

Do stringent environmental policies deter FDI?

The M&A versus Greenfield

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Does the degree of environmental location matter for the location decisions of the firms?

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Rather strong theoretical support
(Siebert 1974, Markusen et.al. 1993, McGuire 1982, Copeland and Taylor 1994)

PHH

Mixed empirical evidence (FDI channel):

- List and Co (2000)
 - US inbound data, macro level
 - supporting evidence
- Smarzynska, Javorcik and Wei (2004)
 - Eastern and Central Europe (in- and outflows), micro level
 - mixed support
- Wagner, Timmins (2008)
 - outbound German data, macro level
 - agglomeration effect
 - support for PHH for chemical industry, no PHH in primary metals and paper
- Manderson, Kneller (2011)
 - outbound UK data, micro level
 - controlling for firm's individual characteristics
 - no robust support for PHH

Contribution of the paper

Controlling for heterogeneity:

- Differentiation between M&A and Greenfield investments

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- Differentiation between M&A and Greenfield investments
 - grandfathering
 - capitalization of the environmental policy in the price
 - different purposes for M&A investments

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Why Germany?

- 10% of the total world exports
- share of 5-8% in the world FDIs in the years considered
- distinction between modes of entry

Present paper: first to combine heterogeneity in industries (environmental intensity) and mode of entry in a location choice model.

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We find significant and robust effects of environmental regulations on investment decisions. We also show that distinction between M&A and GF is an empirically important one.

Model

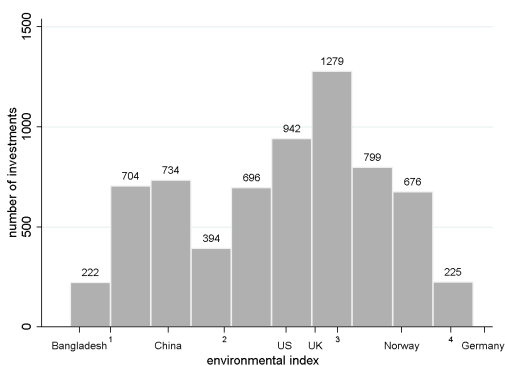
Data on all new German affiliates abroad for years 2005-2009 (approx. 6600 investments performed by 2000 companies).

Parent firms seeks to maximize (expected) profits by selecting among 70 possible host countries. Industry and mode of entry considered predetermined.

$$\begin{aligned}
 \Pi_{k,l} = & \alpha + \beta_1 \text{envindex}_l & (1) \\
 & + \beta_2 (\text{Greenfield}_k \cdot \text{LowPoll}_k \cdot \text{envindex}_l) \\
 & + \beta_3 (\text{Greenfield}_k \cdot \text{MedPoll}_k \cdot \text{envindex}_l) \\
 & + \beta_4 (\text{Greenfield}_k \cdot \text{HighPoll}_k \cdot \text{envindex}_l) \\
 & + \beta_5 (\text{M\&A}_k \cdot \text{MedPoll}_k \cdot \text{envindex}_l) \\
 & + \beta_6 (\text{M\&A}_k \cdot \text{HighPoll}_k \cdot \text{envindex}_l) \\
 & + \gamma \mathbf{x}_{k,l} + \epsilon_{k,l}
 \end{aligned}$$

Controls

- Environmental stringency and enforcement → environmental index



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- Industry: heavy polluting H- medium polluting M- low polluting L
- entry mode: M&A - Greenfield
- corruption and labour freedom
- population/GDP per capita / openness
- corporate tax (additionally interacted with the entry mode)
- distance
- stock of FDI (proxy for agglomeration effect)

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- Industry: heavy polluting H- medium polluting M- low polluting L
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- stock of FDI (proxy for agglomeration effect)
- robustness check variables (FDI restrictiveness, HDI, GDP growth, inflation etc.)

