The Impact of a Rare Earth Processing Plant's Establishment on Property Values

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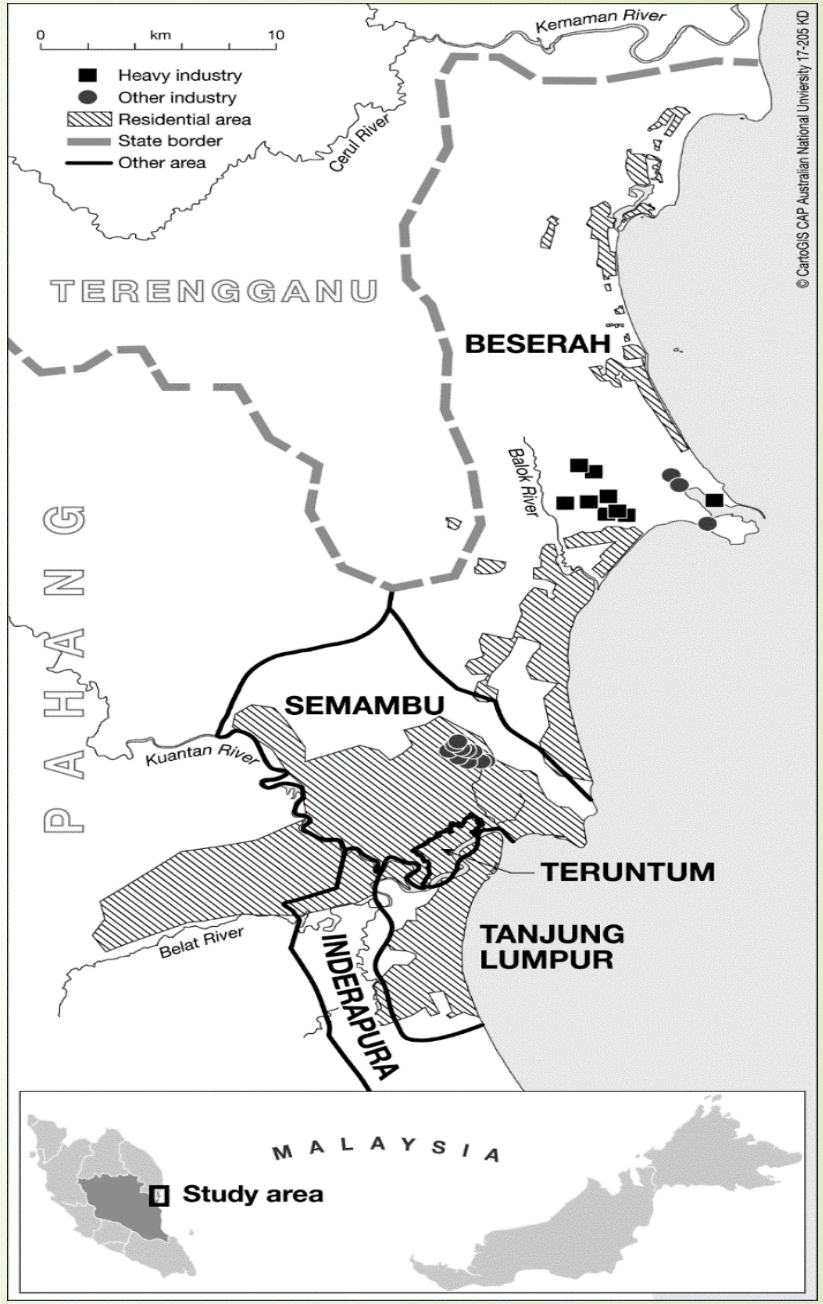
Background & Problem

- Rare Earth Elements are used in everyday life
- Rare earth plant, Lynas Advanced Material Plant (LAMP) was built in Kuantan
- However, it faced community's objection
  - historical memory of Asian Rare Earth project in 1980s
  - article in the *New York Times* - poor structural integrity of waste storage = environmental contamination
  - in depth study conducted by Schmidt (2013) confirmed this possibility

Cont…

- Industrial activities = job opportunities
- Tourism destination - one of its major economic activities
- Property prices: might ↑ (amenities) or ↓ LAMP & others (pollution)



Map : Studied Area – Kuantan

Cont…

Cont…

- Anti-LAMP: prices ⬇
- Minister of Pahang State: prices ⬆
- Changes in prices may be driven by actual pollution produced by LAMP or by people's perceptions of that pollution

Objective & Model

- Analyse impact of objective & subjective measures on house prices
- Hedonic pricing model:

$$P_i = P(S_{i1}, \dots, S_{ij};\ N_{i1}, \dots, N_{ik}; Q_{i1}, \dots, Q_{im})$$

S_{i1} are structural characteristics of the house: number of rooms, size, age

N_{i1} are characteristics of the neighborhood: crime rate, distance from city and other facilities

