

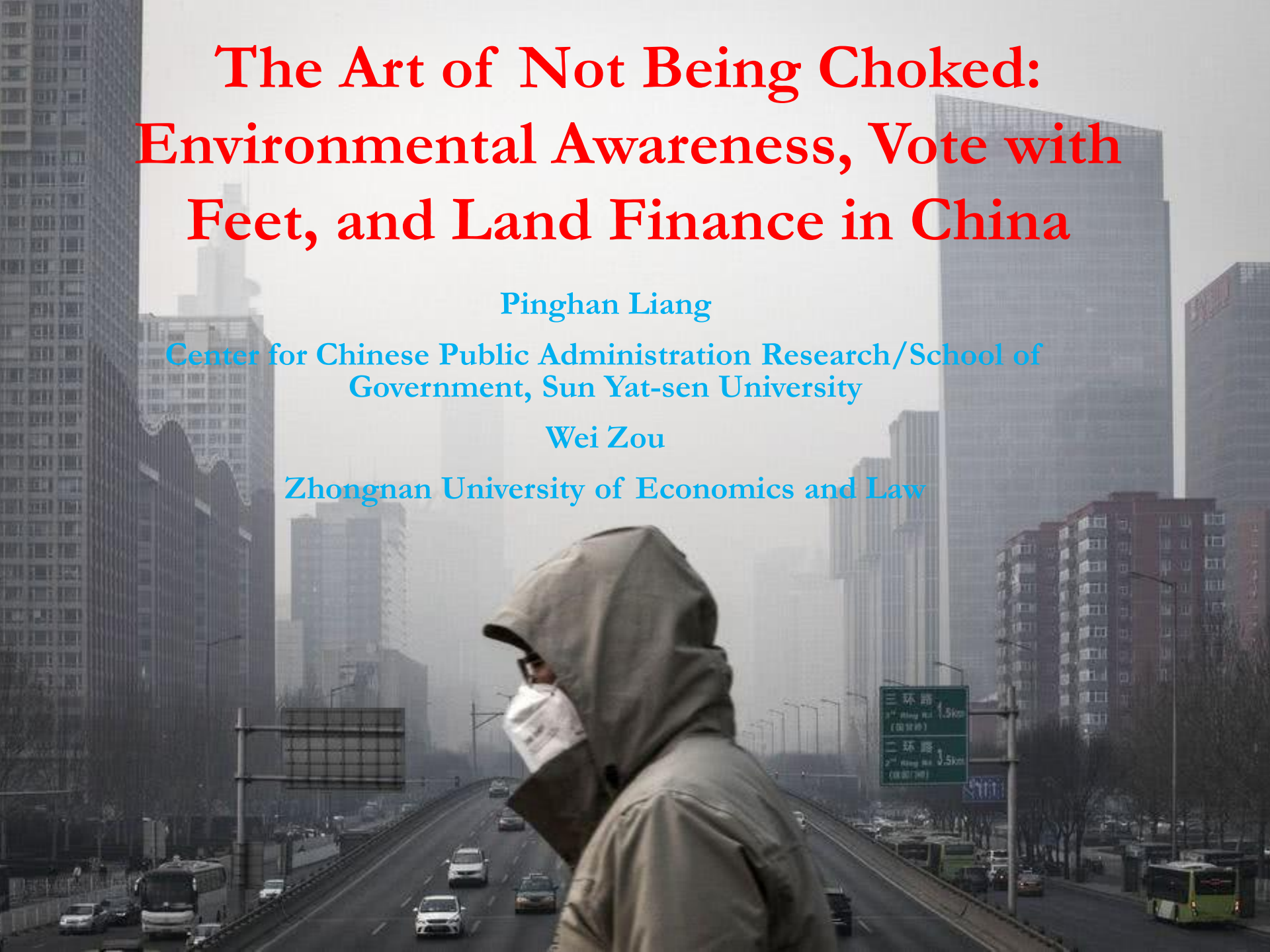
The Art of Not Being Choked: Environmental Awareness, Vote with Feet, and Land Finance in China

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Introduction

- This paper investigates the impact of air pollution on land transaction, from the perspective of residents environmental awareness.
- Tiebout model (1955) suggests that by “vote with feet”, changing residents’ environmental awareness could have real effects on mobility, which would further affect housing value..
- Challenges to identification:
 - 1) it is difficult to observe exogenous changes in residents’ perception of air quality.
 - 2) it is methodologically challenging to isolate the value of land from that of the attached houses and apartments.
- We use a natural experiment, the unexpected release of the documentary “*Under the Dome*” in China early 2015, to introduce a exogenous shock in residents preferences for air quality.

