The Speculation Channel and Crowding Out Channel: Real Estate Shocks and Corporate Investment in China

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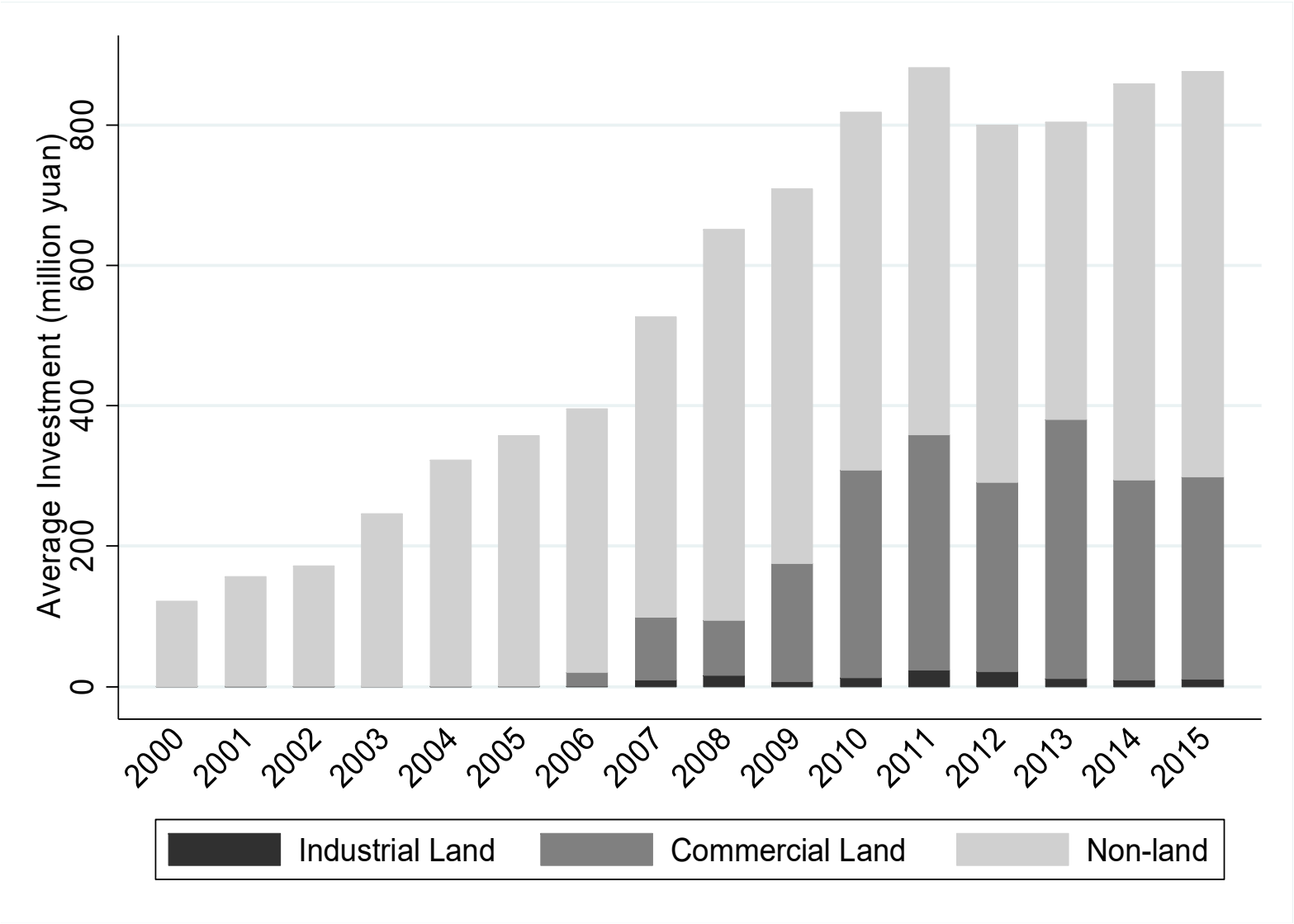
Investment of Publicly Listed Firms in China

(excluding financial and real estate firms)



Motivation

- Real estate fluctuations have important implications for long-run growth and business cycles (Liu, Wang and Zha, 2012)

- Different channels for a real estate boom to affect firm investment
  - The collateral channel: it relaxes financial constraints faced by land-holding firms
    - Gan (2007) and Chaney, Sraer and Thesmar (2012)
  - The speculation channel: it may induce firms to speculate in real estate investment unrelated to their core businesses
    - Chen and Wen (2014) and Miao and Wang (2014)
  - The crowding out channel: it crowds out bank credit to firms with land-holdings as collateral
    - Bleck and Liu (2014) and Chakraborty, Goldstein and MacKinlay (2014)

- A systematic analysis of these channels is lacking
  - What is the net effect of a real estate boom?

