A Close Look at Loan-To-Value Ratios in Japan: Evidence from Real Estate Registries

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BACKGROUND AND MOTIVATION

Background and Motivation

- Recent financial crisis witnesses:
  - Credit booms/busts often accompanied by surges in real estate prices
  - ←→ "excessive risk taking by banks"
    - loans secured by real estate underwritten based on lax lending standards
- A measure of risk-taking: Loan-to-value (LTV) ratios
  - = (amount of a loan) / (value of assets pledged as collateral)
    - represent lenders' risk exposure
      - decrease in V by 1-LTV percent → debtor is in negative equity → lender may suffer from losses (given default)

Background and Motivation

× LTV ratios are important in shock amplification mechanism within an economy

+ IMF (2011) and Almeida, Campello, and Liu (2006)

× Effects of income shocks on house prices and/or mortgage borrowings are larger in countries/periods where the LTV ratios are higher

+ → strong *financial accelerator* mechanism positively associated with high LTV ratio

Background and Motivation

- Discussion on macroprudential policy

  - to construct the effective framework to

    - ... deal with banks' excessive risk-taking through secured loans

    - ... curb the amplification of external shock within market /economy

- One prospective measure

  - restriction (cap) on LTV ratio (e.g., FSB 2012)

    - Already applied in a number of countries to tame real estate booms and busts

      - Example) Hong Kong and Korea (hard limit), U.S., U.K. and Germany (soft limit (BIS risk weight))

    - But mostly for residential loans

    - Japan: No restriction

Background and Motivation

- Our focus: LTV ratios for business loans

  - LTV for business loans also important

    - Taking real estate as collateral is a common practice

      - "fixed-asset lending" as one of the lending technologies (Berger and Udell 2002)

    - Japan's experience during its bubble period (late 1980s – early 1990s)

      - Conventional wisdom

        - Banks' excessive risk-taking through higher LTV ratio loans

        - lax lending standards in anticipation of further surges in real estate prices

        - → credit bubbles and the bad loans problems

  - "Caps on the LTV ratio could have curbed banks' excessive risk-taking?"

6

Background and Motivation

× Sparse empirical evidence on the LTV ratio using micro-data

+ → validity of the conventional wisdom unclear:

1. whether the LTV ratio procyclical

2. what determines the ratio?

3. whether high LTV borrowers perform poorly?

+ → also, no evidence to judge:

× whether we should impose caps on LTV ratios

★ Do the caps constrain risky loans only?

→ Important to answer the questions above

THIS PAPER

Aim of this paper

* Aim of the paper: answer these questions by showing various facts of the LTV ratios
  + We examine
    1. the evolution of loan-to-value (LTV) ratios,
    2. their determinants, and
    3. the ex post performance of the borrowers by LTV ratios
  + Using unique data
    * nearly 400,000 LTV ratios from 1975 to 2009
    * Source: real estate registry info compiled by the Teikoku Databank (TDB)
      * the largest credit information provider in Japan

LTV definition

- LTV ratios = L/V (443,379 obs.)
  - L: loan amount (extended or committed)
    - Available in the TDB database
  - V: value of land pledged
    - Lands pledged identified in the TDB database
    - V= its acreage * estimated price (hedonic approach: Appendix A)
- Other information (to link with LTV)
  - Basic borrower characteristics (for 288,472 obs. (in 1981-2009))
    - e.g., # of employees, industry, location, and identity of mortgagees (lenders)
  - Borrower financial statement information (for 73,454 obs.)
  - Lender financial variables (for a further subset of the sample)
    - For ordinary banks, Shinkin banks

Data

* Data restrictions
  * In return for the rich information, the data have limitation
    * Due to the data collection by TDB's credit research
    1. Sample firms mostly small and medium-sized enterprises (SMEs)
    2. Limited coverage
       * Not cover the entire registration (but sufficient coverage)
    3. Mortgages registered in 1975-2009 but existed in database as of 2008-2010
       * 1975-2007 registration = those survived until 2008 on
       * → Concern for survival bias
       * → Control for firm- and loan-characteristics

Our analysis

✖ Threefold analyses

1. the evolution of loan-to-value (LTV) ratios (sec. 3.1)

2. their determinants (sec. 3.2, 3.3)

3. the ex post performance of the borrowers by LTV (sec. 4)

✖ Findings

1. LTV ratio exhibits counter-cyclicality

2. LTV ratios associated with many loan-, borrower- and lender-characteristics

3. No worse ex post performance for high LTV firms

RESULT 1
EVOLUTION OF LTV (SEC. 3.1)

Background information

- Business cycle and the land price evolution in Japan
  - Figure 2 (aggregate data): real GDP, the average land price, bank loans and the business conditions index
  - Confirm: surges during the bubble (late 1980s and early 1990s)

Real GDP, land price, and bank loans (growth rate)
(%)
Real GDP
Land price
Bank loans

