Economics Bulletin

Volume 38, Issue 1

Land and Real Estate Price Sensitivity to a Disaster: Evidence from the 2011 Thai Floods

Yasuyuki Sawada
University of Tokyo and Asian Development Bank

Hiroyuki Nakata
University of Leicester

Kunio Sekiguchi
Ehime Prefectural Government

Yoko Okuyama
Yale University

Abstract

This paper investigates the impacts of a natural disaster on land and real estate prices. Using unique land and real estate price panel datasets for multiple periods, one group before and the other after the 2011 floods in Thailand, we find that the floods adversely affected land prices for industrial use. However, the prices of commercial and residential land did not decline despite substantial damages from the floods, suggesting a relative lack of liquidity or other frictions in the land and real estate markets in Thailand.

This study is conducted as part of the project "Post-disaster Recovery Policies and Insurance Mechanisms against Disasters: Case Studies on Earthquakes in Japan and Floods in Thailand," undertaken at Research Institute of Economy, Trade and Industry (RIETI). The authors appreciate the excellent support from Akito Kamei in his capacity as research assistant. We are also grateful for the helpful comments and suggestions from Masahisa Fujita, Masayuki Morikawa, Yoshitsugu Kanemoto, and Atsushi Nakajima. The usual disclaimers apply.
Citation: Yasuyuki Sawada and Hiroyuki Nakata and Kunio Sekiguchi and Yoko Okuyama, (2018) "Land and Real Estate Price Sensitivity to a Disaster: Evidence from the 2011 Thai Floods", *Economics Bulletin*, Volume 38, Issue 1, pages 89-97
Contact: Yasuyuki Sawada - sawada@e.u-tokyo.ac.jp, Hiroyuki Nakata - hn66@leicester.ac.uk, Kunio Sekiguchi - sekiguchi-kuniou@pref.ehime.jp, Yoko Okuyama - y.okuyama816@gmail.com.
Submitted: January 07, 2018. **Published:** January 24, 2018.

1 Introduction

In October 2011, areas along the lower Chao Phraya River in Thailand were hit by serious floods. Unexpectedly, the floods substantially damaged the seven industrial estates (hereafter, IEs) along the lower Chao Phraya River between Ayutthaya and Bangkok (Sawada, Nakata, Sekiguchi, and Okuyama, 2014). The floods were indeed the worst in decades, if not centuries. The World Bank (2012) estimated the total economic losses to the Thai economy at THB 1,425 billion (USD 45.7 billion). The manufacturing sector was hit the worst, with losses totaling THB 1,007 billion (USD 32 billion), followed by the commercial sector, especially finance and banking (THB 115,276 billion), tourism (THB 94,808 billion), and housing (THB 83,797 billion).

Theoretically, the impacts of a natural disaster may be reflected in changes in land prices because the land price is equal to the present value of future returns from land use when the market is efficient (Skantz and Strickland, 1987; Wong, 2009; World Bank and United Nations, 2010). In order to test this hypothesis, we investigate the impacts of the 2011 Thailand floods on real estate prices using unique land price datasets for two periods, one before and the other after the 2011 floods.

The remainder of the paper is organized as follows. Section 2 examines the impacts of the 2011 floods on real estate prices, which include not only land prices for industrial use but also land prices for residential and commercial use and prices of detached houses, townhouses, and condominiums. The final section provides concluding remarks and possible policy implications.

2 Impacts of the 2011 Floods on Land Prices

In order to quantify the impacts of the 2011 floods on real estate prices, we employ two datasets on real estate prices (Sawada, Nakata, Sekiguchi, and Okuyama, 2014): land prices of IEs collected by the Japan External Trade Organization (JETRO); prices residential, commercial, and industrial land, as well as of detached houses, townhouses, and condominiums, compiled by the Agency for Real Estate Affairs (AREA) of Thailand. Both datasets cover periods before and after the 2011 floods.

We use each of these two panel datasets to estimate regression models based on a difference-in-difference (DID) framework. We consider the 2011 floods a natural experiment by using the 2011 flood-affected areas as the "treated" group and the unaffected areas as the "control" group; we then capture the differences between the values before and after the floods.