China's Real Estate Market

- Representing 14% of GDP in 2013, real estate sector investment is important for China's economy growth
- Dramatic real estate appreciations in last 15 years put any effects of real estate shocks under a magnifying lens
  - Fang, Gu, Xiong and Zhou (2015)
- Substantial heterogeneity in the real estate boom across regions

Research Questions

- How do real estate shocks affect firm investment in China?
- How do banks allocate credit in response to real estate shocks?
- How do real estate shocks affect the efficiency of resource allocation?

Road Map

- Data description
- Empirical results on examining the three channels
- A quasi-policy experiment based on the home purchase restriction policy adopted by 46 cities in 2010
- Effect of real estate shocks on efficiency of resource allocation

Land Transactions

- Since real estate reform in 1990s, local governments routinely sold land (lease holds) in the primary land market

- Rigid zoning restrictions
  - Industrial land designated for industrial and manufacturing facilities
  - Commercial land for commercial and business facilities
  - Residential land for residential facilities
  - Difficult to change the category after initially set by government
  - Manufacturing firms cannot use commercial land and residential land for production purposes; we group them together as commercial land

- All land transactions in 2000-2015, 1.65 million transactions in 330 cities
  - Hand collected from Ministry of Land and Resources
  - Land buyer, land area, total payment, land usage, location, and transaction price

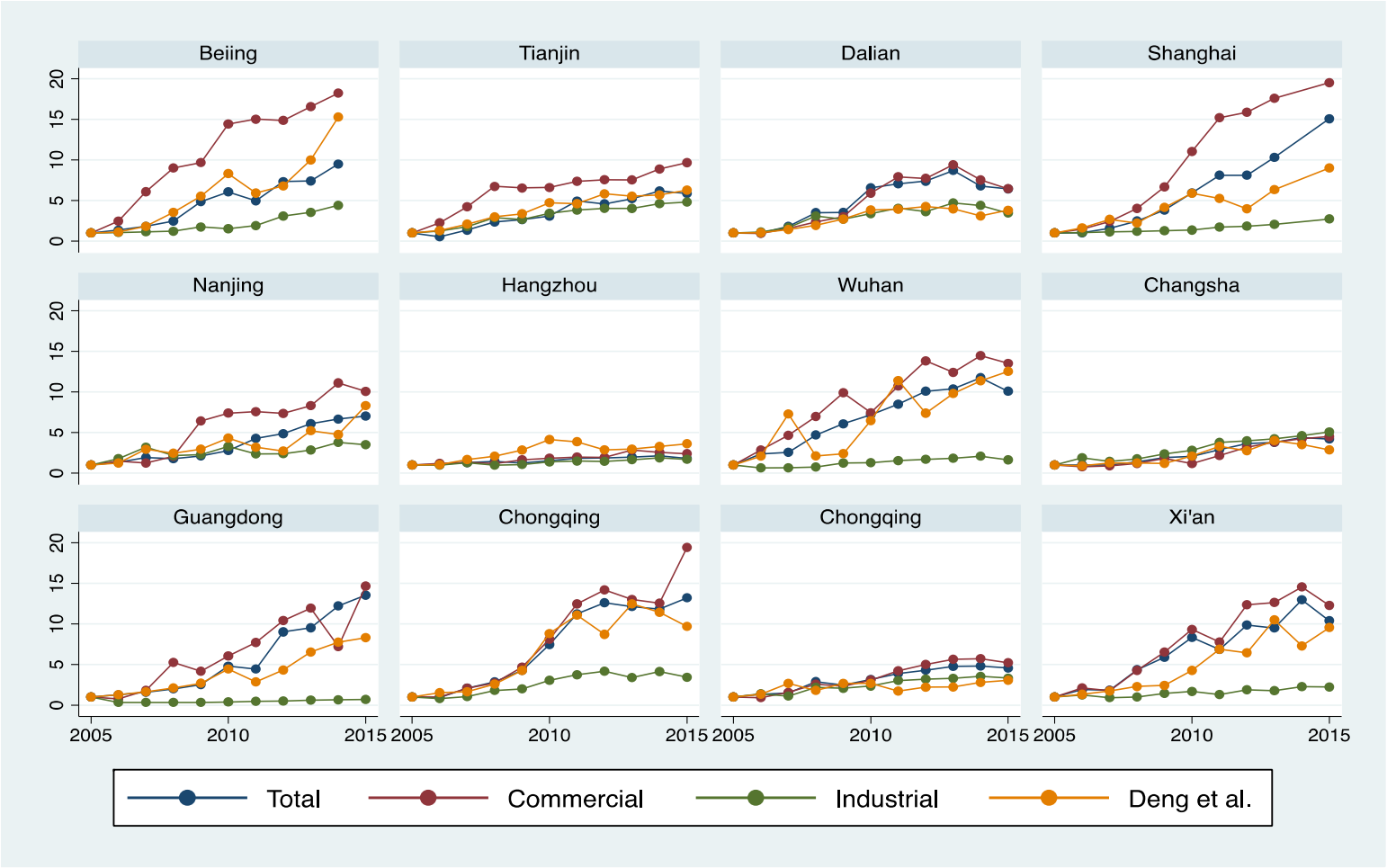
- We merge the transactions with all publicly listed firms by firm names
  - delete finance, insurance, real estate, construction, and mining industries
  - 38,213 land transactions by 2,174 publicly listed firms
  - 2,054,506,896 square meters, and total payment 2341.2 billion RMB, 14.76% of all transactions