Real GDP, land price, and bank loans (level)
(2005=100)
Real GDP
Land price
Bank loans
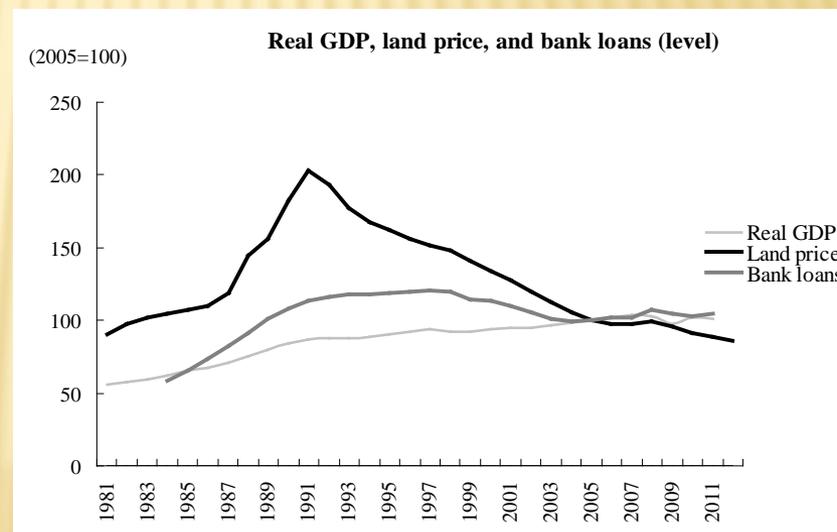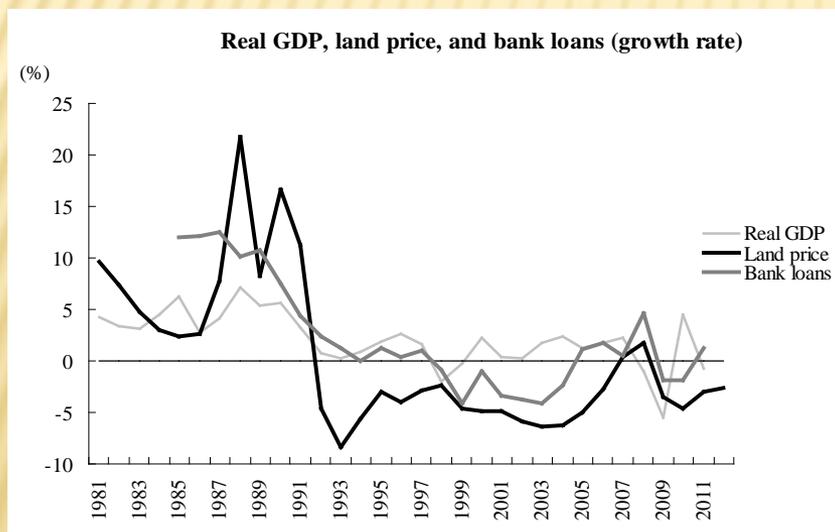
Evolution of L and V

- Figure 3: 25, 50, and 75 percentile of L and V through the business cycle (our micro data: for individual loans)
  - Finding: *Both L and V fluctuate in a pro-cyclical manner*

