Bank Lending Channel of Real Estate Prices

12/15/2014

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Introduction

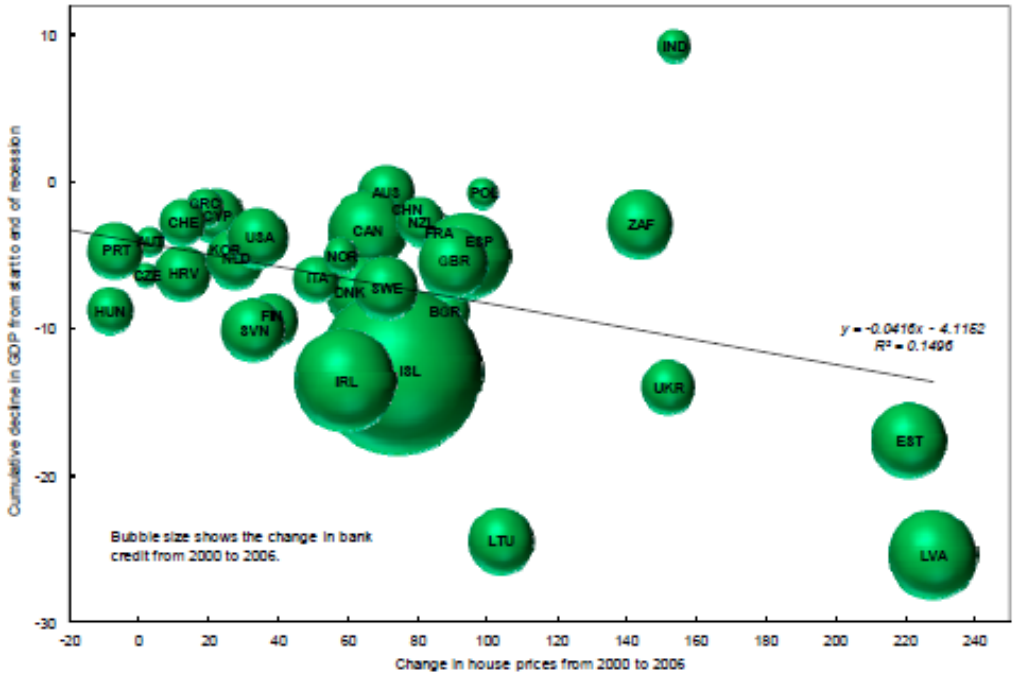
Propagation of shocks from real estate markets

- Real estate markets have been the epicenter of a number of disastrous financial crises in the world including Japan, US, and Europe
  - Reinhart and Rogoff (2009)

    Housing prices are one of the most important indicators of banking crises
  - Crowe et al. (2010)

    More sizable decline of GDP after bubbles among countries that experienced larger increase in housing prices

Figure 2. House Price Run-Up and Severity of Crisis



Collateral and bank lending channels of real estate prices

- Financial aspect of interactions between real estate market and the economy (Bernanke and Gertler (1989), Kiyotaki and Moore (1997))

  Real estate price↑ ⇒ firms' collateral value & banks' lending capacity↑ ⇒ consumption & investment↑ ⇒ real estate price↑

- A number of studies on collateral channel (focusing on firms' collateral) and bank lending channel (focusing on banks' lending capacity)

- Many of them focus on countries that experienced sizable increase and decrease of real estate prices

  Japan in the 1980s and 1990s

  US in the 1990s and 2000s

Collateral and bank lending channels of real estate prices (continued)

- Studies on collateral channel

  Ogawa et al. (1996), Ogawa and Suzuki (1998), Gan (2007a), Chaney, Sraer, and Thesmar (2012)

  After estimating market values of firms' collateral, find their positive impact on investment

- Studies on bank lending channel

  Peek and Rosengren (1997), 星(2000), 小川(2003), Gan (2007b), Puri, Rocholl, and Steffen (2011), Chakraborty, Goldstein, and MacKinlay (2014), Cuñat, Cvijanović, and Yuan (2014)

  Employing bank-level data or firm-bank matched data, examine the impact of real estate shock on bank lending and firms' investment

Collateral and bank lending channels of real estate prices (continued)

- Mixed results on the relationship between real estate prices and loans/investment/economic activities

  Positive: Peek and Rosengren (1997), 小川 (2003), Gan (2007b) , Puri, Rocholl, and Steffen (2011), Cuñat, Cvijanović, and Yuan (2014)

  Negative (forbearance lending):星(2000)

  Negative (portfolio reallocation): Chakraborty, Goldstein, and MacKinlay (2014)

- Limited number of studies that consider heterogeneous real estate price shocks to banks

  Exceptions: Cuñat, Cvijanović, and Yuan (2014), Chakraborty, Goldstein, and MacKinlay (2014)

- Comparison of results using different real estate prices

  Appraisal prices or transaction prices (next slide)?

