA_{t-1}. We also controlled for the year and industry sector.

4.3 Stage 2: Intensity of OFDI

4.3.1. Dependent variable

To measure OFDI intensity, we used the amount of FDI invested.

4.3.2 Independent variables

We used similar measures for the independent variables as in the first stage. Firms' EP was sourced from the widely used REFINITIV EIKON database and we used the EPI developed by Yale University to measure the host-country EP.

4.3.3 Control variables

We also included some control variables that have been shown to be significant predictors of Chinese OFDI (Buckley *et al*., 2018). Previous studies have indicated that factors such as GDP per capita, GDP growth rate, and openness to FDI could influence market attractiveness for OFDI (Bailey, 2018; Buckley *et al*., 2007). Furthermore, Chinese firms have been known to use OFDI to secure domestically scarce factor inputs (Buckley *et al*., 2007). As a result, we expect a positive association between the host country's natural resource endowment and Chinese firms' OFDI intensity.

Previous research suggests that Chinese firms may be encouraged to invest further in specific host countries if they have experience and accumulated FDI knowledge from previous entries (Dowell and Killaly, 2009; Lu *et al*., 2014). To account for this, we included the amount of existing FDI by Chinese firms in the host country, sourced from the Statistical Bulletin of China's Outward FDI by the Ministry of Commerce of People's Republic of China.

As the geographic distance between the home- and host-country increases, firms may become less willing to invest in culturally and administratively distant markets (Bailey, 2018; Berry *et al*., 2010). MNEs investing in culturally distant markets may face significant obstacles when understanding local customs, norms, and behaviors. Therefore, our analysis includes a physical distance variable to complement the cultural and administrative proximity variables. We adopted the geographic distance provided by Mayer and Zignago (2011) to measure the physical distance between the capital cities of the host countries and Beijing (e.g., Chen and Lee, 2020).

To capture the impact of political risk on firms' OFDI (e.g., Dowell and Killaly, 2009; Lu *et al*., 2014), we controlled the regulatory distance between the home- and host countries using the regulatory quality indicator from the Worldwide Governance Indicator (WGI) to proxy the soundness of policies and regulations.

For more information on the variables used in our analysis, please refer to Table II, which includes variable descriptions and data sources. Descriptive statistics for our variables can be found in Table III, while Table IV shows the correlations between the main variables.

Table II here

Table III here

Table IV here

4.4 Data analysis

As OFDI involves two stages, the decision to enter a market and the decision on how much to invest, there is a potential selection bias in just testing the effect of EP on OFDI intensity using only a sample of firms that conduct OFDI. To correct for this potential bias, we employed the Heckman two-stage estimator, a commonly used statistical method that corrects for sample selection bias in empirical analysis, especially in cases where self-selection mechanisms are present in the sample (Hult *et al*., 2008; Krammer *et al*., 2018).

In the first stage of our models, we utilized probit estimation to determine whether a firm engages in OFDI. This stage incorporated eight variables, including control variables, as illustrated in Figure 1, and was estimated using the entire sample of 2,002 observations. In the second stage, we employed linear regression to test OFDI intensity using only the 96 firms (569 observations) that had been involved in OFDI activities. The regression models that we estimated are:

In the first stage (probit model),

$$\Pr(OFDI_{i=1}) = \Phi(\alpha_1 EP_{i,\,t-1} + \alpha_2 \text{China EPI}_t + \alpha_3 \text{Controls} + \varepsilon^1)$$

where $OFDI_i$ is a binary variable indicating whether firm *i* engages in OFDI activities (1) or not (0), China EPI_t is China's environmental performance in year *t*, $EP_{i,\,t-1}$ is the EP of $firm_i$ lagged by one year, Controls represents a vector of control variables, including firm-level characteristics, and ε^1 is the error term;

and in the second stage (linear regression model),

$$\ln(\text{OFDI Intensity}_i) = \beta_1 EP_{i,\,t-1} + \beta_2 \text{ Host EPI}_t + \beta_3 IMR_i + \beta_4 \text{Controls} + \varepsilon^2$$

where OFDI Intensity_i is the natural logarithm of the amount of OFDI investment made by $firm_i$, $EP_{i,\,t-1}$ is the one-year lagged EP of $firm_i$, Host EPI_t is the host-country EP in year *t*, IMR_i is the Inverse Mills Ratio calculated in the first stage of the model, $Controls_i$ represents a vector of control variables, including firm-level characteristics and the host-country market factors, and ε^2 is the error term.

