Online Appendix

"External Sources of Clean Technology: Evidence from the Clean Development Mechanism"

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A1 Clean Development Mechanism: An Introduction

The CDM is a flexibility mechanism under the Kyoto Protocol. Specifically, the CDM allows emissions reduction projects in developing countries to earn certified emission reduction (CER) credits. These credits can then be sold to industrialized countries having formal emission reduction obligations under the Kyoto Protocol (Annex B parties).[1]

The CDM employs a seven-step project cycle.[2] At the first stage, proponents of a particular project complete a Project Design Document (PDD). The document contains a general description of the project, justifies a methodology for establishing baseline greenhouse gas emissions and reductions, as well as more general information about environmental and other impacts. Second, the host country's designated national authority certifies that the country is party to the Kyoto Protocol, and that participation in the project is voluntary. At the third step, a qualified third party – usually a consultancy specializing in the CDM – reviews the PDD and verifies that it is consistent with CDM policies. Once the PDD has been verified, it is forwarded to the Executive Board for a decision. If successful, the project is formally registered with the CDM. The next stages involve monitoring and verification of emission reductions. Once verification is complete, the Executive Board issues the credits.

[1] For an introduction from a corporate perspective, see Lütken and Michaelowa (2008).

[2] See `http://cdm.unfccc.int/Projects/diagram.html`. Accessed on March 26, 2012.

A2 Examples of Technology Transfer

Table A1 provides several examples of technology transfer coding.

Project	**Host**	**Year**	**Technology Transfer**	**Explanation**
Huadian Laizhou Wind Farm Project	China	2008	NO	"Most technologies utilized in the turbines are domestic technologies."
Fugong Mukeji Hydropower Project	China	2007	NO	"The generators and turbines are produced by Fujian Lanping Landian Hydroelectric Facility Co. Ltd. All other items of equipment used in FMHP are produced domestically as well."
Orissa Lighting Energy Efficiency Project	India	2009	NO	*Technology transfer not mentioned in the project design document.*
Yuexi Dayan Small Hydropower Project	China	2007	NO	"The main equipments, such as the turbines and electricity generators, are made in the host country. No technology transferred from other countries is involved in this project activity."
Project for GHG Emission Reduction by Thermal Oxidation of HFC 23	India	2003	EQUIPMENT	"Though there are indigenous processes for incineration of wastes but none of these companies have any experience with HFCs. GFL proposes to import the thermal oxidation plant from experienced licensing / engineering companies as well as the incinerator plant suppliers using Ineos Fluor Holdings Ltd (and its subsidiaries including Ineos Fluor Limited) as the technology sponsor, who have substantial operating experience in thermal oxidation of Chlorinated or Fluorinated or mixture of chlorinated and fluorinated hydrocarbons."
Brazil MARCA Landfill Gas to Energy Project	Brazil	2004	KNOWLEDGE	"The technology used to collect, destroy and generate electricity is from Biogas Technology Ltd from UK. Equipments were imported and installed in Brazil, representing a transfer of technology."

Table A1: Examples of technology transfer projects. In the table, "NO" denotes that no technology transfer has taken place, while "EQUIPMENT" denotes equipment transfer, and "KNOWLEDGE" denotes knowledge transfer. The "Explanation" column explains the coding decision.

A3 Distribution of Project Types by Host Country

Table A2 shows project shares by implementing country, separately for China, India, and the rest of the world. In line with the coding in the CDM Pipeline's guidance document we aggregated projects into nine main categories. The table illustrates that for China, India, and all other countries more than 85 percent of all projects fall into three categories: renewables; CH4, cement, and coal; and supply side energy efficiency measures.

#	**Project Type**	**Shares by Country**		
		China	India	Rest of World
1	CH4, cement, and coal	8.88	7.05	41.97
2	CO2 usage	0.00	0.00	0.17
3	Energy efficiency (demand side)	0.30	10.09	2.43
4	Energy efficiency (supply side)	13.97	12.57	4.22
5	Reforestation	0.20	0.64	2.31
6	Fuel switch	1.61	2.56	2.72
7	HFCs and N2O	2.12	1.12	2.95
8	Renewables	72.82	65.09	42.60
9	Transport	0.10	0.88	0.64
	Total	100.00	100.00	100.00

Table A2: Distribution of project types by host country.

A4 Correlation Matrices

Table A3 shows correlation matrices for the full sample, and for two samples excluding China and India, respectively. One remarkable feature that is worth mentioning is the high correlation between renewable project type and the interaction term. This is because there is a large number of non-renewable projects, for which both the interaction term and the renewable project dummy scores zero. Importantly, the correlation between the interaction term and GDP is much lower, which ultimately allows us to estimate our models.

Full sample: correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Technology Transfer	1.000								
(2) Renewables	-0.311***	1.000							
(3) GDP (log, lagged)	-0.319***	0.182***	1.000						
(4) Renewables x GDP	-0.329***	0.997***	0.239***	1.000					
(5) Renewable Projects (cum. #)	-0.377***	0.209***	0.555***	0.239***	1.000				
(6) Other Projects (cum. #)	-0.255***	0.033*	0.250***	0.046**	0.653***	1.000			
(7) Small Project	-0.100***	0.075***	-0.166***	0.063***	-0.031*	0.168***	1.000		
(8) Unilateral Project	-0.103***	0.025	-0.117***	0.012	0.096***	0.449***	0.174***	1.000	
(9) Corruption (lagged)	-0.046**	-0.016	0.197***	0.002	0.019	-0.109***	-0.053***	-0.231***	1.000