Appraisal vs transaction prices

- Public notice of land prices (PNLP):

  Appraisal land values issued by the Ministry of Infrastructure, Land, and Transportation

  Professional appraisals of individual properties

  Real estate prices for taxation (fixed property tax and inheritance tax) are linked to PNLP

  Banks are likely to frequently employ PNLP-based prices for collateral evaluation

  Tend to lag actual transaction prices

- Transaction land prices:

  Actual prices of traded real estate in the market

  Likely to be closer to the value of collateral disposal than appraisal value

Research questions and quick answers

- Is there a bank lending channel of real estate prices in Japan? (Hypothesis 1 in the paper)

  → YES, in case we employ appraisal real estate prices for analysis

- Is there a substitution/complementarity between real estate lending and non-real estate lending? (Hypothesis 2 in the paper)

  → Weak substitution between real estate and non-real estate lending

Research questions and quick answers (continued)

- In case of substitution, is the result consistent with portfolio reallocation hypothesis or with forbearance lending hypothesis? (Hypothesis 2 in the paper)

  → Consistent with portfolio reallocation hypothesis

- Do results differ depending on the real estate prices: appraisal prices and transaction prices?

  → YES, they differ significantly

Empirical approach

Data sources

1. Information on banks including balance sheet items and loan amount obtained from Nikkei Financial Quest

2. Real estate prices publicly available from the Ministry of Land, Infrastructure, Transportation, and Tourism

   PNLP (appraisal value): 20 thousand+ per year

   Transaction prices of land: More than 2 million records between 2005-2014

3. Geographical distribution of firms that has transaction relationships with each of the banks in the sample

   Aggregated by local municipalities (市区町村)

4. Local economic condition by prefectures (都道府県)

Construction of dataset

- Using real estate prices (PNLP or transaction), apply hedonic approach regression model for each municipality, and obtain average predicted real estate prices for each municipality-year

- Using geographical distribution of borrower firms as weights, aggregate these municipality-level prices into the real estate price for each bank

- Append banks' loan amount outstanding and characteristics variables for each bank

- Also append variables on local economic conditions for each bank

Estimation methodology

- Fixed effect model estimation

$$BANKASSET_{jt} = \alpha_j + \delta_t + \beta_1 PRICE_{jt-1} + \beta_2 BANK_{jt-1} + \beta_3 MACRO_{jt-1} + \varepsilon_{jt} \qquad (1)$$

where *BANKASSET* is loan amount or capital ratio for bank j in year t, *PRICE* is real estate price that bank j faces in year t-1, *BANK* is a vector of variables on the characteristics of bank j in year t-1, and *MACRO* represents local economic activities in year t-1 where bank j is located

- Admittedly, omitted variables that affect both real estate price and demand for loans may bias the estimated parameters upward

- Constructing IVs that represent the supply-side shock is necessary for further analyses (Saiz (2010) for the US)

Results

Summary statistics

Variable names	Definitions	N	mean	sd	p50
Dependent variables					
Loan amount					
LOAN_r	Total loan amount outstanding/Total asset	2681	0.5371	0.1176	0.5304
lnLOAN	ln(Total loan amount outstanding)	2685	12.5578	1.5197	12.3041
LOAN_COLL_r	Amount of loans collateralized by real estate/Total asset	2673	0.1579	0.0900	0.1480
lnLOAN_COLL	ln(Amount of loans collateralized by real estate)	2536	11.1737	1.3912	11.0408
LOAN_RE_r	Amount of loans to construction and real estate industries/Total asset	2681	0.1196	0.0541	0.1114
lnLOAN_RE	ln(Amount of loans to construction and real estate industries)	2635	10.9998	1.5070	10.8774
LOAN_NONCOLL_r	Amount of loans not collateralized by real estate/Total asset	2673	0.3788	0.1276	0.3547
lnLOAN_NONCOLL	ln(Amount of loans not collateralized by real estate)	2673	12.1677	1.5945	11.8879
LOAN_NONRE_r	Amount of loans to other industries/Total asset	2681	0.4175	0.1109	0.4010
lnLOAN_NONRE	ln(Amount of loans to other industries)	2685	12.2964	1.5401	12.0241
Capital ratio					
B_CAPRATIO	Capital ratio	2683	0.0521	0.0186	0.0491

Summary statistics (continued)

Variable names	Definitions	N	mean	sd	p50
Explanatory variables (all the variables are lagged by one year)					
Real estate prices					
PRICE_PNLP	Public notice of land price (公示地価) (Unit: yen per square meter)	2659	170745.2	263670.6	78426.79
lnPRICE_PNLP	ln(public notice of land price)	2659	11.5104	0.8826	11.2699
PRICE_TRANS	Transaction land price (Unit: yen per square meter)	2685	113037.8	161702.3	50856.75
lnPRICE_TRANS	ln(transaction land price)	2685	11.0864	0.9363	10.8368
Bank characteristics					
lnB_ASSET	ln(bank's total asset)	2685	13.1858	1.4094	12.9894
B_CAPRATIO	Capital ratio	2685	0.0520	0.0186	0.0490
B_ROA	Business profit（業務純益）/Total asset	2685	0.0013	0.0052	0.0021
B_DEPOSITCOST	Interest payment amount to deposits/Deposits	2685	0.0020	0.0012	0.0018
Local economic conditions					
UNEMP	Unemployment rate in the prefectures where bank branches are located (Unit: %)	2685	4.2470	0.9003	4.2000

