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Discussion Paper Series

Does corporate environmental performance change through environmental policies between pre and post 2011? Evidence from firm-level data in Germany and Japan

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Abstract

After the nuclear disaster, in the aftermath of the Great East Japan Earthquake in 2011, the Japanese government shut down all nuclear power plants in Japan. The German government decided to permanently phase out nuclear power. Japan was, and still is, directly affected by the nuclear disaster and Germany is considered the most sensitive country to nuclear energy after the nuclear disaster. This study aims to empirically examine whether there were changes in corporate environmental performance through companies' implementations of environmental policies from before 2011 to after 2011 in Germany and Japan in the non-financial and non-energy. The dependent variable (as corporate environmental performance) is defined as a firm's sales divided by corporate direct greenhouse gas emissions (Scope 1) in the logarithm form. The independent variables are nine corporate policies, which all are dummy variables. This study uses the global firm dataset from the Bloomberg professional service where the number of observation is 832 in over a seven-year period (2006-2012). In the regression result, we find that when roughly examining pre and post 2011, using a dummy variable, there is significant change regarding the Japan and both sample. We then find that in eight out of the nine cases there is no effect of implementing the environmental policies on corporate efficiency.

Key words: Environmental efficiency; Pre and post disaster; Germany and Japanese companies; environmental, social, and governance policies; greenhouse gas emissions

JEL classification: F21, O13, Q54

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1. Introduction

In March 2011, the biggest earthquake ever recorded in Japan, now known as the Great East Japan Earthquake, hit the Japanese island. The quake caused a tsunami that in turn damaged the Fukushima nuclear power plant, leading to the uncontrolled release of radioactivity (Carpenter, 2012). After the nuclear disaster, the Japanese government shut down all nuclear power plants in Japan. The country was, and continues to be, directly affected by the nuclear disaster. Meanwhile, even though Germany is on the other side of the world from Japan, the German government decided to permanently phase out nuclear power. Therefore, Germany is considered the most sensitive country to nuclear energy after the nuclear disaster. Focusing on the two countries Japan and Germany, this study aims to examine how the nuclear energy crisis affects corporate activities in these countries. It is important to assess the vulnerability of the nuclear energy of both countries not only for corporate managers but also for policy makers and investors. This is because energy is one of the most essential input sources for companies.

The purpose of this paper is to empirically examine whether changes in corporate environmental performance took place through companies' implementations of environmental policies from before 2011 to after 2011 in Germany and Japan. The research specifically focuses on companies in the non-financial and non-energy sectors because these sectors likely need to adopt a flexible attitude considering environmental efficiency in and after 2011. This research accounts for corporate characteristics using nine different environmental policies from Bloomberg Professional database, and examines policy effects on corporate environmental performance between pre 2011 and post 2011.

This study is structured as follows. Section 2 provides a general overview of the policy and industry trends both Germany and in Japan, and previous studies about environmental efficiency and corporate governance. Section 3 explains the data and model of this study, examining to what extent corporate environmental performance is affected by corporate policies. Section 4 explores and discusses the results of the regression with business implications, and Section 5 concludes.

2. Background

2.1 GERMANY

Germany has the strongest economy of Europe and is ranked fourth after the United States, China, and Japan in terms of GDP (World Bank, 2014). It is a member state of the European Union (EU) and therefore has to build up its energy policy in accordance with the requirements of the EU. Due to a lack of energy resources like oil or gas, the EU is importing more than half of all of its energy supply from non-EU countries. It is expected by the European Commission that, until 2050, the trend will rise to even 84% regarding oil supplies and 93% regarding the natural gas supply. In order to decrease dependency and secure a steady energy supply for the whole European region, a long-term European energy strategy is needed. (Bundesverband der Deutschen Industrie (BDI), 2015a). The BDI acts as a representative organ of the needs and wants of the German industries. Currently, the BDI comprises 36 member federations, including one working group, and represents the interests of 100,000 businesses, with 8 million employees (BDI, 2015b).