5. Results

The outcomes of the models are displayed in Table V. (To save space, the results for the year dummies and industry dummies have been excluded.)

Table V here

5.1 Stage 1: OFDI propensity

Model 1 evaluates the impact of the control variables on OFDI propensity. The results indicate that firms' revenues and ROA promote OFDI propensity, consistent with prior literature and empirical studies (e.g., Buckley *et al*., 2007). Chinese firms operating in specific industry sectors, such as energy, industrials, consumer cyclicals, healthcare, and technology, are more likely to engage in OFDI. However, firms in the

consumer non-cyclical industry sector, such as food and tobacco, beverages, drug retailing, and personal and household products, are less likely to engage in OFDI.

Models 2 and 3 show the separate effects of firm-level EP and home-country EP on OFDI propensity, respectively. Model 4 shows that the effects remain significant when both firm-level EP and home-country EP are included in the same model. Model 4 shows that EP_{t-1} has a positive correlation with Chinese firms' OFDI propensity ($\alpha_1 = 0.814$ at $p < 0.001$), confirming Hypothesis H_1. Additionally, China's EPI positively correlates with firms' OFDI propensity ($\alpha_2 = 9.444$ at $p < 0.001$), confirming Hypothesis H_3.

5.2 Stage 2: OFDI intensity

In the second stage, we tested the effect on OFDI intensity as measured by the amount of OFDI, including the IMR computed in the first stage as an independent variable to account for the impact of the unobserved factors from the first stage. If the IMR is statistically significant, it indicates the existence of a sample selection bias and the direction of this correlation; if the IMR is insignificant, it implies that the unobserved factor has minimal or no effect on the dependent variables in the second stage (Krammer *et al*., 2018; Tang and Wei, 2009; Dutta and Magableh, 2006).

Model 5 examines the effects of the control variables on OFDI intensity. The results show that the host country's GDP per capita is negatively related to firms' OFDI intensity ($p < 0.001$), implying that the intensity of OFDI by Chinese MNEs is higher in less-developed markets. Similarly, regulatory distance negatively influences firms' investment amount ($p < 0.01$), indicating that Chinese MNEs prefer to invest more in markets with lower regulatory standards. Both the total FDI by Chinese firms and the host country's natural resource variables are positively correlated with firms' OFDI amount ($p < 0.1$ and $p < 0.01$, respectively), which is consistent with prior arguments as discussed in the literature review (e.g., Berry *et al*., 2010).

Models 6-8 examine the impact of the independent and control variables. Models 6 and 7 show the separate effects of firm-level EP and host country EP on OFDI intensity, respectively. Model 8 shows that the effects remain significant when both firm-level EP and host country EP are included in the same model. Model 8 shows that firms' EP positively influences the amount of OFDI ($\beta_1 = 0.513$, $p < 0.01$), which supports our hypothesis H_2 while the host country EP negatively influences firms' OFDI intensity ($\beta_2 = -0.884$, $p < 0.05$), indicating that Chinese MNEs prefer to invest more in markets with lower environmental standards, supporting our hypothesis H_4. The IMR is statistically insignificant in all the models, indicating no significant sample selection bias was detected.

5.3 Robustness tests

To ensure the robustness of our findings, we conducted additional tests. First, we used the number of jobs created in the host country resulting from the OFDI as an alternative measure for OFDI intensity. The results are shown in Table VI.

Table VI here

The results of the Heckman stage 1 estimation are the same as the results shown in Table V, confirming our hypotheses H_1 and H_3. The results of stage 2 indicate a positive correlation between firms' EP and the number of jobs created in the host country ($\beta = 0.366$, $p < 0.05$). Moreover, the host country EPI negatively correlates with the number of jobs created ($\beta = -0.571$, $p < 0.1$). These results support our hypotheses H_2 and H_4. The IMR is statistically significant ($\beta = 0.143$, $p < 0.1$) in model 16, confirming that the error terms of the first- and second-stage regression are correlated, and the use of the Heckman two-stage model is efficient.

Secondly, as the insignificant IMR in models 5-8 suggested no significant selection bias in our model, we ran OLS regression models to predict the second equation without the IMR variable. As shown in Model

20 of Table VII, the results indicate that firms' EP positively affects firms' OFDI amount in the host country ($\beta = 0.456$, $p < 0.01$), confirming our hypothesis H_2. Moreover, the host country EPI is negatively related to firms' OFDI ($\beta = -0.878$, $p < 0.05$), which is consistent with our hypothesis H_4.

