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Hurricane Damage and Exports from Southeast Asia

Tam Bang Vu
University of Hawaii
Hawaii, USA

Abstract

This research examines the feedback effects between hurricane damage and exports in Southeast Asian economies from 2000 to 2022. Using data for Southeast Asia, we construct a damage index based on the speed of wind when each storm passes through a region and the distance of the area to the largest city in the vicinity. We then estimate the feedback effects between these hurricanes and exports. We also examine the disparities among the Southeast Asian countries.

Keywords: Southeast Asia, hurricane damage, feedback effects, exports

1. Introduction

Over the past thirty years, hurricane intensity has increased in Southeast Asia, along with rapid gains in per capita income and exports. There are concerns that unsustainable development partly contributes to global warming through unorganized zones and environmental degradation.

Literature on the effects of overall disasters on the global economy often shows that countries with higher per capita income, a better educational system, greater openness, and better infrastructure experience less damage (Toya and Skidmore, 2007). These two authors also found that disasters that destroyed capital in many developed countries even increased production. This positive result supports the "investment-producing destruction" argument presented by Tol and Leek (1999), which explains GDP growth resulting from efforts to replace the destroyed capital stock with new and better capital.

Concerning hurricanes, Michaels *et al.* (2006) showed that a threshold of sea-surface temperature exceeding 28.25 °C, the link between rising temperatures and the increasing intensity of hurricanes becomes clear. Bender *et al.* (2010) confirmed this link in the Atlantic region. Knutson *et al.* (2007) predicted that the intensity of the Pacific hurricanes would rise in the future.

Mendelsohn *et al.* (2012) pointed out that each region's climate pattern determined the change in frequency of high-intensity storms. Estrada *et al.* (2015) noted that hurricane damage levels increase with rising temperatures in the North Atlantic Basin. They showed that between $2 billion and $14 billion in hurricane damage in the United States could be attributed to climate change in 2005 alone.

Concerning the East Asian (EA) region, Chang (2010) provided some evidence of a link between high temperatures and the rising frequency of superstorms in EA. Hershberger (2014) presented six challenges facing EA nations: endangered species conservation, air pollution, destruction of coral reefs, deforestation, water security, and disorganized urbanization. Most of these problems could lead to climate change. Ponnudurai (2015) discussed the link between unsustainable development and rising temperatures in EA.

Bluedorn (2005) studied the impacts of hurricanes in developing countries of the Central American and Caribbean region and found that hurricanes caused output to fall on average by 0.3 percent. In contrast, Strobl (2008), who examined the same area, suggested a 0.8 percent reduction in production. Coffman and Noy (2009) provided an account of Hurricane Iniki's impact on Kauai Island in Hawaii, finding that its short-term effects were devastating, and that it took the island an extended period (7-8 years) to return to its pre-Iniki level of production. Sytsma (2020) find that hurricanes have negative effects on bilateral trade flows, both imports and exports in the U.S.

On the feedback effects, UNESCO's "Save the Ifugao Terraces Movement" team (2008) emphasized that unsustainable exports could lead to severe environmental degradation. Hitchcock and Parnwell (2010) also analyzed the negative consequences of unsustainable exports, which can quickly destroy the environment. Le (2014) noted that the construction of new buildings and disorganized urbanization are impacting deforestation and pollution.

None of the existing articles examine the feedback effects between the hurricanes and unsustainable exports in SEA. Section 2 of the paper discusses the data issues. Section 3 introduces the model and methodology. Section 4 analyzes the aggregate and country-specific effects. Section 5 concludes.

2. Data Issues

The U.S. National Climatic Data Center (NCDC) website provides Tropical Cyclone Best Track tables in text files and tropical cyclone narratives in PDF format in its Annual Tropical Cyclone Reports (hereafter referred to as the Reports). In each "Best Track" table, all available satellite and radar imagery are used to determine the most accurate location and intensity of a cyclone for every six hours. We constructed our tables based on the Best Track tables and Section 3 of the Reports, which provide details of each cyclone's development, landfall, and dissipating process over time. The Reports are written by the Joint Typhoon Warning Center (JTWC) of NOAA, which posted the information on the NCDC website. We supplement the data with country reports for missing information.