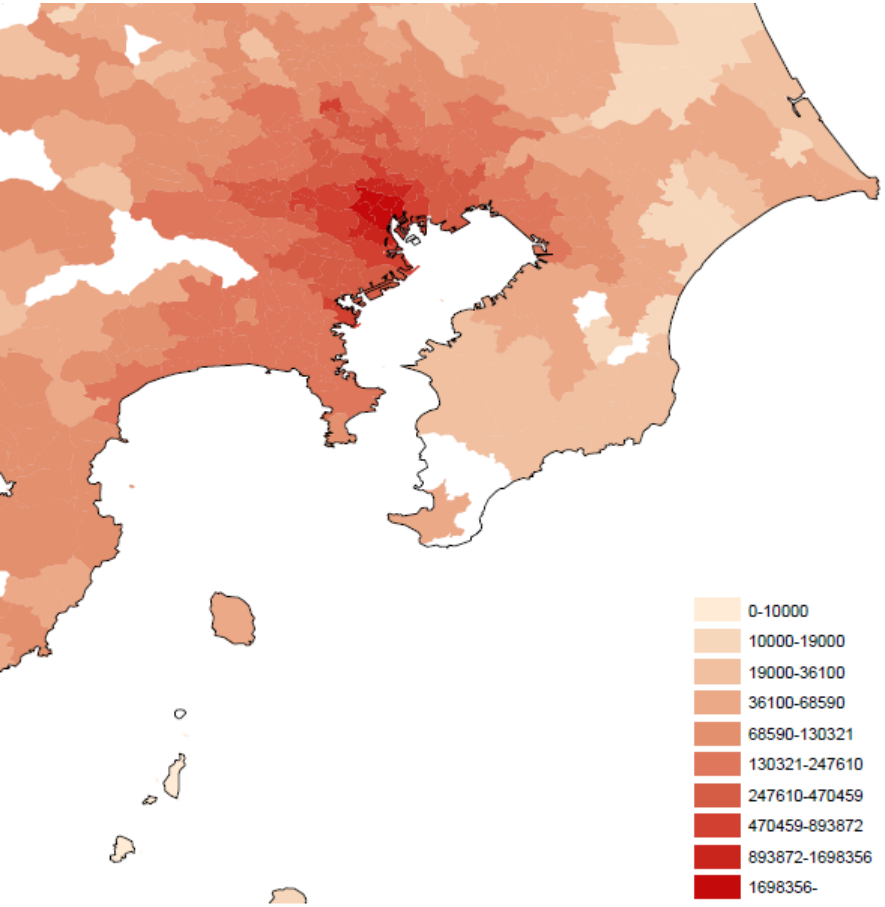
Summary statistics (by year)

	year	N	mean	sd	p50
LOAN_r(t)	2007	393	0.5520	0.1114	0.5478
	2008	391	0.5498	0.1153	0.5393
	2009	385	0.5571	0.1170	0.5478
	2010	382	0.5425	0.1155	0.5335
	2011	379	0.5305	0.1167	0.5193
	2012	376	0.5180	0.1182	0.5064
	2013	375	0.5079	0.1214	0.4905
lnLOAN(t)	2007	393	12.5017	1.5179	12.2473
	2008	391	12.5246	1.5114	12.2730
	2009	387	12.5753	1.5190	12.3024
	2010	382	12.5657	1.5159	12.2915
	2011	379	12.5773	1.5213	12.3377
	2012	376	12.5825	1.5223	12.3615
	2013	377	12.5802	1.5405	12.3340

