Effect of transparency on changing views regarding nuclear energy before and after Japan's 2011 natural disasters: A cross-country analysis

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Abstract

Using cross-country data, this paper examines the influence of government transparency on changing views regarding nuclear energy before and after Japan's natural and nuclear disasters of 2011. Empirical results show that transparency increases the rate of favor for nuclear energy.

Keywords: Natural disaster, Nuclear energy, Transparency

JEL classification: D73, D82, H12, Q54

1. Introduction

On 11 March 2011, one of the worst natural disasters in modern times hit Japan—a devastating earthquake accompanied by a tsunami. As a consequence, a number of serious accidents occurred in a nuclear power plant, resulting in nuclear leakage. This combination of disasters caused tremendous damage to the Japanese economy. Furthermore, economic globalization meant that the effects of the disaster were felt worldwide. In terms of the political consequences, approximately two weeks after the disaster, with nuclear energy becoming a hotly debated international topic, a German political party that opposed nuclear energy won their state election (Baden-Wurttemberg state). This result would indicate that Japan's nuclear disaster has influenced views regarding nuclear energy in countries some distance from Japan.

A growing number of researchers are investigating the outcomes of natural disasters (e.g., Skidmore and Toya 2002; Toya and Skidmore 2007; Yamamura 2010). Existing literature has shown that democratic nations, and those with effective governments suffer less damage from natural disasters compared with other countries. (Kahn 2005; Escaleras et al., 2007). Eisensee and Stromberg (2007) have stated that information obtained through the news media can play a critical role in disaster relief. Berger (2010) found that in Germany, nuclear incidents such as Chernobyl can increase an individual's concern for the environment. The quality and quantity of information regarding nuclear energy is important in forming views about nuclear energy. Government is expected to provide sufficient information regarding nuclear energy for the public to then form an opinion. Islam (2006) developed an indicator that measures the frequency with which governments update data to be released to the public. This paper uses that indicator to examine how government transparency influenced changes

in views regarding nuclear energy before and after the 2011 Japan disaster.

2. Data and Model

In March 2011, approximately two weeks after Japan's natural disaster, WIN-Gallup International (2011) conducted a survey regarding nuclear energy in 47 countries. The survey contained the following questions: "What was your view about nuclear energy prior to the Japan earthquake?" and "What was your view about nuclear energy after the Japan earthquake?" Respondents were given two response options: "favorable" or "unfavorable". The results regarding the favoring of nuclear energy before and after the natural disaster in each county are available from WIN-Gallup International (2011). The data from this survey were used to calculate any changes in the rate of favoring nuclear energy and the results are presented in Table 1. With the exception of Azerbaijan, Fiji, Morocco, South Africa, and Spain, the rates of favoring nuclear energy are represented by a negative value for the surveyed countries. These results suggest that the nuclear accident in Japan has made people more cautious about nuclear energy. Thus, the accident has had an obvious impact on views regarding nuclear energy worldwide. Definitions and the basic statistics for the variables used in the estimations are presented in Table 2. The estimated function takes the following form:

$$DVIEW_i = \alpha_0 + \alpha_1 TRANS_i + \alpha_2 BVIEW_i + \alpha_3 NCLEAR_i + \alpha_4 Ln(POP)_i + \alpha_5 GDP_i + \alpha_6 GOVSIZ_i + \alpha_7 EASIA_i + \alpha_8 EUROP_i + \alpha_9 NDIS_i + u_{it},$$

where DVIEW represents a change in the rate of favoring nuclear energy before and after the natural disaster in country i, α represents regression parameters and u is an error term. The rate of favoring nuclear energy before the natural disaster has been

included (BVIEW) to control for the initial level of favoring nuclear energy. The frequency with which government-update data is available to the public is considered to represent government transparency (TRANS). TRANS was sourced from Islam (2006). As nuclear energy plants increase, the likelihood of nuclear accidents also rises. The number of nuclear energy plants is included to control for this effect. Economic factors are captured by including population, GDP per capital, and government expenditure (% of GDP). These data were sourced from the Penn World Table (PWT 6.3) [1]. There appears to be a negative externality with regard to nuclear leakage caused by natural disaster. The possibility of suffering such an externality varies with regard to a nation's distance from Japan. Thus, the location of countries with regard to Japan influences changes in views about nuclear energy. Dummies for East Asian countries and European countries were incorporated into this model to capture such effects. The experience of natural disasters is thought to be related to predictions regarding the outcome of natural disasters and, in turn, influence views regarding nuclear power. To capture this effect, the total number of disasters that have occurred since 1970 are incorporated in the function.