Sample without China: correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Technology Transfer	1.000								
(2) Renewables	-0.233***	1.000							
(3) GDP (log, lagged)	-0.305***	0.062**	1.000						
(4) Renewables x GDP	-0.251***	0.998***	0.114***	1.000					
(5) Renewable Projects (cum. #)	-0.375***	0.202***	0.470***	0.227***	1.000				
(6) Other Projects (cum. #)	-0.312***	0.084***	0.534***	0.113***	0.849***	1.000			
(7) Small Project	-0.120***	0.127***	0.076***	0.131***	0.147***	0.146***	1.000		
(8) Unilateral Project	-0.272***	0.174***	0.314***	0.189***	0.477***	0.459***	0.072***	1.000	
(9) Corruption (lagged)	0.015	-0.116***	-0.032	-0.113***	-0.152***	-0.048*	0.058**	-0.110***	1.000

Sample without India: correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Technology Transfer	1.000								
(2) Renewables	-0.346***	1.000							
(3) GDP (log, lagged)	-0.351***	0.208***	1.000						
(4) Renewables x GDP	-0.370***	0.996***	0.273***	1.000					
(5) Renewable Projects (cum. #)	-0.401***	0.251***	0.614***	0.290***	1.000				
(6) Other Projects (cum. #)	-0.219***	-0.006	0.358***	0.020	0.526***	1.000			
(7) Small Project	-0.034	0.017	-0.201***	0.004	-0.140***	0.028	1.000		
(8) Unilateral Project	0.031	-0.014	-0.190***	-0.032	-0.184***	0.125***	0.074***	1.000	
(9) Corruption (lagged)	-0.080***	-0.010	0.229***	0.013	0.193***	0.191***	-0.020	-0.117***	1.000

Table A3: Correlation matrices for the full sample and for samples excluding China and India. The correlations are based on the sample including all the control variables discussed in the main text.

A5 Further Data Description

The following figures further illustrate distributions, frequencies, and time trends of our key variables. Figures A1 to A5 summarize the most important aspects of our data.

- Figure A1 shows the distribution of lagged GDP (log).
- Figure A2 shows the distribution of the corruption variable (lagged).
- Figure A3 shows the number of total and renewable CDM projects, 2004-2010.
- Figure A4 shows the number of total and renewable CDM projects in China, 2004-2010.
- Figure A5 shows the number of total and renewable CDM projects in India, 2004-2010.

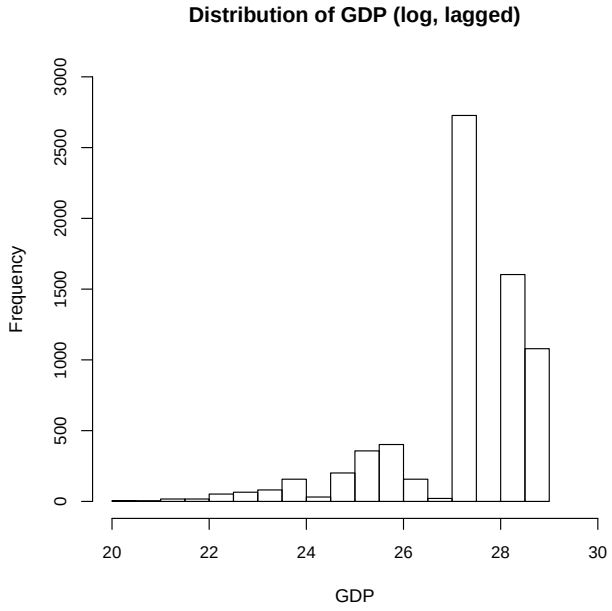

Figure A1: Histogram of lagged GDP (log).

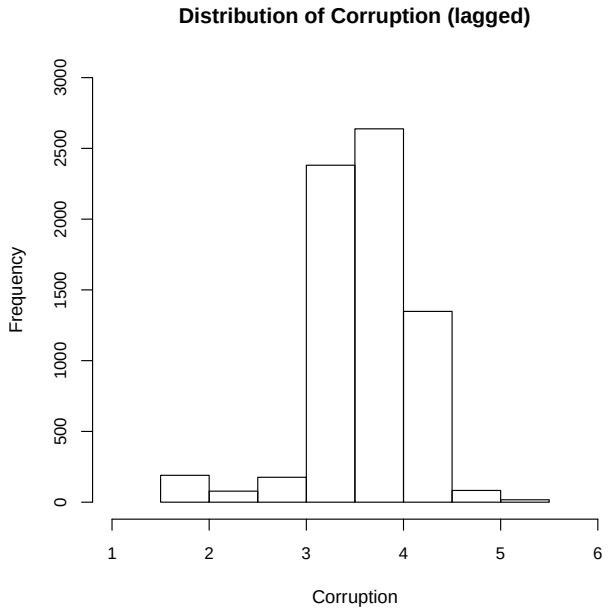

Figure A2: Histogram of lagged corruption variable.

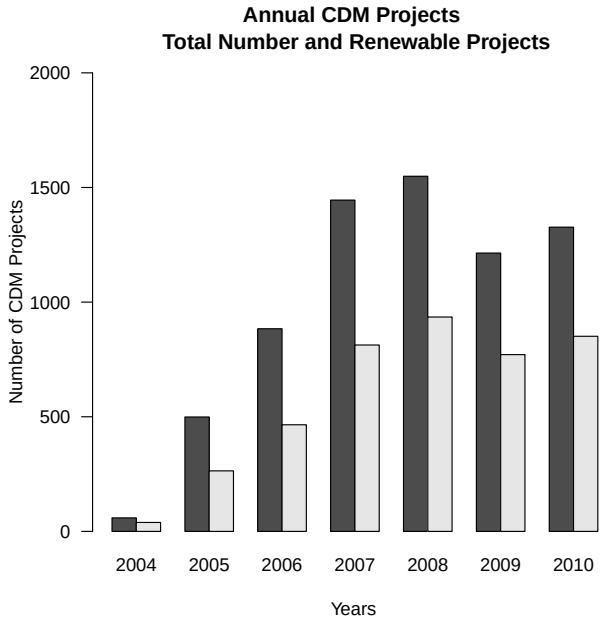

Figure A3: Number of CDM projects, total (dark gray) and renewable (light gray) projects.