Estimated models:

- linear probability model
- logit, conditional logit
- mixed logit
 - allows “taste heterogeneity” among parent firms
 - does not impose IIA
- estimated with clusters at the parent level

	(1d)
<i>envl</i>	.0067
	(.434)***
...	
<i>M&A # med-poll # envl</i>	-
<i>M&A # high-poll # envl</i>	-
<i>Greenf # low-poll # envl</i>	-
<i>Greenf # med-poll # envl</i>	-
<i>Greenf # high-poll # envl</i>	-
<i>med-poll # envl</i>	-
<i>high-poll # envl</i>	-
<i>Log likelihood</i>	-22006

Table: Estimation results - mixed logit.

***, ** and * denote significance at the 1%, 5% and 10% level respectively. No. of observations: 459267, number of Halton draws - 300.

	(1d)	(1ld)
<i>envl</i>	.0067	.1645***
	(.434)***	(.4769)***
...		
<i>M&A # med-poll # envl</i>	-	-
<i>M&A # high-poll # envl</i>	-	-
<i>Greenf # low-poll # envl</i>	-	-
<i>Greenf # med-poll # envl</i>	-	-
<i>Greenf # high-poll # envl</i>	-	-
<i>med-poll # envl</i>	-	-.5592***
		(.3112)***
<i>high-poll # envl</i>	-	-.418***
		(.2793)***
<i>Log likelihood</i>	-22006	-21904

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	(IId)	(IIId)	(IIIId)
<i>envl</i>	.0067	.1645***	.226***
	(.434)***	(.4769)***	(.0016)
...			
<i>M&A # med-poll # envl</i>	-	-	-.455***
			(.3494)***
<i>M&A # high-poll # envl</i>	-	-	-.3079***
			(.5589)***
<i>Greenf # low-poll # envl</i>	-	-	-.2298***
			(.7463)***
<i>Greenf # med-poll # envl</i>	-	-	-.9616***
			(.375)*
<i>Greenf # high-poll # envl</i>	-	-	-1.0354***
			(.1896)
<i>med-poll # envl</i>	-	-.5592***	-
		(.3112)***	-
<i>high-poll # envl</i>	-	-.418***	-
		(.2793)***	-
<i>Log likelihood</i>	-22006	-21904	-21871

Table: Estimation results - mixed logit.

***, ** and * denote significance at the 1%, 5% and 10% level respectively. No. of observations: 459267, number of Halton draws - 300.

	(IId)	(IIId)	(IIIId)
<i>ctax</i>	-.0278*** (.0823)***	-.0234*** (.0797)***	-.0251*** (.0787)***
<i>Greenf # ctax</i>	.007 (.0508)***	.0033 (.099)	.0113** (.0405)***
<i>population</i>	.8259*** (.4354)***	.8092*** (.4554)***	.8697*** (.4508)***
<i>gdp</i>	1.0864*** (.5358)***	.9355*** (.1373)***	1.089*** (.409)***
<i>openness</i>	-.0003 (.0034)***	-.0015*** (.0038)***	-.0004 (.0038)***
<i>distance</i>	-.4754*** (.4545)***	-.5413*** (.4453)***	-.5003*** (.4365)***
<i>corruption fr</i>	.0014 (.0231)***	-.0007 (.0274)***	-.001 (.0265)***
<i>labor fr</i>	-.0014 (.0206)***	-.0014 (.0235)***	.00 (.022)***
<i>FDIstock</i>	.174*** (.0263)	.1996*** (.0992)***	.1883*** (.0949)***

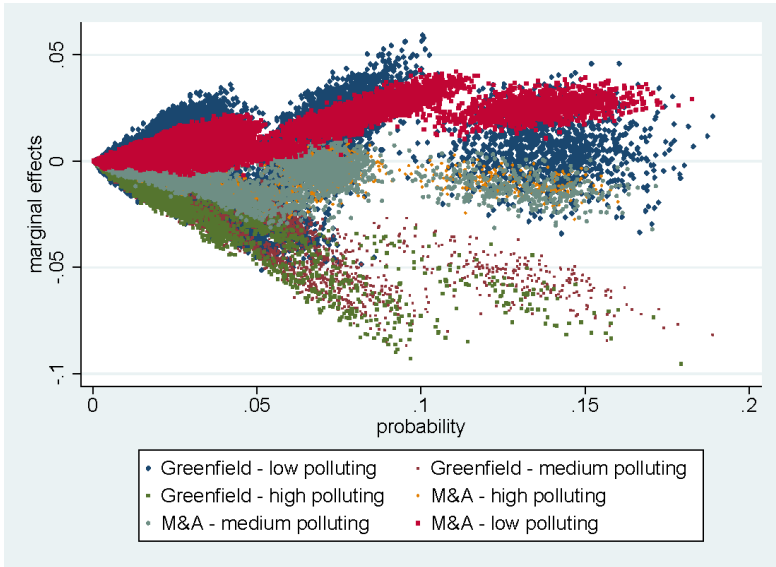
Table: Estimation results - mixed logit.