In order to promote the deployment of low-carbon technologies, the BDI patronizes support measures for renewable energies as long as these measures are cost-efficient and competition neutral. Already in 2010, the German Government decided on the implementation of an energy system that will pave the way for entering the new era of renewable energy. At this point, the government still intended to rely on nuclear energy as a bridging function to the point where the country is able to rely solely on renewable energy. Its principal objective is to ensure the provision of environmentally friendly, reliable, and affordable energy supply while turning Germany into one of the greenest economies in the world.

With the Fukushima nuclear disaster of 2011, the German Government updated the energy concept and decided to incrementally shut down all German nuclear power plants by the year 2022 to reflect the accelerated shift to renewable energy (Energiewende). More specifically, the strategy aims to increase the share of renewable energies in electricity generation to 35% by 2020 and reduce demand for primary energy by 50% by 2050. Furthermore, the government is promoting the expansion of the electricity network and the use of electric vehicles (FMEAE, 2011). In addition, several legislative acts have been agreed on in 2011 to implement this strategy. In December 2012, the government presented the first annual

monitoring report on the progress of the Energy Concept. Accordingly, increased action is required regarding energy efficiency and the expansion of the electricity grid (FMEAE, 2011).

As stated by the BDI, the German energy policies have a great effect on the total energy market, the communication and cooperation of the participating actors, and electric users. That is why the BDI represents the opinion that a sustainable energy policy, premised on the market economy and aligned to the whole European continent, established through systematic thinking and integrated answers is essential to structure and the secure an sustainable and affordable electricity market of the future (BDI, 2015b). Already in 2001, the Germany Government, at that time under the lead of the Social Democratic Party of Germany (SPD), decided on a nuclear exit plan. However, this plan was overturned in 2005 when there was a change in the leading party from SPD to the Christian Democratic Union of Germany (CDU) under the lead of Chancellor Angela Merkel. With this shift, the CDU intended to prevent dependency on other nations and implement a slower but more considerate change to renewable energy (Focus, 2005). Since 2005, the CDU steadily stood by its intention to keep the nuclear power plants of Germany running for several years. This changed abruptly with the Fukushima nuclear disaster of 2011. After the disaster, the party changed its general principle of supporting nuclear energy to a new nuclear exit plan. The government directly shut down the seven oldest power plants in Germany and decided on a total nuclear exit by the year 2022 (Regional Center for Political Education, 2011).

The above-stated events and resulting changes suggest that there are visible changes regarding the implementation of environmental policy and their effect on corporate performance before and after the year 2011 in Germany. This study hypothesizes and assesses whether environmental performance actually changes in the empirical model, which is explained below.

2.2 JAPAN

Keidanren (Japan Business Federation) in Japan is an economic association that has 1,329 Japanese companies, 109 nationwide industry associations, and a total of 47 regional economic organizations as its members. The federation’s mission is to make its contributions to the development of the Japanese economy by supporting the activities of not only corporations but also local communities and individuals.

In addition, Keidanren aims to continuously increase the quality of life for the Japanese population (Keidanren, 2015a).

In December 2009, Keidanren announced that, in order to achieve a low-carbon society, it aims to play an instrumental role as a member of the Japanese business community in an effort to halve the global greenhouse gas (GHG) emissions by the year 2050 (Keidanren, 2015b). In order to approach that issue, the Keidanren will stick to its Commitment to a Low Carbon Society. The commitment is based on the following four individual pillars (Keidanren 2015c): (1) maximizing the introduction of best available low-carbon technologies in corporate activities, (2) developing and commercializing products and services that harness world-leading energy-saving technologies for consumers, (3) transferring technology and expertise to other countries, and (4) developing innovative technologies.

There is a clear effect of the Fukushima nuclear disaster on Japan's energy efficiency visible in directly after the disaster. When the nuclear power plants were shut down, the available total amount of electricity, supplied by ten main suppliers, decreased by nine percent in July 2011, compared to the previous year. As a measurement to deal with the electricity shortage, a nationwide media campaign called setsuden ("power saving" in Japanese) was started in order to support the necessary limited use of electricity. The setsuden included turning off Tokyo's famous neon lights, slowing down trains, promoting dressed-down outfits, and scheduling the use of air conditioning as well as simply switching lights off when leaving the room (The Guardian, 2011). According to the data provided by the Statistics Bureau of Japan, setsuden was effective, and energy consumption (i.e., domestic primary energy supply) went down from a total of 22,039 petajoules in 2010 to 21,154 petajoules in 2011 and 20,819 petajoules in 2012 (Statistics Bureau of Japan, 2015).