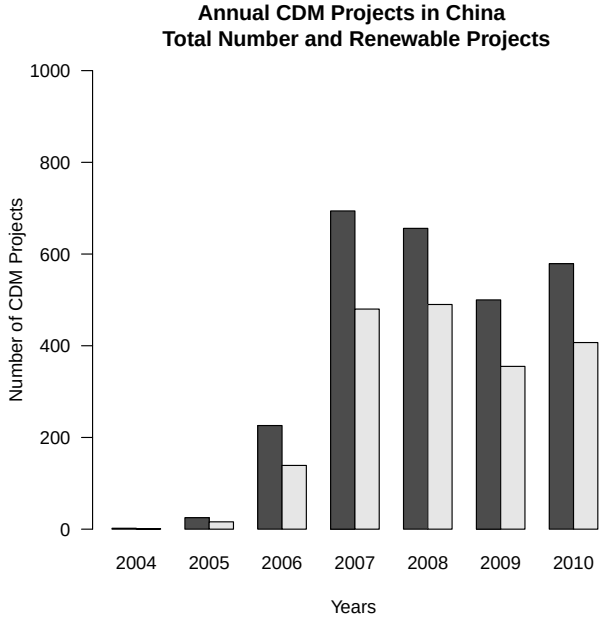

Figure A4: Number of CDM projects in China, total (dark gray) and renewable (light gray) projects.

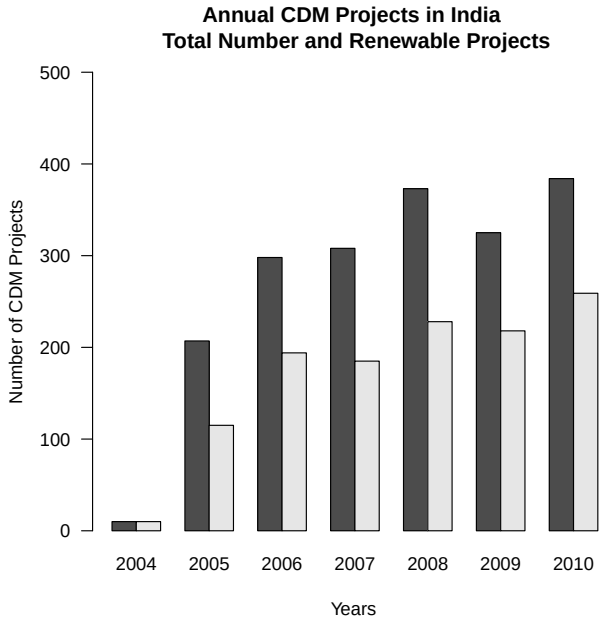

Figure A5: Number of CDM projects in India, total (dark gray) and renewable (light gray) projects.

A6 Matching Exercise

We further test the robustness of our inferences concerning the causal effect of renewable projects and GDP by implementing Coarsened Exact Matching (CEM) for renewable projects (Iacus, King, and Porro, 2012). To account for the possibility of heterogeneity or nonlinear effects of our main covariates on technology transfer, we use matching to improve covariate imbalance for renewable and non-renewable projects. We apply Sturges's rule to determine the "bins" for the matching algorithm.

As shown in Table A4 the matching algorithm only identifies 11 unmatched observations in the overall sample, which suggests that our initial dataset is already relatively balanced. Despite this small number of unmatched observations, CEM reduces both univariate and multivariate distance quite substantially. This indicates that matching considerably strengthens causal inference with our observational data.

Table A5 replicates the results table from our main text. In line with our expectations, using the matched dataset does not change our main results. We still find a strong and negative interaction effect; technology transfer decreases with increasing levels of a country's absorptive capacity.

Matching on Renewable Projects
L1 distance

Matching	Small Project	Unilateral Project	Corruption	Multivariate
Pre	0.075	0.020	0.189	0.226
Post	0.000	0.000	0.139	0.148

Matched 4,934; Unmatched 11

Table A4: Matching diagnostics for CEM matching on renewable projects.

	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
Renewables	11.77***	6.26***	11.63***	12.64***	7.73***	12.82***
	(1.49)	(2.03)	(1.49)	(1.63)	(2.25)	(1.64)
GDP (log, lagged)	-2.48**	4.21***	-4.01***	-4.77**	0.50	-6.12**
	(1.00)	(1.52)	(1.05)	(2.27)	(2.76)	(2.39)
Renewables x GDP	-0.47***	-0.26***	-0.47***	-0.51***	-0.31***	-0.52***
	(0.06)	(0.08)	(0.06)	(0.06)	(0.09)	(0.06)
Renewable Projects (cum. #)				0.00	0.03**	0.01
				(0.01)	(0.01)	(0.01)
Other Projects (cum. #)				-0.04	-0.13***	-0.14***
				(0.03)	(0.04)	(0.04)
Small Project				-0.68***	-0.40***	-0.78***
				(0.09)	(0.11)	(0.11)
Unilateral Project				-0.24**	-0.45***	-0.20
				(0.12)	(0.12)	(0.15)
Corruption (lagged)				-0.49***	-0.32***	-0.13
				(0.11)	(0.11)	(0.13)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4885	2905	3639	4355	2601	3245
Pseudo R^2	0.105	0.052	0.119	0.132	0.075	0.154

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy.
Models (2) and (5) exclude China. Models (3) and (6) exclude India.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Regression results after CEM matching.

A7 Robustness Checks

Robustness: Main Models without Hydroelectricity Projects

Hydroelectricity projects are special for two reasons: first, they not only account for 45 percent of all renewable projects, but also account for about one quarter of our entire dataset (1,362 hydroelectricity projects out of 4,894 projects in total). Second, hydroelectricity projects are known to span a wide range of project costs, and technology intensity depends on the exact nature of the project. It is easy to imagine that little technological know-how is needed to change the run of a river, but high-end expertise is needed for the implementation of a large-scale hydroelectricity dam. To safeguard our analysis against these concerns, we re-estimate all our models excluding all hydroelectricity projects.