Table VII here

Finally, we also tested models with a random year effect and models replacing some control variables, such as return on sales (ROS) instead of ROA, political stability instead of regulatory distance, and GDP inflation instead of GDP growth. All the findings from these tests align with the outcomes obtained from the primary tests, providing further evidence supporting our hypotheses. Because of space constraints, the results of these robustness tests have not been shown but are available upon request.

6. Discussion and conclusion

All our hypotheses were supported, and our results show how OFDI is driven by a combination of EP at three levels — the firm, the home country, and the host country. First, our findings support the argument that firms' EP is an important contributor to the international competitive advantage of Chinese MNEs in pollutive industries. Superior EP facilitates their OFDI, firstly, by enabling firms to comply with host country institutional requirements (Fransen *et al*., 2019) and, secondly, by reducing their LOF in the host country markets.

Our finding that the home-country EP has a significant positive relationship with FDI propensity extends the literature on the influences of home-country institutional environments on firms' OFDI. This literature shows that home country institutions, especially in a context like China, significantly impact OFDI from the country (Voss *et al.*, 2010). However, the overall effect of home country institutions on OFDI is complex. Prior studies have established that some of the institutional factors in the home country, such as access to cheap loans from state policy banks and other fiscal and financial support from the home country government, may play a critical and positive role in supporting the OFDI (Yao and Sutherland, 2009), while

others such as a cumbersome approval process may constrain OFDI (Voss *et al.*, 2010). Few studies have explored the effects of stricter environmental policies and regulations in a country like China on its OFDI, despite the increasing prominence of these policies and regulations in the home country institutional environment. To the best of our knowledge, our study makes a first attempt in the international business literature to fill this important gap.

Our findings are consistent with Rugman's (2010) argument that firms can benefit from both firm- and country-specific advantages in FDI. However, our findings show that home country EP specifically can contribute to the propensity of FDI in the case of environmentally pollutive industries. One possible explanation involves the improved reputational effects of the home country EP on the FDI of MNEs from the country. As Elango and Sethi (2007) note, "a country's reputation or cachet, if viewed in positive (or negative) terms by the governments and citizens of another country, may give an advantage (or disadvantage) to firms from that country" (p. 372). In general, improved EP of Chinese firms may be passed onto Chinese MNEs and reduce the LOF in their OFDI. Another is through learning effects. The results are also consistent with Porter's hypothesis that strict environmental regulation in the home country will force firms to innovate and acquire competitive advantages (Porter and van der Linde, 1995). Both possibilities are consistent with our finding that the intensity of OFDI of Chinese MNEs in a country is significantly related to the prior FDI by Chinese firms. Furthermore, Dowell and Killaly (2009) suggest that companies with prior entry experience into a particular market are more likely to make additional investments in that market compared to those with less experience. Such experience can be shared with other units within the same company or related organizations. Therefore, the effects might be further augmented as FDI activities continue.

Our findings also highlight the importance of considering the host country EP in the decision of where to invest. Our finding that Chinese MNEs are more likely to invest in foreign markets with lower environmental standards lends support to the "pollution haven hypothesis" that firms prefer to invest in countries with lower environmental standards. They also lend support to the general proposition that firms

may use FDI to escape from unfavorable home-country environments (Lewin and Witt, 2007). However, they highlight the importance of considering the difference between the host country's environmental standards and the home country's environmental standards in the case of environmentally pollutive industries. While increasing environmental standards at home may increase the EP of firms by stimulating innovation, they may also increase operating costs and lead some firms to seek markets with lower environmental standards and lower operating costs.

Limitations and further research

As our sample is limited to Chinese MNEs in pollutive industries, future research is necessary to test the generalizability of our findings with a larger sample of MNEs from other countries and other industry sectors. Moreover, our data only covers the 2009-2019 period, and we suggest exploring the effects of EP over longer periods to test the effects with increased time lags between the improvement in EP and firms' ODFI activities.

Conclusion

Our study shows that not only can OFDI by Chinese MNEs impact the EP of the home country, as found by Long *et al.* (2022), but that OFDI by Chinese MNEs in pollutive industries is affected by a combination of firm-level EP, home country EP, and host country EP and that propensity and intensity of OFDI are driven by different EP factors. Our study also contributes more generally to understanding OFDI by MNEs, highlighting the importance of the firm's capabilities, home country institutional environment, and host country institutional environment as significant predictors of OFDI.