Figure 3   Loans and values over the business cycle

(A) Amount of Loans (L)
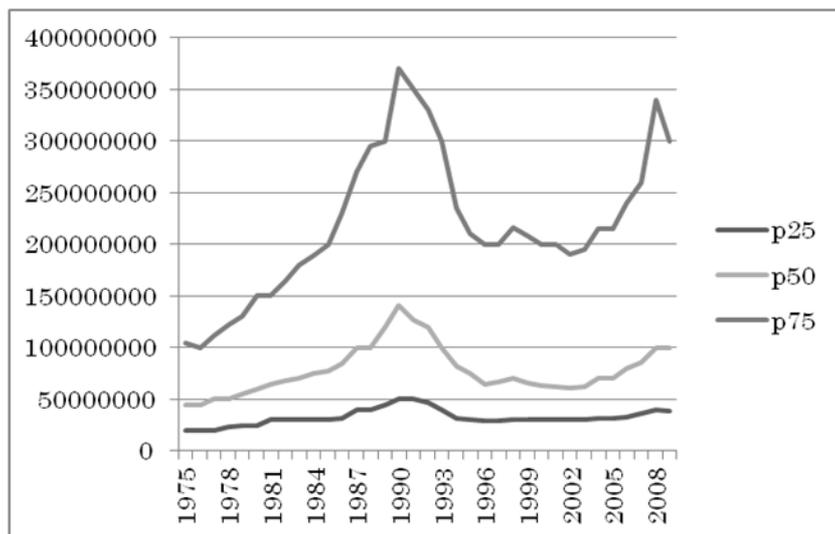
(B) Values of Land (V)
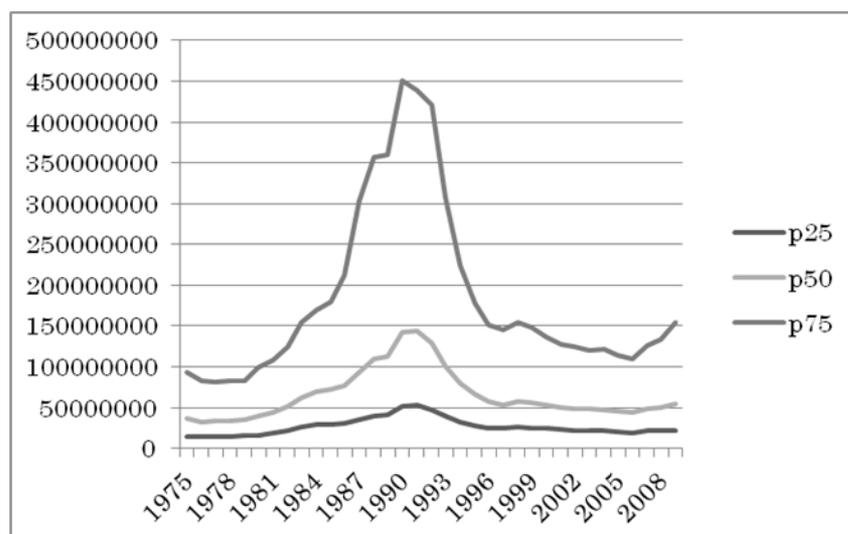
(Unit: in 1 Japanese yen)

Evolution of LTV

× Figure 4: 25, 50, and 75 percentile of our LTV through the business cycle

Figure 4   LTV over the business cycle
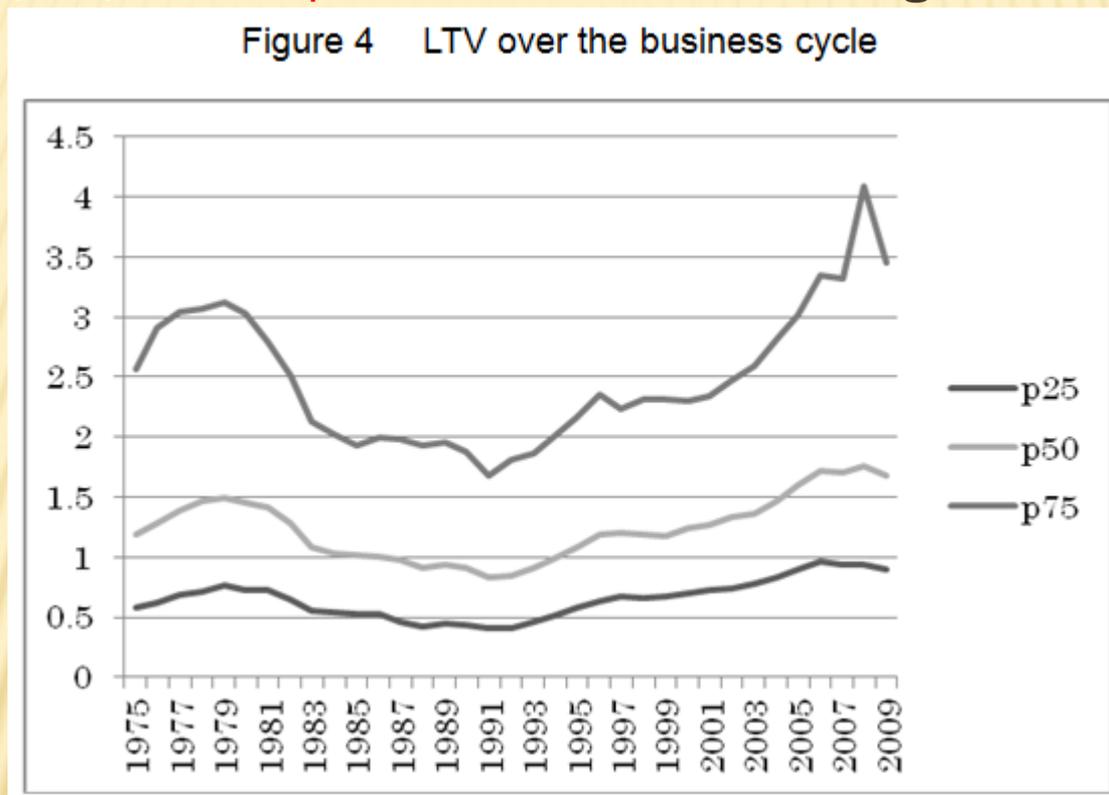
+ Finding: **counter-cyclicality**, at least until early 2000s

    × Increase in L during the bubble more than offset by increase in V

    × Banks' exposure did not increase during the bubble

    × Simple LTV cap might not have been effective

Evolution of LTV

✖ Anything wrong with data or methodology?