The results are shown in Table A6 and testify strongly to our hypotheses. Again, the identified interaction effect remains strong and negative. This result is remarkable given the large reduction in sample size to about 80 percent of the original dataset.

	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
Renewables	9.20***	12.78***	9.38***	8.89***	11.82***	9.18***
	(1.94)	(2.81)	(1.97)	(2.09)	(3.02)	(2.12)
GDP (log, lagged)	-2.66**	5.81***	-4.52***	-3.21	3.24	-4.00
	(1.07)	(1.67)	(1.14)	(2.53)	(2.98)	(2.65)
Renewables x GDP	-0.35***	-0.49***	-0.36***	-0.34***	-0.46***	-0.35***
	(0.07)	(0.11)	(0.07)	(0.08)	(0.11)	(0.08)
Renewable Projects (cum. #)				-0.01	0.02	-0.01
				(0.01)	(0.01)	(0.01)
Other Projects (cum. #)				0.00	-0.12***	-0.11***
				(0.03)	(0.04)	(0.04)
Small Project				-0.40***	-0.39***	-0.32**
				(0.11)	(0.12)	(0.13)
Unilateral Project				-0.14	-0.34**	-0.15
				(0.13)	(0.14)	(0.16)
Corruption (lagged)				-0.58***	-0.32**	-0.14
				(0.12)	(0.13)	(0.14)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3522	2422	2419	3128	2174	2148
Pseudo R^2	0.088	0.056	0.105	0.099	0.070	0.117

Standard errors in parentheses

Dependent Variable: Technology Transfer Dummy.

Models (2) and (5) exclude China. Models (3) and (6) exclude India.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6: Regression results without hydroelectricity projects.

Robustness: Main Models without Energy Efficiency Projects

CDM projects that focus on the reduction of energy efficiency do mostly require considerable technological improvements. While hydroelectricity projects, for instance, are often built around very mature technologies, energy efficiency projects often comprise technological innovation. To ensure that our results are not driven solely by energy efficiency projects, we exclude all 680 energy efficiency projects from the analysis and re-estimate our main models.

The results are shown in Table A7 and speak strongly in favor of our hypotheses. In fact, the interaction effect is consistently negative, which is an encouraging result given the non-negligible reduction in sample size.

	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
Renewables	13.86***	8.18***	13.66***	14.95***	9.65***	15.08***
	(1.61)	(2.16)	(1.61)	(1.76)	(2.37)	(1.78)
GDP (log, lagged)	-2.34**	3.49**	-3.49***	-3.84	-0.49	-4.46*
	(1.09)	(1.74)	(1.13)	(2.41)	(2.84)	(2.49)
Renewables x GDP	-0.56***	-0.33***	-0.55***	-0.60***	-0.39***	-0.60***
	(0.06)	(0.08)	(0.06)	(0.07)	(0.09)	(0.07)
Renewable Projects (cum. #)				-0.00	0.02*	-0.00
				(0.01)	(0.01)	(0.01)
Other Projects (cum. #)				-0.04	-0.11***	-0.12***
				(0.03)	(0.04)	(0.04)
Small Project				-0.82***	-0.51***	-0.88***
				(0.10)	(0.12)	(0.12)
Unilateral Project				-0.29**	-0.53***	-0.25
				(0.13)	(0.14)	(0.16)
Corruption (lagged)				-0.43***	-0.31***	-0.14
				(0.11)	(0.12)	(0.13)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4222	2524	3259	3758	2258	2902
Pseudo R^2	0.108	0.053	0.115	0.143	0.081	0.156

Standard errors in parentheses

Dependent Variable: Technology Transfer Dummy.

Models (2) and (5) exclude China. Models (3) and (6) exclude India.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A7: Regression results without energy efficiency projects.

Robustness: Exclusion of Canceled Projects

To safeguard our analysis to be driven by canceled projects, we exclude all projects that are either withdrawn by the project developer (4 projects), are rejected by the CDM's Executive Board (36 projects), or received negative validation by the Designated Operational Entities (37 projects). When we exclude those projects that are presumably different, Table A8 shows that our results continue to hold: technology transfer decreases as GDP increases.

	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
Renewables	11.80***	6.37***	11.66***	12.83***	8.00***	12.96***
	(1.51)	(2.04)	(1.51)	(1.64)	(2.27)	(1.66)
GDP (log, lagged)	-2.64***	4.17***	-4.17***	-4.73**	0.35	-6.03**
	(1.01)	(1.53)	(1.05)	(2.29)	(2.80)	(2.41)
Renewables x GDP	-0.47***	-0.26***	-0.47***	-0.51***	-0.32***	-0.52***
	(0.06)	(0.08)	(0.06)	(0.06)	(0.09)	(0.06)
Renewable Projects (cum. #)				0.00	0.03**	0.00
				(0.01)	(0.01)	(0.01)
Other Projects (cum. #)				-0.04	-0.12***	-0.13***
				(0.03)	(0.04)	(0.04)
Small Project				-0.69***	-0.42***	-0.78***
				(0.09)	(0.11)	(0.11)
Unilateral Project				-0.24**	-0.45***	-0.20
				(0.12)	(0.13)	(0.15)
Corruption (lagged)				-0.49***	-0.32***	-0.13
				(0.11)	(0.11)	(0.13)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4818	2867	3586	4284	2558	3188
Pseudo R^2	0.105	0.051	0.118	0.132	0.074	0.154

Standard errors in parentheses

Dependent Variable: Technology Transfer Dummy.

Models (2) and (5) exclude China. Models (3) and (6) exclude India.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A8: Regression results without rejected, withdrawn, or negatively validated projects.

Robustness: Exclusion of Projects in South Korea

Like China, South Korea also has policies in place to promote technology transfer from CDM projects Popp (2011). While we exclude Chinese projects in all of our analyses, we drop all 72 South Korean projects for this robustness check. Table A9 demonstrates that none of our results changes. Technology transfer continues to be negatively correlated with increasing levels of GDP.