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Figure 1. Conceptual framework

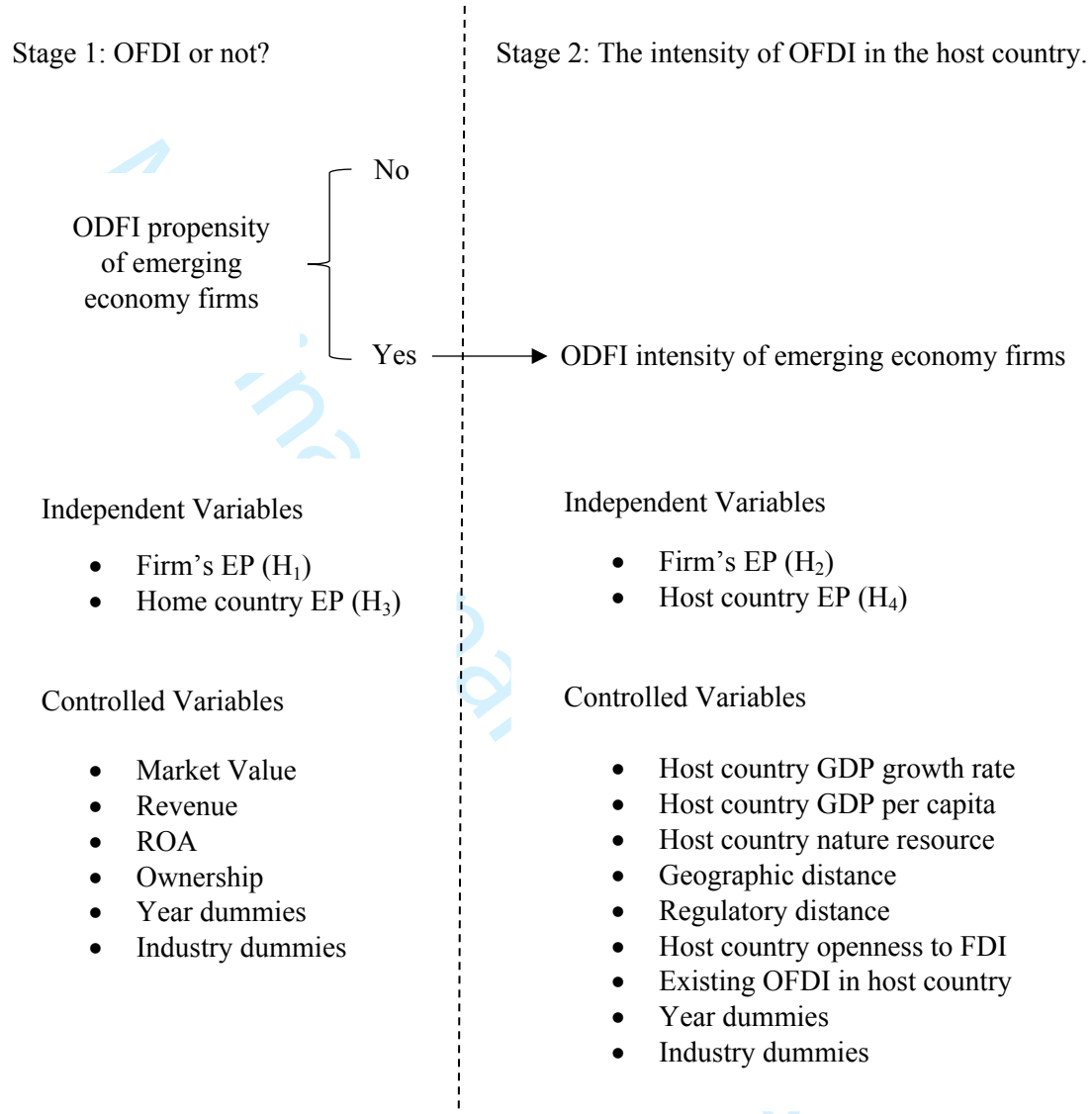

Figure 2. Chinese firms' average EP from 2009-2019, calculated from the REFINITIV EIKON database

