Journal of International Business Studies (2016)
© 2016 / [illegible] 004 -2506/16
www.jibs.net

[illegible]

[illegible]

[illegible] 16, 86159 A[illegible]

Correspondence:
Marcus Wagner, Faculty of Business Administration and Economics, Augsburg University, Universitätsstr. 16, 86159 Augsburg, Germany.
Tel: +49 821 598 4079;
e-mail: marcus.wagner@wiwi.uni-augsburg.de

Abstract

[illegible] (2016). doi:10.1057/s41267-016-0013-4

Keywords: [illegible]

Received: 3 October 2013
Revised: 19 May 2016
Accepted: 7 June 2016

INTRODUCTION

Foreign direct investment (FDI) is viewed as being capable of facilitating both a “race to the bottom” and a “race to the top” (Madsen, 2009; Kolk, 2016). In this regard, the pollution haven argument suggests that multinational enterprises (MNEs) relocate to countries with weaker environmental regulations to avoid the cost of implementing expensive pollution control measures and related processes (Christmann & Taylor, 2001; Copeland & Taylor, 1994; Strike, Gao & Bansal, 2006). The opposing, the induced innovation argument, suggests that such locations will not be a barrier if MNEs have superior environmental capabilities that help them meet strict regulatory requirements at lower cost (Palmer, Oates & Portney, 1995; Porter & van der Linde, 1995). In the latter case, environmental regulation leads to the embodied transfer of environmental capabilities – that is, the transfer of innovations from home to host countries through direct investment by foreign firms (Lanjouw & Mody, 1996), which ultimately results in additional innovation in the host countries.

Although empirical evidence exists for both arguments (Brunnermeier & Levinson, 2004; Copeland & Taylor, 2004; Jeppesen & Folmer, 2001; Kellenberg, 2009; Rezza, 2015), studies often do not sufficiently control for potential confounding influences, such as firm-specific endowments of environmental capabilities or regulatory heterogeneity. For example, individual capabilities can affect firm choices, but this may be masked if only aggregated measures (i.e., those gauging the joint influence of several capabilities, typically in an additive manner as a net sum) are used. Furthermore, capabilities can interact with other firm characteristics, and not accounting for this interaction can result in omitted variable bias, which may result in distorted assessments or even methodological artifacts that negatively affect policy design or firm strategizing. Therefore it is necessary to integrate firm characteristics into the analysis, specifically with regard to their interactions.

Similarly, studies pooling countries mask regulatory heterogeneity across administrative subunits within one country (e.g., provinces or federated states) by wrongly assuming one homogenous level of regulatory stringency across a whole country. To enable better assessment, it is necessary to account for variation of the regulatory conditions in a host country and over time. Furthermore, it is necessary to control for cultural and institutional distances and differences, for example by focusing on individual home and host countries, because such factors can produce omitted variable biases if not controlled for comprehensively in multi-country studies on FDI and regulation. That such controls are not included in many extant studies could have contributed to the inconclusive results found.

To fill the gap in the literature, our research addresses these issues in the context of United States (US) firms' FDI in China based on novel data on US MNE investments that allow us to overcome several of the shortcomings of earlier studies. Our analysis integrates the cost-based pollution haven argument (where firms evade strict regulation as an external force but are treated as behaving homogeneously in the same manner) with the benefit-based induced innovation argument. This latter argument implies that firm-specific environmental capabilities or the lack thereof (partly in interaction with other firm characteristics) nuance corporate reactions to regulation levels, in turn attenuating or amplifying the effect of regulation on FDI choices.

Based on this extended framework integrating both arguments, we hypothesize and analyze which characteristics of firms determine their location in regions with differing environmental standards. In doing so, we clarify the inconclusive empirical evidence on the pollution haven argument (due to spatial and temporal regulatory heterogeneity, cultural and institutional distances and differences or insufficiently integrated theory bases) and provide novel insights into how methodological choices affect this unsettled issue. Our focus on one home and one host country allows us to properly control for cultural and institutional heterogeneity.

We find that firm characteristics matter as determinants of FDI choice, particularly in terms of heterogeneity in environmental (in-)capabilities and size as well as their interaction. Furthermore, we show that the results depend on the aggregation level in terms of either an aggregated (net sum) index of firms' environmental strengths and weaknesses or disaggregated individual environmental capabilities and concerns (that is, measuring additively the joint influence of several capabilities versus gauging their individual effects).