	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
Renewables	11.84***	7.21***	11.76***	12.76***	8.80***	12.99***
	(1.49)	(2.06)	(1.49)	(1.63)	(2.27)	(1.64)
GDP (log, lagged)	-2.47**	4.55***	-4.07***	-4.50*	0.79	-6.23**
	(1.02)	(1.56)	(1.07)	(2.33)	(2.80)	(2.46)
Renewables x GDP	-0.48***	-0.30***	-0.48***	-0.51***	-0.36***	-0.52***
	(0.06)	(0.08)	(0.06)	(0.06)	(0.09)	(0.06)
Renewable Projects (cum. #)				0.00	0.03*	0.00
				(0.01)	(0.01)	(0.01)
Other Projects (cum. #)				-0.04	-0.13***	-0.15***
				(0.03)	(0.04)	(0.04)
Small Project				-0.68***	-0.39***	-0.78***
				(0.09)	(0.11)	(0.11)
Unilateral Project				-0.23*	-0.44***	-0.20
				(0.12)	(0.13)	(0.15)
Corruption (lagged)				-0.49***	-0.32***	-0.12
				(0.11)	(0.11)	(0.13)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4822	2842	3576	4290	2536	3180
Pseudo R^2	0.111	0.058	0.126	0.137	0.080	0.162

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy.
Models (2) and (5) exclude China. Models (3) and (6) exclude India.
All models exclude South Korea.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A9: Regression results without South Korea as host country.

Robustness: Main Models with Current Number of Projects

While we use the cumulative number of projects for our main models to account for learning and selection, we also run a robustness check using current numbers of CDM projects instead of cumulative ones. The results from this additional test are shown in Table A10. They strongly accord with our hypotheses; technology transfer gets less likely as the levels of GDP increase.

	(1) Model	(2) Model	(3) Model
Renewables	19.34***	13.38***	19.39***
	(2.19)	(2.78)	(2.22)
GDP (log, lagged)	-4.74***	1.80	-5.85***
	(1.24)	(1.93)	(1.30)
Renewables x GDP	-0.74***	-0.51***	-0.74***
	(0.08)	(0.10)	(0.08)
Renewable Projects (#)	-2.94***	-2.14**	-2.76***
	(0.83)	(0.83)	(0.83)
Other Projects (#)	3.16***	2.47**	3.26***
	(1.11)	(1.10)	(1.12)
Small Project	-0.69***	-0.40***	-0.77***
	(0.09)	(0.11)	(0.11)
Unilateral Project	-0.22*	-0.42***	-0.15
	(0.12)	(0.12)	(0.15)
Corruption (lagged)	-0.54***	-0.41***	-0.31**
	(0.11)	(0.11)	(0.12)
Time Polynomial	Yes	Yes	Yes
Observations	4358	2604	3248
Pseudo R^2	0.137	0.074	0.155

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy.
Model (2) excludes China. Model (3) excludes India.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A10: Regression results with current number of CDM projects.

Robustness: Interaction Models

To test the robustness of our results more systematically, we re-estimated our main model specification while including additional interaction effects of the renewable project dummy with one of the following: project size, unilateral project implementation, corruption, democracy, and population. For all five different model specifications, our hypothesized effects are in line with our expectations: the interaction effect of renewable project type and GDP is consistently negative throughout.

Interaction Model with Small Projects

	(1) Model	(2) Model	(3) Model
Renewables	13.22***	7.73***	13.65***
	(1.71)	(2.24)	(1.76)
GDP (log, lagged)	-4.78**	0.58	-6.12**
	(2.27)	(2.75)	(2.39)
Renewables x GDP	-0.52***	-0.31***	-0.54***
	(0.06)	(0.08)	(0.06)
Renewable Projects (cum. #)	0.00	0.03**	0.01
	(0.01)	(0.01)	(0.01)
Other Projects (cum. #)	-0.04	-0.13***	-0.15***
	(0.03)	(0.04)	(0.04)
Small Project	-0.59***	-0.43***	-0.64***
	(0.13)	(0.14)	(0.15)
Renewables x Small Project	-0.19	0.04	-0.27
	(0.18)	(0.21)	(0.21)
Unilateral Project	-0.23*	-0.44***	-0.19
	(0.12)	(0.12)	(0.15)
Corruption (lagged)	-0.49***	-0.32***	-0.13
	(0.11)	(0.11)	(0.13)
Time Polynomial	Yes	Yes	Yes
Observations	4358	2604	3248
Pseudo R^2	0.132	0.074	0.155

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy.
Model (2) excludes China. Model (3) excludes India.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A11: Regression results with small project interaction.

Interaction Model with Unilateral Projects

	(1) Model	(2) Model	(3) Model
Renewables	12.10***	7.78***	11.81***
	(1.64)	(2.28)	(1.67)
GDP (log, lagged)	-4.73**	0.58	-6.03**
	(2.27)	(2.75)	(2.39)
Renewables x GDP	-0.49***	-0.32***	-0.48***
	(0.06)	(0.09)	(0.06)
Renewable Projects (cum. #)	0.00	0.03**	0.00
	(0.01)	(0.01)	(0.01)
Other Projects (cum. #)	-0.04	-0.13***	-0.14***
	(0.03)	(0.04)	(0.04)
Small Project	-0.68***	-0.41***	-0.78***
	(0.09)	(0.11)	(0.11)
Unilateral Project	-0.42***	-0.45***	-0.54***
	(0.15)	(0.16)	(0.19)
Renewables x Unilateral Project	0.40**	0.01	0.73***
	(0.19)	(0.22)	(0.25)
Corruption (lagged)	-0.49***	-0.32***	-0.11
	(0.11)	(0.11)	(0.13)
Time Polynomial	Yes	Yes	Yes
Observations	4358	2604	3248
Pseudo R^2	0.133	0.074	0.157

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy.
Model (2) excludes China. Model (3) excludes India.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A12: Regression results with unilateral project interaction.

