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Abstract

This paper examines the impact of economic freedom on losses of natural disasters in 35 Asian countries over the period 2000 – 2018. Results from various estimation methods show that economic freedom reduces natural disasters – proxied by both of total number of deaths and total economic losses from natural disasters, and this beneficial impact is intensified with the improvement of property rights and government integrity. Our findings assert the important role of economic freedom, property rights and government integrity in mitigating the losses of natural disasters.

Keywords: Economic freedom; Natural disasters' losses; Property right; Government integrity

JEL classifications: A11; B12; D23; Q54

1. Introduction

In neoclassical economics, market failure happens when individuals in a free market pursue their pure self-interest that leads to a net loss of economic value. Externality – the uncompensated impact of one person's actions on the well-being of a bystander – is one of market failure because it causes environmental degradation and inefficient results. For example, upstream people can pollute those who are downstream without compensation for the loss. Therefore, environmental problems are considered the dark side of free market economy. Another argument supporting this view is the so-called "tragedy of the commons" – a situation when individuals act independently for their own self-interest to overuse, deplete or spoil the shared resources such as the atmosphere, rivers, and oceans (Hardin, 1968). For this reason, common resources can

be over-exploited and destroyed in the long run, leading natural tragedy.

However, free-market environmentalists argue that environmental problems are not the market failure, but the government failure (Stroup, 1990; Anderson & Leal, 2001). According to these scholars, the presence of many environmental problems is attributed to the lack of markets, and distortions of the market; and many environmental detriments are caused by government actions when governments cannot adequately protect property rights or maintain too high transaction costs that can reduce or eliminate the externality. In their view, free market can preserve the environment, internalize pollution costs, and conserve resources as long as it is accompanied by strong property rights and tort law. Free market is a solution for environmental problems because free markets can be more successful than governments.

Similarly, Ostrom (1990) disproves the concept of "tragedy of the commons" by studying on how people in local small communities manage shared natural resources including forests, grasslands, and fishing waters. She demonstrates that rules are established steps by steps when natural resources are jointly used by their users in a way that is both economically and ecologically sustainable. Moreover, many natural resources are not commonly used by anyone but they are managed by government, and by this way the property is put into a political commons, where individuals try to appropriate public resources for their own gain, a phenomenon called rent-seeking.

On the one hand, economists accuse free market for environmental problems. Even to Devine (2020), the market won't save us from climate disaster, and we must rethink our system because "expecting the free market to fix global warming is like trying to pound nails with a saw". On the other hand, free-market environmentalists propose free market as the best means to protect environment. Then what is the answer for this? Does free market economy, proxied by economic freedom, lead to more

serious natural disasters' losses? To find the answer, in this paper, we examine the impact of economic freedom on natural disasters' losses in 35 Asian countries over the period 2000 – 2018. Our contributions to the literature are twofold. First, this is the first empirical study on the impact of economic freedom on natural disasters' losses in Asia – the most vulnerable continent to climate change in the world. Second, results from our empirical study can provide clearer evidence to reconcile contradictory views on the role of economic freedom in relation with environmental issues and natural disasters.

The remainder of this study is structured as follows. Section 2 provides some conceptual issues on free market economy and natural disasters. Section 3 presents empirical framework and data. Section 4 describes the methodology. Empirical results and discussion are provided in section 5. The final section concludes and offers main policy implications.

2. Free market economy and natural disasters: some conceptual issues

Free market is an economic system based on the law of supply and demand without or with little government control. Although there is no pure free market economy in reality due to political and legal rules of each country, economists can measure the degree of freedom in markets of an economy basing on various criteria such as business freedom, trade freedom, monetary freedom, fiscal freedom, investment freedom, financial freedom, freedom from corruption, and labour freedom. The index of economic freedom, annually published by the Heritage Foundation and the Wall Street Journal (HF&WSJ) since 1995, is one of the most popular indicators to measure the levels of free market economy for 171 countries in the world (Heritage Foundation & Wall Street Journal, 1995).