The contribution of our article to the field of international business (IB) is fourfold: First, by integrating the pollution haven and induced innovation arguments, a systematic examination of these opposing arguments is facilitated which allows deriving more refined hypotheses. This helps to avoid empirical designs focused on testing only one of the arguments. Second, we contribute novel insight on the theoretical validity of the pollution haven and "race to the bottom" debates by linking them to firm capabilities. This approach enables a broader theoretical understanding at the intersection of the sustainability and IB literatures because it joins country-specific and firm-specific advantages (Christmann & Taylor, 2001; Madsen, 2009; Rugman & Verbeke, 1998a; Strike et al., 2006). Third, we contribute an assessment of the degree to which aggregation levels and firm-specific advantages captured by firm characteristics and their interactions co-determine (together with country-specific advantages) FDI choices, thus also explaining previously inconclusive evidence on the aforementioned arguments. Fourth, we contribute empirical evidence by using more comprehensive and updated data and measures to analyze the above issues. More specifically, by choosing a context of intra-country regulation differences, we are able to focus on one home and one host country and thus avoid issues raised by the literature on cultural and institutional distance, and effect differs depending on whether the investor is ethnic Chinese, thereby suggesting that firm characteristics need to be accounted for. Finally, Bu, Liu, Wagner and Yu (2013) show that incorporating an overall social responsibility index in the analysis can have an effect that opposes the pollution haven argument.

Overall, the mixed evidence on the pollution haven argument suggests a research gap and a corresponding need to analyze whether the methodological choices of empirical studies (e.g., in terms of the set of variables included in the analysis or the measurement specifications chosen) can affect the results. For example, Husted and Allen (2006) analyze the relationship between global and country-specific corporate social responsibility (CSR, of which one component in their study is environmental management) and international strategy and find that country-specific CSR is more common among multi-domestic and transnational corporations than among global MNEs, whereas global CSR is equally common across all MNEs. This refutes assuming identical firms (i.e., not allowing for differing strategies or capabilities) with the same cost per firm to achieve a given level of regulation. Opposed to this, differing cost can be modeled if heterogeneity across firms, for example, with regard to environmental capabilities or weaknesses, is permitted.

Additionally, the methodological choice of pooling firms with greater or fewer environmental capabilities could distort the evidence for or against the pollution haven argument, as two opposing behavioral patterns are mixed in one set of data. Similarly, firm heterogeneity in environmental capabilities —if incorporated in the analysis—can, for example, be modeled by means of sum indices, threshold levels or individual item variables, again implying the possibility of results being artifacts of specific methodological choices. In sum, there is a need for further and more refined analyses of such issues to address a gap in the literature, the illumination of which can significantly contribute to resolving the empirical ambiguity surrounding the pollution haven argument.

have no competitive advantage (Dowell, Hart & Yeung, 2000). Such firms lack firm-specific advantages in terms of specific environmental strengths or have, on balance, more weaknesses than strengths, which is a disadvantage for host countries because multinationals investing in a country account for a large share of embodied environmental capability transfer (Albornoz, Cole, Elliott & Ercolani, 2009; Lanjouw & Mody, 1996). For example, in the ex-communist block after 1990, industry was largely rebuilt by means of FDI from multinational firms, which implied considerable embodied environmental capability transfer that was largely built on firm-specific advantages in terms of environmental strengths (Rugman & Verbeke, 1998a, b). This argument suggests that multinational firms with firm-specific environmental advantages are often less concerned about strict environmental regulations than is assumed in the pollution haven argument and accelerate innovation in the host country, a notion that has more recently also been confirmed in the context of institutional voids (El Ghoul, Guedhami & Kim, 2016; Marano, Tashman & Kostova, 2016).

In sum, what emerges from the literature review is that (i) the pollution haven argument is mainly cost-based, while the induced innovation argument is largely benefit-based, and there is therefore a need to integrate these two only seemingly conflicting views; (ii) evidence on the pollution haven argument is equivocal (partly due to measurement issues); and (iii) it is thus desirable to better understand which characteristics lead firms to be willing to pursue FDI in regions with stricter environmental regulations and what the influence of omitted variables is in relation to parallel measurement issues. To do so, it is necessary to directly

Path dependencies and historic lock-ins lead to heterogeneity and to a distribution of environmental capabilities for the firm population in one host country. In sum, environmental activities create strategic resources that correspond to greater capabilities to address the requirements of strict environmental regulation and hence increase the likelihood that firms will choose to locate FDI in regions with stringent environmental regulation. These considerations lead to the first hypothesis:

> **H o he i 1a:** Firms with greater environmental capabilities are more likely to locate FDI in regions with stricter environmental regulation.