2.1 DID analysis using JETRO data

We first use the JETRO dataset, which covers approximately 40 IEs in Thailand and provides multi-period observations on land prices for each year. We restrict our attention to the latest 10 rounds of surveys conducted between October 2008 and November 2012. JETRO conducted six surveys before and four after the severe floods that occurred in October 2011. Furthermore, we identified seven *flooded IEs* based on the reports by JETRO: Bangpa-In IE, Hi-Tech IE, Rojana Industrial Park, Saharattanakorn IE, and Factory Land IE in Ayutthaya province and Bangkadi Industrial Park and Navanakorn IE in Pathum Thani province.

For some IEs, we know only the upper and lower bounds of the land price. In the analysis, we treat the upper and lower bounds as different data points, using *price category* dummies whose value is unity if a particular price is adopted as one of control variables in our regression analyses.

As a preparatory analysis of DID estimation, we check the parallel trend assumption by using the pre-floods data to regress land prices on floods "treated" dummy, survey round dummies, and interaction variables of "treated" and survey round dummy variables, together with IE fixed effects. As we can see from the estimation results shown in Table 1, the interaction terms are not statistically different from zero, suggesting that the IE land price trends before the floods run parallel in the flooded and non-flooded areas.

With a newly defined "After flood" indicator variable that takes one for the post-flood survey rounds and zero otherwise, the DID analysis with IE fixed effects reported in Table 2 shows that the 2011 floods had a significantly negative impact on the land price in the flooded areas relative to the non-flooded ones: From the point estimates of the coefficients for the interaction variable of "Treatment" and "After flood" variables, the magnitude of the negative impact is 8.27% of the mean land price [specification (2) of Table 2] in the entire after-flood period and 11.74% [specification (3) of Table 2] in round 9.[1]

2.2 DID analysis using AREA data

In order to test the robustness of the findings from the JETRO dataset, we employ another dataset obtained from the Agency for Real Estate Affairs (AREA), Thailand. The AREA dataset contains time series of prices for different types of land (industrial, residential, and commercial) and real estate (detached houses, town houses, and condominiums). Prices are collected for 43 districts in various prefectures: 3 districts in Ayutthaya, 6 in Pathum Thani, 5 in Nonthaburi, 11 in Bangkok, 4 in Chachoengsao, 4 in Chon Buri, 3 in Prachin Buri, 4 in Samut Prakan, and 3 districts in Saraburi. The dataset reports annual prices for four years from 2010 until 2013. We treat all districts in Ayutthaya, Pathum Thani,

[1] Considering that the mean land price in the non-flooded area after the flood is THB 3966.575 per Rai (Table 2), the magnitude of the impact is 8.27%.

and Nonthaburi as flooded "treated" areas and all districts in Chon Buri, Prachin Buri, Samut Prakan, and Saraburi as non-flooded "control" areas.

Since we have only single cross-sectional observations before the floods, we conduct the baseline balancing test by regressing prices on the flood "treated" indicator variable, controlling for the type of price. The estimation results reported in Table 3 show no systematic difference in land and real estate prices between the treated and control groups before the floods.

Table 4 shows the DID estimation results for each land and real estate price with district fixed effects. For each type, we have two specifications of the main interaction variable: one with the "After flood" variable, which takes one for 2011, 2012, and 2014 and zero otherwise, and the other with year dummy variables. As with the estimation results based on the JETRO dataset, the 2011 floods negatively affected the prices of industrial-use land. From our point estimates after the flood [specifications (1) and (2) of Table 4], the industrial land price declined by 6.49% over the entire post-flood period and by 9.43% in 2012. We also found a negative impact on townhouse prices, which declined by 4.85% [specification (9) of Table 4].

In contrast, land for commercial and residential uses and real estate in the form of detached houses and condominiums witnessed no statistically significant price effect. The absence of an absolute decline in prices even in the flooded areas is somewhat similar to Wong's (2008 finding that house prices barely reacted to the severe acute respiratory syndrome (SARS) epidemic in Hong Kong in the 2003. After the outbreak of the disease, the average house price declined by 1–3% if the estate was directly affected by SARS and by 1.6% for all estate. These observations suggest that land and real estate prices may not react to a negative event, reflecting the relative lack of liquidity and other frictions in the land and real estate markets.

3 Conclusions

We examine the impact of a natural disaster on real estate prices using unique land price datasets for two periods, one before and the other after the 2011 floods in Thailand. We find that although the floods adversely affect land prices for industrial use, commercial and residential land prices did not decline despite substantial damages from the floods, suggesting a relative lack of liquidity or other frictions in the land and real estate markets in Thailand.