Interaction Model with Corruption

	(1) Model	(2) Model	(3) Model
Renewables	12.13***	5.52**	12.44***
	(1.65)	(2.38)	(1.66)
GDP (log, lagged)	-5.09**	0.10	-6.34***
	(2.28)	(2.80)	(2.40)
Renewables x GDP	-0.53***	-0.30***	-0.54***
	(0.06)	(0.09)	(0.06)
Renewable Projects (cum. #)	0.00	0.03**	0.01
	(0.01)	(0.01)	(0.01)
Other Projects (cum. #)	-0.05*	-0.14***	-0.15***
	(0.03)	(0.04)	(0.04)
Small Project	-0.68***	-0.40***	-0.78***
	(0.09)	(0.11)	(0.11)
Unilateral Project	-0.23*	-0.44***	-0.19
	(0.12)	(0.12)	(0.15)
Corruption (lagged)	-0.67***	-0.60***	-0.27*
	(0.14)	(0.15)	(0.15)
Renewables x Corruption	0.34**	0.53***	0.27*
	(0.15)	(0.16)	(0.16)
Time Polynomial	Yes	Yes	Yes
Observations	4358	2604	3248
Pseudo R^2	0.133	0.079	0.155

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy.
Model (2) excludes China. Model (3) excludes India.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A13: Regression results with corruption interaction.

Interaction Model with Democracy

	(1) Model	(2) Model	(3) Model
Renewables	13.39***	4.36*	15.53***
	(1.83)	(2.34)	(1.97)
GDP (log, lagged)	-4.83**	0.32	-6.11**
	(2.27)	(2.77)	(2.39)
Renewables x GDP	-0.53***	-0.13	-0.61***
	(0.07)	(0.09)	(0.07)
Renewable Projects (cum. #)	0.00	0.03**	0.01
	(0.01)	(0.01)	(0.01)
Other Projects (cum. #)	-0.04	-0.13***	-0.15***
	(0.03)	(0.04)	(0.04)
Small Project	-0.69***	-0.40***	-0.80***
	(0.09)	(0.11)	(0.11)
Unilateral Project	-0.23*	-0.42***	-0.17
	(0.12)	(0.13)	(0.15)
Corruption (lagged)	-0.49***	-0.32***	-0.14
	(0.11)	(0.11)	(0.13)
Democracy (lagged)	0.49	0.75	0.47
	(0.68)	(0.68)	(0.68)
Renewables x Democracy	-0.16	-1.72***	-0.58**
	(0.19)	(0.32)	(0.23)
Time Polynomial	Yes	Yes	Yes
Observations	4358	2604	3248
Pseudo R^2	0.132	0.086	0.156

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy.
Model (2) excludes China. Model (3) excludes India.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A14: Regression results with democracy interaction.

Interaction Model with Population

	(1) Model	(2) Model	(3) Model
Renewables	14.16***	6.82***	10.37***
	(1.85)	(2.18)	(1.79)
GDP (log, lagged)	-4.64**	0.06	0.07
	(2.29)	(0.15)	(0.15)
Renewables x GDP	-0.62***	-0.30**	-0.31**
	(0.12)	(0.13)	(0.14)
Renewable Projects (cum. #)	0.01	0.02**	-0.02***
	(0.01)	(0.01)	(0.00)
Other Projects (cum. #)	-0.09***	-0.11***	-0.08***
	(0.03)	(0.03)	(0.03)
Small Project	-0.68***	-0.39***	-0.74***
	(0.09)	(0.10)	(0.11)
Unilateral Project	-0.23*	-0.46***	-0.18
	(0.12)	(0.12)	(0.14)
Democracy (lagged)	0.11	0.04	0.04
	(0.68)	(0.31)	(0.30)
Corruption (lagged)	-0.43***	-0.35***	-0.17
	(0.11)	(0.10)	(0.11)
Population (log, lagged)	33.61***	-0.01	0.10
	(8.92)	(0.16)	(0.16)
Renewables x Population	0.07	0.02	-0.17
	(0.10)	(0.10)	(0.13)
Time Polynomial	Yes	Yes	Yes
Observations	4358	2645	3289
Pseudo R^2	0.136		

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy.
Model (2) excludes China. Model (3) excludes India.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A15: Regression results with population interaction.

Robustness: Additional Interaction Effects

In this section, we implemented two additional models with extra interactions with renewable energy patents and electricity capacity. These extra interactions capture the possibility that domestic technological prowess, as opposed to concerns about reverse-engineering, is the key issue. While there are virtually no effects for renewable energy patents, there is still a strong negative correlation for renewable project type and a country's GDP.

The results also show that renewable electricity capacity is important, but still GDP continues to have a negative interaction with the renewable energy project type. The only models that are not robust are those where the interaction for renewable electricity capacity is included, but China is excluded. For our models with control variables, the negative interaction is very weak. This is, however, not surprising given extremely high within-correlations for renewable electricity capacity and GDP for the three largest CDM host countries, i.e., China (r=0.9807), India (r=0.9924), and Brazil (r=0.9372).