Beyond the environmental capabilities (i.e., strengths) of firms that may induce FDI in locations with stringent environmental regulation, weaknesses in terms of lesser capabilities or concerns about corporate social irresponsibility also need to be considered. This follows from the logic of integrating the pollution haven and induced innovation arguments to explain FDI choices with respect to environmental regulation differences because studies suggest that strengths and weaknesses concerning environmental management are orthogonal to one another (e.g., Strike et al., 2006).

Furthermore, profitable or at least cost-effective opportunities at the firm level for pollution abatement do not always exist (Kolk & Pinkse, 2008). Thus, firms' compliance decisions are based on the probability of detection and the expected penalty if non-compliance is found (Cohen, Fenn & Naimon, 1995). It is therefore possible that firms show concerns and weaknesses with regard to environmental management, for example in terms of high emissions that exceed stringent regulatory limits and even result in fines or penalties.

For such firms, following the pollution haven argument, siting in weakly regulated locations is a means to reduce non-compliance or its detection

study to remain comparable over time. Given that the data are collected by firm-independent researchers, problems of social desirability that frequently confound empirical work on environmental management (especially in the case of self-evaluation, for example, as in surveys) are much added value created in the manufacturing industry (to control for province size) is used to gauge the strictness of a province's environmental regulation (named "Environmental regulation strictness").[3] Importantly, we use a comprehensive measure of water, air and waste emission fees that is more encompassing than the measures used thus far in the Chinese context. Using emission fees for these different environmental media jointly as a measure of regulatory stringency is also advisable, as the relevance of different emissions is industry specific. For example, Dean et al. (2009) use only chemical oxygen demand (COD) load per ton of wastewater as an indicator of environmental stringency, but this measure has been shown to vary greatly in relevance across industries (Tyteca, Carlens, Berkhout, Hertin, Wehrmeyer & Wagner, 2002). Our measure is not affected by such a potential bias.[4] Additionally, other than Dean et al. (2009), who only use values of one baseline year in their data, our dependent variable is time-varying, that is, we account for changes in regulatory stringency over time by using annual values of our dependent variable of regulation strictness for each province. As detailed later, we also employ a binary variant of this dependent variable in one of our sensitivity analyses.

Figure

account for important firm-level characteristics. First, return on assets (named "ROA") and market-to-book value (named "Tobin's Q") are included in variants of the analysis as alternative measures of profitability. These variables are used because, all else being equal, higher profits should make a firm more inclined to invest in a foreign location with more stringent environmental regulation, given

expectation that the large majority of provinces are still on the increasing slope part of the Environmental Kuznets Curve (EKC), which further increases our confidence in the measure.[7]

Initially, an ordinary least squares (OLS) regression with robust standard errors clustered by province-year is applied to the data to test the hypotheses derived above, as suggested by Rabe-Hesketh and Skrondal (2008). In the sensitivity analyses, we employ probit models with robust standard errors clustered by province-year based on a binary dependent variable that is derived as described below (we are grateful to one reviewer

Table 3 / [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				0.46 (0.4)	0.46 (0.46)	0.23 (0.4)
[illegible]						1.40 (0.5)*
[illegible]	1. 2 (1.26)	1.6 (1.32)	1. 4 (1.41)			
[illegible]			−1.52 (2.1)			
[illegible]	0.40 (0. 1)	0.40 (0. 3)	0.0 (0.)			
[illegible]			1.05 (2.06)			
[illegible]	1. 4 (1.13)†	2.04 (1.15)†	2.16 (1.13)†			
[illegible]			−0.14 (1.54)			
[illegible]	1.1 (1.04)	1.01 (1.06)	0.25 (1.10)			
[illegible]			−3.46 (1.)†			
[illegible]	0.54 (0. 3)	0.66 (0. 6)	1.02 (0.)			
[illegible]			−2.03 (1.0)†			
[illegible]	−2.35 (1.0)*	−2.23 (1.0)*	−2.35 (1.13)*			
[illegible]			0.24 (1.0)			
[illegible]	−0.21 (0.4)	−0.11 (0.51)	−0.6 (0. 2)	−0.12 (0.4)	−0.02 (0.4)	−0.14 (0.4)
[illegible]	0.0001 (0.003)	0.001 (0.004)	−0.0005 (0.004)	0.001 (0.003)	0.003 (0.003)	0.002 (0.003)
[illegible]	0.05 (0.04)	0.05 (0.04)	0.0 (0.04)†	0.05 (0.04)	0.06 (0.04)	0.0 (0.04)†
[illegible]	0.0 (0.13)	0.0 (0.13)	0.23 (0.15)	−0.02 (0.13)	−0.00 (0.13)	0.10 (0.14)
[illegible]		−0. 5 (1. 3)	−2.10 (1. 3)		−0.2 (1. 4)	−0.5 (1.)
[illegible]		. . 2 (33.13)	16.14 (35.10)		6.31 (34. 2)	.43 (35.05)
[illegible]	−2.3 (2.20)	−2. 1 (2.25)	−3. (2.30)	−2. (2.21)	−3.0 (2.21)	−3.2 (2.1)
[illegible]	−1.51 (1.66)	−1.5 (1.63)	−1.4 (1. 0)	−1. (1.40)	−2.0 (1.41)	−1.40 (1.3)
[illegible]	−0.006 (0.12)	−0.01 (0.12)	−0.00 (0.12)	0.004 (0.13)	−0.005 (0.12)	0.005 (0.12)
[illegible]	−0.001 (0.0003)***	−0.001 (0.0003)***	−0.001 (0.0003)***	−0.001 (0.0003)***	−0.001 (0.0003)***	−0.001 (0.0003)***
[illegible]	3.35 (3.12)	3.21 (3.13)	4. 1 (3.36)	2. 4 (3.1)	2. (3.1)	3.25 (3.1)
[illegible]	. .2 (1. 3)***	. .15 (1. 3)***	. . 4 (1. 5)***	. .6 (1.60)***	. .53 (1.56)***	. . 6 (1.52)***
[illegible]	−6. 5 (2.64)*	−6.6 (2.6)*	−5.60 (2.61)*	−6.62 (2.56)*	−6.56 (2.5)*	−6.33 (2.56)*
[illegible]	−3.20 (4.51)	−3.20 (4.50)				2 (6. 5)-336.2000124((2.-342. .... 3 ((1.41))