The 2011 Thailand floods showed us that unexpected, severe, adverse events could occur in an otherwise steadily growing middle-income country such as Thailand. However, market mechanisms do not function well in response to such disaster risks. A large shock, including a natural disaster, may have significant impacts on firm location choice and alter the demand for real estate. Such an impact of a natural disaster is ultimately reflected

in changes in land prices because the land price is the present value of future returns from land use when the real estate market is efficient. The lack of liquidity and other frictions in the land and real estate markets, which are closely related to the costly nature of relocation, may still hinder the direct impacts of a natural disaster on real estate prices.

Funding: This research was funded by Research Institute of Economy, Trade and Industry (RIETI).

Declarations of interest: none

Table 1: Parallel trend test using JETRO data before the floods

	(1) land price
Treated *Round2	151.6
	(209.2)
Treated *Round3	-160.8
	(105.7)
Treated *Round4	-90.44
	(181.3)
Treated *Round5	-90.44
	(181.3)
Treated *Round6	42.66
	(233.7)
Upper price	506.4**
	(220.4)
Lower price	-168.6
	(204.8)
Round 2	138.4
	(120.6)
Round 3	204.5*
	(118.4)
Round 4	294.0**
	(118.1)
Round 5	294.0**
	(118.1)
Round 6	383.9***
	(119.3)
Constant	2978.0***
	(116.5)
Observations	286
Adjusted R^2	0.174
Industrial estate (IE) fixed effects	YES

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.010

Table 2: DID analysis using JETRO data

	(1) land_stack	(2) land_stack	(3) land_stack	(4) land_stack
Treated * After flood	-337.9**	-328.1*		
	(168.4)	(180.2)		
Treated * After flood * upper price		-30.72		
		(178.9)		
Treated * After flood * lower price		-193.6		
		(129.3)		
Treated * Round2				158.3
				(206.6)
Treated * Round3				-148.0
				(129.1)
Treated * Round4				-95.86
				(184.9)
Treated * Round5				-95.86
				(184.9)
Treated * Round6				34.99
				(250.8)
Treated * Round7			-190.6	-216.0
			(134.2)	(188.5)
Treated * Round8			-227.9	-252.9
			(218.9)	(259.6)
Treated * Round9			-472.7***	-497.5***
			(113.9)	(169.2)
Treated * Round10			-461.5*	-486.5*
			(257.1)	(284.8)
Upper price	587.8**	589.0**	593.7**	593.1**
	(247.0)	(251.3)	(246.8)	(247.6)
Lower price	-171.8	-166.6	-165.9	-166.5
	(140.4)	(140.4)	(138.7)	(134.1)
Round 2	162.6	162.0	161.5	131.7
	(107.2)	(107.2)	(107.3)	(132.2)
Round 3	173.1*	172.7*	172.2*	200.6
	(102.8)	(102.8)	(102.9)	(129.4)
Round 4	283.2***	283.1***	282.7***	297.5**
	(99.63)	(99.90)	(100.1)	(123.5)
Round 5	283.2***	283.1***	282.7***	297.5**
	(99.63)	(99.90)	(100.1)	(123.5)
Round 6	407.8***	407.6***	407.2***	404.4***
	(109.6)	(109.7)	(109.8)	(130.8)
Round 7	501.8***	500.4***	483.6***	488.7***
	(126.6)	(126.8)	(126.4)	(145.4)
Round 8	700.8***	699.4***	687.6***	692.3***
	(130.9)	(130.9)	(130.6)	(149.1)
Round 9	677.0***	680.3***	694.5***	699.1***
	(127.8)	(128.3)	(128.7)	(147.1)
Round 10	905.2***	903.8***	921.2***	925.9***
	(187.2)	(187.1)	(196.6)	(207.2)
Constant	2925.2***	2924.2***	2923.1***	2922.0***
	(117.2)	(117.8)	(117.6)	(122.6)
Observations	484	484	484	484
Adjusted R^2	0.283	0.280	0.282	0.278
Industrial estate (IE) fixed effectsl	YES	YES	YES	YES

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table 3: Parallel trend test using AREA data

	(1) land and housing price
Flooded area	-393580.4
	(257190.1)
Raw land price -Residential uses	-130712.4
	(105666.1)
Raw land price - industrial uses	-173419.4
	(119031.1)
Detached houses	4594601.4***
	(622081.6)
Townhouses	1313185.2***
	(205863.3)
Condominiums	384034.3***
	(127697.2)
Constant	302913.6*
	(179822.7)
Observations	153
Adjusted R^2	0.511