Interaction Model with Renewable Patents

	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
Renewables	9.28***	8.43***	9.53***	9.63***	8.23***	10.99***
	(2.06)	(2.63)	(2.10)	(2.28)	(2.81)	(2.38)
GDP (log, lagged)	-3.20***	4.61***	-5.17***	-4.85**	1.58	-6.15**
	(1.17)	(1.74)	(1.24)	(2.39)	(3.29)	(2.52)
Renewables x GDP	-0.37***	-0.34***	-0.38***	-0.39***	-0.33***	-0.44***
	(0.08)	(0.10)	(0.08)	(0.09)	(0.11)	(0.09)
Renewable Patents	0.00	-0.00	0.00	-0.00	-0.00	-0.00
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)
Renewables x Patents	-0.01***	0.00	-0.01***	-0.01***	0.00	-0.01*
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)
Renewable Projects (cum. #)				-0.00	0.02	-0.00
				(0.01)	(0.01)	(0.01)
Other Projects (cum. #)				-0.02	-0.12***	-0.13***
				(0.03)	(0.04)	(0.04)
Small Project				-0.70***	-0.45***	-0.82***
				(0.10)	(0.11)	(0.11)
Unilateral Project				-0.21*	-0.42***	-0.15
				(0.12)	(0.13)	(0.16)
Corruption (lagged)				-0.49***	-0.31***	-0.12
				(0.11)	(0.12)	(0.13)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4687	2707	3441	4206	2452	3096
Pseudo R^2	0.118	0.059	0.135	0.142	0.080	0.167

Standard errors in parentheses

Dependent Variable: Technology Transfer Dummy.

Models (2) and (5) exclude China. Models (3) and (6) exclude India.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A16: Regression results with renewable patents interaction.

Interaction Model with Renewable Electricity Capacity

	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
Renewables	6.61***	-6.68**	2.77	7.46***	-4.91	1.47
	(2.15)	(3.07)	(2.43)	(2.34)	(3.47)	(2.74)
GDP (log, lagged)	1.45	7.26***	3.32*	-6.37**	1.11	-1.68
	(1.72)	(2.05)	(1.77)	(2.93)	(2.81)	(2.68)
Renewables x GDP	-0.26***	0.27**	-0.11	-0.29***	0.20	-0.05
	(0.08)	(0.12)	(0.10)	(0.09)	(0.14)	(0.11)
Electricity Capacity (log, lagged)	-0.65**	-0.54	-1.36***	0.72	0.36	-1.29*
	(0.32)	(0.39)	(0.35)	(0.55)	(0.72)	(0.68)
Renewables x Electricity Capacity	-0.48***	-0.97***	-0.89***	-0.51***	-0.90***	-1.16***
	(0.15)	(0.17)	(0.20)	(0.17)	(0.19)	(0.23)
Renewable Projects (cum. #)				0.00	0.02	0.02*
				(0.01)	(0.02)	(0.01)
Other Projects (cum. #)				-0.05*	-0.13***	-0.14***
				(0.03)	(0.04)	(0.04)
Small Project				-0.70***	-0.42***	-0.83***
				(0.09)	(0.11)	(0.11)
Unilateral Project				-0.25**	-0.45***	-0.19
				(0.12)	(0.13)	(0.15)
Corruption (lagged)				-0.49***	-0.31***	-0.07
				(0.11)	(0.12)	(0.13)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4894	2914	3648	4358	2604	3248
Pseudo R^2	0.108	0.066	0.130	0.134	0.084	0.164

Standard errors in parentheses

Dependent Variable: Technology Transfer Dummy.

Models (2) and (5) exclude China. Models (3) and (6) exclude India.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A17: Regression results with electricity capacity interaction.

Robustness: Alternative Measure for Absorptive Capacity

Even though we are convinced that GDP is a good measure for absorptive capacity, and we argue in favor of it, we also use the total number of patents as an alternative measure. The data come from the 1976 Patent Cooperation Treaty, which are available from the OECD website.[3] We replace our GDP variable with patents data, and the results of this robustness check are shown in Table A18. While the results are not as strong as in our main models, the analyses that exclude China tell a convincing story in favor of our hypothesis: the likelihood of technology transfer decreases as a country's absorptive capacity increases.

[3] See `http://stats.oecd.org/Index.aspx?DatasetCode=PATS_IPC`. Accessed on April 18, 2012.

	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
Renewables	0.55**	-0.16	0.48*	0.40	-0.30	0.33
	(0.25)	(0.29)	(0.26)	(0.27)	(0.31)	(0.27)
Patents Count (log, lagged)	-0.33*	0.08	-0.30*	-0.41*	0.06	-0.19
	(0.18)	(0.19)	(0.18)	(0.23)	(0.24)	(0.23)
Renewables x Patents Count	-0.25***	-0.08	-0.26***	-0.23***	-0.06	-0.24***
	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.04)
Renewable Projects (cum. #)				-0.01**	0.03**	-0.01**
				(0.00)	(0.01)	(0.01)
Other Projects (cum. #)				-0.03	-0.13***	-0.11***
				(0.03)	(0.04)	(0.03)
Small Project				-0.72***	-0.44***	-0.84***
				(0.10)	(0.11)	(0.11)
Unilateral Project				-0.18	-0.41***	-0.06
				(0.12)	(0.13)	(0.15)
Corruption (lagged)				-0.40***	-0.33***	-0.08
				(0.11)	(0.11)	(0.13)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4683	2703	3437	4202	2448	3092
Pseudo R^2	0.109	0.052	0.122	0.133	0.075	0.157

Standard errors in parentheses

Dependent Variable: Technology Transfer Dummy.

Models (2) and (5) exclude China. Models (3) and (6) exclude India.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A18: Regression results with total number of patents as alternative measure for absorptive capacity.

Further Analysis: Distinguishing Between Equipment and Knowledge Transfer

In its analysis of the role of technology transfer in the CDM, the UNFCCC not only coded if there has been technology transfer, but also if either equipment or knowledge has been transferred (UNFCCC, 2010). We make use of this information by running our models separately for equipment and knowledge transfers. For this, we use the entire dataset, but only code projects with equipment or knowledge transfer as "1" on our dependent variable.

Interestingly, we find that for equipment transfers (505 projects) our hypothesis gains again very strong support (Table A19). For knowledge transfers (200 projects), on the other side, we do not find a consistently negative interaction effect (Table A20). Instead, the coefficient of the interaction effect changes signs depending on the model specification. While this result may easily be due to the lack of variation on the dependent variable, it may also be the case that for knowledge transfers the technology that is transferred is more easily controllable by the foreign investor. With knowledge transfers, there are no concerns for e.g., reverse-engineering, and hence our non-finding here supports our theoretical argument.