Introduction

- Evidence show that individuals may move to avoid air pollution: migration (Chen, et al., 2022, Qin and Zhu, 2017), short-term movements (Chen et al., 2020a, b).

- The state is the sole owner of urban land.
- Residents, as the end-users of residential land, could affect the demand in the primary land market.
- Our logic: exposure to the film increases environmental awareness, as well as the intention to move to cleaner cities, this preference change transits to the demand in primary land market.
- Even if there are eligibility requirements on buying local houses in some cities, the expectations of lowering demand in housing market would subsequently reduce the demand for lands.

Preview of results

- We exploit the transaction-level data, and use the city-level popularity of Chai Jing in 2014 to measure the exposure to the film. The continuous DID estimation shows that after the release of the film, each 10 percent point increase in the exposure to the film leads to a 0.15 percentage point lower transaction value of individual land parcels, and a 0.12 percentage point smaller area of leasing land parcel, respectively.
- We use the birthplace of the interviewees in her signature program “Insight” before 2013 as the instrument for her popularity.
- After the release of this documentary, the cities more exposed to the documentary exhibit significantly more search volume of these pollution-related keywords.
- Residents increase searching for housing prices in cleaner cities after the release of film.

Contributions

- Residents responses to air pollution:
 - Defensive actions towards severe air pollution: Barwick et al., 2024; Zhang and Mu, 2018; Ito and Zhang, 2020.
 - Temporarily run away from the extremely polluted days: Chen et al., 2020a, b; Barwick et al., 2022; Dai et al., 2024.
 - Migration: Chen et al., 2022; Gao et al., 2023; Qin and Zhu, 2018.
- The real outcomes of media:
 - *Al Gore effect* in United States (Jacobsen, 2011); *Under the Dome* increases WTP for clean air (Tu et al., 2019).
 - We indicate the potential of social media, even under increasingly strict censorship, in disseminating information and raising environmental awareness.
 - Market institutions enable the expression of individual preferences.
- Land transactions:
 - Environmental quality and property value: Chay and Greenstone, 2005; Banzhaf and Walsh, 2008; Currie et al., 2015; and Pan et al., 2022.
 - Our research complements by indicating the impact of environmental perception on land values.

Background

- Release of the documentary “Under the Dome” online by the well-known investigation journalist Chai Jing, who resigned from the state media in 2013, on 10 am, Feb 28, 2015.
- 103-minutes documentary, illustrates the current state of haze pollution in Chinese cities, the health hazards of haze pollution, and the roles of governments and polluting companies, among other topics.
- Independent environmental documentary streamed on *Tencent*, *Youku*, and the *People’s Daily Online*. Within two days after the film was released, it was viewed more than 200 million times online, and rapidly attracted a massive response across the country.
- The documentary was not covered by traditional media, and was taken offline from Chinese video sites three days after its release, and was banned on March 7th, 2015.



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Foreign Policy 2015 Leading Global Thinkers

Times 100 Most Influential People
in 2015

The 100 Most Influential People

Green fighter

Chai Jing's 2015 documentary on pollution, *Under the Dome*, is one of the most important pieces of environmental awareness building ever in China. Her very personal and powerful story is one that millions of people in China can relate to, which points to the reason it was viewed 200 million times just days after it was first broadcast. Her background as an investigative reporter shines through as she weaves together complex scientific and policy issues into a coherent and compelling narrative that has empowered ordinary Chinese to join a policy debate for the first time. In fact, the documentary has



Tao Xiaofang—Imaginechina/AP



Chinese land market

- Urban land is owned by the state and highly regulated by the local govts.
 - The land use right (maximum holding period of 70 years) could be leased to developers.
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- Local govts are the monopolistic sellers in the primary land market.
 - Transaction methods: English auction (Paimai), listing auction (guapai), invited auction (zhaobiao), bilateral agreement (Xieyi), and government transfer (Huabo). Paimai and guapai are the most frequently used auction methods.
 - Buyers could be either corporate entities or individuals.
 - Local govts have relied heavily on the revenue of land sales, in 2018, the land revenue of Chinese local governments accounted for 30% of total Chinese fiscal revenue.