It is likely that nuclear plants will exist in the countries where people favor nuclear energy. The OLS estimation results above possibly suffer from endogeneity bias because there appears to be a reverse causality between the dependent variable (DVIEW) and independent variable (NCLEAR). To control for this bias, instrumental variables were used to conduct the 2SLS estimation. The building of nuclear energy plants requires sufficient land area. Furthermore, it is difficult to find the space to build plants in more densely populated countries. Therefore, population density and land

[1] The data are available from the Center of International Comparisons at the University of Pennsylvania. http://pwt.econ.upenn.edu/ (accessed 28 March 2011).

area were used as instrumental variables in the 2SLS estimations. The data were obtained from World Development Indicators[2].

3. Results

The estimation results for OLS are reported in Table 3. The results excluding BVIEW are shown in columns (1) and (2), while those including BVIEW are shown in columns (3) and (4). The sample size was 45 and therefore considered small. Thus, the jackknife method was used to calculate the standard error to ensure that the results were not spurious.

The results for TRANS yielded positive signs, and were statistically significant in all estimations. The absolute values for TRANS were 2.21 when BVIEW was excluded, and 1.73 when BVIEW was included. The results controlling for the initial rates regarding the favoring of nuclear energy suggest that a 1-point increase in TRANS led to a 1.73% increase in rates regarding the favoring of nuclear energy after the natural disaster. Most of the other control variables were not statistically significant and did not affect changes in views regarding nuclear energy.

With regard to the 2SLS estimation results exhibited in Table 4, an over-identification test provided a method of testing for exogeneity in instrumental variables. Test statistics were not significant in columns (1)–(4) and, therefore, do not reject the null hypothesis that the instrumental variables are uncorrelated with the error term. This suggests that the instrumental variables are valid. TRANS yielded a positive sign in all estimations. In addition, with the exception of column (4), TRANS is statistically significant. The absolute values of the coefficient for 2SLS are similar to

[2] The data are available from HP of World Bank http://databank.worldbank.org/ddp/home.do (accessed 28 March 2011).

those of the OLS estimation. Therefore, the estimation results are considered robust.

The above evidence can be interpreted to state that government transparency increases the rate of favoring nuclear energy after a natural disaster. Thus, it can be argued that government transparency plays a critical role in the formation of views regarding nuclear energy, especially when people are confronted with a crisis such as a natural disaster.

4. Conclusions

This study used cross-country data from 45 countries to examine how government transparency influenced changes in views regarding nuclear energy before and after the 2011 Japanese disasters. It was observed that in the majority of countries studied in this paper that the rate of favoring nuclear energy declined after the disaster. However, after controlling for various factors and endogeneity bias, empirical results have shown that transparency can increase rates of favoring nuclear energy after a disaster.

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Table 1 Change in views regarding nuclear energy
(rate of favoring nuclear energy after a natural disaster) – (rate of favoring nuclear energy before a natural disaster)

Country	Difference	Country	Difference
Austria	–4	Italy	–4
Azerbaijan	3	Japan	–23
Bangladesh	–13	Kenya	–11
Belgium	–9	South Korea	–1
Bosnia and Herzegovina	–3	Latvia	–1
Brazil	–2	Macedonia	–2
Bulgaria	–6	Morocco	19
Cameroon	–4	Netherlands	–7
Canada	–8	Nigeria	–2
China	–13	Pakistan	–2
Colombia	–1	Palestine	–9
Czech	–2	Poland	–6
Egypt	–13	Romania	–10
Fiji	1	Russia	–11
Finland	–6	Saudi Arabia	–9
France	–8	Serbia	–4
Georgia	–9	South Africa	4
Germany	–8	Spain	2
Greece	–2	Switzerland	–6
Hong Kong	–8	Tunisia	–5
Iceland	–6	Turkey	–4
India	–9	United States	–6
Iraq	–13	Vietnam	–5
Ireland	–4		

Note: Serbia and Palestine are excluded in the regression estimation because independent variable data was not available.