　✚ Counter-cyclicality not due to land price stickiness (see fig. 3)

　✚ Unlikely due to survival bias (bias → older borrower better → more L for older borrowers → decreasing trend in LTV)

Figure 4　LTV over the business cycle
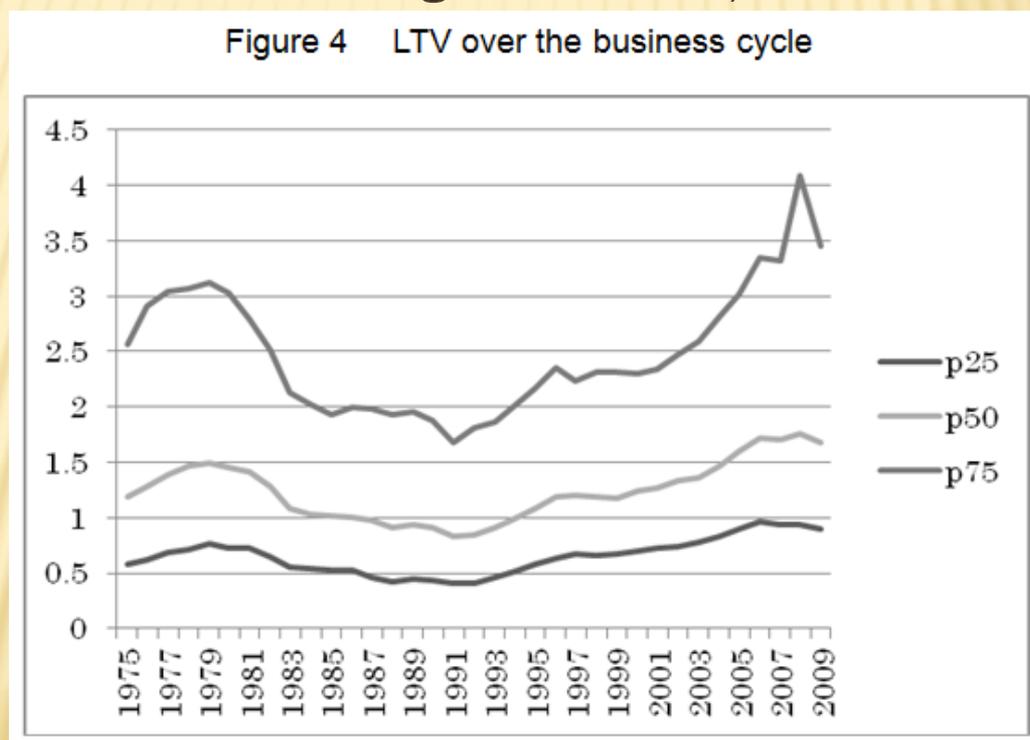
✖ Consistent evidence : counter-cyclicality of LTV for housing loans

　✚ Goodhart et al.(2012) (simulation), Bank of Japan (2012) (1994-09)

Evolution of LTV

× Robustness

 + Figure 6: Median LTV under different definition of V (denominator)

    × Perfect foresight: V(t+1)

    × Naïve interpolation: V(t-1)·{V(t-1)/V(t-2)}
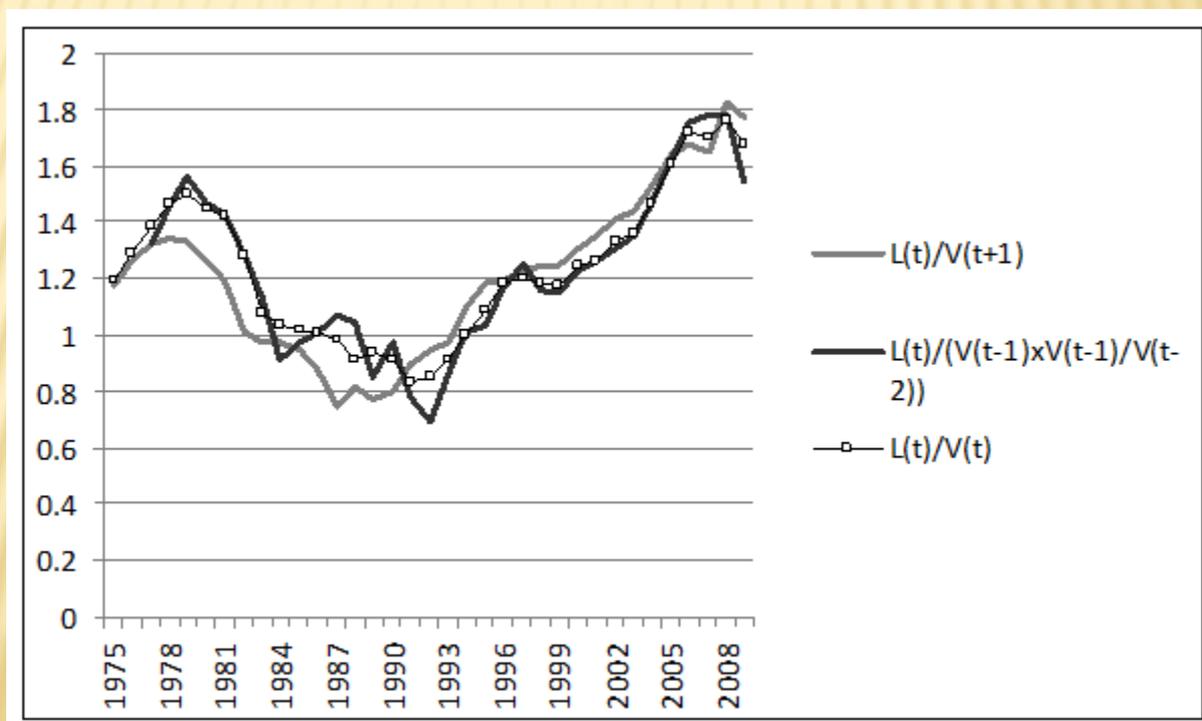
Land price increase and LTV during the bubble