Data

- Exposure to the film: popularity of filmmaker, measured by the city-level Baidu search volume index (SVI) of Chai Jing in 2014.
- People's intended place of apartment purchasing: city-level monthly Baidu SVI of house price in a city other than their own.
- Migration intention: questionnaire in National Mobile Population Dynamics Monitoring Survey (NMPDMS)
- Environmental awareness: daily SVI of the keywords related to air pollution, e.g., “PM2.5”, “haze”, “air pollution”, from 2013 to 2017.
- Land transaction: all leasing public land records in 284 prefecture-cities, from 2011 to 2019.
- Other control variables: daily AQI, daily weather data, city-level economic activity.

Empirical specification

- A difference-in-difference design
- $$Y_{ickst} = \beta_0 + \beta_1 EA_c * Post + \gamma X_{ickst} + \alpha_c + \alpha_t + \varepsilon_{ickst}$$
- Y_{ickst} natural logarithm of the value or area of land parcel i sold by municipal government c to buyer k for usage s in day t .
- EA_c , the exposure to the film in city c .
- Post: 2015/03/01
- Time length: 2013-2017.
- X : a set of land-level control variables, including the land area, quality, distance to the center, the leasing methods, daily AQI, daily weather variable, and city level variables.
- Fixed effect: city×season×usage fixed effect, province×year fixed effect
- Standard errors are clustered at the city level.

Instrumental variable

- Instrumental variable: the birthplace of the interviewees in Chai Jing's signature program "Insight" (看见).
 - Local interviewees attract more local viewers of this program, consequently increase the popularity of the host.
 - The plan to produce the documentary started after Chai Jing resigned from the state media, the selection of interviewees was not related to environmental concerns. Besides, her previous programs did not cover air pollution at all.
- Placebo IV: the birthplaces of guests from similar talk-show programs on television "Dialogue" (对话).