Following the background of Japan as stated above, this study focuses on the change of environmental efficiency (i.e., sales per GHG) at the firm level. Especially, this study aims to examine what kind of the companies can adapt to the environment adequately, considering their corporate policies.

2.3 Literature review

In the extant literature, the relationship between environmental management and corporate performance has been discussed widely. While a number of authors articulate the view that the protection

of the environment increases costs, a second group represents the opinion that protecting the environment can be highly beneficial and can increase corporate performance (Porter and van der Linde, 1995). Both points of view find supporters in form of empirical studies in the existing literature. However, Wagner (2001) argues that there seems to be a large amount of studies arguing in favor of the hypothesis that there is no negative effect on corporate performance when engaging in environmental protection or, at least, that there is evidence that a poor environmental performance does not benefit the corporate performance.

Wang et al. (2013) argue that there is a link between the amount of GHG emissions and corporate financial performance. The study discusses the above-mentioned relationship by using the 2010 GHG emission dataset from 69 Australian companies listed on the ASX 200. The research is conducted the data of finds that both are significantly positively correlated.

Wagner and Schaltegger (2004) examine the relationship between the environmental and economic performance of companies in the European manufacturing sector, focusing on the influence of corporate environmental strategy choice. The study is constructed by using multiple regression models and the data of surveys that are sent to 1000 firms in the UK and 2000 firms in Germany with 301 valid responses, 135 in the UK and 166 in Germany. The study concludes that the relationship between environmental performance and different dimensions of economic performance is more positive for firms with shareholder value-oriented strategies than for firms without such a strategy.

As criticized in the literature, however, the relationship between the implementation of environmental policies and corporate performance can be found as positive, negative, or even neutral. Schaltegger and Synnestvedt (2002) argue that this relationship variety might be a result of the limited size and coverage of the data sets used. That is, it is difficult to achieve clear results as the influence of implementing environmental policies on corporate performance, and it seems to be much smaller than the influence of other potential factors.

The literature has examined that there are studies supporting both the assumption that implementing environmental policies has a positive effect or that it has a negative or no effect on corporate performance. This study focuses mainly on the effect of macro shocks on the corporate behaviour of companies in the non-financial and non-energy sectors. As a corporate behaviour, this study uses environmental efficiency. The reason this study focuses on these sectors is that these sectors are less likely

to be regulatory sectors, and hence, corporate adaption to nuclear disaster is expected to vary. Examining the response of companies will be informative not only for (rival) companies, but also policy makers, investors, and so on.

3. Methodology

3.1 Model

This study examines how environmental efficiency changes between pre- and post-2011 periods through corporate policies. This study calculates environmental efficiency as sales divided by GHG in the logarithm form. This is because the nuclear energy crisis should affect largely the energy policies of each company (or, equivalently, GHG emissions). This study firstly examines if the environmental efficiency has changed between pre- and post-2011 periods, using interaction terms as follows:

$$\ln\left(\frac{sales}{GHG}\right) = \beta + \beta_1 D_{post\,2011} + \sum_j \beta_j CON_j + \beta_t + e \qquad (1)$$

where $D_{post\,2011}$ denotes a dummy variable if the firm is observed in the post-2011 period. CON_j denotes jth control variables, which are total assets in the log-form, capital labor ratio in the log-form, and return on assets. β_t denotes year t fixed effects, and e denotes an error term.

Then, this study examines if the environmental efficiency has changed through environmental policies in the following equation:

$$\ln\left(\frac{sales}{GHG}\right) = \beta + \sum_k \beta_k POL_k + \sum_k \gamma_k POL_k \cdot D^{GE}_{post\,2011} + \sum_k \delta_k POL_k \cdot D^{JP}_{post\,2011} + \sum_j \beta_j CON_j + \beta_t + e \qquad (2)$$

where POL_k denotes corporate policy k. $D^{GE}_{post\ 2011}$ and $D^{JP}_{post\ 2011}$ denote dummy variables if the firm is observed in Germany post 2011 or in Japan post 2011, respectively.