- ✖ Closer look at LTV during the bubble (y1991)
  - ✛ Higher LTV for more land price surge? (lax lending?)
  - ✛ Figure 7: LTV sorted by land price appreciation (V(91)/V(86))

(A) Actual LTV: L(91)/V(91)   (B) Counterfactual LTV: L(91)/V(86)
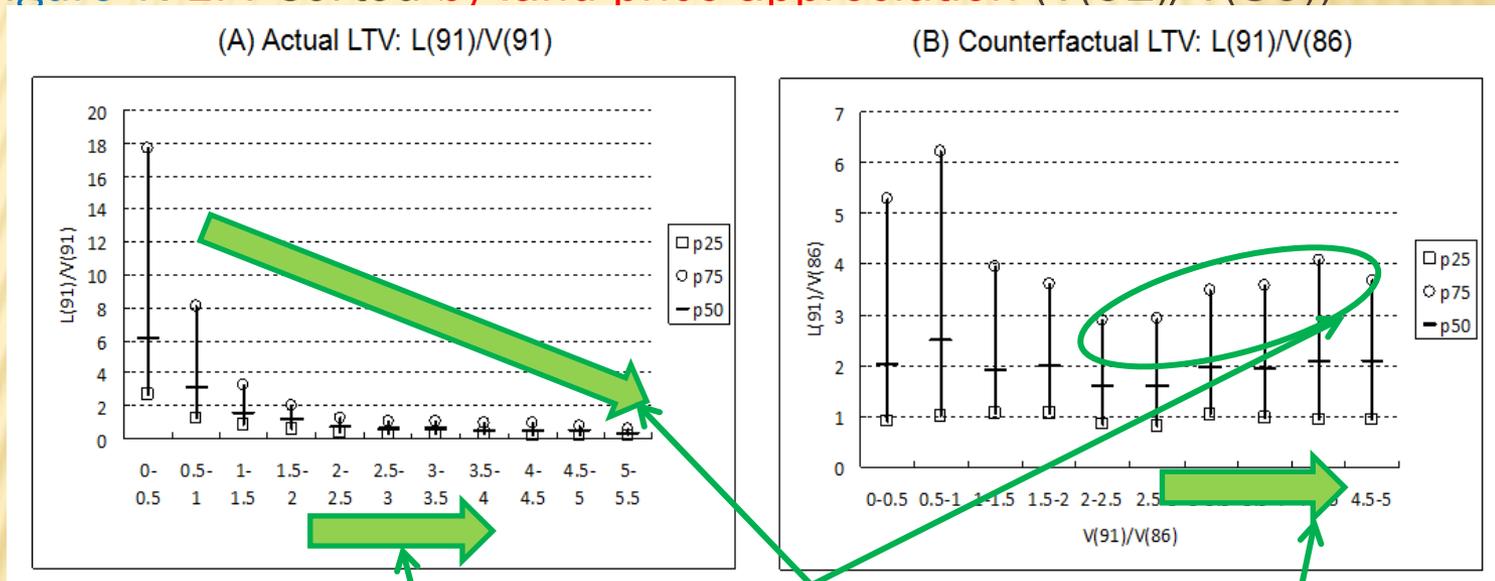
  - ✛ Finding
    - ✖ Panel (A): more land price surge → lower LTV → (interpretation) reluctant to lend more (given V)
    - ✖ Panel (B) Counterfactual LTV (L(91)/V(86)): land price surge → L larger (comp. w/V(86)) for higher LTV loans (Interpre.: lax standards)

RESULT 2
UNIVARIATE ANALYSIS (SEC. 3.2)