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Table: Marginal effects and conditional marginal effects of environmental index and their significance in different setups.

	AME	p> t	CME Greenf. low poll.	p> t	CME Greenf. medium poll.	p> t	CME Greenf. high poll.	p> t	CME M&A low poll.	p> t	CME M&A medium poll.	p> t	CME M&A high poll.	p> t
setup IIIb	.00019	.789	-.00163	.043	-.00233	.001	-.0024	.001	.00156	.049	.0001	.169	.00077	.302
logit	(.0007)		(.0008)		(.0007)		(.00071)		(.00079)		(.00746)		(.00075)	
setup IIIc	.0002	.917	-.00002	.924	-.01036	.00	-.01024	.00	.00314	.156	-.00214	.294	-.00275	.226
cond.logit	(.00199)		(.00194)		(.00191)		(.00212)		(.00222)		(.00202)		(.00226)	
setup IIId	.0001	.99	-.0001	0.924	-.0094	.00	-.0105	.00	.0029	.00	-.0029	.008	-.0014	.355
mixed logit	(.0008)		(.00105)		(.00151)		(.00211)		(.00084)		(.00108)		(.00151)	

Note: Standard errors of the estimates are given in brackets. In case of logit and conditional logit models, the errors were calculated using the delta method, for the mixed logit they were bootstrapped using 229 repetitions.



Magnitudes of the marginal effects depend on probabilities

Table: Importance of the environmental policy changes for China and Great Britain - comparison between different investment types.

Variable	China						Great Britain					
	Marginal effects			St. dev. change			Marginal effects			St. dev. change		
	AME	CME	CME	Average	For	For	AME	CME	CME	Average	For	For
		Greenf.	M&A		Greenf.	M&A		Greenf.	M&A		Greenf.	M&A
	high	low		high	low		high	low		high	low	
envl	-.0068	-.0545	.0086	-.0027	-.0398	.0085	.0055	-.0384	.0163	.011	-.0287	.0176
ctax	-.0009	-.0007	-.0011	-.0216	.002	-.0039	-.0016	-.0006	-.002	-.0005	.0002	-.0009
gdp per cap	.0418	.0651	.0359	.0574	.0866	.0503	.0745	.0565	.081	.1142	-.0898	.1231
FDI stock	.0074	.0116	.0064	.0157	.0244	.0136	.0128	.0094	.0138	.0105	.0112	.0162
Probability	.055	.0868	.047				.0756	.0551	.0824			

Note: "Probability" gives the calculated probability of a new investment project of a given type locating in the investigated country. Calculations based on mixed logit estimates.

Robustness checks:

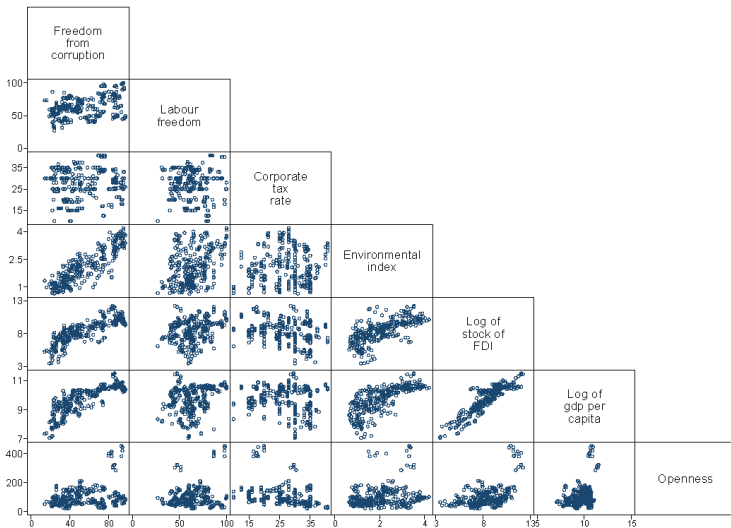
- sample increased to 2005-2011, 120 countries to choose from
- country fixed effects
- exclusion of services
- additional control variables: GDP growth, inflation, exchange rate, no. of documents needed to import
- panel data
- 3rd country effects
- endogeneity of environmental index (preliminary tests)

- heterogeneity matters

- heterogeneity matters
- policy implications

Thank you for your attention

BACK-UP SLIDES



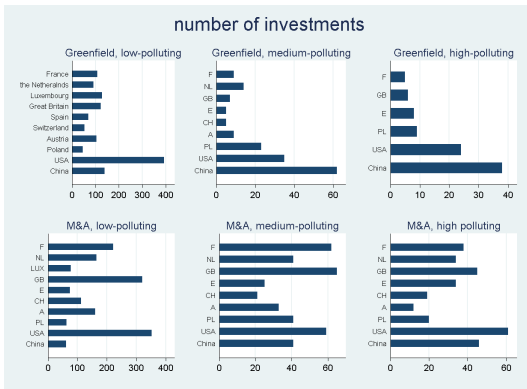
Variable	Mean	Std. dev.	Min	Max	Source
<i>Environmental index</i>	1,99	0,93	.416	4,20	WEF
<i>Corporate tax</i>	26,88	7,10	10,00	40,70	Hebous et al. 2011
<i>Openness</i>	99,53	72,50	19,88	453,43	Penn Tables
<i>Freedom from corruption</i>	52,68	16,06	14,00	97,00	Heritage Foundation
<i>Labour freedom</i>	62,97	16,06	14,00	97,00	Heritage Foundation
<i>Log of FDI stock</i>	8,13	1,84	3,44	12,22	UNCTAD
<i>Log of population</i>	9,86	1,64	5,69	11,50	Penn Tables
<i>Log of GDP per capita</i>	9,59	0,96	7,07	11,51	Penn Tables
<i>Log of distance</i>	8,00	1,20	5,15	9,84	CEPII
<i>HDI</i>	0,77	0,12	0,43	0,94	UN
<i>FDI restrictiveness</i>	0,07	0,16	0,00	1,00	OECD

The data

German data on outward FDI, 5 years of observations (2005-2009).
Approx. 6600 investments performed by some 2000 firms.

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	(Ic)	(IIc)
<i>envl</i>	.0131	.1347**
<i>ctax</i>	-.019***	-.0184***
<i>Greenf # ctax</i>	.0131*	.012*
<i>population</i>	.7975***	.8001***
<i>gdp</i>	.9533***	.9614***
<i>openness</i>	.0021***	.0021***
<i>dist</i>	-.3795***	-.3769***
<i>corruption fr</i>	.0005	.0003
<i>labor fr</i>	.0018	.0017
<i>FDI stock</i>	.1233***	.1274***
<i>M&A # med-poll # envl</i>	-	-
<i>M&A # high-poll # envl</i>	-	-
<i>Greenf # low-poll # envl</i>	-	-
<i>Greenf # med-poll # envl</i>	-	-
<i>Greenf # high-poll # envl</i>	-	-
<i>med-poll # envl</i>	-	-.4563***
<i>high-poll # envl</i>	-	-.4399***
(pseudo) R2	.1642	.1675
Log-likelihood	-23407	-23312

Table: Estimation results for conditional logit.