Data for Singapore, Brunei, East Timor and Taiwan are not comprehensive. Hence, we eliminated these four countries from our study. Most of the cyclones that reached Laos and Cambodia made their landfalls in central and southern Vietnam, interrupting the flow of Vietnamese imports from these two neighboring countries along the cyclone trails. For this reason, the impacts of cyclones on exports from Cambodia and Laos might still be significant although the cyclones had become weak once they reached these two countries. We therefore included Cambodia and Laos in this research.

Table 1 displays the distribution of cyclones that affected countries in SEA between 2000 and 2022, based on JTWC and country reports. The table shows that the Philippines experienced the highest frequency of cyclones, followed by Vietnam. Laos suffered the least frequency and Cambodia the second least.

Table 1. Distribution of Cyclones in Affected SEA Countries during 2000-2022

Country	Total	Mean	Standard Deviation	Maximum	Minimum
Cambodia	18	0.8428	0.8341	4	1
Indonesia	34	1.6846	1.2045	6	2
Laos	15	0.7371	0.6533	3	1
Malaysia	23	1.1582	1.1674	5	1
Myanmar	25	1.2635	0.8058	5	1
Philippine	99	4.8965	2.6441	17	5
Thailand	29	1.3686	1.1163	6	2
Vietnam	85	4.1592	2.4792	14	4

Sources: US National Climatic Data Center, NOAA Website and country reports

Emanuel (2005) showed that the hurricane damage index in a country at time t is based on the total damage due to hurricanes with n = 1, 2,… N cyclones that affected county i during this time, when they make landfall in locations j = 1, 2 … J is:

$$DAM_{it} = \sum_{n=1}^{N}\left[\sum_{j=1}^{J}(V_{ijt} / J)\right]^3 \quad (1)$$

where V_{ijt} is the velocity of the wind at location *j* due to storm *n* observed in country *i* during time *t*. We followed this approach.

Granvorka and Strobl (2010) argued that between two equally affected areas in terms of wind speed, the more crowded one is likely to endure more damage. We believe that this argument is not appropriate for SEA, which have locations far away from a large city receiving much less support from the central government and therefore endure more severe damage from a hurricane. For example, Noy and Vu (2010) and Vu and Noy (2015) examined the impact of disaster damage in Vietnam and China, respectively, and showed that the distance of a province to the central government determines the level of disaster damage on the local economy instead of population density. Hence, we modified Equation (1) to allow the weight of the distance, *d*, from a province where the hurricane lands to a large city. If more than one city is in the vicinity of a province, average distances are used:

$$DAM_{it} = \sum_{n=1}^{N}\left[\sum_{j=1}^{J}d_j(V_{ijt} / J)\right]^3 \quad (2)$$

Having constructed a dataset for hurricane damage, we gathered data on the number of exports, infrastructure, school enrollments at all levels of education, and capital formation from the World Development Indicators posted on the World Bank website. Data on other variables were downloaded from the US Department of Agriculture Website and International Monetary Fund (IMF) website.

Data on inflation and real exchange rate were downloaded from the U.S. Department of Agriculture website through its database for international macroeconomic data. The real exchange rates are expressed relative to the U.S. exchange rate, which is normalized to unity. The consumer price index of each country measures inflation. Data on interest rates were downloaded from the International Monetary Fund (IMF) website.

3. Methodology

We constructed the dataset on damage index (DAM) based on the methods discussed in section 2. We then estimated a system of equations to account for the possible feedback effects among the variables:

$$EXP_{i,t} = \alpha_1 DAM_{i,t} + \sum_{k=1}^{K}\alpha_k DAM_{i,t-k} + \beta X_{i,t} + q_i + s_t + \varepsilon_{i,t} \quad (3.1)$$

$$FEEDBC_{i,t} = \varphi Z_{i,t} + \sum_{l=1}^{L}\gamma_l Z_{i,t-l} + v_i + w_t + \omega_{i,t} \quad (3.2)$$

where *EXP* denotes exports, which is estimated alternatively as the ratio of exports to population or the growth rate of this ratio, and DAM is the damage index caused by the cyclones. *FEEDBC* is any variable on the right-hand sides of the two equations that might cause feedback effects among the variables. *X* and *Z* are two potential control variables that may affect the dependent variables in the system. The subscript *i* is country index among EA countries, *t* is the time index measured in years, *k* and *l* are the number of lagged periods. The last three variables in each equation are country specific effect, time specific effect, and idiosyncratic disturbances.