Univariate analyses

- Compare LTV by loan-, borrower-, and lender-characteristics
  - Aim
    - To show various facts of LTV ratios
    - Determinants of LTV ratios
    - Especially, association with borrower risk and performance (for policy purpose)
  - In this presentation
    - Below, we report only notable results
      - The other results: please refer to the paper

LTV by priority

: Median LTV by mortgage priority

(B) LTV by priority (50 percentile)
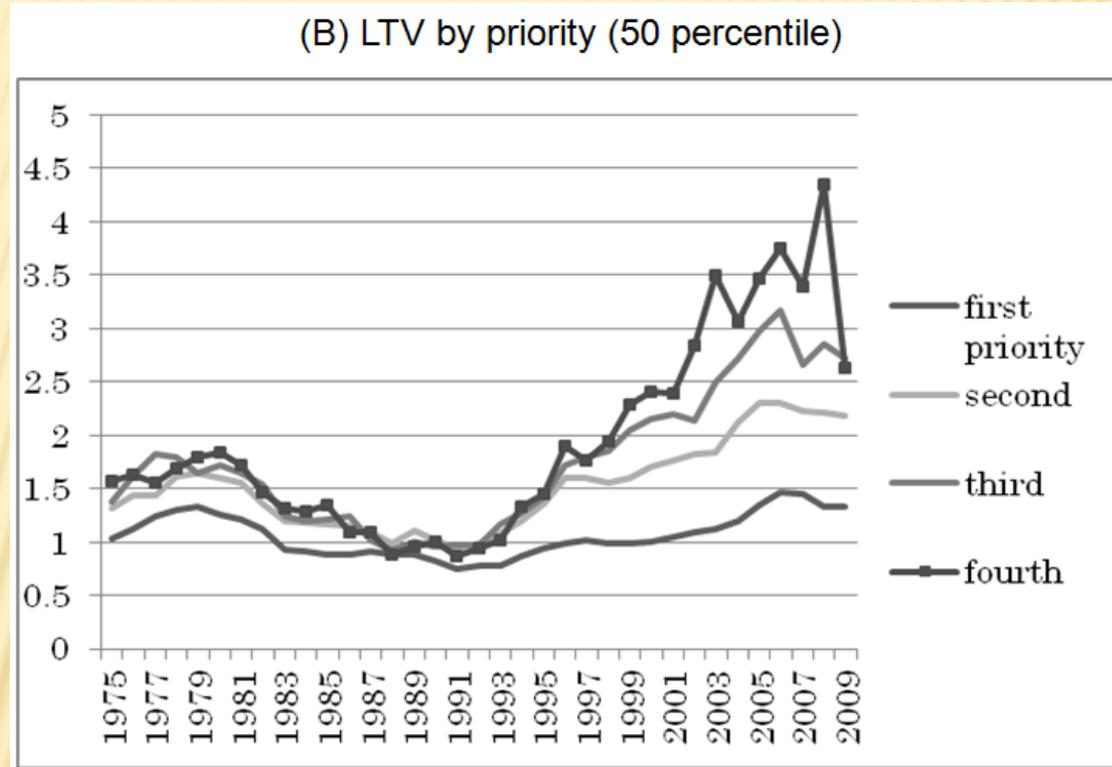
- Finding
  - Higher priority mortgages have lower LTV ratios (almost by definition)

Share of loans by priority

- Sec. 3.2.2 (Figure 10): Share of loans by priority
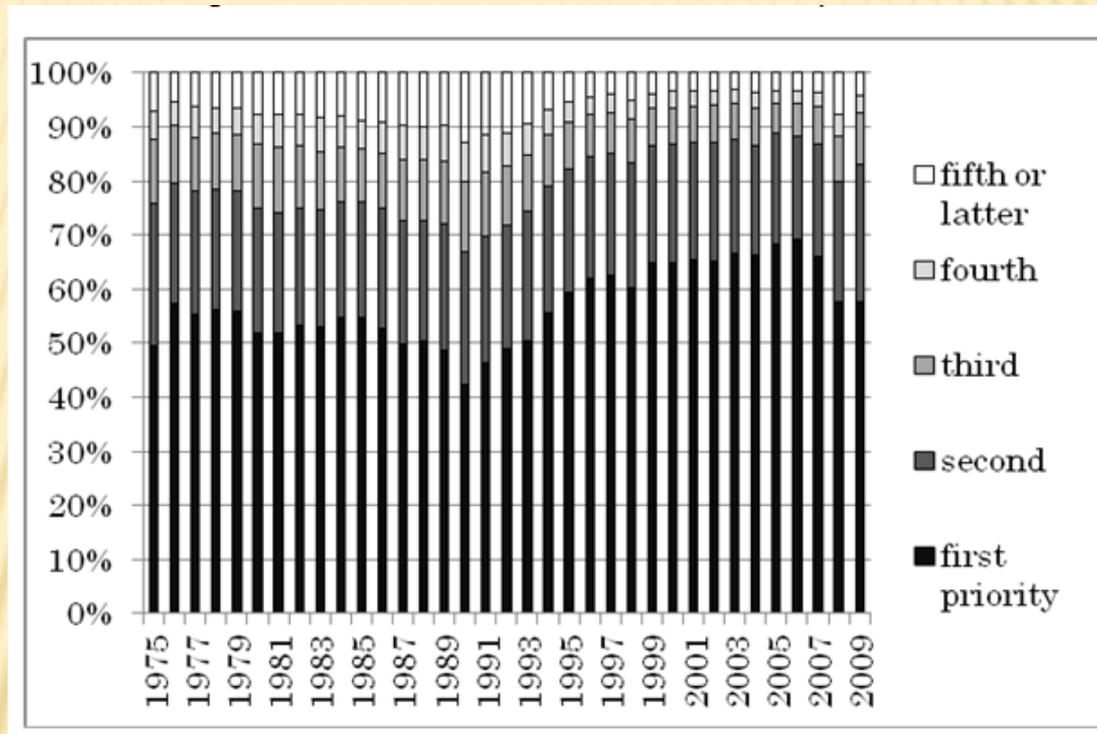
- Finding
  - Higher share for lower priority mortgages during the bubble period (interpretation: lax standard)