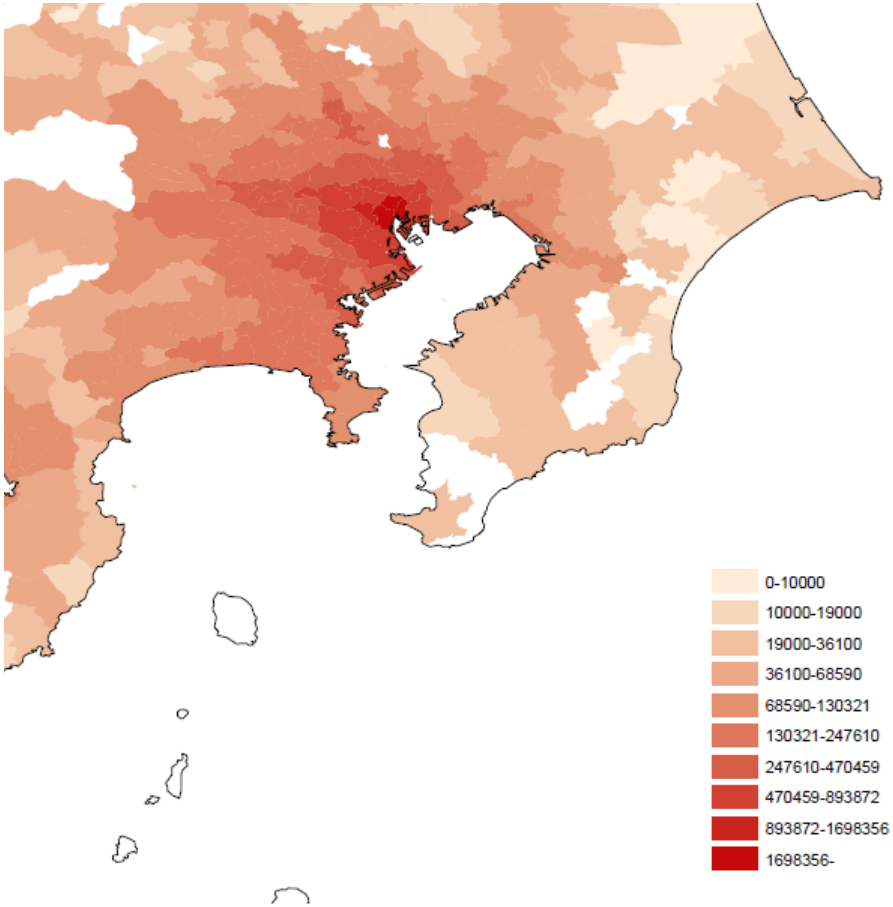
	year	N	mean	sd	p50
PRICE_PNLP(t-1)	2006	393	155225.9	210807.6	82299.9
	2007	387	172381.3	258007.4	81160.0
	2008	382	191877.1	309040.2	81808.3
	2009	379	181810.1	289451.3	78426.8
	2010	374	168861.5	261642.2	76241.9
	2011	372	164343.9	256249.2	73462.3
	2012	368	161183.8	252217.7	71311.7
PRICE_TRANS(t-1)	2006	393	121177.2	165911.7	57486.9
	2007	391	136587.2	207925.5	57590.3
	2008	385	129435.8	195796.2	55018.0
	2009	382	102148.5	133224.0	47658.9
	2010	379	103669.8	141822.7	48094.2
	2011	376	101453.4	135690.8	47500.8
	2012	375	95699.2	126059.4	44279.1

Appraisal and transaction prices of real estate

Public notice of land prices (2008)

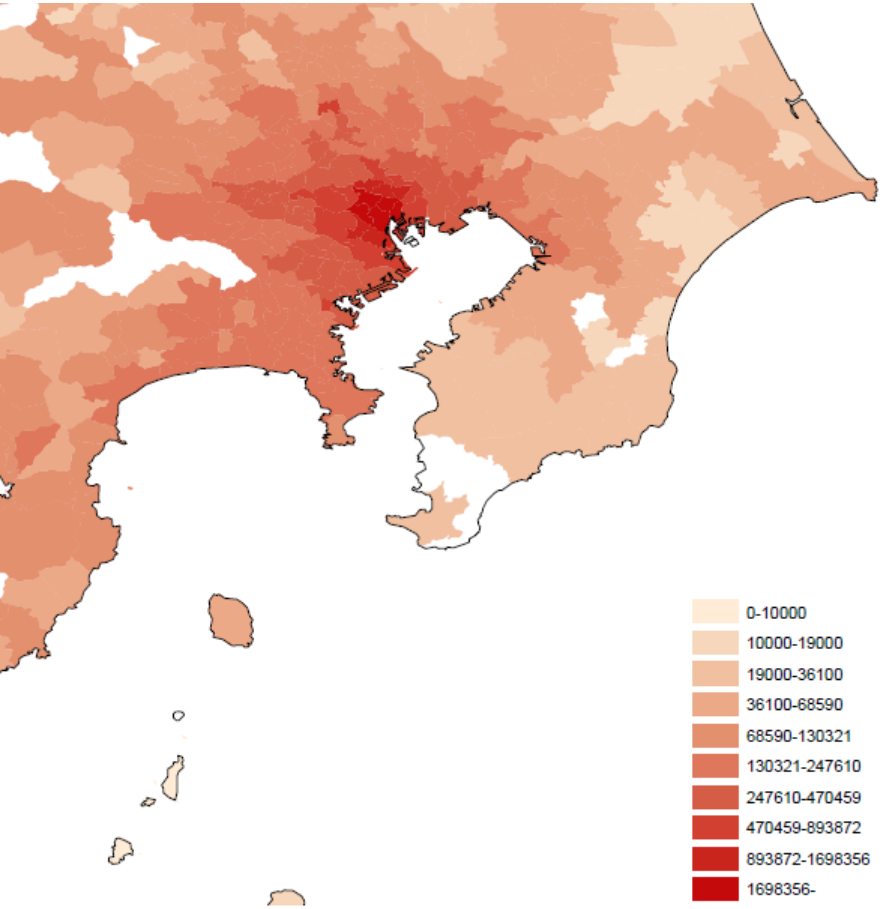


Transaction prices (2008)