Although the free market can optimally allocate scarce resources, its downsides

cannot be ignored such as inequality and environmental problems. It is unanimously held among economists that environmental issues are one of the free market failures due to negative externality. Moreover, by pursuing own self-interest, individuals can act independently to deplete or spoil the shared resources such as the atmosphere, rivers, and oceans (Hardin, 1968). For this reason, common resources can be over-exploited and destroyed in the long run, leading natural tragedy. In addition, more activities of production and consumption, accompanied by more energy consumption in free markets are main drivers for air pollution and global warming (Copeland & Taylor, 2005; Acaravcia and Ozturk, 2010; Iwata et al., 2012; Kim & Adilov, 2012; Copeland &Taylor, 2013; Huynh & Hoang, 2019; Huynh, 2020; Huynh & Ho, 2020). As a result, the free market economy with its dark sides from negative externality and "tragedy of the commons" can lead to more pollution, global warming and natural destruction.

However, the free market economy can also reduce natural disasters and their losses through various channels. *First*, if property rights are well-defined with low transaction costs and strong law enforcement (such as effective system of courts and strong contract enforcement) negotiation through private bargaining between polluters and community groups can control pollution related externalities to correct the market failure (Coase, 1960). *Second*, the "tragedy of the commons" destroying the natural resources may not happen when local small communities can manage shared natural resources by formulating rules to use in a way that is both economically and ecologically sustainable (Ostrom, 1990). *Third*, the free market economy generates motivation for research and development (Aghion et al., 1997, 2005; Bloom et al., 2019) as well as innovation and technology progress (Baumol, 2002; Coelli et al., 2020; Karlson et al, 2021) that can improve environmental quality (Andreoni & Levinson, 2001; Brock & Taylor, 2010; Acemoglu et al., 2012). *Fourth*, free market boosts

economic growth and living standard (Barro, 1991; Gwartney et al., 1999; Haan & Sturm, 2000; Hussain & Haque, 2016), and people with higher living standard have higher capability to adapt with climate disasters (Brooks et al., 2005; Tol & Yohe, 2007; Fankhauser & McDermott, 2013).

To summarize, there is no research investigating the impact of economic freedom on natural disasters' losses. However, prior studies on the impacts of trade openness or economic freedom on pollution, global warming and climate change as discussed above offer us hints for filling this research gap. With the above argument, we postulate that economic freedom can reduce natural disasters' losses because the market efficiency outweighs its failure, and the improvements in property rights and government integrity intensifies this beneficial effect.

3. Empirical framework and data

To formulate theoretical impact of free market economy on natural disasters, we define the natural disasters' losses (NDL) as a function of economic freedom (ECOF) because in traditional view, environmental problems are arisen from market failure, as follows:

$$NDL = f(ECOF) \quad (1)$$

Following Coase (1960) and free-market environmentalists (Stroup, 1990; Anderson & Leal, 2001), we include property rights (PR) and government integrity (GI) into Eq. (1) with the proposition that property rights and government integrity can correct the market failure. Thus, Eq. (1) becomes:

$$NDL = f(ECOF, PR, GI) \quad (2)$$

Then, we add a vector of control variables (Z) to Eq.(2). As such, the baseline model in this study can be written in the following alternative form:

$$NDL_{it} = \alpha_0 + \alpha_1 ECOF_{it} + \alpha_2 PR_{it} + \alpha_3 GI_{it} + Z'_{it} \beta_j + \varepsilon_{it} \quad (3)$$

where the subscripts represent the country i; the year t; the respective coefficients α_1, α_2, α_3, and β_j; and the error term ε.

Considering PR and GI as conditions to correct the presence of externality, we take their interactions with ECOF into account to get the baseline model as follows:

$$NDL_{it} = \alpha_0 + \alpha_1 ECOF_{it} + \alpha_2 PR_{it} + \alpha_3 GI_{it} + \alpha_4 ECOF_{it}*PR_{it} + \alpha_5 ECOF_{it}*GI_{it} + Z'_{it} \beta_j + \varepsilon_{it} \quad (4)$$

With the proposition that economic freedom reduces the natural disasters' losses, and the improvements in property rights and government integrity intensifies this beneficial effect, we expect that α_1, α_2, α_3, α_4, and α_5 are negative.