Furthermore, the Liaoning dummy has a significant positive and the Guangxi, Sichuan and Tianjing dummies a significant negative association. In the model with interactions, the debt-to-asset ratio additionally has a significantly positive association with the dependent variable.

Concerning the model specification variant with the aggregated net sum index integrating the six individual variables described above, the fifth to seventh columns of Table 3 reveal that no omnibus effect occurs, while the effects for the control variables remain unchanged. That is, the aggregation to total sum scores masks the individual effects, or, stated another way, siting decisions with regard to the stringency of environmental regulation can be predicted better from the specific

We also carried out a range of sensitivity tests and robustness checks with a binary specification of our dependent variable based on the annual median of regulatory stringency. More specifically, we calculated a binary dummy variable based on the complete regulatory stringency data for all provinces in each year. It assumes unity if the environmental regulation level of a province in a given year is above the median regulation level across all provinces for that year and zero if it is below the median level. The results of these sensitivity tests are reported in Tables 5 and 6 and show that the basic results and outcomes of the hypothesis tests remain as in Tables 3 and 4.

First, all of the models are again highly significant overall ($p < 0.001$). For the models with

Table 5 / [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				0.2[illegible] (0.12)*	0.31 (0.13)*	0.20 (0.14)
[illegible]						0.[illegible] (0.1[illegible])***
[illegible]	0.[illegible] (0.4[illegible])*	0.[illegible] (0.5[illegible])†	0.4[illegible] (0.[illegible]5)			
[illegible]			0.4[illegible] (0.[illegible])			
[illegible]	0.10 (0.25)	0.0[illegible] (0.2[illegible])	−0.10 (0.33)			
[illegible]			0.[illegible] (0.[illegible]2)			
[illegible]	0.[illegible] (0.32)**	1.04 (0.3[illegible])**	0.[illegible]4 (0.34)*			
[illegible]			−0.05 (0.5[illegible])			
[illegible]	0.21 (0.32)	0.0[illegible] (0.34)	−0.10 (0.34)			
[illegible]						
[illegible]						