Land Price Indices

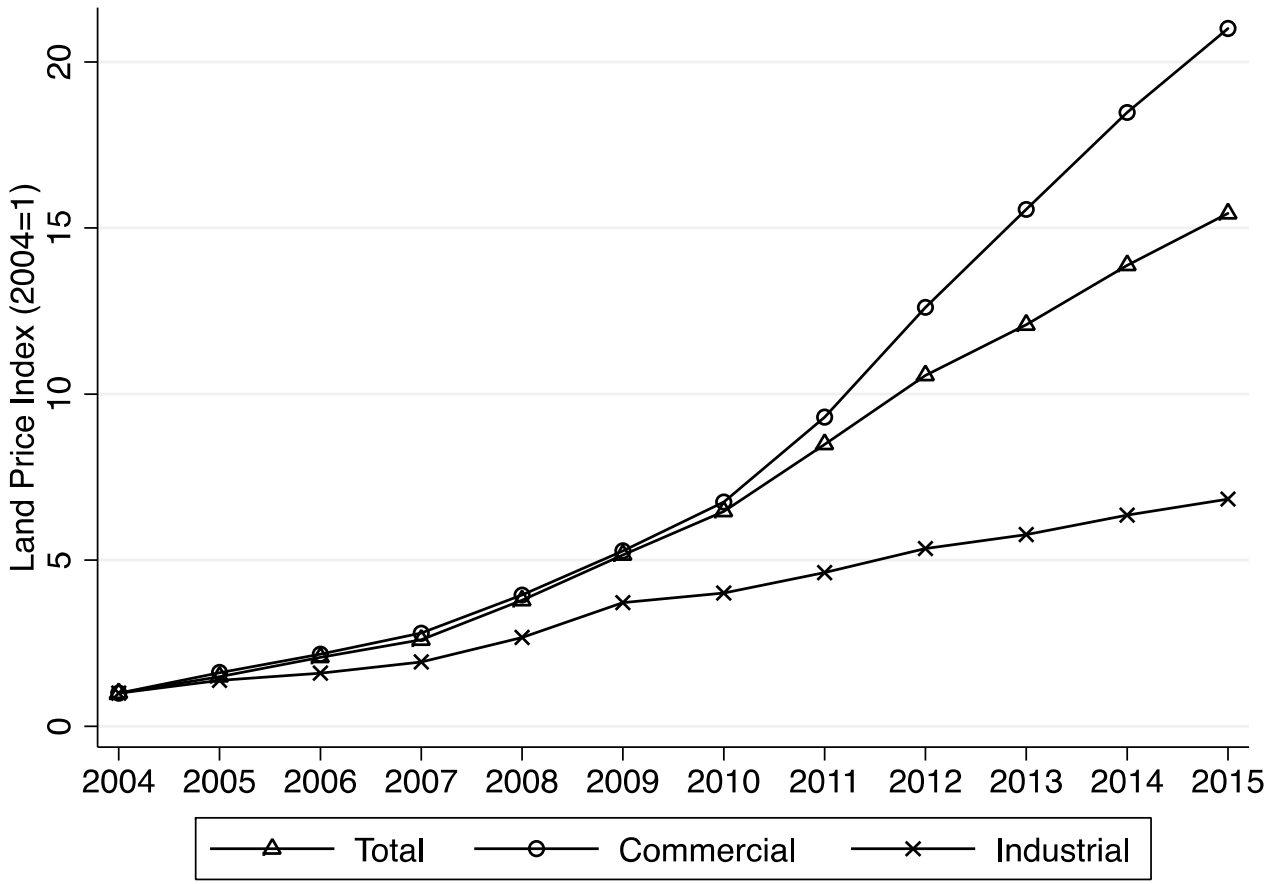
- Following Deng, Gyourko and Wu (2012), we adopt the hedonic price regression approach:
  - $lnP_{i,k,c,t} = \beta_{k,c,0} + \sum_{s=1}^{T} \beta_{k,c,s} \cdot 1_{s=t} + \theta_{k,c} X_i + \varepsilon_{i,t},$