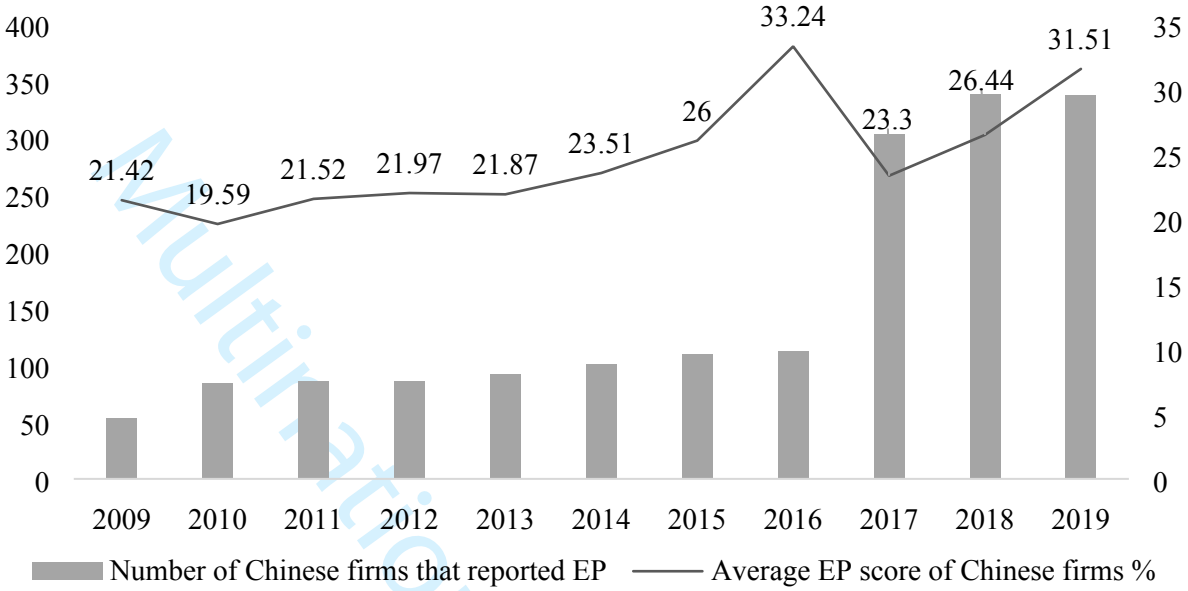

Table I. Number of firms and firm-year observations by industry

No.	TRBC Industry	No. of firms	No. of obs.	No. of firms with OFDI	No. of OFDIs
1	Energy	22	196	9	63
2	Basic materials	48	275	14	71
3	Industrials	75	447	25	114
4	Consumer Cyclicals	75	419	21	174
5	Consumer Non-cyclicals	37	164	4	5
6	Healthcare	31	74	3	6
7	Technology	39	250	15	121
8	Utilities	32	177	5	15
	Total	359	2,002	96	569

Less pollution-intensive industry sectors, i.e., Financials and Real Estate are excluded.

Table II. Variable descriptions and data sources

Variable	Description
EP	a percentile score of firms' Environmental performance, combining emission (i.e., emissions, waste, biodiversity, and environmental management systems), innovation (i.e., product innovation, environmental R&D and capital expenditures), and resource use (i.e., water, energy, sustainable packaging, and environmental supply chain)
Market value	logarithm of the firm's market value
Revenues	logarithm of the firm's revenues
ROA	firm's return on assets
SOE	State-owned enterprise dummy, 1 if yes, 0 if no
Year	Year dummy
Ind. sector dummy	Categorical data using REFINITIV EIKON TRBC Industry sector category, see Table I
Data Source: REFINITIV EIKON Database	
OFDI amount	logarithm of OFDI amount
OFDI dummy	OFDI dummy, 1 if yes, 0 if no
Data Source: fdiMarkets database	
Host EPI	The host country EP from 2009 to 2019, a percentile ranking score
China EPI	China's EP from 2009 to 2019, a percentile score
Data Source: Environmental Performance Index (EPI) from Yale Center for Environmental Law and Policy at https://epi.yale.edu/	
Host GDP	logarithm of the host country GDP per capita
Host GDP Growth	Annual percentage growth rate of the host country GDP
Host Nat. Res.	ten-year average (2009-2019) of total natural resource rents (% GDP) in the host country. Total natural resources rents (sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents).
Host FDI inflow	Net FDI inflows (% GDP) in the host country from foreign investors
Data Source: The World Bank Data	
Regulatory Dist.	Regulatory distance is the difference between China's and the host country's regulatory quality. Regulatory quality, a score range between -2.5 and 2.5, captures the soundness of policies and regulations that permit and promote private sector development
Data Source: Worldwide Governance Indicator (WGI)	
Prior China FDI	Prior entries (at the end of the previous year) by Chinese firms in the host country (in billion US dollars, logarithm of)
Data Source: Statistical Bulletin of China's Outward FDI by Ministry of Commerce of the PR China	
Geo. Dist.	Geographic distance (logarithm of) calculated by the geographic distance between the capital cities of China and the host country
Data Source: Mayer and Zignago, 2011	