Standard errors in parentheses
* p¡0.10, ** p¡0.05, *** p¡0.010

Table 4: Effect of Flooding on Land and Housing Prices

	(1) Industrial uses	(2) Industrial uses	(3) Residential uses	(4) Residential uses	(5) Commercial uses	(6) Commercial uses
Treated *After flood	-1025*		-2473.4		-606.7	
	(507.1)		(4070.1)		(4617.5)	
Treated *year (2011)		-658.3*		-1566.7		170.0
		(330.4)		(2561.7)		(2909.5)
Treated *year (2012)		-1527.4***		-2862.0		-1090.0
		(526.2)		(4602.0)		(5057.4)
Treated *year (2013)		-889.3		-2991.4		-900.0
		(851.0)		(5192.2)		(6289.0)
year 2011	793.4**	658.3*	4029.7	3713.4*	3277.8	2760.0
	(364.5)	(330.4)	(2711.0)	(2206.7)	(3257.7)	(2119.0)
year 2012	1556.6***	1741.7***	6506.4	6642.0	5097.8	5420.0
	(503.7)	(513.2)	(4025.7)	(4247.5)	(3918.9)	(4266.3)
year 2013	1625**	1575.0*	7877.3*	8058.0*	6644.4	6840.0
	(685.5)	(815.8)	(4312.0)	(4685.0)	(4278.4)	(5293.0)
Constant	14131.6***	14131.6***	40286.6***	40286.6***	40526.7***	40526.7***
	(237.0)	(241.6)	(1852.8)	(1867.8)	(1621.1)	(1662.2)
Observations	76	76	172	172	60	60
Adjusted R^2	0.309	0.317	0.114	0.105	0.280	0.256
District fixed effects	YES	YES	YES	YES	YES	YES

	(7) Detached houses	(8) Detached houses	(9) Town houses	(10) Town houses	(11) Condominiums	(12) Condominiums
Treated *After flood	4780.7		-71456.1**		-19515.2	
	(46502.8)		(34282.3)		(13548.0)	
Treated *year (2011)		-20394.7		-45991.9**		-7840.9
		(27953.8)		(20155.4)		(5613.5)
Treated *year (2012)		34736.8		-49574.9		-12159.1
		(57571.2)		(33400.3)		(16548.6)
Treated *year (2013)		-2.81e-11		-118801.6		-38545.5
		(84587.5)		(78109.5)		(23845.3)
year 2011	48149.4*	57894.7**	64029.1***	53684.2***	14006.4	9090.9
	(25455.9)	(21696.0)	(21964.0)	(19229.5)	(8579.7)	(5421.2)
year 2012	76859.1***	65263.2**	112310.3***	103421.1***	24006.4	20909.1
	(25887.9)	(25018.9)	(26720.2)	(27403.0)	(14038.5)	(15731.5)
year 2013	178149.4***	180000***	198029.1***	217263.2***	56532.7***	64545.5***
	(49375.8)	(63436.6)	(56287.6)	(75118.7)	(17928.1)	(22143.9)
Constant	4745161.3***	4745161.3***	1473750***	1473750***	515263.2***	515263.2***
	(16970.0)	(17163.9)	(14650.7)	(14812.6)	(5730.6)	(5841.9)
Observations	124	124	128	128	76	76
Adjusted R^2	0.304	0.299	0.293	0.297	0.412	0.439
District fixed effects	YES	YES	YES	YES	YES	YES

Data; Agency for Real Estate Affairs, Thailand
Standard errors in parentheses
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

References

[1] Sawada, Y., Nakata, H., Sekiguchi, K., 2014. Natural disasters, land price, and location of firms: Evidence from Thailand. Discussion paper series 14-E-029, Research Institute of Economy, Trade and Industry.

[2] Skantz, T.R., Strickland, T.H.,1987. House prices and a flood event: An empirical investigation of market efficiency. J. Real Estate Res. 2, 75–83.

[3] Wong, G.,2009. Has SARS infected the property market? Evidence from Hong Kong. J. Urban Econ. 63, 74–95.

[4] World Bank, 2012. Thai Flood 2011: Overview Rapid Assessment for Resilient Recovery and Reconstruction Planning. World Bank.

[5] World Bank, United Nations, 2010. Natural Hazards, Unnatural Disasters: The Economics of Effective Prevention.