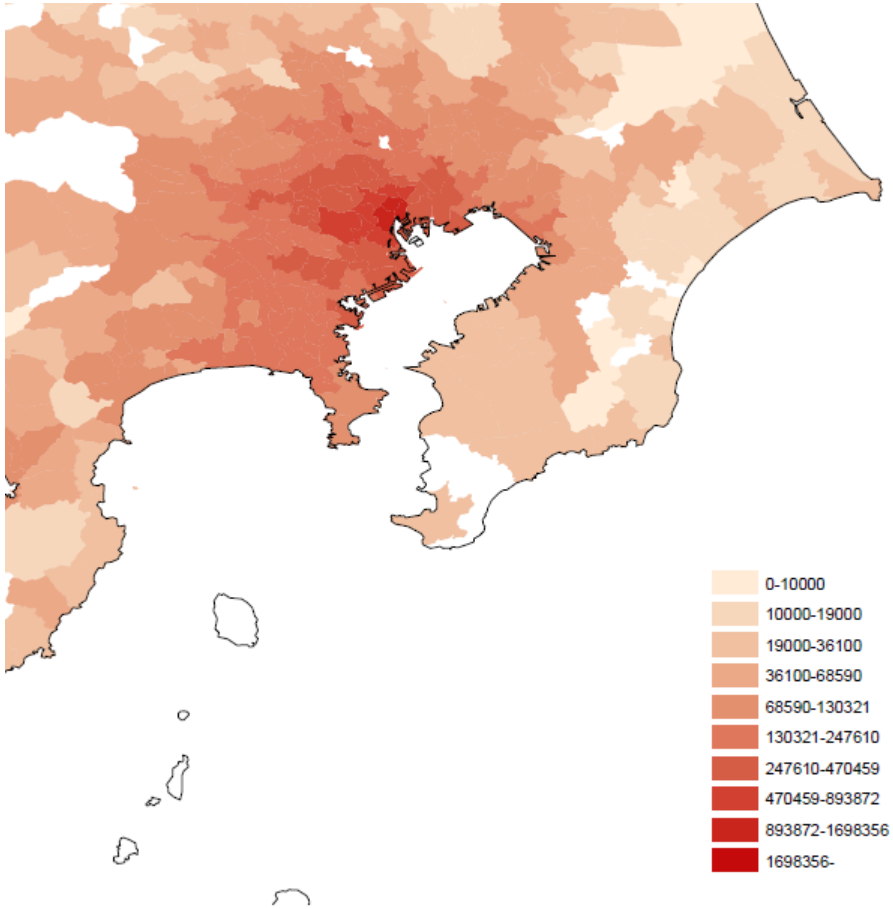


Appraisal and transaction prices of real estate

Public notice of land prices (2009)

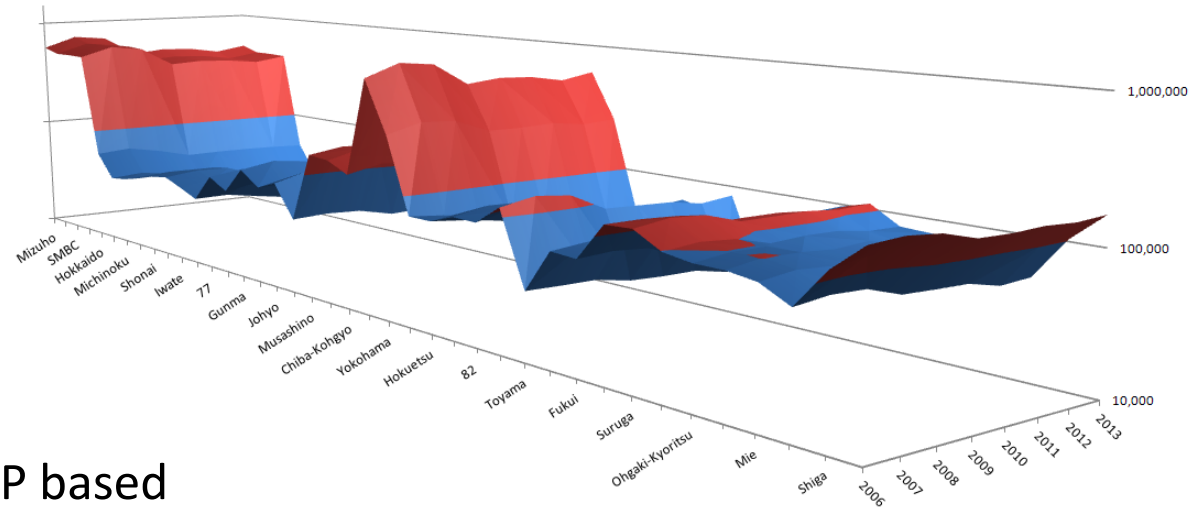


Transaction prices (2009)