3.2 Data

This study uses the global firm dataset from the Bloomberg professional service. It is a service through which users can monitor and analyze real-time financial market data and place trades on an electronic trading platform. Most large financial firms have subscriptions to the Bloomberg Professional service (Bloomberg, 2015). Table 1 shows descriptive statistics of this study. It targets the environmental performance of companies in Germany and in Japan that are active in the non-financial and non-energy sectors because these sectors likely need to adopt a flexible attitude considering environmental efficiency in and after 2011. The number of observations in the original dataset is 832 over a seven-year period (2006-2012). The observations are 26, 45, 74, 115, 183, 190, and 199 from 2006 to 2012, respectively.[1]

This study observes the environmental performance of companies in the following seven different sectors in accordance with the Global Industry Classification Standard: materials, industrials, consumer discretionary, consumer stables, health care, information technology, and telecommunication services. The dependent variable (as corporate environmental performance) is defined as a firm's sales divided by corporate direct GHG emissions (Scope 1) in the logarithm form (i.e., ln(sales/Scope1)). The independent variables are the following nine corporate policies, which all are dummy variables: 1) Emission Reduction Policy, 2) Green Building Policy, 3) Climate Change Policy, 4) Environmental Quality Management Policy, 5) Biodiversity Policy, 6) Energy Efficiency Policy, 7) Sustainable Packaging Policy, 8) Environmental Supply Chain Management Policy, and 9) Waste Reduction Policy.

1) Emission Reduction Policy refers to the emission reduction initiatives that are undertaken by a firm and indicates whether the company has implemented any initiatives to reduce its environmental emissions to air. 2) Green Building Policy indicates whether the company has taken any steps towards using environmental technologies and/or environmental principles in the design and construction of its buildings. 3) Climate Change Policy indicates whether the company has outlined its intention to help reduce global emissions of the GHGs that cause climate change through its ongoing operations and/or the

[1] However, there is no data for Japan in 2012.

use of its products and services. Examples in this field might include efforts to reduce GHG emissions, efforts to improve energy efficiency, efforts to derive energy from cleaner fuel sources, and investment in product development to reduce emissions generated or energy consumed in the use of the company's products. 4) Environmental Quality Management Policy indicates whether the company has introduced any kind of environmental quality management and/or environmental management system to help reduce the environmental footprint of its operations. 5) Biodiversity Policy indicates whether the company has implemented any initiatives to ensure the protection of biodiversity. This might include trees and vegetation as well as wildlife and endangered species. 6) Energy Efficiency Policy indicates whether the company has implemented any initiatives to make its use of energy more efficient. 7) Sustainable Packaging indicates whether the company has taken any steps to make its packaging more environmentally friendly. This might involve efforts to improve the recyclability of packaging, to use less environmentally damaging materials in packaging, etc. 8) Environmental Supply Chain Management indicates whether the company has implemented any initiatives to reduce the environmental footprint of its supply chain. Environmental footprint reductions could be achieved by reducing waste, by reducing resource use, by reducing environmental emissions, by insisting on the introduction of environmental management systems, etc., in the supply chain. 9) Waste Reduction Policy indicates whether the company has implemented any initiatives to reduce the waste generated during the course of its operations.

4. Results

The regression results are shown in Table 2 (equation 1) and Table 3 (equation 2). Columns 1, 2, and 3 indicate the results of using the German sample, Japanese sample, and both samples, respectively. In terms of equation 1, the coefficient of $D_{post\ 2011}$ is not statistically significant in column 1, and is statistically significantly different from zero and positive in columns 2 and 3. It indicates that the change of environmental efficiency between pre- and post-2011 is not found in Germany, but is found in Japan (and in both countries). Especially, the coefficient shows that companies in the non-financial and non-energy sectors in Japan had experienced 22.8% increase in environmental efficiency in (post-)2011.