LTV by industry

: Median LTV by industry

(B) LTV by industry (50 percentile)
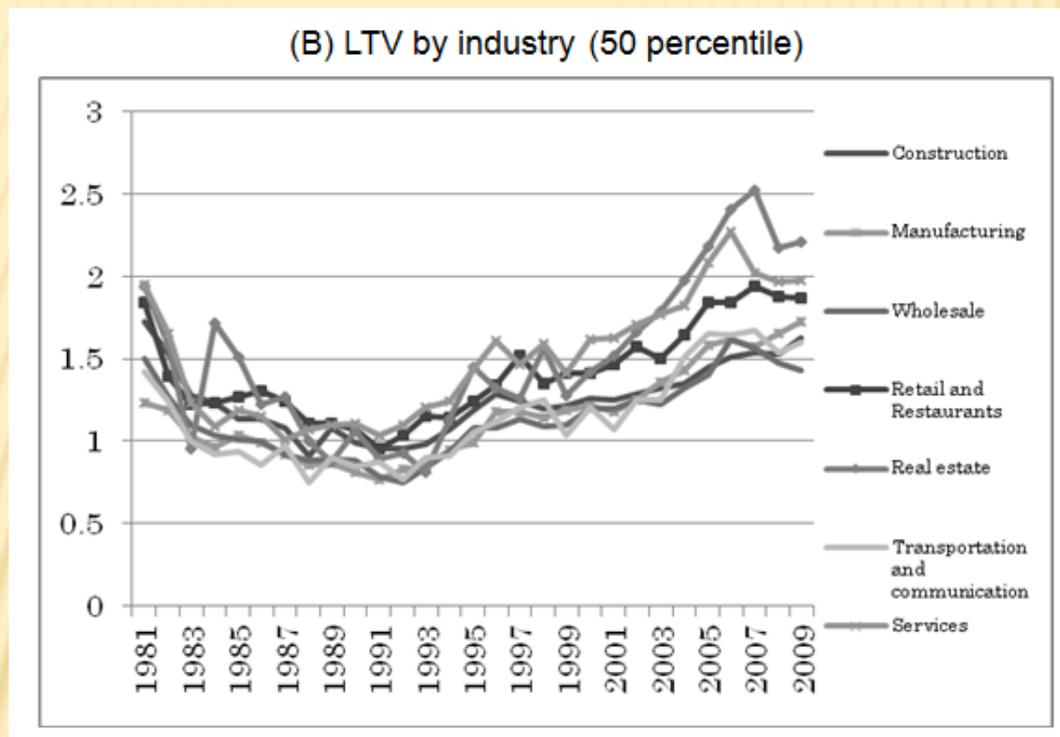
- Finding
  - Higher LTV for Real estate, Services, and Retail and restaurants
  - Higher LTV for Construction before the bubble
  - Volatile LTV for Real estate