with the individual capability and concern vari-

Table 6 [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				0.31 (0.12)*	0.33 (0.14)*	0.23 (0.14)
[illegible]						0.6 (0.1)***
[illegible]	1.00 (0.50)*	0. (0.5)†	0.46 (0. 1)			
[illegible]			0.3 (0. 4)			
[illegible]	0.11 (0.25)	0.10 (0.2)	−0.06 (0.34)			
[illegible]			1.00 (0. 3)			
[illegible]	0. 5 (0.33)*	1.01 (0.3)**	0. 2 (0.35)*			
[illegible]			−0.04 (0.5)			
[illegible]	0.16 (0.33)	0.04 (0.35)	−0.15 (0.34)			
[illegible]			−1.10 (0.43)*			
[illegible]	0.24 (0.30)	0.25 (0.33)	0.42 (0.34)			
[illegible]			−0.5 (0.35)			
[illegible]	−1.12 (0.2)***	−1.13 (0.2)***	−1.0 (0.34)**			
[illegible]			−0. 2 (0.3)*			
[illegible]	−0.1 (0.15)	−0.14 (0.16)	−0.35 (0.25)	−0.11 (0.14)	−0.0 (0.15)	−0.23 (0.1)
[illegible]	0.002 (0.006)	0.003 (0.00)	0.005 (0.00)	0.003 (0.005)	0.004 (0.006)	0.00 (0.00)
[illegible]	0.00 (0.01)	0.00 (0.01)	0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	0.01 (0.00)
[illegible]	−0.03 (0.03)	−0.02 (0.03)	0.01 (0.03)	−0.04 (0.02)	−0.03 (0.02)	−0.001 (0.02)
[illegible]		0.13 (0.63)	0.00 (0.6)		0.4 (0.54)	0.4 (0.56)
[illegible]		23.23 (12.0)†	31.16 (11.3)**		20.34 (11.5)†	23. 2 (10.40)*
[illegible]	0.23 (0.63)	0.22 (0.5)	−0.0 (0.66)	0.1 (0.66)	0.15 (0.61)	0.13 (0.62)
[illegible]	−0. 0 (0.4)†	−1.03 (0.52)*	−1.05 (0.53)*	−1.01 (0.42)*	−1.10 (0.46)*	−0. 5 (0.45)†
[illegible]	0.03 (0.02)	0.03 (0.03)	0.02 (0.02)	0.04 (0.02)	0.03 (0.03)	0.03 (0.03)
[illegible]	−0.0001 (0.0000)	−0.0001 (0.0001)	−0.0002 (0.0000)	−0.0001 (0.0000)	−0.0001 (0.0000)	−0.0001 (0.0000)
[illegible]	0.30 (0.)	0.2 (1.01)	0.54 (1.02)	0.35 (0.)	0.35 (1.00)	0.51 (1.02)
[illegible]	5. 5 (0.6)***	6.0 (0. 1)***	6.61 (1.14)***	5.6 (0.42)***	5.6 (0.4)***	6.44 (0. 5)***
[illegible]	− .66 (0.)***	− . 0 (0.)***	−6.3 (0. 3)***	−6.22 (0.6)***	−6.1 (0.63)***	−6.15 (0.5)***
[illegible]	−4. 6 (1.30)***	−4. (1.5)**	−4.1 (1.43)**	−5.0 (1.44)***	−5.21 (1.61)**	−4.63 (1.30)***
[illegible]	−0. (0. 2)	−1.11 (0. 1)	−0. (0. 1)	−0. 4 (0. 1)	−1.01 (0.6)	−0. (0.6)
[illegible]	−0.64 (0.)	−0.66 (0.)	−0.5 (0. 0)	−0.33 (0. 1)	−0.33 (0. 2)	−0.23 (0. 2)
[illegible]	−0.22 (0.55)	−0.2 (0.56)	−0.2 (0.5)	0.02 (0.54)	0.001 (0.56)	0.0 (0.56)
[illegible]	−1.55 (0.4)**	−1.51 (0.50)**	−1.3 (0.50)**	−1.45 (0.4)**	−1.3 (0.4)**	−1.36 (0.4)**

environmental concerns are to locate in more weakly regulated provinces because they are perceived relatively better in such locations. It also clarifies why smaller firms with environmental concerns are less likely to do so, due to their lower visibility.

Therefore, our findings suggest that firms are aware of (and as a result implement rational strategic choices conditional on) their endowments and characteristics when accounting for the stringency of environmental regulation as part of siting decisions. Consistent with this approach, larger firms with lesser environmental capabilities are

[illegible] 200[illegible] [illegible], 43(2): 231–256.

[illegible] 2001. [illegible]

[illegible] 2002. [illegible], 21(1): 1–22.

[illegible] 2014. [illegible], 45(6): [illegible]

ABOUT THE AUTHORS

Maoliang B is Associate Professor at the School of Business, Nanjing University and Adjunct Professor of International Economics at Hopkins-Nanjing Center. His research is mainly on globalization and environmental sustainability. He is an Alexander von Humboldt Fellow.

Marc Wagner is Professor of Management, Innovation and International Business at Augsburg University and Associate Member of the Bureau d'Economie Théorique et Appliquée, Strasbourg, where he was a Marie Curie Fellow. His research focuses on innovation, global sustainability and strategic management, and has been published, inter alia, in Journal of Business Venturing, Long Range Planning, and Research Policy.

Accepted by Mona Makhija, Area Editor, 7 June 2016. This article has been with the authors for four revisions.