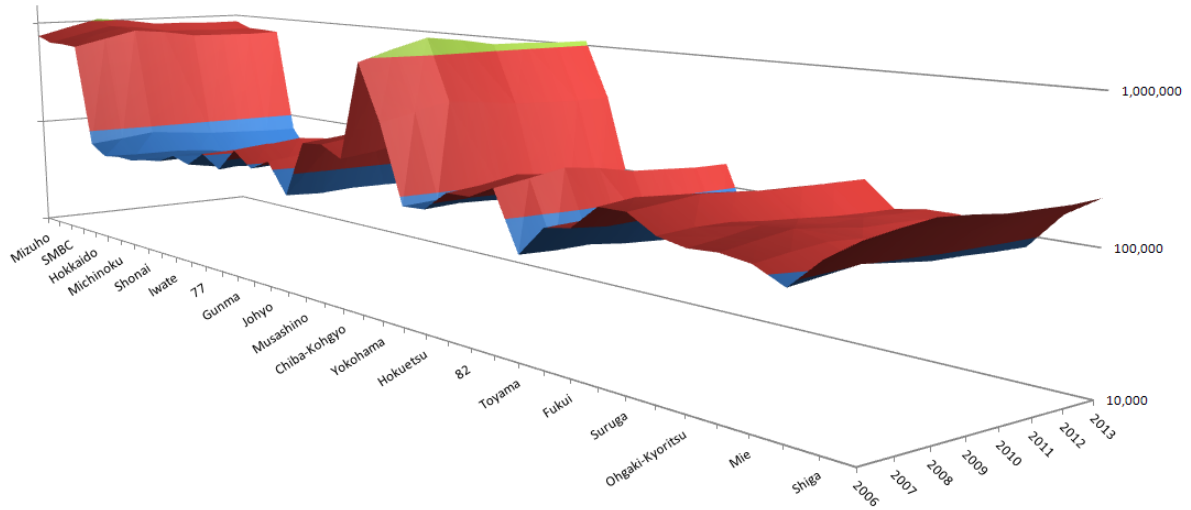


Heterogeneity of real estate prices among banks

- Transaction price based



- PNLP based



Baseline results for total loans and capital ratio (PNLP-based prices)

	Total loans						**Capital ratio**		
	Dependent variable								
	(2)			(4)			(5)		
	LOAN_r			lnLOAN			B_CAPRATIO		
	Coef.	t-value		Coef.	t-value		Coef.	t-value	
lnPRICE	0.0186	1.9	*	0.0583	2.19	**	0.0057	2.05	**
lnB_ASSET	-0.0517	-2.66	***	0.4424	7.25	***	-0.0001	-0.01	
B_CAPRATIO	-0.1494	-0.83		0.1258	0.32				
B_ROA	0.1231	0.72		0.4949	1.6		0.2230	3.62	***
B_DEPOSITCOST	2.8400	2.46	**	3.5202	1.36		-0.6039	-1.37	
UNEMP	0.0100	4.27	***	0.0201	3.56	***	-0.0008	-1.11	
YEAR2008	-0.0013	-0.83		-0.0065	-2.01	**	-0.0038	-6.93	***
YEAR2009	-0.0004	-0.13		0.0092	1.4		-0.0083	-6.57	***
YEAR2010	-0.0246	-6.32	***	-0.0203	-2.52	**	-0.0010	-0.68	
YEAR2011	-0.0326	-9.64	***	-0.0317	-4.45	***	-0.0028	-2.32	**
YEAR2012	-0.0374	-12.74	***	-0.0215	-3.17	***	-0.0020	-2.2	**
YEAR2013	-0.0394	-12.32	***	-0.0209	-2.44	**	0.0014	1.62	
Constant	0.9854	3.37	***	5.9745	7.03	***	-0.0066	-0.08	
NOB	2655			2659			2657		
F-value	59.5			15.08			63.89		
Prob> F	0			0			0		
R-sq: within	0.4481			0.2414			0.2381		
between	0.1445			0.9748			0.0036		
overall	0.0961			0.973			0.0013		

Results for real estate loans (PNLP-based prices)

	Loans with real estate being pledged as collateral				Loans extended to construction or real estate industries			
	Dependent variable				Dependent variable			
	(2)		(4)		(2)		(4)	
	LOAN_COLL_r		lnLOAN_COLL		LOAN_RE_r		lnLOAN_RE	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
lnPRICE	0.0305	2.6 ***	0.1902	2.25 **	0.0183	2.36 **	0.1549	2.56 **
lnB_ASSET	-0.0050	-0.45	0.4400	4.26 ***	-0.0127	-1.3	0.4684	5.68 ***
B_CAPRATIO	-0.1814	-1.61	-0.3588	-0.39	-0.0289	-0.36	0.0397	0.05
B_ROA	-0.1170	-1.09	-0.3851	-0.52	-0.0318	-0.43	0.2613	0.46
B_DEPOSITCOST	-2.0953	-1.15	-5.4250	-0.4	-0.7183	-0.75	-10.1059	-1.07
UNEMP	-0.0004	-0.19	-0.0100	-0.58	0.0014	0.79	0.0118	0.79
Year dummies	yes		yes		yes		yes	
NOB	2510		2510		2605		2609	
F-value	28.11		11.83		7.7		11.35	
Prob> F	0		0		0		0	
R-sq: within	0.3716		0.1684		0.0425		0.1243	
between	0.1177		0.8772		0.1715		0.936	
overall	0.1648		0.8732		0.1821		0.9326	