    1. shortest distance to the city center (identified by the brightest 1% grids as showed in the annual average nighttime light density data)
    2. county/district dummy (6-digit administrative unit)
    3. size of the land parcel
    4. subcategories of land usage (54 types)
    5. method of transaction (an indicator for transaction through invited bidding, listing bidding, English auction, or bilateral agreement)
    6. a subjective evaluation of land quality (11 ranks)

Land Prices in 12 Major Cities



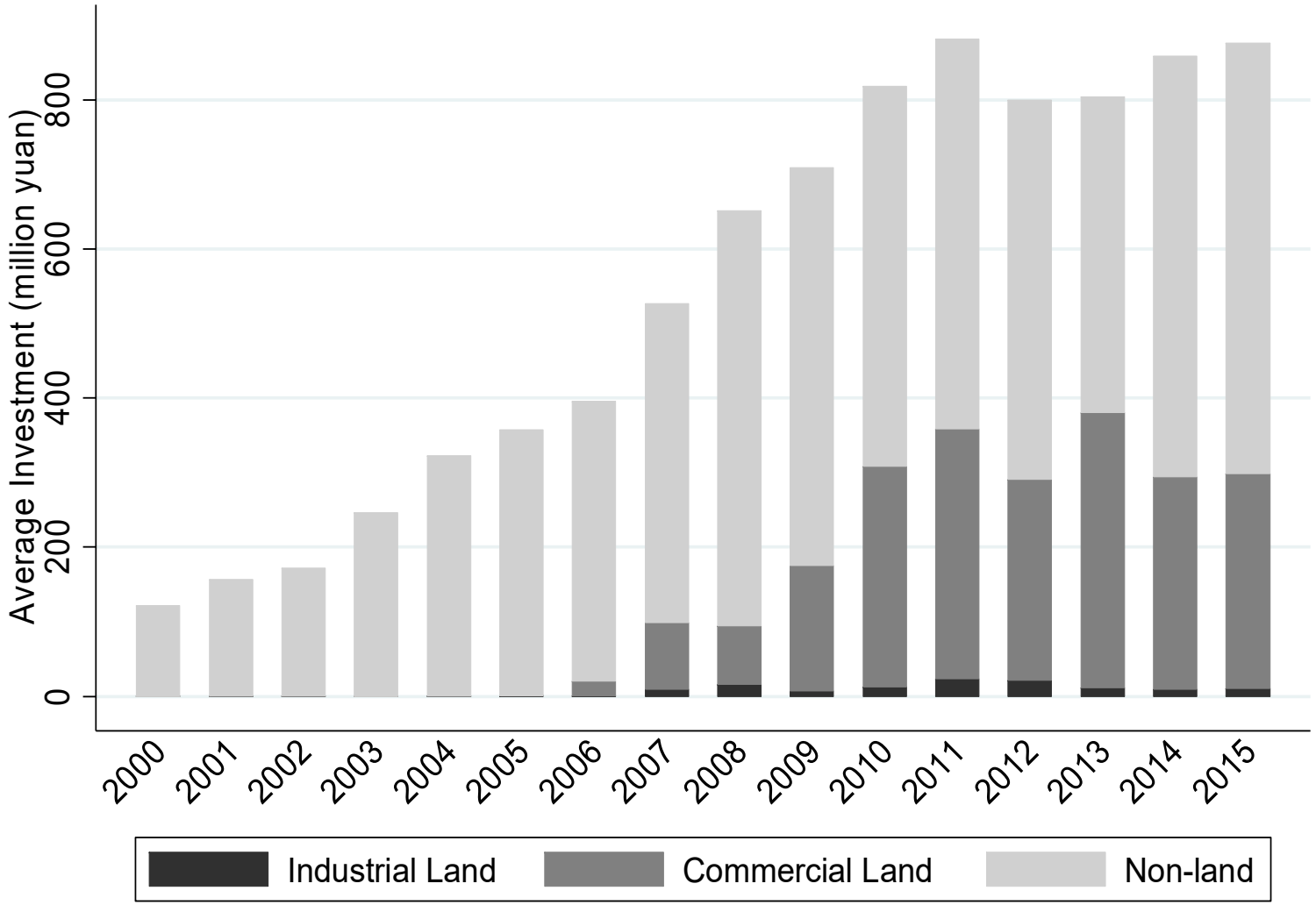
National Land Prices



Other Data

- Land Values
  - Measure the value of each firm's land holdings by initial transaction prices of each land parcel adjusted by the land price index of the city
- Firm investment
  - annual sample of 30,344 firm-year observations in 2000-2015 for 3,112 unique firms
  - Three components: Non-land, industrial land, commercial land
- Innovation activities
  - Successful grant applications filed by each firm in each year
  - We count invention patents and utility model patents, but not design patents
  - 57,234 patents granted to 1,330 listed firms in 2000-2015.