To find the possible multicollinearity, we employed the Variance Inflation Factors (VIF) test as discussed in Kennedy (2008), which recommends the elimination of any variable that has VIF greater or equal to 10. After performing the VIF test to eliminate the variables with high correlations, we performed the RAMSEY RESET test for omitted variables. This test is also discussed in Kennedy (2008). The p-value for the test is 0.415, implying that there is no important omitted variable.

Skidmore and Toya (2002) provided an assumption of weak exogeneity for aggregate disaster measures in general. Since cyclone damages might be very different from overall disaster damages, we performed Granger-causality tests to investigate the possible feedback effects among the variables in the system. As discussed in Kennedy (2008), an explanatory variable X "Granger-causes" a dependent variable Y if current and lagged values of X are statistically significant. The t-statistics for exports and the F-statistics for joint significance of the current and lagged values for TOUR all indicate that TOUR does Granger-cause DAM. In addition, we found that there is a feedback effect between DAM and growth rate of per capita income, which is one of the control variables.

To examine the stationarity of the time series, we performed the Dickey-Fuller tests as discussed in Kennedy (2008). The tests reveal that the series is stationary. We then conducted the Hausman test and found that a fixed-effects model is more appropriate than a random-effects model. Hence, the fixed effect three-stage least squares estimations (FE3SLS) were employed. The Akaike Information Criteria procedures also show that the model with one lagged value in each equation is the most appropriate. As a result, System (4) of our structural equations is written as:

$$EXP_{i,t} = \alpha_1 DAM_{i,t} + \alpha_2 DAM_{i,t-1} + \beta_1 PERCA_{i,t} + \beta_2 EXC_{i,t} + \beta_3 INFRA_{i,t} + q_i + s_t + \varepsilon_{i,t} \quad (4.1)$$

$$DAM_{i,t} = \theta_1 EXP_{i,t} + \theta_2 EXP_{i,t-1} + \lambda_1 PERCA_{i,t} + \lambda_2 EDU_{i,t} + \lambda_3 INFRA_{i,t} + r_i + u_t + e_{i,t} \quad (4.2)$$

$$PERCA_{i,t} = \kappa_1 DAM_{i,t} + \kappa_2 DAM_{i,t-1} + \varphi_1 EXP_{i,t} + \varphi_2 INIT_{i,t} + \varphi_3 CAP + v_i + w_t + \omega_{i,t} \quad (4.3)$$

where PERCA is growth rate of per capita income, *EXC* real exchange rates, *INFRA* infrastructure, *EDU* education, *INIT* the initial value of per capita income, and *CAP* capital formation.

In cross-sectional data analysis, it is not easy to find an instrumental variable (IV). In panel data analysis, lagged dependent variables can be used as IVs, and the system generalized method of moments (SGMM) as discussed in Bond (2002) can be employed to control for any problem caused by the lagged dependent variables. We can regress a reduced form with DAM as dependent variables on all exogenous variables and use the predicted value (PDAM) as the IV for DAM in (4.1) and (4.3). System (4) was then estimated simultaneously using the FE3SLS technique to avoid simultaneity bias.

4. Results

Table 2 reports the aggregate results for System (4). The results appear to support our assumption of the feedback effects among EA cyclones, per capita income (*PERCA*), and exports (*EXP*), which is defined as the ratio of exports to population (*E-RATIO*) or growth rate of this ratio (*T-GROW*). Panel (2a) presents the results for Equation (4.1). Panel (2b) is for (4.2), and Panel (2c) is for (4.3). Since the results involve both current and lagged values in the three panels, we report the sums of these values, as well as the p-values for the tests of their significance. For example, the effect of DAM on E-RATIO in the current period (short-term impact) is –0.25, and the effect after one year (long-term impact) is –0.09. The composite impact is – 0.34 (= – 0.25 – 0.09), and the p-value for this sum is 0.047. This implies that a one percent increase in the damage index seems to decrease the export ratio to population in SEA by 0.34%, and the effect is statistically significant. The interpretations for the other variables follow the same pattern.