Q_{i1} are characteristics of the environment: air or water quality

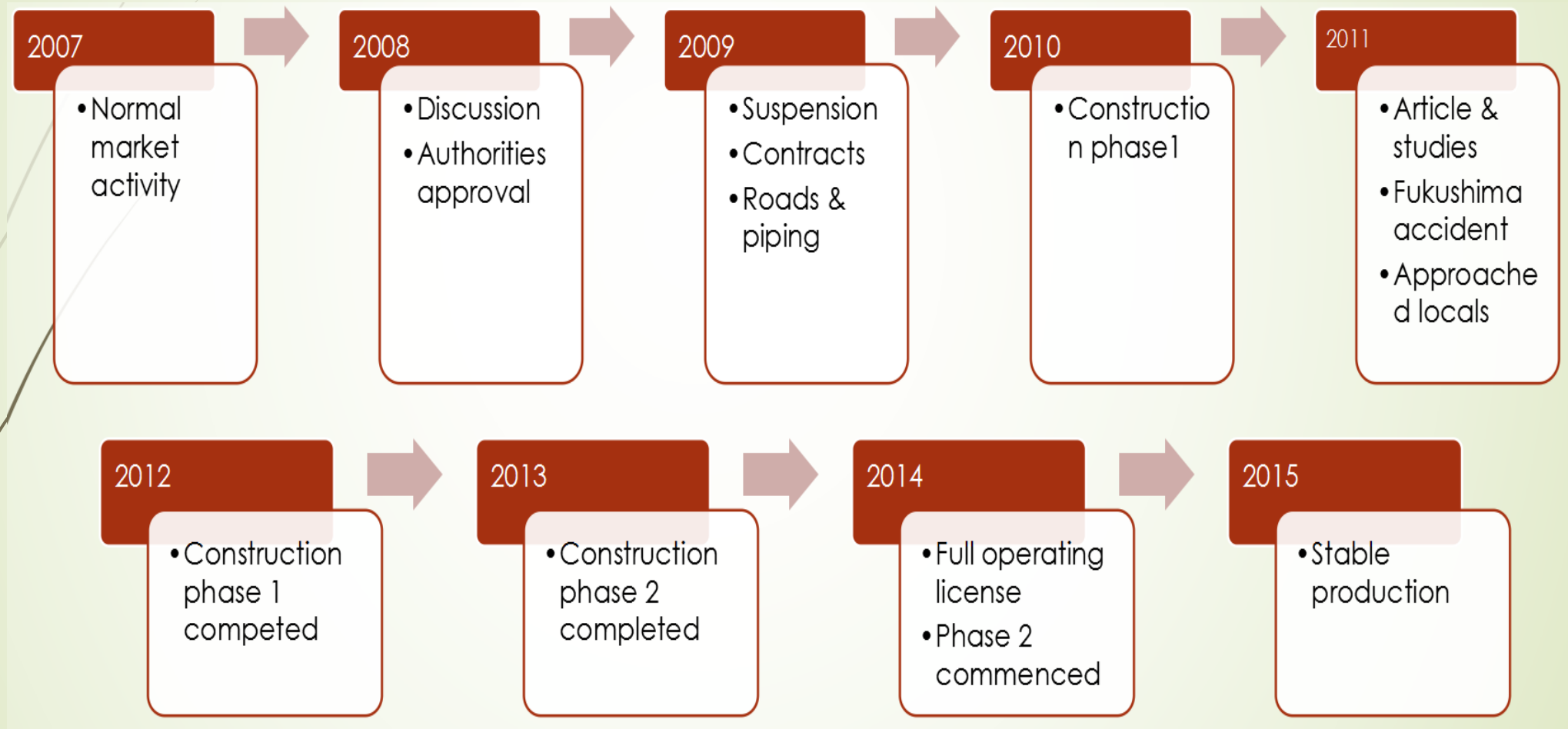
Literature review

Authors	Findings
Objective measure: Neelawala et al. (2012), Davis (2011)	proximity to point-source pollution reduced property prices
Subjective measure: Freeman III et al. (2014), Kohlhase (1991)	Perception reduced prices. Announcement time (before & after) of toxic waste site
Both: significant (noise) Baranzini et al. (2010)	Objective - daytime & day-night noise index Subjective - likert scale: no noise, small, moderate, important, & very important
Both: objective was better (incinerator sitting) Poor et al. (2001), Kiel & McClain (1995)	Objective - distance from site Subjective - 5 time periods: pre-rumour, rumour phase, construction, operation & final period.
Both: subjective was better (air) Berezansky et al. (2010), Chasco & Gallo (2013)	Objective - pollution index Subjective – perceived noise

Data

- Secondary data: 900 houses (2007 – 2015)
- Structure (National Property Information Centre), neighbourhood & environmental characteristics (DOE, Lynas EIA, Google map)
- A total of 27,415 units was selected randomly - 100 units /year
- Objective measure: actual (GLC) & proxy for pollution (LAMP's area, distance to LAMP & wind direction).
- Subjective measure: year dummy (2007-2015) to indicate perceptions of LAMP due to information circulation.