The dependent variable is the Natural disasters' losses (NDL), proxied by total number of deaths (TD) and total economic losses (EL, millions of US$) from natural disasters, collected from the EMDAT International Disaster Database (EMDAT, 2019). For a disaster to be entered into the database at least one of the following criteria must be fulfilled: i) ten or more people reported killed, ii) hundred or more people reported affected, iii) declaration of a state of emergency, iv) call for international assistance. All natural disasters include those from extreme weather, extreme temperature, droughts, floods, storms, landslides, volcanic activity, wildfires, and earthquakes.

The three main regressors are economic freedom (ECOF), property rights (PR) and government integrity (GI). We use the index of economic freedom (scale from 0 – repressed – to 100 – freest) to measure ECOF with eight components (including business freedom, trade freedom, monetary freedom, fiscal freedom, investment freedom, financial freedom, freedom from corruption, and labour freedom), collected from the Heritage Foundation and the Wall Street Journal (Heritage Foundation & Wall Street Journal, 2000-2018). Data for property rights and government integrity are also

collected from the Heritage Foundation and the Wall Street Journal (Heritage Foundation & Wall Street Journal, 2000-2018).

The vector of control variables (Z) consists of temperature (TEM), forest cover (FC) and air pollution (AP). TEM is the mean annual temperature, collected from the University of East Anglia's Climate Research Unit (CRU-UEA)[1]. Temperature represents for global warming which causes various natural disasters such as droughts (Nuccitelli, 2014), heat waves (Rahmstorf & Coumou, 2011), floods (Lenderink & van Meijgaard, 2008; Pall et al., 2011), and storms (Grinsted et al., 2013). Similarly, air pollution is strongly linked to natural disasters (Chandrappa & Kulshrestha, 2015; Thomas & López, 2015), especially CO_2 concentrations will triple the number of category 5 storms (Anderson & Bausch, 2006). Meanwhile, forests not only reduce the risk of natural disasters but also lessen the damage from natural disasters such as such as floods, landslides, snow avalanches and tsunamis (ÇElik, 2008; European Environment Agency, 2015). We use forest area (% of land area) and CO2 emissions (kg per 2010 US$ of GDP) as proxies for forest cover and air pollution, respectively. Data for these two variables are extracted from World Development Indicators (WDI) of World Bank (2020). Table 1 provides measurements, expected signs and sources of all variables.

Table 1. Measurements, expected signs, and sources of all variables

Variables	Measurements	Expected signs	Sources
Dependent variable			
TD	Total number of deaths (person)		EMDAT
EL	Total economic losses (millions of US$)		EMDAT
Regressors			

[1] *See: http://www.cru.uea.ac.uk/data/*

ECOF	Free market economy (estimated number)	–	HF&WSJ
PR	Property rights (estimated number)	–	HF&WSJ
GI	Government integrity (estimated number)	–	HF&WSJ
ECOF*PR	Interaction of ECOF and PR	–	
ECOF*GI	Interaction of ECOF and GI	–	
TEM	Temperature (^{0}C)	+	CRU-UEA
FC	Forest cover (% of land area)	–	WDI, WB
AP	CO_2 emissions (kg per 2010 US$ of GDP)	+	WDI, WB

All data in the baseline model (4) are collected for 35 Asian countries over the period 2000 – 2018, including Afghanistan, Bangladesh, Bhutan, Brunei, Cambodia, China, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Laos, Lebanon, Malaysia, Mongolia, Myanmar, Nepal, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Singapore, South Korea, Sri Lanka, Tajikistan, Thailand, United Arab Emirates, Vietnam, and Yemen. Summary statistics for all variables are presented in Table 2.

Table 2. Summary statistics.

Variables	Mean	Std. dev	Min	Max	Obs
TD	1593.8	11732.2	1	166041.1	555
EL	5.97e+08	1.99e+09	1380.3	2.18e+10	482
ECOF	64.603	8.143	20.033	89.688	619
PR	42.386	21.077	5	98.4	611
GI	37.935	20.376	4	94	619
TEM	20.143	8.352	-1.1	29.3	525
FC	25.671	25.935	0.0065	82.108	578
AP	0.740	0.465	0.097	4.125	593