Panel (2a) also reveals that the overall effect of DAM on E-GROW in SEA is negative and statistically significant for the current value. In contrast, it is negative and weakly significant for the lagged value. The composite effect, as shown by the sum of these two values, is negative and significant, implying an adverse impact of cyclones on the growth rate of the tourist-arrival ratio to population as well.

Panel (2b) shows that the short-term effect of TOUR on DAM in SEA is weakly significant, while the long-term impact is statistically significant. They imply that the rise in unsustainable development in SEA does increase the damage levels of the cyclones.

Panel (2c) reveals that the overall effects of DAM on PERCA are smaller than those effects on exports. However, they are negative and statistically significant for the current value, insignificant for the lagged value, and the sum of these two values is negative and significant.

The results for the control variables in each panel of Table 3 are as expected. For example, an appreciation of the real exchange rate (a decrease in the domestic currency required to exchange for one US dollar) seems to decrease exports, whereas improved infrastructure appears to attract more exports.

Table 2. Feedback Effect between Cyclones and Exports in SEA: Aggregate Effects

Panel (2a) Dependent Variable: ratio of exports to population or growth rate of this ratio						
	E-RATIO			*E-GROW*		
Variable	Current	Lag	Sum	Current	Lag	Sum
DAM	-0.25**	-0.09**	-0.34**	-0.13**	-0.06*	-0.19**
	(0.028)	(0.032)	(0.047)	(0.035)	(0.089)	(0.031)
PERCA	0.19**			0.25**		
	(0.032)			(0.031)		
EXC	0.06**			0.03**		
	(0.031)			(0.035)		
INFRA	0.07**			0.04**		
	(0.045)			(0.039)		
Panel (2b) Dependent Variable: cyclone damage						
Variable	Current	Lag	Sum	Current	Lag	Sum
EXP	0.02*	0.14**	0.16**	0.02*	0.13**	0.15**
	(0.084)	(0.037)	(0.042)	(0.079)	(0.025)	(0.031)
PERCA	0.15**			0.06**		
	(0.034)			(0.036)		
EDU	-0.04**			-0.04**		
	(0.028)			(0.029)		
INFRA	-0.06**			-0.03**		
	(0.033)			(0.037)		
Panel (2c) Dependent Variable: growth rate of per capita income						
Variable	Current	Lag	Sum	Current	Lag	Sum
DAM	-0.05**	0.02	-0.03**	-0.04**	0.01	-0.03*
	(0.024)	(0.504)	(0.038)	(0.026)	(0.189)	(0.072)
EXP	0.05**			0.06**		
	(0.027)			(0.041)		
INIT	-0.03**			-0.01***		
	(0.039)			(0.001)		
CAP	0.32***			0.33**		
	(0.007)			(0.034)		
Number of observations				169		
P-value for the F-test of the model				0.001		
Average RMSE				0.149		
P-value for AR(1)				0.315		
P-value for AR(2)				0.642		
P-value for heteroscedasticity (White) test				0.541		

Note: *, **, and *** denote 10%, 5%, and 1% statistical significance, respectively. The p-values are in parentheses.

Panel 2(a) suggests that improving living standards by increasing per capita income and infrastructure leads to higher exports. This makes sense as a high standard of living rises the necessary resources to offer quality services to exports, and good infrastructure provides easy access to tourist attractions. From Panel 2(b), it seems that education mitigates cyclone damage. This is possible through an increased awareness of cyclone damage and knowledge of preventive measures. From Panel 2(c) cyclone damage appears to decrease exports. The other variables have the expected signs of the factors in a production function model.