Descriptive statistics

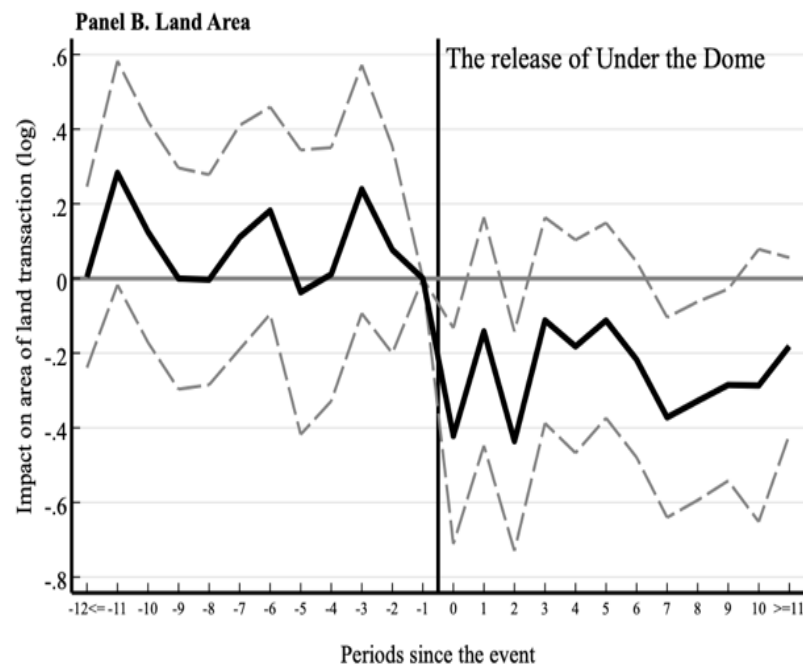
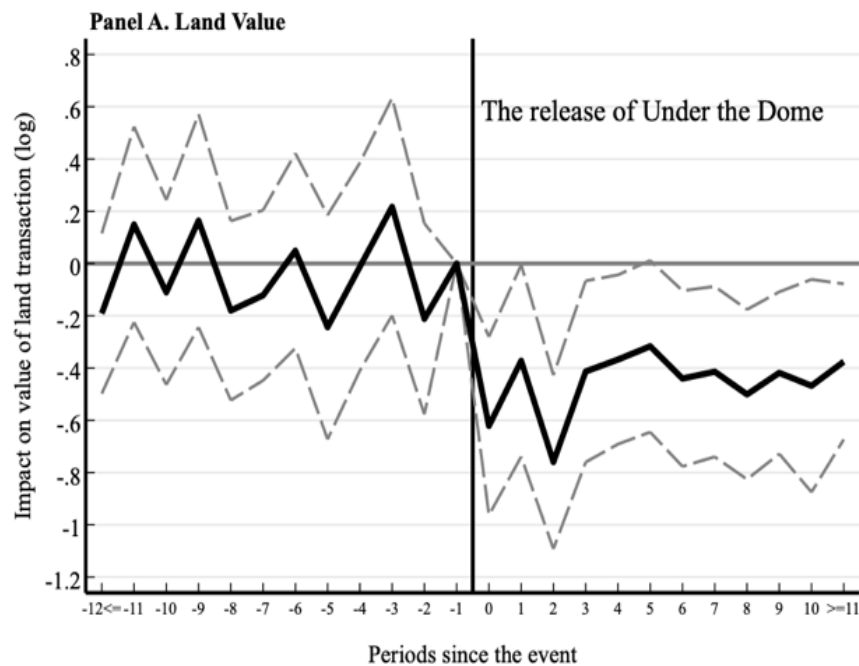
Variables	Obs.	Mean	SD
<i>Core independent variable</i>			
EA (Chai Jing's Baidu Index)	287	18670	15600
<i>Dependent Variables</i>			
Land value (10,000 yuan)	300310	2677.19	8227.85
Land area (hectare)	303095	1.86	3.11
Keywords for "PM _{2.5} " in baidu platform	10700	2837	3032
Keywords for "Haze" in baidu platform	10700	2152	2694
Keywords for "Air Pollution" in baidu platform	10700	466	709
Keywords for "PM _{2.5} + Haze +Air Pollution" in baidu platform	10700	281423	303535
Keywords for "Housing prices in city XX" in baidu platform	1127100	6.09	26.8
<i>Control Variables</i>			
<i>Land Parcel Level</i>			
Land quality (=1,2,...,18)	303095	5.50	4.42
Land guapai (=1)	303095	0.55	0.50
Distance to the city center(km)	303095	50.7	109.1
<i>City-Year Level</i>			
AQI, city-day-level	127029	86.8	84.9
Precipitation, city-day-level	153492	3.03	9.58
Temperature, city-day-level	153492	15.3	10.7
Wind speed, city-day-level	153492	2.16	1.13
Income per capita, city-year-level (yuan)	1425	54120	13024.8
Population, city-year-level (10,000 person)	1425	449.8	319.4
Internet penetration	1425	0.21	0.18
Mobile phone penetration	1425	1.06	0.81
Fix phone penetration	1425	0.17	0.17
Education level, city-year-level	1425	0.017	0.022
Urbanization, city-year-level	1425	0.018	0.039
Share of secondary industry, city-year-level (%)	1425	47.1	10.2
Per capita road area, city-year-level (square meter)	1425	5.15	6.65
Fiscal pressure, city-year-level	1425	2.76	1.66
<i>Migration Intention</i>			
Stay intentions(=0,1,2)	982828	0.87	0.34