In terms of equation 3 (regression with corporate policies), the coefficient of Green Building Policy is statistically significantly different from zero and positive in columns 1 and 3. These findings indicate that companies in Germany have increasingly been implementing Green Building Policies and that they have had a positive effect on corporate performance. Through implementing this policy, an estimated 33% increase in environmental efficiency has occurred. However, there is no such visible change in Japan, suggesting that the difference in implementing corporate policies does not lead to the difference in environmental efficiency.

In terms of the interaction terms between post-2011 and corporate policies, the results show that all coefficients are not statistically significant. These findings indicate that there is no sign about which corporate policies are effective for the (nuclear) energy crisis from pre- to post-2011 both in Germany and Japan.

The regression results furthermore show that, in terms of year dummies (baseline: 2006), the coefficient of year 2007 is statistically significant from zero and negative in column 2. This indicates that, compared to 2006, the sample in Japan had experienced a 46.3% decrease in the environmental efficiency. This could be due to the general financial situation in Japan. In Japan in 2007, the economy was doing very well, seen on a rising GDP growth rate, peaking in 2007 at a high of 2.2 percent (World Bank 2015). This booming economy in the short run may present a competitive disadvantage from the viewpoint of GHG emissions.

5. Conclusion

This study empirically examines whether there were changes in corporate environmental performance through companies' implementation of environmental policies from the pre-2011 to post-2011 periods in Germany and Japan. This study focuses on companies in the non-financial and non-energy sectors, using Bloomberg professional database. If firstly examines whether the environmental efficiency has changed between the pre- and post-2011 periods. Rough examination of pre- and post-2011 data reveals a significant change regarding the Japanese sample. Secondly, this study examined whether the environmental efficiency has changed through environmental policies. It is found that, in eight out of the

nine cases, there is no effect of implementing the environmental policies on corporate efficiency. Only the implementation of Green Building Policy is found to improve the environmental efficiency, but only in the German sample. In addition, using year dummies between 2007-2012 (baseline: 2006), compared to 2006, the sample in Japan had experienced a 46.3% decrease in the environmental efficiency in 2007, probably due to the booming economy in 2007.

Following the result, this study suggests important implications. As seen in the above sections, there have been major changes in energy policy and also energy efficiency in both observed countries. Both countries decided on the nuclear exit, and both countries are taking several measurements to ensure a more efficient use of energy. However, non-energy and non-financial sectors both in Germany and Japan seem to be less likely to take action regarding environmental policies and against the nuclear energy crisis resulting from the Fukushima disaster in 2011. This indicates that the companies in the above mentioned sectors show certain slowness in adapting their corporate behavior to macro shocks such as, in this case, the Fukushima nuclear disaster. On the contrary, it implies that implementing environmental policies does not have any negative effect on corporate performance; hence, in order to satisfy other aspects such as customers and consumers following the governmental energy policy trends, this result may indicate that it is still advisable to implement environmental policies, even if there is no positive effect on corporate performance visible in the short run. In summary, the study suggests that there are a wide variety of policies that lead to an unclear effect on environmental performance.

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Table 1. Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
ln (Sales/ GHG)	832	24.766	1.981	17.395	31.245
Emission Reduction Policy	832	0.966	0.180	0	1
Green Building Policy	832	0.109	0.312	0	1
Climate Change Policy	832	0.895	0.306	0	1
Environmental Quality Management	832	0.944	0.231	0	1
Biodiversity Policy	832	0.613	0.487	0	1
Energy Efficiency Policy	832	0.965	0.184	0	1
Sustainable Packaging	832	0.350	0.477	0	1
Environmental Supply Chain Management	832	0.865	0.342	0	1
Waste Reduction Policy	832	0.893	0.309	0	1
ln (Total Assest)	832	23.339	1.255	19.491	26.735
ln (Capital Labour)	832	11.728	0.878	9.158	14.322
Return on Assets	832	0.057	0.050	−0.360	0.427