4. Econometric methodology

We employ three methods including Pooled Ordinary Least Squares (OLS), Fixed Effects (FE) and Random Effects (RE) to estimate the empirical model (4) with the procedure as follows. *First*, we perform Pooled OLS and RE estimations. *Second*, we use the Breusch–Pagan Lagrange multiplier test for RE with the null hypothesis of no country-specific effects in intercepts (Breusch & Pagan, 1980). Pooled OLS is applied if there is no significant difference across countries (no panel effect). If the null hypothesis is rejected, we choose RE. *Third*, we perform FE estimation and use the Hausman test to compare FE to RE with the null hypothesis that difference in coefficients is not systematic (Hausman, 1978). RE can be used to control unobserved time-variant country-specific effects. If the null hypothesis is rejected, we employ FE to remove unobserved time-invariant country-specific effects. *Fourth*, we also check heteroscedasticity by using the Breusch–Pagan Lagrange multiplier test after RE (Breusch & Pagan, 1979), and the modified Wald test after FE (Greene, 2000). In addition, the Wooldridge test or the Breusch-Pagan LM test of independence is employed for checking the serial autocorrelation in panel data (Wooldridge, 2010). Fifth, the Feasible Generalized Least Squares (FGLS) is employed to correct the presence of autocorrelation within panels and heteroscedasticity across panels (Greene, 2012).

5. Empirical results and discussions

The empirical model (4) is estimated in three specifications. We examine the impacts of free market economy, property rights, and government integrity on the anger of Mother Nature (proxied by TD and EL) in the first specification (1). Next, interaction terms between free market economy and property rights as well as between free market

economy and government integrity are added in the second specification (2). Finally, in the third specification (3) – our baseline one, other control variables are included.

Following the five steps described in the section 4 (Econometric methodology), we obtain the estimation results and relevant tests presented in Tables 3 & 4. Results from the Breusch–Pagan Lagrange multiplier test and the Hausman test reject the null hypotheses of no country-specific effects in intercepts and of no time-variant country-specific effects, respectively, indicating that FE estimations are appropriate for all three specifications. Besides, results from the modified Wald test and the Wooldridge test after FE prove the presence of heteroscedasticity but the absence of autocorrelation in the three specifications. Thus, we use FGLS to correct the presence of heteroscedasticity across panels. In addition, we include year dummies for regressions of all specifications to control the overall effects of technological changes over time.

Table 3. Estimation results for Eq. (4) with total number of deaths as dependent variable

Dependent variables: TD						
Regressors	(1)		(2)		(3)	
	FE	FGLS	FE	FGLS	FE	FGLS
ECOF	-330.19***	-234.96***	-437.90***	-360.27***	-450.23***	-338.27***
	(4.60)	(3.06)	(2.77)	(2.76)	(2.87)	(2.69)
PR	-25.13**	-16.81**	-82.38***	-95.92**	-551.96**	-211.47**
	(2.28)	(2.23)	(3.12)	(2.43)	(2.31)	(2.38)
GI	-40.38***	-36.46***	-95.86***	-25.32**	-82.19***	-50.31***
	(3.37)	(3.11)	(2.79)	(2.16)	(3.21)	(2.95)
ECOF*PR			-11.95**	-13.80**	-22.29**	-23.44**
			(2.27)	(2.33)	(2.16)	(2.21)
ECOF*GI			-28.61***	-25.17***	-28.75***	-31.79***
			(3.21)	(2.86)	(3.07)	(2.85)

TEM					451.72***	368.93***
					(3.64)	(2.67)
FC					-379.39**	-220.27***
					(2.36)	(2.53)
D.AP					150.90**	162.28*
					(2.32)	(2.16)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	24838***	20523***	29644***	24492***	34826***	20619***
Observation	508	508	508	508	429	429
Hausman	197.35***		183.29***		169.55***	
Wooldridge	218		205		178	
MW-P	0.000	0.175	0.000	0.311	0.000	0.274
LM-P	0.529		0.618		0.527	

*Absolute T-statistics appear in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively. MW-P: P-value of Modified Wald test. LM-P: P-value of Breusch-Pagan LM test.*

Table 4. Estimation results for Eq. (4) with total economic losses as dependent variable