Baseline: OLS Estimation: Film and Land Transaction

	(1)	(2)	(3)	(4)	(5)
Specification	Land value (log)	Land area (log)	Land value (log)	Land area (log)	Land value (log)
	OLS	OLS	IV	IV	IV
<i>EA (log) × Post</i>	-0.015*** (0.00)	-0.012** (0.00)	-0.113*** (0.04)	-0.103*** (0.03)	
<i>EA per capita (log) × Post</i>					-0.312*** (0.11)
Land quality	-0.005 (0.01)	0.017 (0.01)	-0.005 (0.01)	0.016 (0.01)	-0.005 (0.01)
Land guapai (=1)	2.702*** (0.26)	2.208*** (0.20)	2.708*** (0.26)	2.213*** (0.20)	2.710*** (0.26)
Distance from city center (log)	-0.230*** (0.04)	-0.113*** (0.03)	-0.230*** (0.04)	-0.113*** (0.03)	-0.230*** (0.04)
Controls	Yes	Yes	Yes	Yes	Yes
City-Season-Usage FE	Yes	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes	Yes
First Stage F-stat			51.268	50.205	33.211
Observation	300310	303095	300310	303095	300310
Adj. R-square	0.679	0.681	0.176	0.155	0.175

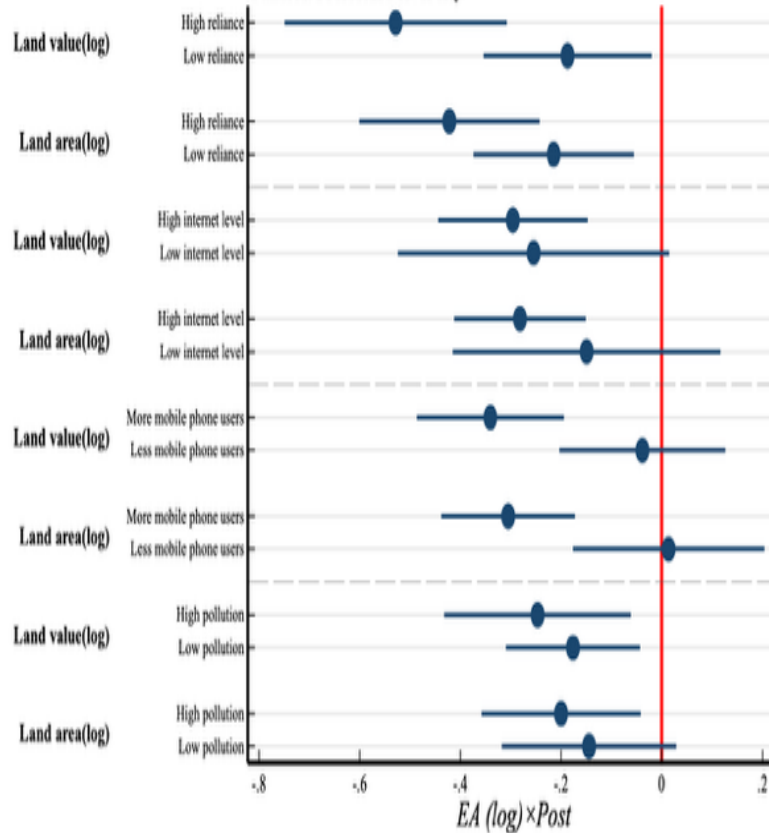
Each 10 percentage point increase in the exposure to the film leads to a 0.15 percentage point lower transaction value of individual land parcels, and a 0.12 percentage point smaller area of leasing land parcel, respectively, after the release of this film.

Dynamic effects (IV)