Firm Investment



Summary Statistics

Variables	Mean	Standard Deviation	Median
Panel A			**Full Sample (N= 23,828)**
Corporate Investment (million *yuan*)	448.457	2199.174	94.419
Corporate Investment/Kt-1	0.549	0.958	0.237
Non Land Investment (million yuan)	309.403	1939.232	85.96
Non Land Investment/Kt-1	0.398	0.717	0.187
Non Land Investment Share	0.733	0.717	1
Land Investment ^{Commercial} (million yuan)	130.479	1439.599	0
Land Investment ^{Commercial}/Kt-1	0.140	0.616	0.000
Land Investment ^{Commercial} Share	0.232	0.713	0
Land Investment ^{Industrial} (million yuan)	8.575	130.396	0
Land Investment ^{Industrial}/Kt-1	0.010	0.102	0.000
Land Investment ^{Industrial} Share	0.035	0.146	0
Land Value (million yuan)	385.573	2745.848	0
Land Valuet/Kt-1	0.245	1.001	0

The Collateral Channel

- Hypothesis: a real estate boom allows land-holding firms to borrow more and invest more

- $\frac{I_{i,t}}{K_{i,t-1}} = \alpha + \beta \cdot \frac{LandValue_{i,t-1}}{K_{i,t-1}} + \theta X_{it} + \varepsilon_i + \delta_t + \epsilon_{it}$

  - X_{it}: Tobin's Q, end-of-year cash flow, total sale, and total firm asset
  - Following Chaney, Sraer, and Thesmar (2012)
  - IV analysis skipped

Land Value and Gross Investment

	Gross Investment		
	(1)	(2)	(3)
Land Value $_{t-1}$	0.120***		
	(0.019)		
Land Value $_{t-1}^{Commercial}$		0.094***	
		(0.021)	
Land Value $_{t-1}^{Industrial}$			0.073
			(0.056)
Tobin's Q	0.024***	0.026***	0.026***
	(0.007)	(0.007)	(0.007)
Sale	0.012**	0.012**	0.012**
	(0.005)	(0.005)	(0.005)
Cash Flow	0.016***	0.017***	0.018***
	(0.003)	(0.003)	(0.003)
Total Asset	0.095***	0.090***	0.091***
	(0.018)	(0.018)	(0.018)
Number of Obs.	24545	24545	24545
Adj. R-squared	0.321	0.312	0.308

The Speculation Channel

- Hypothesis: a real estate boom not only gives land-holding firms more financing but may also induce them to pursue more housing speculation and reduce innovation activities.

$$Y_{i,t} = \alpha + \beta \cdot \frac{LandValue_{i,t-1}}{K_{i,t-1}} + \gamma \cdot \Delta LandPriceIndex_{i,t-1} + \eta \cdot \frac{LandValue_{i,t-1}}{K_{i,t-1}} \cdot \Delta LandPriceIndex_{i,t-1} + \theta X_{it} + \varepsilon_i + \delta_t + \epsilon_{it}$$

  - $Y_{i,t}$: investment in a type (non-land, industrial land, commercial land) or patent applications
  - $\Delta LandPriceIndex_{i,t-1}$: price change of overall land, industrial land, or commercial land

Firm Investment and Overall Land Price Change

	Non-Land Investment		Commercial Land Investment		Industrial Land Investment		New Patents	
Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Land Value $_{t-1}$	0.128***	0.142***	0.028***	0.021***	0.042***	0.043***	-0.047***	-0.048***
	(0.025)	(0.026)	(0.005)	(0.005)	(0.006)	(0.006)	(0.009)	(0.009)
Price Change$_{t-1}$	-0.037***	-0.023**	0.009**	-0.001	-0.001	0.000	0.000	0.000
	(0.011)	(0.011)	(0.004)	(0.003)	(0.002)	(0.001)	(0.011)	(0.012)
Land Value$_{t-1}$*Price Change$_{t-1}$		-0.054***		0.026***		-0.003		0.001
		(0.020)		(0.007)		(0.006)		(0.004)
Number of Obs.	23828	23828	23828	23828	23828	23828	23828	23828
Adj. R-squared	0.415	0.417	0.137	0.147	0.259	0.259	0.787	0.787