Results for non-real estate loans (PNLP-based prices)

	Loans without real estate being pledged as collateral				Loans extended to other industries			
	Dependent variable				Dependent variable			
	(6) LOAN_NONCOLL_r		(8) lnLOAN_NONCOLL		(6) LOAN__NONRE_r		(8) lnLOAN_NONRE	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
lnPRICE	-0.0265	-1.94 *	-0.0606	-1.54	0.0088	0.6	0.0224	0.59
lnB_ASSET	-0.0520	-2.49 **	0.4034	6.63 ***	-0.0376	-1.84 *	0.4492	6.42 ***
B_CAPRATIO	0.1250	0.64	0.8133	1.55	-0.2470	-1.3	-0.1639	-0.35
B_ROA	0.0054	0.04	0.3075	0.85	0.1805	0.95	0.6593	1.59
B_DEPOSITCOST	4.2852	2.54 **	8.5344	2.28 **	3.9784	2.74 ***	6.2305	2.16 **
UNEMP	0.0175	2.73 ***	0.0445	3.13 ***	0.0062	1.58	0.0165	1.89 *
Year dummies	yes		yes		yes		yes	
NOB	2647		2647		2655		2659	
F-value	15.8		20.91		32.94		13.24	
Prob> F	0		0		0		0	
R-sq: within	0.105		0.2124		0.2696		0.141	
between	0.2243		0.9611		0.1851		0.9715	
overall	0.1789		0.9561		0.1284		0.9686	

Summary of results (PNLP-based prices)

- Positive coefficients on lnPRICE for capital ratio (B_CAPRATIO), total loans to total asset ratio (LOAN_r), and loan amount (lnLOAN) estimations
- Also positive coefficients on lnPRICE for real estate-related loans estimations
- In contrast, negative and marginally significant coefficient on lnPRICE only for non-collateralized loans ratio (LOAN_NONCOLL_r) estimation

PNLP-based real estate price↑ ⇒ banks' lending capacity↑, total loans↑ real estate loans↑ non-real estate loans?

Consistent with the existence of bank lending channel

Weak evidence for the portfolio reallocation between real estate and non-real estate loans

Results for total loans and capital ratio (transaction-based prices)

	Total loans								**Capital ratio**	
	Dependent variable									
	(1)		(2)		(3)		(4)		(5)	
	LOAN_r		LOAN_r		lnLOAN		lnLOAN		B_CAPRATIO	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
PRICE	-8.30E-09	-0.39			5.46E-08	1.09				
lnPRICE			-0.0069	-0.87			-0.0086	-0.61	0.0080	2.54 **
lnB_ASSET	-0.0496	-2.56 **	-0.0493	-2.55 **	0.4469	7.3 ***	0.4480	7.33 ***	-0.0002	-0.03
B_CAPRATIO	-0.1262	-0.71	-0.1192	-0.68	0.2674	0.69	0.2740	0.72		
B_ROA	0.1099	0.63	0.1030	0.6	0.3370	1.07	0.3853	1.23	0.2134	3.34 ***
B_DEPOSITCOST	2.6903	2.23 **	2.6818	2.31 **	2.1530	0.79	2.8614	1.11	-0.7620	-1.61
UNEMP	0.0109	4.63 ***	0.0111	4.73 ***	0.0233	4.01 ***	0.0230	3.96 ***	-0.0008	-1.18
Year dummies	yes		yes		yes		yes		yes	
NOB	2681		2681		2685		2685		2683	
F-value	62.26		62.11		15.17		15.1		64.36	
Prob> F	0		0		0		0		0	
R-sq: within	0.451		0.4513		0.2337		0.2328		0.2508	
between	0.1681		0.1713		0.9776		0.9777		0.0047	
overall	0.1146		0.1186		0.9762		0.9763		0.0001	

Results for real estate loans (transaction-based prices)

Loans with real estate being pledged as collateral

	Dependent variable							
	(1)		(2)		(3)		(4)	
	LOAN_COLL_r		LOAN_COLL_r		lnLOAN_COLL		lnLOAN_COLL	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
PRICE	-7.10E-08	-2.47 **			-5.50E-07	-2.95 ***		
lnPRICE			-0.0149	-1.78 *			-0.1217	-2.15 **

Loans extended to construction or real estate industries

	Dependent variable							
	(1)		(2)		(3)		(4)	
	LOAN_RE_r		LOAN_RE_r		lnLOAN_RE		lnLOAN_RE	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
PRICE	-3.18E-08	-1.86 *			-1.48E-07	-1.38		
lnPRICE			-0.0102	-2.18 **			-0.0734	-2 **