Table III. Summary statistics of variables

	Variable	Obs.	Mean	S.D.	Min	Max
1	OFDI dummy	2,002	0.284	0.451	0	1
2	OFDI amount (log)	569	1.584	0.821	0.041	4.250
3	EP_{t-1}	2,002	0.316	0.220	0.002	0.916
4	Host EPI	569	0.638	0.145	0.291	0.904
5	China EPI	2,002	0.500	0.070	0.422	0.651
6	Host GDP Growth	569	0.031	0.026	-0.108	0.145
7	Host GDP (log)	569	4.045	0.668	2.576	5.067
8	Host FDI Inflow	569	0.029	0.069	-0.401	0.542
9	Prior China FDI (log)	569	1.478	2.693	-0.824	16.981
10	Host Nat. Res.	569	0.048	0.066	0.000	0.380
11	Geo. Dist. (log)	569	3.861	0.213	2.980	4.290
12	Regulatory Dist.	569	0. 675	1.293	-3.491	3.784
13	Market $Value_{t-1}$ (log)	2,002	3.722	0.600	1.069	5.693
14	$Revenues_{t-1}$ (log)	2,002	6.628	0.879	0.000	8.673
15	ROA_{t-1}	2,002	0.057	0.120	-2.279	0.955
16	SOE	2,002	0.227	0.419	0	1
17	Year	2,002			2,009	2,019

Table IV. Correlations of variables

	Variable	1	2	3	4	5	6	7	8	9
1	OFDI dummy	1								
2	OFDI amount	.	1							
3	EP_{t-1}	0.166	-0.011	1						
4	Host EPI	.	-0.299	0.037	1					
5	China EPI	0.075	-0.012	0.015	0.322	1				
6	Host GDP Growth	.	0.101	-0.019	-0.407	0.006	1			
7	Host GDP	.	-0.301	0.128	0.684	-0.070	-0.292	1		
8	Host FDI inflow	.	-0.009	-0.047	-0.009	0.090	0.105	-0.027	1	
9	Prior. China FDI	.	-0.073	-0.036	0.292	0.070	-0.088	0.424	0.003	1
10	Host Nat. Res.	.	0.275	-0.098	-0.315	0.094	0.101	-0.402	0.021	-0.230
11	Geo. Dist.	.	-0.056	-0.002	0.301	-0.022	-0.362	0.338	-0.066	0.237
12	Regulatory Dist.	.	-0.228	-0.031	0.494	-0.104	-0.246	0.539	-0.061	0.298
13	Market $Value_{t-1}$	0.270	0.005	0.174	-0.120	-0.009	0.035	-0.018	0.001	0.004
14	$Revenues_{t-1}$	0.339	-0.004	0.113	-0.069	-0.003	-0.021	-0.019	0.058	-0.050
15	ROA_{t-1}	0.031	-0.022	0.004	-0.106	-0.070	0.109	-0.007	-0.046	0.138
16	SOE	0.108	0.041	-0.046	-0.054	-0.022	0.007	0.004	0.069	-0.069
17	Year	0.008	-0.021	0.200	0.089	0.111	-0.085	0.085	-0.112	0.233

		10	11	12	13	14	15	16	17
10	Host Nat. Res.	1							
11	Geo. Dist.	-0.114	1						
12	Political Dist.	-0.298	0.240	1					
13	Market $Value_{t-1}$	0.163	-0.100	-0.105	1				
14	$Revenues_{t-1}$	0.165	-0.083	-0.135	0.615	1			
15	ROA_{t-1}	-0.027	-0.068	0.080	0.255	0.142	1		
16	SOE	0.132	0.003	-0.077	0.222	0.262	-0.047	1	
17	Year	-0.129	0.059	0.008	-0.041	-0.032	-0.040	-0.086	1