Table 2. Regression Results

	(1) Germany		(2) Japan		(3) Germany and Japan	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Dummy of post-2011 (0:pre-2011; 1:post-2011)	0.006	0.067	0.228***	0.086	0.131**	0.058
ln (total assets)	0.201	0.184	0.024	0.347	−0.196	0.211
ln (capital labour)	−0.337	0.250	−1.02***	0.328	−0.712***	0.236
Return on Assets	1.068	0.799	0.259	1.147	0.901	0.796
constant	23.611***	4.335	36.191***	8.005	28.421***	4.857
Fixed effects	Yes		Yes		Yes	
year dummies	No		No		No	
obs	190		642		832	
group	47		180		227	
R-squared:						
within	0.0254		0.0380		0.0285	
between	0.0130		0.0707		0.0715	
overall	0.0151		0.0789		0.0732	

Note: *** and ** denote 1% and 5% levels of statistical significance, respectively.

Table 3. Regression Results with corporate policies

	(1) Germany		(2) Japan		(3) Germany and Japan	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Emission Reduction Policy	0.264	0.202	—	—	0.317	0.315
Green Building Policy	0.331*	0.183	0.265	0.262	0.329*	0.181
Climate Change Policy	0.077	0.171	0.318	0.292	0.106	0.183
Environmental Quality Management	0.227	0.162	−0.306	0.377	0.178	0.194
Biodiversity Policy	0.154	0.152	−0.155	0.126	−0.115	0.103
Energy Efficiency Policy	−0.102	0.216	—	—	−0.130	0.329
Sustainable Packaging	−0.291	0.266	−0.150	0.151	−0.147	0.132
Environmental Supply Chain Management	0.190	0.150	0.397	0.305	0.156	0.173
Waste Reduction Policy	−0.065	0.162	−0.037	0.772	−0.095	0.215
Interaction term of post-2011 in Germany						
Emission Reduction Policy	−0.164	0.328			−0.178	0.519
Green Building Policy	−0.249	0.180			−0.224	0.252
Climate Change Policy	0.120	0.222			0.033	0.317
Environmental Quality Management	−0.019	0.302			−0.024	0.455
Biodiversity Policy	−0.183	0.180			−0.046	0.268
Energy Efficiency Policy	0.507	0.323			0.397	0.515
Sustainable Packaging	0.150	0.223			0.046	0.270
Environmental Supply Chain Management	−0.069	0.198			−0.121	0.308
Waste Reduction Policy	−0.125	0.164			−0.046	0.257
Interaction term of post-2011 in Japan						
Emission Reduction Policy			0.810	0.934	—	—
Green Building Policy			−0.217	0.246	−0.244	0.204
Climate Change Policy			−0.420	0.386	−0.159	0.310
Environmental Quality Management			0.666	0.590	0.170	0.440
Biodiversity Policy			−0.185	0.186	−0.143	0.166
Energy Efficiency Policy			—	—	0.407	0.970
Sustainable Packaging			0.173	0.133	0.172	0.122
Environmental Supply Chain Management			−0.177	0.255	−0.037	0.225
Waste Reduction Policy			−0.159	0.756	−0.037	0.576
ln (total assets)	0.120	0.196	−0.906**	0.454	−0.190	0.245
ln (capital labour)	−0.413	0.276	−1.100***	0.349	−0.707***	0.249
Return on Assets	2.001**	0.947	1.072	1.312	1.489	0.909
year dummies						
2007	0.018	0.172	−0.463*	0.245	−0.240	0.173
2008	0.161	0.175	0.255	0.261	0.198	0.177
2009	0.247	0.176	0.093	0.254	0.139	0.174
2010	0.059	0.183	0.314	0.272	0.216	0.184
2011	−0.108	0.463	−0.066	0.084	0.095	0.696
2012	−0.100	0.475	—	—	0.146	0.700
constant	25.688***	4.592	58.281***	10.498	36.773***	5.694
Fixed effects	Yes		Yes		Yes	
obs	190		642		832	
group	47		180		227	
R-squared:						
within	0.228		0.093		0.077	
between	0.002		0.018		0.060	
overall	0.005		0.025		0.070	

Note: ***, **, and * denote 1%, 5%, and 10% levels of statistical significance, respectively.

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