Cont…


2007
•Normal market activity
2008
•Discussion
•Authorities approval
2009
•Suspension
•Contracts
•Roads & piping
2010
•Construction phase1
2011
•Article & studies
•Fukushima accident
•Approached locals
2012
•Construction phase 1 competed
2013
•Construction phase 2 completed
2014
•Full operating license
•Phase 2 commenced
2015
•Stable production

Cont…

Summary statistics

Variables	Exp. Sign
Real sale prices (RM)	
Structure	
Category (=1 if new dwelling and 0 otherwise)	+
Status (= 1 if freehold and 0 otherwise)	+
Type (= 1 if detached and 0 otherwise)	+
Material (= 1 if concrete bricks and 0 otherwise)	-
House size (sqm)	+
Lot (sqm)	+
Number of bedroom (unit)	+
Number of bathroom (unit)	+
Number of car can be parked (unit)	+
Finishing (= 1 if tile and 0 otherwise)	+
Neighbourhood	
Distance to CBD (km)	-
Distance to schools (km)	-
Distance to clinics (km)	-
Distance to mosques (km)	+/-
Distance to shops (km)	-
Distance to shops (km)	-
Bumi (= 1 if live in a Bumiputra area and 0 otherwise)	-
Floodfree (= 1 if live in a flood free area and 0 otherwise)	+
Environment	
Area (=1 if located in the LAMP area)	-
Distance from the LAMP (km)	+
Wind (1= wind blowing area)	-
GLC (mg/ m^3)	-
API (air pollution index)	-
Year dummy	
Y_2008	+/-
Y_2009	+/-
Y_2010	+/-
Y_2011	-
Y_2012	+/-
Y_2013	+/-
Y_2014	+/-
Y_2015	+/-

Methods

- OLS: data from 2007 - 2015
- DID: compares btw participants (treatment group) and non-participants (control group) before and after any intervention

Cont...

Results from ordinary least squares

Variables	LAMP area	Dist.to LAMP	Wind	lnGLC	lnAPI
Category	.038*	.043**	.041*	.043**	.037*
	(.022)	(.022)	(.022)	(.022)	(.022)
Status	.152***	.146***	.147***	.145***	.147***
	(.028)	(.028)	(.028)	(.028)	(.028)
Type	.065**	.057*	.058*	.058*	.059*
	(.031)	(.031)	(.031)	(.031)	(.031)
lnsize	.412***	.415***	.415***	.415***	.411***
	(.04)	(.04)	(.04)	(.04)	(.04)
lnlot	.246***	.246***	.246***	.246***	.244***
	(.026)	(.026)	(.026)	(.026)	(.026)
#Bedroom	.051**	.055**	.055**	.056**	.055**
	(.024)	(.024)	(.024)	(.024)	(.023)
#Car	.369***	.371***	.371***	.371***	.369***
	(.028)	(.028)	(.028)	(.028)	(.028)
Finishing	.22***	.215***	.216***	.214***	.216***
	(.036)	(.036)	(.035)	(.036)	(.035)
Dist.to CBD	-.005***	-.006***	-.006***	-.006***	-.005***
	(.001)	(.001)	(.001)	(.001)	(.001)
LAMP area	-.045				
	(.034)				
Dist.to LAMP		-.0			
		(.001)			
Wind			.005		
			(.024)		
lnGLC				.015	
				(.025)	
lnAPI					-.111**
					(.055)
Y_2008	-.913***	-.9***	-.912***	-.912***	-.906***
	(.041)	(.054)	(.041)	(.041)	(.041)
Y_2009	1.341***	1.357***	1.343***	1.343***	1.359***
	(.041)	(.054)	(.041)	(.041)	(.041)
Y_2010	.294***	.311***	.297***	.298***	.311***
	(.042)	(.056)	(.042)	(.042)	(.042)
Y_2011	-.284***	-.27***	-.284***	-.283***	-.272***
	(.041)	(.055)	(.042)	(.041)	(.042)
Y_2012	.429***	.439***	.425***	.228	.436***
	(.042)	(.055)	(.042)	(.333)	(.042)
Y_2013	.262***	.275***	.262***	0.63	.262***
	(.042)	(.054)	(.043)	(.335)	(.042)
Y_2015	.446***	.458***	.445***	.248	.458***
	(.043)	(.056)	(.043)	(.333)	(.043)
n	900	900	900	900	900
Adjusted R2	0.863	0.862	0.862	0.862	0.863

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

Cont...

Results from difference-in-difference

Variable	2007 & 2011
LAMP Area	-.186**
	(.085)
Status	.2***
	(.063)
lnsize	.218***
	(.061)
lnlot	.192***
	(.047)
#Bedroom	.252***
	(.052)
#Car	.483***
	(.054)
Finishing	.195***
	(.076)
Dist. to CBD	-.006***
	(.002)
Dist. to clinic	.038***
	(.009)
Bumi	.193***
	(.05)
Sold after information circulation (=1)	-.339***
	(.055)
DID interaction term	.009
	(.087)
n	200
R2	.814

Conclusion

- OLS: Information circulation in 2011 & price dropped.
- DID: inconclusive results (LAMP area + sold after 2011 + interactive term)
- Lack of community engagement = Social License to Operate?