Results for non-real estate loans (transaction-based prices)

Loans without real estate being pledged as collateral

	Dependent variable							
	(5)		(6)		(7)		(8)	
	LOAN_NONCOLL_r		LOAN_NONCOLL_r		lnLOAN_NONCOLL		lnLOAN_NONCOLL	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
PRICE	5.02E-08	2.16 **			2.71E-07	3.59 ***		
lnPRICE			-0.0060	-0.56			0.0077	0.31

Loans extended to other industries

	Dependent variable							
	(5)		(6)		(7)		(8)	
	LOAN_NONRE_r		LOAN__NONRE_r		lnLOAN_NONRE		lnLOAN_NONRE	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
PRICE	3.32E-09	0.11			1.52E-07	1.87 *		
lnPRICE			0.0025	0.26			0.0128	0.64

Summary of results (transaction-based prices)

- Insignificant coefficients on lnPRICE and PRICE for total loans ratio (LOAN_r) and total loan amount (lnLOAN) estimations
- Positive coefficient for capital ratio estimation
- Negative coefficients on lnPRICE and PRICE for real estate loan estimations
- Some positive coefficients on PRICE for non-real estate loan estimations

Transaction-based real estate price↓ ⇒ banks' lending capacity↓, total loans →, real estate loans↑, non-real estate loans↓

Interpretation:

Banks' lending decision is based on PNLP

Actual transaction prices may have declined even when banks increased their loans based on the information that PNLP increased

Conclusion

Conclusion

- Bank lending channel of real estate prices exists in Japan assuming that banks mainly use PNLP-based prices
- A weak substitution exists between real estate lending and non-real estate lending

  Weakly consistent with portfolio reallocation hypothesis of Chakraborty, Goldstein, and MacKinlay (2014)

  Inconsistent with forbearance lending hypothesis of 星(2000)

- Results significantly differ when we employ transaction-based real estate prices for estimation

  Our interpretation is that banks may have changed their behavior if they utilize the transaction-based price information

  Results of a robustness check for smaller-sized banks (Shinkin banks), which are more likely to follow PNLP rather than to collect their own information due to their capacity, suggest that the interpretation is valid (See results in the appendix)

Future works

- Construction of instruments that are similar to the one proposed by Saiz (2010) for the US in order to deal with the possible endogeneity issue

- Use of bank branch level information rather than bank level information in order to examine the extent of portfolio reallocation

  Able to identify branch-level real estate price shocks

- Further examination on why results differ between PNLP-based prices and transaction-based prices

  Following transaction-based prices rather than PNLP-based prices improves the efficiency of resource allocation?

Appendix: Major banks vs Shinkin banks

PRICE_PNLP (Public notice of land price or Koji Chika)

Major banks, Regional banks, and Second-tier regional banks

	Total loans				Loans with real estate being pledged as collateral				Loans without real estate being pledged as collateral			
	LOAN_r		lnLOAN		LOAN_COLL_r		lnLOAN_COLL		LOAN_NONCOLL_r		lnLOAN_NONCOLL	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
PRICE	-2.39E-09		9.65E-08		-6.64E-08		-4.24E-07		6.12E-09		7.68E-08	
lnPRICE	0.0228		0.0838		0.0062		0.0403		-0.0849		-0.1528	

Shinkin banks

	Total loans				Loans with real estate being pledged as collateral				Loans without real estate being pledged as collateral			
	LOAN_r		lnLOAN		LOAN_COLL_r		lnLOAN_COLL		LOAN_NONCOLL_r		lnLOAN_NONCOLL	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
PRICE	2.64E-08	**	2.14E-08		2.89E-08	**	1.98E-08		-1.44E-09		-1.18E-08	
lnPRICE	0.0185	*	0.0557	**	0.0340	***	0.2352	***	-0.0148		-0.0385	

PRICE_TRANS (Transaction price of real estate)

Major banks, Regional banks, and Second-tier regional banks

	Total loans				Loans with real estate being pledged as collateral				Loans without real estate being pledged as collateral			
	LOAN_r		lnLOAN		LOAN_COLL_r		lnLOAN_COLL		LOAN_NONCOLL_r		lnLOAN_NONCOLL	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
PRICE	2.52E-08		1.70E-07		-1.67E-07	**	-1.17E-06	**	9.15E-08		3.12E-07	**
lnPRICE	0.2127		0.0884	**	-0.0422		-0.2021		-0.1032		-0.1492	

Shinkin banks

	Total loans				Loans with real estate being pledged as collateral				Loans without real estate being pledged as collateral			
	LOAN_r		lnLOAN		LOAN_COLL_r		lnLOAN_COLL		LOAN_NONCOLL_r		lnLOAN_NONCOLL	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
PRICE	1.29E-08		2.17E-08		-4.83E-08	*	-5.05E-07	**	6.15E-08	**	2.88E-07	***
lnPRICE	-0.0019		0.0055		-0.0060		-0.0854	*	0.0041		0.0327	