***, ** and * denote significance at the 1%, 5% and 10% level respectively.

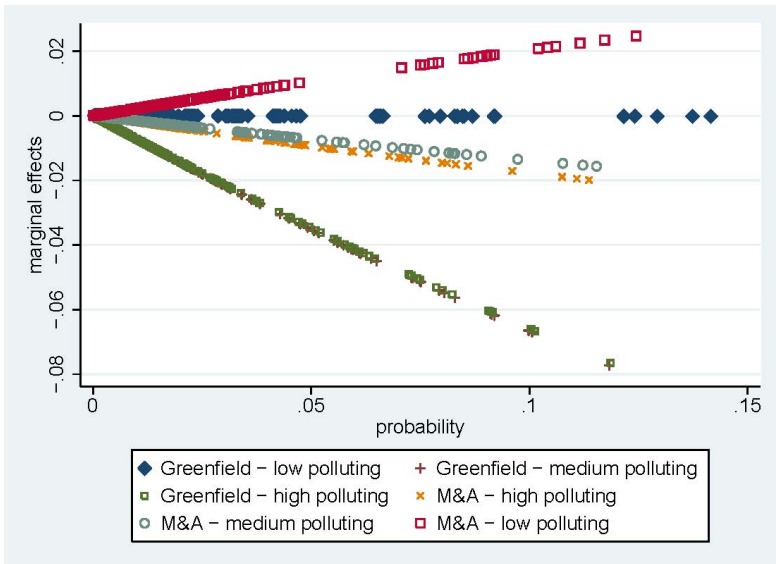
Clustered standard errors at the investing company level were used. Number of observations: 459267.

	(Ic)	(IIc)	(IIIc)
<i>envl</i>	.0131	.1347**	.2267***
<i>ctax</i>	-.019***	-.0184***	-.0207***
<i>Greenf # ctax</i>	.0131*	.012*	.018**
<i>population</i>	.7975***	.8001***	.8017***
<i>gdp</i>	.9533***	.9614***	.9711***
<i>openness</i>	.0021***	.0021***	.0021***
<i>dist</i>	-.3795***	-.3769***	-.3762***
<i>corruption fr</i>	.0005	.0003	.0002
<i>labor fr</i>	.0018	.0017	.0017
<i>FDI stock</i>	.1233***	.1274***	.1286***
<i>M&A # med-poll # envl</i>	-	-	-.38***
<i>M&A # high-poll # envl</i>	-	-	-.4239***
<i>Greenf # low-poll # envl</i>	-	-	-.228***
<i>Greenf # med-poll # envl</i>	-	-	-.9675***
<i>Greenf # high-poll # envl</i>	-	-	-.9596***
<i>med-poll # envl</i>	-	-.4563***	-
<i>high-poll # envl</i>	-	-.4399***	-
<i>(pseudo) R2</i>	.1642	.1675	.1696
<i>Log-likelihood</i>	-23407	-23312	-23253

Table: Estimation results for conditional logit.

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Clustered standard errors at the investing company level were used. Number of observations: 459267.



Magnitudes of the marginal effects depend on probabilities

Table: Importance of the environmental policy changes for France and U.S. - comparison between different investment types.

Variable	France						U.S.					
	Marginal effects			St. dev. change			Marginal effects			St. dev. change		
	AME	CME	CME	Average	For	For	AME	CME	CME	Average	For	For
		Greenf.	M&A		Greenf.	M&A		Greenf.	M&A		Greenf.	M&A
	high	low		high	low		high	low		high	low	
envl	.0052	-.0359	.0148	.0096	-.0246	.0149	.0043	-.0627	.0211	.0046	-.0473	.0206
ctax	-.0001	.0006	-.0005	.0055	.0102	.0029	.0014	.0023	.0007	.0141	.0214	.0097
gdp per cap	.0679	.0525	.0729	.1019	.0814	.0109	.1034	.0933	.1068	.1233	.1143	.127
FDI stock	.0116	.0088	.0125	.0254	.0195	.0271	.017	.0151	.0176	.0346	.0311	.0357
Probability	.0686	.0505	.0742				.1343	.1132	.1388			

Note: "Probability" gives the calculated probability of a new investment project of a given type locating in the investigated country. Calculations based on mixed logit estimates.