To compare the feedback effects among the affected countries in SEA, we generated interactive variables for Cambodia (CAM), Indonesia (INDO), Laos (LAO), Malaysia (MAL), Myanmar (MYAN), the Philippines (PHIL), and Thailand (THAI). These dummies were interacted with the above benchmark variables to form slope dummies for the study. Vietnam (VIET) is used as the base group. As such, the coefficient estimates for DAM represent the effects for VIET, whereas the coefficient estimates for the other countries reveal the comparative impact for other countries compared to VIET.

Table 3 reports the results of the benchmark variables equivalent to those in Table 3. The coefficient estimates for DAM are also labeled as (VIET). For the other countries, the first column presents the coefficient estimate of each dummy, which is expressed as the comparative value of the dummy to VIET. In contrast, the second column presents the absolute values for each country by calculating the sum of each dummy coefficient and that of Vietnam. We then tested for the significance of these sums and reported their p-values in each panel.

Comparing Panel (3a) and Panel (2a), one can see that Vietnamese exports seem to endure slightly less cyclone damage than the aggregate damage for SEA as a group. Relating these results to Table 1, which shows that the number of cyclones that landed in Vietnam is more than twice the average in SEA, the results might imply that Vietnam is slightly more experienced in dealing with hurricanes than the other countries. The effect of cyclone damage in Thailand is approximately the same as the average; those in Laos and Cambodia are significantly lower than average and only weakly significant, whereas those in Indonesia, Malaysia, and Myanmar are all substantially below the average. The Philippines suffers the heaviest losses, more than twice the average for the SEA region.

Panel (3b) shows that cyclone damage due to unsustainability in Vietnam appears to be the same as the aggregate effects for SEA, those for Cambodia, Indonesia, Laos, and Myanmar are slightly higher than the average. In contrast, those for China, Japan, Korea, Malaysia, and Thailand are below the average. The damage in the Philippines is again much higher than the average for SEA.

Table 3. Cyclones and Economic Development in SEA: Country Effects

Panel (3a) Dependent Variable: ratio of exports to population or growth rate of this ratio

	E-RATIO		*E-GROW*	
Variable	Comparative	Absolute	Comparative	Absolute
DAM (VIET)		-0.29**		-0.16**
		(0.031)		(0.035)
CAM	0.15**	-0.14*	0.12**	-0.04*
	(0.036)	(0.082)	(0.032)	(0.086)
INDO	0.08**	-0.21**	0.04**	-0.12**
	(0.033)	(0.025)	(0.041)	(0.037)
	(0.035)	(0.017)	(0.006)	(0.026)
LAO	0.16**	-0.12*	0.12*	-0.03*
	(0.043)	(0.092)	(0.058)	(0.069)
MAL	0.14**	-0.14**	0.06**	-0.09**
	(0.028)	(0.033)	(0.043)	(0.035)
MYAN	0.09**	-0.19**	0.04**	-0.11**
	(0.018)	(0.022)	(0.043)	(0.035)
PHIL	-0.22**	-0.50***	-0.14***	-0.29***
	(0.022)	(0.004)	(0.003)	(0.009)
THAI	-0.03**	-0.31**	-0.03**	-0.17**
	(0.029)	(0.034)	(0.048)	(0.037)

Panel (3b) Dependent Variable: cyclone damages

Variable	Comparative	Absolute	Comparative	Absolute
EXP (VIET)		0.18**		0.15**
		(0.027)		(0.032)
CAM	0.01**	0.19**	0.02*	0.17**
	(0.035)	(0.047)	(0.044)	(0.036)
INDO	0.02**	0.20**	0.01**	0.16**
	(0.025)	(0.032)	(0.046)	(0.021)
	(0.694)	(0.021)	(0.595)	(0.025)
LAO	0.02**	0.20**	0.01**	0.16**
	(0.025)	(0.049)	(0.034)	(0.026)
MAL	-0.01	0.17**	0.01	0.15**
	(0.274)	(0.027)	(0.396)	(0.032)
MYAN	0.03**	0.21**	0.02**	0.17**
	(0.039)	(0.028)	(0.026)	(0.033)
PHIL	0.07**	0.25**	0.06**	0.21**
	(0.031)	(0.046)	(0.032)	(0.024)
THAI	-0.01	0.17**	0.01	0.15**
	(0.405)	(0.027)	(0.621)	(0.032)