Table V. The effect of EP on OFDI propensity and intensity

	Model 1		Model 2		Model 3		Model 4	
Heckman Stage 1								
Dependent variable: FDI dummy								
EP_{t-1}			0.814***	(0.168)			0.814***	(0.168)
China EPI					8.770***	(1.608)	9.444***	(1.625)
Market Value $_{t-1}$	-0.068	(0.092)	-0.126	(0.093)	-0.068	(0.092)	-0.126	(0.093)
$Revenues_{t-1}$	0.919***	(0.080)	0.921***	(0.081)	0.919***	(0.080)	0.921***	(0.081)
ROA_{t-1}	1.001†	(0.543)	1.205*	(0.547)	1.001†	(0.543)	1.205*	(0.547)
SOE	0.100	(0.087)	0.138	(0.087)	0.100	(0.087)	0.138	(0.087)
Energy	0.332†	(0.187)	0.263	(0.189)	0.332†	(0.187)	0.263	(0.189)
Basic materials	0.589**	(0.172)	0.617***	(0.173)	0.589**	(0.172)	0.617***	(0.173)
Industrials	0.448**	(0.161)	0.508**	(0.162)	0.448**	(0.161)	0.508**	(0.162)
Cons. Cyclicals	1.130***	(0.162)	1.169***	(0.162)	1.130***	(0.162)	1.169***	(0.162)
Cons. Non-cycl.	-0.718**	(0.266)	-0.656*	(0.268)	-0.718**	(0.266)	-0.656*	(0.268)
Healthcare	0.236	(0.267)	0.247	(0.270)	0.236	(0.267)	0.247	(0.270)
Technology	0.999***	(0.172)	0.941***	(0.173)	0.999***	(0.172)	0.941***	(0.173)
Utilities	*Base category*		*Base category*		*Base category*		*Base category*	
Year (a)								
Constant	-7.534***	(0.438)	-7.693***	(0.441)	-11.395**	(0.901)	-11.850***	(0.913)

	Model 5		Model 6		Model 7		Model 8	
Heckman Stage 2								
Dependent variable: OFDI amount invested								
EP_{t-1}			0.512**	(0.172)			0.513**	(0.171)
Host EPI					-0.886**	(0.380)	-0.884*	(0.377)
Host GDP Growth	1.199	(1.357)	1.058	(1.348)	0.208	(1.416)	0.070	(1.406)
Host GDP	-0.265***	(0.065)	-0.287***	(0.065)	-0.155†	(0.080)	-0.177*	(0.080)
Host FDI inflow	-0.499	(0.466)	-0.515	(0.463)	-0.499	(0.464)	-0.515	(0.461)
Prior. China FDI	0.024†	(0.014)	0.029*	(0.014)	0.021	(0.014)	0.026†	(0.014)
Host Nat. Res.	1.498**	(0.558)	1.615**	(0.555)	1.385*	(0.557)	1.503**	(0.555)
Geo. Dist.	0.131	(0.169)	0.100	(0.168)	0.139	(0.168)	0.109	(0.167)
Regulatory Dist.	-0.069*	(0.030)	-0.065*	(0.030)	-0.053†	(0.031)	-0.049	(0.030)
Inverse Mills Ratio	0.095	(0.098)	0.109	(0.099)	0.098	(0.097)	0.112	(0.099)

Ind. Sector (a)								
Year (a)								
constant	2.384**	(0.714)	2.349**	(0.715)	2.953**	(1.075)	2.633*	(0.099)
No. of obs.		2,002		2,002		2,002		2,002
Selected no. of obs.		569		569		569		569
Prob > chi^2		0.000		0.000		0.000		0.000

Significance levels: *** p< 0.001, ** p< 0.01, * p< 0.05, † p< 0.1

(a) Results not shown to save space

Table VI. The effect of EP on OFDI intensity, robustness test using the number of jobs created by OFDI

	Model 9		Model 10		Model 11		Model 12	
Heckman Stage 1								
Dependent variable: FDI dummy								
EP_{t-1}			0.814***	(0.168)			0.814***	(0.168)
China EPI					8.770***	(1.608)	9.444***	(1.625)
Market $Value_{t-1}$	-0.068	(0.092)	-0.126	(0.093)	-0.068	(0.092)	-0.126	(0.093)
$Revenues_{t-1}$	0.919***	(0.080)	0.921***	(0.081)	0.919***	(0.080)	0.921***	(0.081)
ROA_{t-1}	1.001†	(0.543)	1.205*	(0.547)	1.001†	(0.543)	1.205*	(0.547)
SOE	0.100	(0.087)	0.138	(0.087)	0.100	(0.087)	0.138	(0.087)
Energy	0.332†	(0.187)	0.263	(0.189)	0.332†	(0.187)	0.263	(0.189)
Basic materials	0.589**	(0.172)	0.617***	(0.173)	0.589**	(0.172)	0.617***	(0.173)
Industrials	0.448**	(0.161)	0.508**	(0.162)	0.448**	(0.161)	0.508**	(0.162)
Cons. Cyclicals	1.130***	(0.162)	1.169***	(0.162)	1.130***	(0.162)	1.169***	(0.162)
Cons. Non-cycl.	-0.718**	(0.266)	-0.656*	(0.268)	-0.718**	(0.266)	-0.656*	(0.268)
Healthcare	0.236	(0.267)	0.247	(0.270)	0.236	(0.267)	0.247	(0.270)
Technology	0.999***	(0.172)	0.941***	(0.173)	0.999***	(0.172)	0.941***	(0.173)
Utilities	*Base category*		*Base category*		*Base category*		*Base category*	
Year (a)								
constant	-7.534***	(0.438)	-7.693***	(0.441)	-11.395**	(0.901)	-11.850***	(0.913)