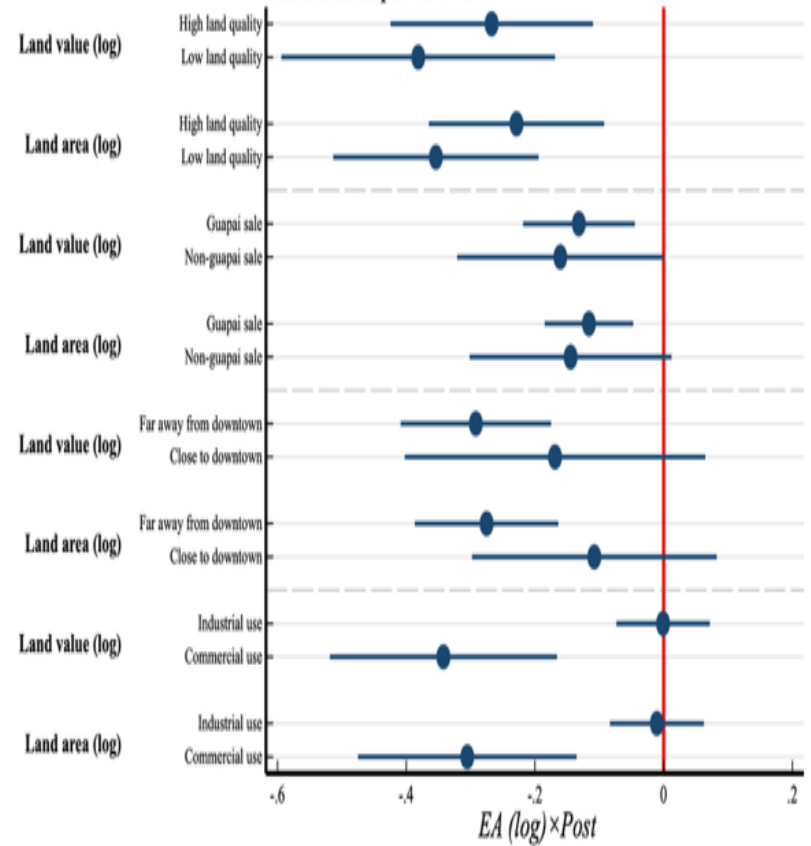


Heterogeneity analysis

Panel A. Prefecture-level city



Panel B. Land parcels level



Mechanism: environmental awareness

Specification	(1) PM _{2.5} (log)	(2) Haze(log)	(3) Air Pollution(log)	(4) PM _{2.5} + Haze + Air Pollution(log)
	IV	IV	IV	IV
<i>EA (log) × Post</i>	0.040*** (0.01)	0.093*** (0.02)	0.090* (0.05)	0.066*** (0.01)
AQI (log)	0.048*** (0.02)	0.005 (0.02)	0.045 (0.05)	0.038** (0.02)
City-level Controls	Yes	Yes	Yes	Yes
City-Month FE	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes
First Stage F-stat	88.629	88.109	88.109	88.109
Observation	9667	9667	9667	9667
Adj. R-square	0.012	0.006	0.029	0.009

Mechanism: moving intentions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Stay intentions (=0,1,2)	Baidu index of housing price (log)					
Specification	NMPDMS Data	Baidu Search Platform					
	Individual Sample	Local Search	Non-local Search	No-local Search	No-local Search	Search for “Dirtier” cities	Search for “Cleaner” cities
	IV	IV	IV	IV	IV	IV	IV
<i>EA (log) × Post</i>	-0.006*** (0.00)	-0.218 (0.21)	0.024** (0.01)	0.024** (0.01)	0.024*** (0.01)	-0.004 (0.01)	0.036** (0.02)
AQI (log)		-0.205 (0.16)	-0.017 (0.01)	-0.017 (0.01)	-0.017*** (0.00)	-0.009 (0.01)	-0.029* (0.02)
Individual-level Controls	Yes	No	No	No	No	No	No
City-level Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	No	No	No	No	No	No
City-Month FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Targeted City FE	No	No	No	Yes	Yes	Yes	Yes
Cluster	City	City	City	City	City Pair	City-Year Pair	City-Year Pair
Observation	592271	4169	1051247	1051247	1051247	145558	507405
Adj. R-square	0.010	0.042	0.001	0.001	0.004	0.003	0.003

Conclusion

- We use the release of *Under the Dome* as a natural experiment, and investigate the causal impact of residents environmental preferences on land transaction.
- DID estimation shows the sizable impact of raising environmental awareness due to the release of the film.
- There is evidence that this is due to the raising intention to move to cleaner cities after the release of the film.
- As long as the market institutions are in presence, the access to information could alter individual choice and consequently affect land market transactions and local public revenue. The governmental responses to this reduction in public revenue would be a worthy topic to pursue.