Firm Investment and Commercial & Industrial Land Price Changes

	Non-Land Investment		Commercial Land Investment		Industrial Land Investment		New Patents	
Panel B	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Land Value $_{t-1}$	0.137***	0.150***	0.029***	0.023***	0.040***	0.043***	-0.044***	-0.040***
	(0.026)	(0.027)	(0.005)	(0.005)	(0.006)	(0.007)	(0.009)	(0.009)
Price Change $_{t-1}^{Commercial}$	-0.046***	-0.034***	0.012***	0.005	0.003	0.001	0.018*	0.023**
	(0.012)	(0.012)	(0.004)	(0.003)	(0.002)	(0.001)	(0.011)	(0.012)
Land Value$_{t-1}$*Price Change$_{t-1}^{Com}$		-0.043**		0.019***		-0.008		-0.012***
		(0.018)		(0.005)		(0.005)		(0.004)
Number of Obs.	23828	23828	23828	23828	23828	23828	23828	23828
Adj. R-squared	0.422	0.424	0.140	0.146	0.269	0.272	0.788	0.788

	Non-Land Investment		Commercial Land Investment		Industrial Land Investment		New Patents	
Panel C	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Land Value $_{t-1}$	0.127***	0.118***	0.029***	0.028***	0.041***	0.041***	-0.039***	-0.039***
	(0.026)	(0.025)	(0.005)	(0.005)	(0.006)	(0.006)	(0.010)	(0.01)
Price Change $_{t-1}^{Industrial}$	0.031**	0.018	0.002	-0.001	0.000	-0.000	0.001	0.000
	(0.014)	(0.013)	(0.004)	(0.003)	(0.003)	(0.002)	(0.013)	(0.014)
Land Value $_{t-1}$*Price Change$_{t-1}^{Ind}$		0.071*		0.012		0.001		0.001
		(0.038)		(0.008)		(0.012)		(0.006)
Number of Obs.	23828	23828	23828	23828	23828	23828	23828	23828
Adj. R-squared	0.417	0.418	0.139	0.14	0.263	0.263	0.785	0.785

Evidence for the Speculation Effect

- In response to an increase in commercial land price and value of land holding, firms tend to
  - increase investment to commercial land and reduce non-land investment
  - reduce innovation activities

- The usual endogeneity problem of real estate shocks being correlated with firms' investment opportunities is not a particular concern.

The Crowding Out Channel

- Hypothesis: A real estate boom reduces investment of non-land-holding firms

Bank Loan Level Analysis

- A loan level dataset for the publicly listed firms
  - obtained from RESSET and CSMAR.
  - 81,872 loans made to 2,862 publicly listed firms in 2000-2015.
  - information on collateral and bank branch of the lender.

- $$Collateral_{i,b,t} = \zeta + \lambda * \Delta LandPriceIndex_{b,c,t} + \theta X_{i,t} + \mu_{ib} + \iota_{bt} + \tau_{bc} + \pi_{i,b,c,t}$$

Land Price Change and Loans of Different Types

	Loans with Real Estate Collateral	Loans with Non-Real Estate Collateral	Loans without Collateral	Real Estate Collateral =2; Non-Real Estate Collateral=1; No Collateral=0
Panel A	(1)	(2)	(3)	(4)
Price Change$_{t-1}$ (Bank Branch City)	0.019***	0.011***	-0.015***	0.019***
	(0.001)	(0.001)	(0.002)	(0.002)
Number of Observations	47321	47321	47321	47321
Adj. R-squared	0.298	0.276	0.296	0.289
Panel B	(5)	(6)	(7)	(8)
Price Change $_{t-1}^{Commercial}$ (Bank Branch City)	0.013***	0.006***	-0.012***	0.017***
	(0.001)	(0.001)	(0.001)	(0.002)
Number of Observations	47008	47008	47008	47008
Adj. R-squared	0.300	0.277	0.299	0.293
Panel C	(9)	(10)	(11)	(12)
Price Change $_{t-1}^{Industrial}$ (Bank Branch City)	0.006	-0.002	-0.008*	0.018**
	(0.004)	(0.003)	(0.004)	(0.007)
Number of Observations	45516	45516	45516	45516
Adj. R-squared	0.305	0.288	0.303	0.296

The Crowding Out Channel

- Hypothesis: A real estate boom reduces investment of non-land-holding firms

Analysis of non-land-holding firms:

- $$Y_{it} = \alpha + \beta * \Delta LandPriceIndex_{i,c,t-1} + \theta X_{it} + \varepsilon_i + \delta_t + \epsilon_{it}$$

Land Price Change and Investment of Non-land-holding Firms

	Corporate Investment	New Patent Applications	Corporate Investment	New Patent Applications	Corporate Investment	New Patent Applications
	(1)	(2)	(3)	(4)	(5)	(6)
Price Change$_{t-1}$	-0.211***	-0.357***				
	(0.041)	(0.047)				
Price Change $_{t-1}^{Commercial}$			-0.192***	-0.263***		
			(0.043)	(0.037)		
Price Change $_{t-1}^{Industrial}$					-0.087*	-0.192***
					(0.045)	(0.059)
Number of Observations	2595	2595	2551	2551	2581	2581
Adj. R-squared	0.409	0.779	0.408	0.781	0.408	0.773