	Model 13		Model 14		Model 15		Model 16	
Heckman Stage 2								
Dependent variable: Number of jobs created by OFDI								
EP_{t-1}			0.365*	(0.147)			0.366*	(0.147)
Host EPI					-0.573†	(0.324)	-0.571†	(0.322)
Host GDP Growth	1.590	(1.154)	1.504	(1.150)	0.949	(1.206)	0.865	(1.201)
Host GDP	-0.400***	(0.055)	-0.414***	(0.055)	-0.329***	(0.068)	-0.344***	(0.068)
Host FDI inflow	-0.194	(0.397)	-0.206	(0.395)	-0.194	(0.396)	-0.206	(0.394)
Prior. China FDI	0.020†	(0.012)	0.023*	(0.012)	0.018	(0.012)	0.021†	(0.012)
Host Nat. Res.	0.722	(0.474)	0.795†	(0.474)	0.649	(0.475)	0.723	(0.474)
Geo. Dist.	0.158	(0.143)	0.139	(0.143)	0.163	(0.143)	0.145	(0.143)
Regulatory Dist.	-0.053*	(0.025)	-0.050*	(0.025)	-0.042	(0.026)	-0.039	(0.026)
Inverse Mills Ratio	0.134	(0.084)	0.512†	(0.172)	0.136	(0.084)	0.143†	(0.085)

Ind. Sector (a)								
Year (a)								
constant	2.438***	(0.607)	2.401***	(0.610)	2.484***	(0.606)	2.447***	(0.609)
No. of obs.		2,002		2,002		2,002		2,002
Selected no. of obs.		569		569		569		569
Prob > chi^2		0.000		0.000		0.000		0.000

Significance levels: *** p< 0.001, ** p< 0.01, * p< 0.05, † p< 0.1

(a) Results not shown to save space

Table VII. Robustness test, the effect of EP on OFDI intensity using OLS model

	Model 17		Model 18		Model 19		Model 20	
ODFI Intensity — linear regression Dependent variable: OFDI amount invested								
EP_{t-1}			0.458**	(0.168)			0.456**	(0.168)
Host EPI					-0.881*	(0.389)	-0.878*	(0.387)
Host GDP Growth	1.268	(1.387)	1.131	-1.38	0.285	(1.448)	0.152	(1.441)
Host GDP	-0.266***	(0.066)	-0.289***	-0.066	-0.157†	(0.082)	-0.180*	(0.082)
Host FDI inflow	-0.522	(0.477)	-0.539	-0.474	-0.523	(0.475)	-0.540	(0.472)
Prior. China FDI	0.023	(0.014)	0.028*	-0.014	0.020	(0.014)	0.025†	(0.014)
Host Nat. Res.	1.482**	(0.570)	1.601**	-0.569	1.370*	(0.570)	1.488**	(0.569)
Geo. Dist.	0.145	(0.172)	0.116	-0.171	0.154	(0.171)	0.125	(0.171)
Regulatory Dist.	-0.068*	(0.031)	-0.064	-0.03	-0.051	(0.031)	-0.047	(0.031)
Ind. Sector (a)								
Year (a)								
constant	2.163**	(0.784)	2. 227**	(0.785)	2. 345**	(0.780)	2.409**	(0.781)
No. of obs.		569		569		569		569
R-squared		0.202		0.209		0.212		0.220
Prob > chi^2		0.000		0.000		0.000		0.000

Significance levels: *** p< 0.001, ** p< 0.01, * p< 0.05, † p< 0.1

(a) Results not shown to save space