Panel (3c) Dependent Variable: growth rate of per capita income

Variable	Comparative	Absolute	Comparative	Absolute
DAM (VIET)		-0.06**		-0.02**
		(0.035)		(0.041)
CAM	-0.008	-0.06**	0.006	-0.02**
	(0.217)	(0.035)	(0.386)	(0.041)
INDO	0.015*	-0.045**	0.008*	-0.012**
	(0.079)	(0.049)	(0.064)	(0.035)
LAO	0.005	-0.06**	-0.003	-0.02**
	(0.275)	(0.035)	(0.602)	(0.041)
MAL	0.045***	-0.015**	0.018***	0.002
	(0.007)	(0.046)	(0.003)	(0.534)

MYAN	0.006		-0.06**	-0.004			-0.02**	
		(0.298)		(0.035)		(0.367)		(0.041)
PHIL		0.024**	-0.036**		0.005**		-0.015**	
		(0.029)		(0.045)		(0.034)		(0.031)
THAI		0.043**	-0.017**		0.009**		0.011**	
		(0.018)		(0.023)		(0.043)		(0.037)
Number of observations					165			
P-value for the F-test of the model						0.000		
Average RMSE					0.138			
P-value for AR(1)						0.293		
P-value for AR(2)						0.537		
P-value for heteroskedasticity (White)test						0.476		

Note: *, **, and *** denote 10%, 5%, and 1% statistical significance, respectively. The p-values are in parentheses.

From Panel (3c), it appears that the effects of cyclone damage on per capita income are smaller than the effects on exports for all of the SEA countries. These results support results in existing literature and appear to reflect government efforts to reinvest in new capital and infrastructure after cyclone strikes, as well as private sector efforts to redirect resources to other sectors of the economy, allowing for more efficient use of resources.

5. Conclusion

The results in Section 4 suggest that the following measures can be implemented to foster sustainable development and mitigate hurricane damage.

First, improve local infrastructure, including telephone lines and broadcasting systems, as well as roads and waterways, to increase the level of damage prevention in rural areas.

Second, prevent disorganized urbanization that increases environmental pollution and leads to higher levels of cyclone damage.

Third, encourage residents to practice responsible resource use for sustainable development, such as conserving water, reducing waste, and minimizing environmental pollution.

Finally, support rural households in sending their children to school, and support rural adults in attending evening classes to enhance their knowledge of cyclone damage and prevention measures to mitigate this damage.

In summary, this paper examines feedback effects where hurricane damage negatively impacts exports and per capita income, which in turn exacerbate cyclone damage levels due to unsustainable practices.

A caveat is that data sets are not comprehensive for all SEA countries. When new data is available, new estimations should be carried out to obtain more comprehensive and precise results. In addition, this paper focuses on per capita income and exports. It is also interesting to examine feedback effects among other sectors in the economy, which serves as a research venue for the future.

References

Bender, M.A,, Knutson, T.R., Tuleya, R., Vecchi, G.A., Sirutis, J.J., Garner, and Held, I. (2010). Modeled Impact of Anthropogenic Warming on the Frequency of Intense Atlantic Hurricanes. *Science*, Vol. 327, No. 5964, 454 – 458.

Bluedorn, J.C. (2005). Hurricanes: Intertemporal Trade and Capital Shocks. Nuffield College

Economics Paper 2005-W22.

Bond, S. (2002). Dynamic panel data models: A guide to micro data methods and practice. CEMMAP working paper, CWP09/, 02.

Chang, C.H. (2010). The impact of global warming on storms and storm preparedness in Southeast Asia. *Kajian Malaysia*, Vol. 28, No. 1, 53-76.

Coffman, M. and Noy, I. (2009). Hurricane Iniki: Measuring the long-term economic impact of a natural disaster using synthetic control. University of Hawaii Economics Working Paper 09-05.

Emanuel, K. (2005). Increasing Destructiveness of Tropical Cyclones over the Past 30 Years. *Nature*, Vol. 4, 686-688.