Dependent variables: EL						
Regressors	(1)		(2)		(3)	
	FE	FGLS	FE	FGLS	FE	FGLS
ECOF	-3978659***	-4523918***	-5193765***	-4832926***	-6193837**	-5928504***
	(3.07)	(2.94)	(2.49)	(2.85)	(2.13)	(2.47)
PR	-7696421***	-6819408***	-7295682***	-8293486**	-7204972***	-6720496**
	(2.76)	(2.58)	(3.72)	(2.16)	(2.55)	(2.04)
GI	-2.75e+07***	-9652001***	-2.50e+08***	-1.63e+08***	-2.09e+08**	-9.44e+07***
	(3.79)	(3.11)	(2.71)	(2.89)	(2.09)	(2.65)
ECOF*PR			- 1432432**	- 1851738**	-6454277**	-2467637**
			(2.16)	(2.33)	(2.11)	(2.15)
ECOF*GI			-3567878***	-2649812**	-4507252***	-1214186***
			(3.64)	(2.10)	(3.81)	(3.18)
TEM					4.16e+08**	5.23e+07***

					(2.24)	(2.96)
FC					- 3.15e+07**	-1.36e+07***
					(2.32)	(2.81)
D.AP					6596352**	4947852**
					(2.18)	(2.06)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.67e+08***	3.19e+09***	3.42e+09***	3.27e+09***	1.22e+10***	1.43e+09***
Observation	452	452	452	452	428	428
Hausman	127.95***		113.29***		106***	
Wooldridge	174		145		162	
MW-P	0.000	0.319	0.000	0.284	0.000	0.469
LM-P	0.493		0.618		0.426	

*Absolute T-statistics appear in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively. MW-P: P-value of Modified Wald test. LM-P: P-value of Breusch-Pagan LM test.*

Results in Tables 3 & 4 provide interesting findings as follows.

First, economic freedom negatively affects the natural disasters' losses proxied by both total number of deaths and total economic losses from natural disasters at statistically significant levels of 1% – 5% in all specifications. This finding supports the view of free-market environmentalists that environmental problems are not the market failure but the government failure, and free market economy with its efficiency is still a best solution for environmental issues (Stroup, 1990; Anderson & Leal, 2001).

Second, the role of property right and government integrity is confirmed when these variables have negative impacts on total number of deaths and total economic losses from natural disasters in all specifications at statistically significant levels of 1% – 5%. It is line with Coase (1960) and free-market environmentalism on the opinion that property rights and rule of law can control environmental problems related externalities.

Third, negative signs of interaction terms between free market economy and property rights as well as between free market economy and government integrity

indicate that the increase in property rights and government integrity reinforces the beneficial effect of economic freedom in lessening the natural disasters' losses.

Fourth, other determinants of the natural disasters' losses are identified in the context of Asia, including global warming, forest cover and air pollution. Global warming positively affects the natural disasters' losses because it is the drivers of various natural disasters droughts (Nuccitelli, 2014), heat waves (Rahmstorf & Coumou, 2011), floods (Lenderink & van Meijgaard, 2008; Pall et al., 2011), and storms (Grinsted et al., 2013). Likewise, the finding that air pollution is strongly linked to natural disasters is consistent with Anderson and Bausch (2006), Chandrappa and Kulshrestha (2015), and Thomas and López (2015). In addition, the forest cover is found to reduce the total number of deaths and total economic losses from natural disasters.

6. Concluding remarks

The linkage between free market and environment has been under debate for a long time. In the traditional view, environmental issues are one of the free market failures. However, free-market Environmentalism argues that free market is a solution for environmental problems because free markets can be more successful than government. This paper examines the impact of free market economy, proxied by economic freedom, on the natural disasters' losses in 35 Asian countries over the period 2000 – 2018. Results from various estimation methods show that economic freedom reduces the natural disasters' losses – proxied by both of total number of deaths and total economic losses from natural disasters, and this beneficial impact is intensified with the improvement of property rights and government integrity. Thus, to reduce market efficiency in environmental issues is government failure. The failure of free market economy does not exceed its efficiency towards environmental issues.

The main findings from the study indicate that governments can utilize economic freedom to reduce the natural disasters' losses and environmental problems, as well as create strong property rights and maintain high government integrity to intensify this beneficial effect. Other policies on lessening the natural disasters' losses should focus on promoting forest cover, as well as control global warming and air pollution.

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