Evidence for the Crowing Out Effect

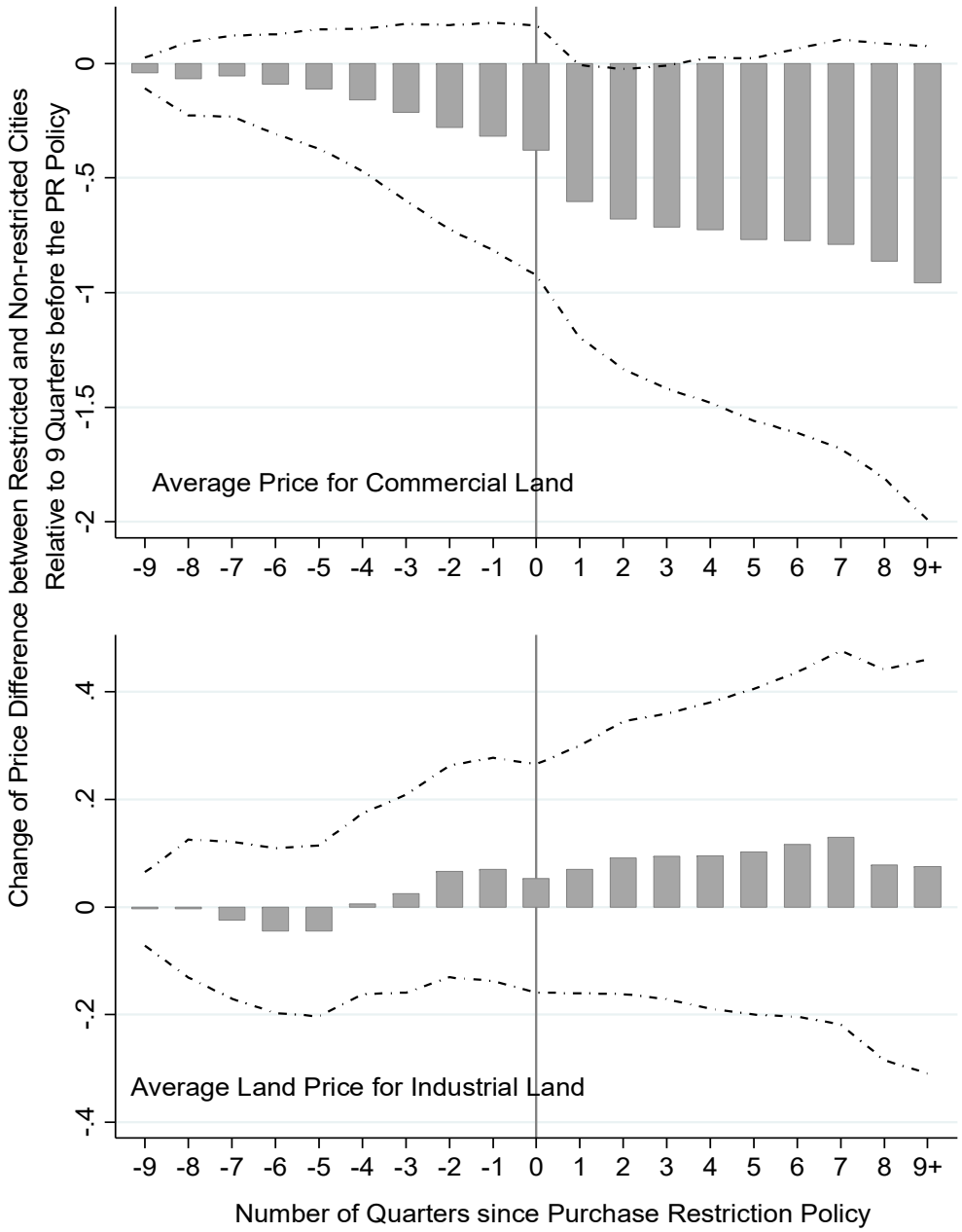
- In response to a real estate boom, banks are more likely to grant loans with land collateral, and consequently firms without land-holdings invest less and reduce innovation activities
  - This result may be subject to the usual endogeneity concern of real estate shocks being correlated with firms' investment opportunities

A Quasi-Policy Experiment

- In 2010, 46 cities adopted policies of restricting residential home purchases to cool the real estate boom
  - As the restriction policy affected only demand for residential housing, it did not directly affect firms' investment opportunities

- Did the policy affect land price?:

$$LandPriceIndex_{j,t} = \alpha + \sum_{\epsilon t} \beta_{\epsilon t} * Treated_j * EventTime_{j,t,\epsilon t} + \sum \lambda_j * t * City_j + \varepsilon_t + \gamma_j + \mu_{j,t}$$