Equipment Transfer

	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
Renewables	22.44***	13.78***	22.38***	21.28***	13.33***	21.57***
	(2.50)	(3.46)	(2.52)	(2.65)	(3.74)	(2.69)
GDP (log, lagged)	-5.39***	4.46*	-6.98***	-6.51**	3.27	-7.66**
	(1.44)	(2.55)	(1.49)	(3.25)	(4.82)	(3.37)
Renewables x GDP	-0.85***	-0.51***	-0.85***	-0.81***	-0.50***	-0.82***
	(0.09)	(0.13)	(0.09)	(0.10)	(0.14)	(0.10)
Renewable Projects (cum. #)				0.00	0.02	0.01
				(0.01)	(0.02)	(0.01)
Other Projects (cum. #)				-0.02	-0.13**	-0.15***
				(0.04)	(0.05)	(0.05)
Small Project				-0.40***	-0.02	-0.57***
				(0.13)	(0.16)	(0.15)
Unilateral Project				0.25	-0.06	0.40**
				(0.17)	(0.18)	(0.20)
Corruption (lagged)				-0.33**	0.00	0.14
				(0.17)	(0.18)	(0.20)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3898	2112	2743	3462	1887	2439
Pseudo R^2	0.092	0.030	0.112	0.093	0.033	0.125

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy (Equipment).
Models (2) and (5) exclude China. Models (3) and (6) exclude India.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A19: Regression results for equipment as technology transfer.

Knowledge Transfer

	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
Renewables	-3.27	-9.71**	-1.53	-0.39	-8.47*	1.73
	(3.27)	(4.19)	(3.26)	(3.60)	(4.65)	(3.70)
GDP (log, lagged)	3.61	-4.37	4.51*	0.08	-11.25	0.93
	(2.32)	(3.63)	(2.54)	(5.72)	(7.83)	(6.31)
Renewables x GDP	0.09	0.35**	0.01	-0.02	0.30*	-0.12
	(0.12)	(0.16)	(0.12)	(0.13)	(0.18)	(0.14)
Renewable Projects (cum. #)				0.01	0.01	0.01
				(0.02)	(0.03)	(0.02)
Other Projects (cum. #)				-0.14**	-0.07	-0.10
				(0.05)	(0.06)	(0.06)
Small Project				-1.05***	-0.93***	-0.99***
				(0.21)	(0.22)	(0.26)
Unilateral Project				-0.17	-0.12	0.26
				(0.24)	(0.25)	(0.30)
Corruption (lagged)				-0.53**	-0.71***	-0.62**
				(0.22)	(0.24)	(0.26)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3548	1905	2418	3124	1693	2125
Pseudo R^2	0.046	0.062	0.055	0.093	0.107	0.105

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy (Knowledge).
Models (2) and (5) exclude China. Models (3) and (6) exclude India.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A20: Regression results for knowledge as technology transfer.

Robustness: Extended Model

In this extended model we add four additional control variables to show the robustness of our findings. In particular, we include the number of internet users to proxy a country's general technological development, the percentage of industry GDP, a country's investment profile, and inward foreign direct investments. None of these control variables has any effect on technology transfer except for foreign direct investments. This effect is negative, but very small in size. Most importantly for our analysis, none of these additional control variables jeopardizes the findings we present in our main analysis.

	(1) Model	(2) Model	(3) Model
Renewables	13.97***	9.09***	13.65***
	(1.69)	(2.33)	(1.69)
GDP (log, lagged)	0.22	-1.20	-1.65
	(2.30)	(2.97)	(2.47)
Renewables x GDP	-0.55***	-0.36***	-0.55***
	(0.06)	(0.09)	(0.06)
Renewable Projects (cum. #)	0.03***	0.05***	0.02**
	(0.01)	(0.02)	(0.01)
Other Projects (cum. #)	-0.10***	-0.14***	-0.15***
	(0.03)	(0.04)	(0.04)
Small Project	-0.71***	-0.41***	-0.82***
	(0.09)	(0.11)	(0.11)
Unilateral Project	-0.25**	-0.41***	-0.17
	(0.12)	(0.13)	(0.15)
Corruption (lagged)	-0.18	-0.21	-0.02
	(0.14)	(0.14)	(0.15)
Democracy (lagged)	0.16	0.29	0.10
	(0.69)	(0.69)	(0.69)
Population (log, lagged)	19.91**	11.17	16.55*
	(8.64)	(8.72)	(8.78)
Internet Users	-0.01	-0.02	0.02
	(0.02)	(0.03)	(0.03)
Pct Industry GDP (lagged)	0.00	0.00	0.04
	(0.05)	(0.05)	(0.05)
Investment Profile (lagged)	0.20*	0.10	0.12
	(0.12)	(0.12)	(0.12)
Inward FDI (lagged)	-0.00***	-0.00**	-0.00***
	(0.00)	(0.00)	(0.00)
Time Polynomial	Yes	Yes	Yes
Observations	4323	2569	3213
Pseudo R^2	0.144	0.078	0.164

Standard errors in parentheses
Dependent Variable: Technology Transfer Dummy.
Model (2) excludes China. Model (3) excludes India.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A21: Regression results with additional control variables.

Online Appendix: References

Iacus, Stefano M., Gary King, and Giuseppe Porro. 2012. "Causal Inference without Balance Checking: Coarsened Exact Matching." *Political Analysis* 20 (1): 1–24.

Lütken, Søren Ender, and Axel Michaelowa. 2008. *Corporate Strategies and the Clean Development Mechanism: Developing Country Financing for Developed Country Commitments?* Northampton: Edward Elgar.

Popp, David. 2011. "International Technology Transfer, Climate Change, and the Clean Development Mechanism." *Review of Environmental Economics and Policy* 5 (1): 131–152.

UNFCCC. 2010. "The Contribution of the Clean Development Mechanism under the Kyoto Protocol." United Nations Framework Convention on Climate Change.