Estrada, F. Botzen W.J. and Tol, R.S.J. (2015). Economic losses from US hurricanes consistent with an influence from climate change, *Nature Geoscience*, Vol. 8, 880-884.

Granvorka, C. and Strobl, E. (2010). The Impact of Hurricanes Strikes on the Exports in the Caribbean. UWI Conference Paper, 1-21, http://sta.uwi.edu/conferences/09/salises/documents/C%20Granvorka.pdf

Hershberger, M. (2014). Six environmental challenges facing Southeast Asia. Amazing Thailand, Matador network,

http://matadornetwork.com/change/6-environmental-challenges-facing-southeast/

International Macroeconomic Data. (2017). US Department of Agriculture Website, http://www.ers.usda.gov/data-products/international-macroeconomic-data-set.aspx

International Monetary Fund Data. (2017). http://www.imf.org/data/imf-finances

Joint Typhoon Warning Center. (2017). Annual Tropical Cyclone Reports. US National Climatic Data Center, National Oceanic and Atmospheric Administration

https://www.ncdc.noaa.gov/data-access

Kennedy, P. (2008). *A Guide to Econometrics*. Sixth Edition, MA: MIT Press.

Toya, H. and Skidmore, M. (2007). Economic Development and the Impacts of Natural Disasters. *Economics Letters*, 94, 20-25.

Knutson, T.R., Sirutis, J.J., Garner, S.T., Held, I., and Tuleya, R. (2007). Simulation of the Recent Multidecadal Increase of Atlantic Hurricane Activity Using an 18-km-Grid Regional Model. *American Meteorological Society BAMS*, 1549-1565.

Hitchcock, M.K., V. and Parnwell, M. eds. (2010). *Exports in Southeast Asia: Challenges and New Directions*. Honolulu: University of Hawaii Press.

Le, T. (2014). Exports, A Balancing Act. Reporting ASEAN Website,

http://www.aseannews.net/sustainable-exports-a-balancing-act/

Mendelsohn, R., Emanuel, K., Chonabayashi, S., and Bakkensen, L. (2012). The impact of climate change on global tropical cyclone damage. *Nature Climate Change,* 2, 205-209.

Michaels, P.J., Knappenberger, P.C., and Davis, R.E. (2006). Sea-surface temperatures and tropical cyclones in the Atlantic basin. *Geophysical Research Letters*, 33, l-4.

Noy, I. and Vu, T.B. (2010). The Economics of Natural Disasters in a Developing Country: The

Case of Vietnam. *Journal of Asian Economics* 21, 345-354

Ponnudurai, P. (2015). Climate Change Conjures Up 'Alarming' Scenarios in Southeast Asia.

Radio Free Asia Website, http://www.rfa.org/english/commentaries/east-asia-beat/climate-change-07022013165938.html

"Save the Ifugao Terraces Movement" Team. (2008). The Effects of Exports on Culture and Environment in Asia and The Pacific. UNESCO website, http://unesdoc.unesco.org/images/0018/001826/182647e.pdf

Skidmore, M. and Toya, H. (2002). Do natural disasters promote long-run growth? *Economic Inquiry*, 40, No. 4, 664-687.

Strobl, E. (2008). The Macro-Economic Impact of Natural Disasters in Developing Countries:

Evidence from Hurricane Strikes in the Central American and Caribbean Region.

Development Durable Discussion Paper

Sytsma, T (2020). The Impact of Hurricanes on Trade and Welfare: Evidence from US Port-level Exports, *Economics of Disasters and Climate Changes*, 4, 625-655.

Tol, R. and Leek, F. (1999). Economic analysis of natural disasters, in: Downing, T., Olsthoorn, A., Tol, R. (Eds.). *Climate Change and Risk*. London: Routledge, 308--327.

Vu, T.B. and Noy, I. (2015). Regional Effects of Natural Disasters in China: Investing in Post-Disaster Recovery. *Natural Hazards*, 75, 111-126.

World Development Indicator. (2015). the World Bank Website, http://data.worldbank.org/indicator/ST.INT.ARVL?page=3