Table 2 Definition of variables and its descriptive statistics

	Definition	Mean	Standard deviation
BVIEW	Rate of favoring nuclear energy before earthquake (%)	44.5	17.4
AVIEW	Rate of favoring nuclear energy after earthquake (%)	39.2	15.3
DVIEW	AVIEW – BVIEW (%)	–5.3	6.1
TRANS	Government transparency indicator	5.1	1.0
NCLEAR	Number of nuclear power plants in operation	7.7	19.1
POP	Population (Millions)	101.5	251.1
GDP	GDP per capita (million dollars)	1.9	1.4
GOVSIZ	Government expenditure of GDP (%)	16.0	8.4
NDIS	Total number of natural disasters since 1970	96.5	139.9
EASIA	Dummies for East Asian countries (Japan, China, and Korea).	---	---
EUROP	Dummies for European countries.	---	---

Note: BVIEW, AVIEW and DVIEW were obtained from WIN-Gallup International (2011). TRANS was sourced from Islam (2006) and NCLEAR from HP of European nuclear society (http://www.euronuclear.org/info/npp-ww.htm accessed at April 30, 2011). POP, GDP and GOVSIZ were obtained from Penn World Table 6.3. (http://pwt.econ.upenn.edu/php_site/pwt_index.php. accessed at April 30, 2011). NDIS was obtained from the International Disaster Database (http://www.emdat.be. accessed at April 30, 2011).

Table 3 OLS estimation

Dependent variable: DVIEW(the difference in views regarding nuclear energy)

	(1)	(2)	(3)	(4)
TRANS	2.21**	2.21**	1.73*	1.73*
	(2.13)	(2.07)	(1.87)	(1.78)
BVIEW			–0.14*	–0.14*
			(–1.88)	(–1.81)
NCLEAR	–0.03	–0.03	–0.01	–0.01
	(–0.34)	(–0.26)	(–0.18)	(–0.12)
Ln (POP)	–1.16*	–1.16	–0.59	–0.57
	(–1.83)	(–1.32)	(–0.99)	(–0.74)
GDP	–1.22	–1.22	–1.22	–1.21
	(–1.21)	(–1.22)	(–1.22)	(–1.20)
GOVSIZ	0.007	0.007	–0.01	–0.01
	(0.04)	(0.04)	(–0.06)	(–0.06)
EASIA	–6.41	–6.41	–3.70	–3.68
	(–0.84)	(–0.68)	(–0.44)	(–0.36)
EUROP	–3.15	–3.14	–2.62	–2.64
	(–1.36)	(–1.22)	(–1.39)	(–1.16)
NDIS		$0.02*10^3$		$-0.45*10^3$
		(0.01)		(–0.02)
Constant	–0.48	–0.48	2.63	2.47
	(–0.07)	(–0.05)	(0.37)	(0.29)
Adjusted R^2	0.09	0.07	0.21	0.19
Observations	45	45	45	45

Note: Values in parentheses are t-statistics calculated by standard errors obtained using the jackknife method. * and ** denote significance at the 10% and 5% levels, respectively.

Table 4 2SLS estimation

Dependent variable: DVIEW(the difference in views regarding nuclear energy)

	(1)	(2)	(3)	(4)
TRANS	2.21**	2.15*	1.70*	1.64
	(2.11)	(1.76)	(1.77)	(1.61)
BVIEW			–0.15**	–0.16**
			(–2.02)	(–2.18)
NCLEAR	0.05	0.15	0.05	0.11
	(0.20)	(0.49)	(0.27)	(0.71)
Ln (POP)	–1.61	–1.44	–0.92	–0.70
	(–1.25)	(–1.26)	(–1.07)	(–0.94)
GDP	–1.92	–2.31	–1.78	–1.96
	(–0.72)	(–1.21)	(–0.92)	(–1.19)
GOVSIZ	–0.01	–0.01	–0.03	–0.03
	(–0.08)	(–0.06)	(–0.13)	(–0.11)
EASIA	–6.65	–6.39	–3.72	–3.37
	(–0.91)	(–0.69)	(–0.46)	(–0.35)
EUROP	–2.77	–2.93	–2.29	–2.45
	(–0.87)	(–1.12)	(–0.93)	(–1.04)
NDIS		–0.01		–0.01
		(–0.99)		(–0.84)
Constant	4.91	4.74	7.18	6.33
	(0.31)	(0.31)	(0.56)	(0.60)
Over-identification (Sargan) test	1.58 P-value=0.21	0.89 P-value=0.34	0.68 P-value=0.40	0.35 P-value=0.55
Adjusted R^2	0.19	0.07	0.32	0.27
Observations	45	45	45	45

Note: Values in parentheses are t-statistics calculated by standard errors obtained using the jackknife method. * and ** denote significance at the 10% and 5% levels, respectively. Instrumental variables are population density and land area.