Change of Price Difference between Restricted and Non-restricted Cities
Relative to 9 Quarters before the PR Policy
0
-.5
-1
-1.5
-2
Average Price for Commercial Land
-9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9+
.4
.2
0
-.2
-.4
Average Land Price for Industrial Land
-9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9+
Number of Quarters since Purchase Restriction Policy

A Quasi-Policy Experiment

- Diff-in-diff analysis of firm investment:
  - $Y_{i,t} = \alpha + \beta * Treated_i * PolicyPeriod_{i,t} + \sum_i \lambda_i * t + \varepsilon_i + \zeta_t + \varphi_{i,t}$
  - $Treated_i$ is a dummy for firm i holding land in one of 46 treated cities
  - $PolicyPeriod_{it}$ is a dummy for city i and year t in the restriction policy
  - Three control groups:
    - all non-treated firms, including all publicly listed firms owning land but not in the treated cities and firms owning no land at all
    - all non-landholding firms with their headquarters in one of the 46 treated cities
    - firms with land but not in the treated cities

Diff-in-Diff Analysis of Firm Investment

	Non-Land Investment	Commercial Land Investment	Industrial Land Investment	New Patent Applications
Panel A: Firms Holding No Land in the Purchase Restricted Cities as Control Group				
	(1)	(2)	(3)	(4)
Treated Firms*Policy Period	0.260***	-0.049***	0.003	0.083***
	(0.034)	(0.008)	(0.004)	(0.028)
Number of Observations	22756	23696	23696	23696
Adj. R-squared	0.448	0.153	0.154	0.793
Panel B: Non-Land-Holding Firms in the Purchase Restricted Cities as Control Group				
	(5)	(6)	(7)	(8)
Treated Firms* Policy Period	0.583***	-0.432***	-0.027	0.165**
	(0.170)	(0.057)	(0.025)	(0.078)
Number of Observations	4830	5234	5234	5234
Adj. R-squared	0.666	0.450	0.456	0.895
Panel C: Land-Owner Firms Holding No Land in the Purchase Restricted Cities as Control Group				
	(9)	(10)	(11)	(12)
Treated Firms* Policy Period	0.200***	-0.068***	0.002	0.015
	(0.037)	(0.011)	(0.005)	(0.030)
Number of Observations	17129	18068	18068	18068
Adj. R-squared	0.410	0.159	0.165	0.791

Effect of the Policy Shock on Non-land-holding Firms

	Investment	New Patent Applications	Investment	New Patent Applications
	(1)	(2)	(3)	(4)
Treated Cities* Policy Period	0.195***	0.134***	0.220***	0.160***
	(0.051)	(0.052)	(0.064)	(0.057)
Firm Specific Time Trend	No	No	Yes	Yes
Number of Observations	5628	5628	5628	5628
Adj. R-squared	0.645	0.733	0.741	0.799

Effects of the Policy Shock

- Among firms affected by the policy shock,
  - land-holding firms increase non-land investment and reduce commercial land investment (reversal of the speculation effect), and any effect on industrial land investment
  - non-land-holding firms make more investment and increase innovation activities (reversal of the crowding out effect)

- These findings help to
  - provide assurance on the endogeneity problem
  - Provide asymmetric effects on the negative side

Real Estate Boom and Efficiency of Resource Allocation

- A real estate boom affect allocation efficiency on both sides:
  - Mitigate financial constraints of land-holding firms through the collateral effect
  - Distort efficiency through the speculation effect and crowding out effect

- Follow Hsieh and Klenow (2009) to measure TFP (total factor productivity) loss due to resource misallocation
  - % of output gain from hypothetical reallocation to the real output
  - Data from China's National Taxation Statistics Data from 2008 to 2011, measured in 47 manufacturing sectors, city level

Land Price Change and TFP losses

	Average TFP Loss				Weighted Average TFP Loss			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Price Change$_{t-1}$	0.092***				0.259***			
	(0.025)				(0.035)			
Price Change $_{t-1}^{Commercial}$		0.086***		0.054*		0.263***		0.238***
		(0.027)		(0.028)		(0.032)		(0.038)
Price Change $_{t-1}^{Industrial}$			0.035	0.036			0.089*	0.077
			(0.028)	(0.033)			(0.052)	(0.061)
Number of Observations	1288	1227	1185	1074	1288	1227	1185	1074
Adj. R-squared	0.591	0.580	0.600	0.581	0.542	0.546	0.553	0.566

Conclusion

- Evidence for a real estate boom to generate not only the well-known collateral effect but also a speculation effect and a crowding out effect

- On net, a real estate boom leads to less (rather than more) efficient resource allocation in China

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