LTV by region

× Sec. 3.2.4 (Figure 12): LTV by region

(B) LTV by region (50 percentile)
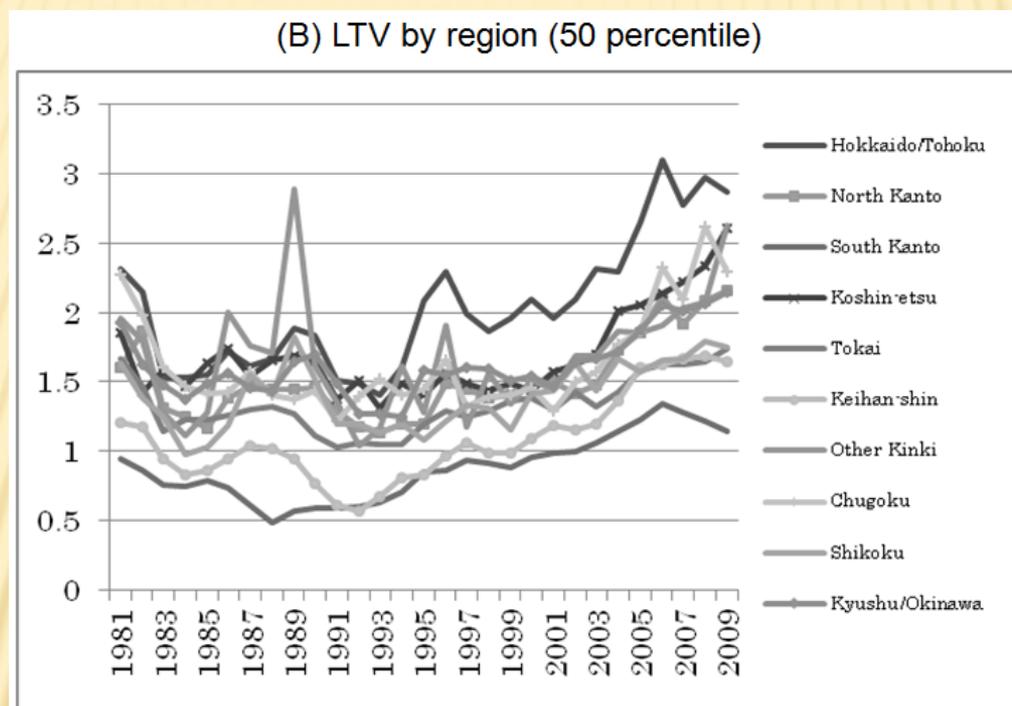
× Finding
+ Lower and stable LTV in urban areas (S. Kanto (incl. Tokyo), Keihanshin)
+ Decreasing trend in 1980s apparent only for urban areas
+ Earlier bottom for South Kanto (in 1988)

LTV by firm characteristics

× Sec. 3.2.5 (Figure 13 (A)): LTV by firm age

(A) Median LTV by firm age quartiles
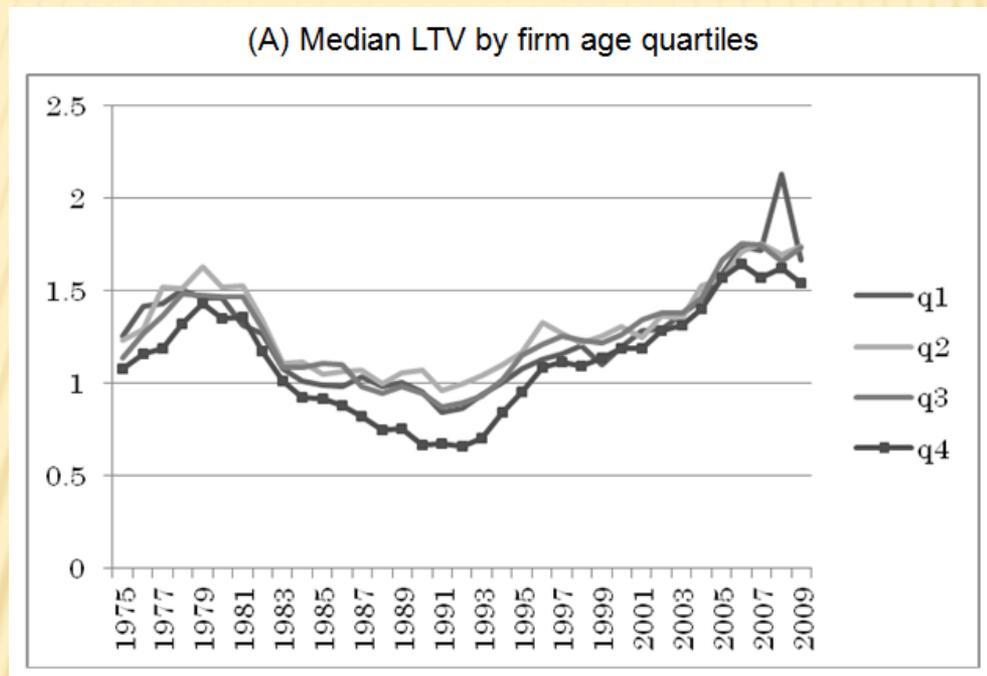
× Finding

+ Lower LTV for older firms (4th q.) especially during the bubble

+ (Interpretation: more assets or lower loan demand for older firms)

LTV by firm characteristics

× Sec. 3.2.5 (Figure 13): LTV by employee size (panel B), sales (panel C)

(B) Median LTV by employee size quartiles
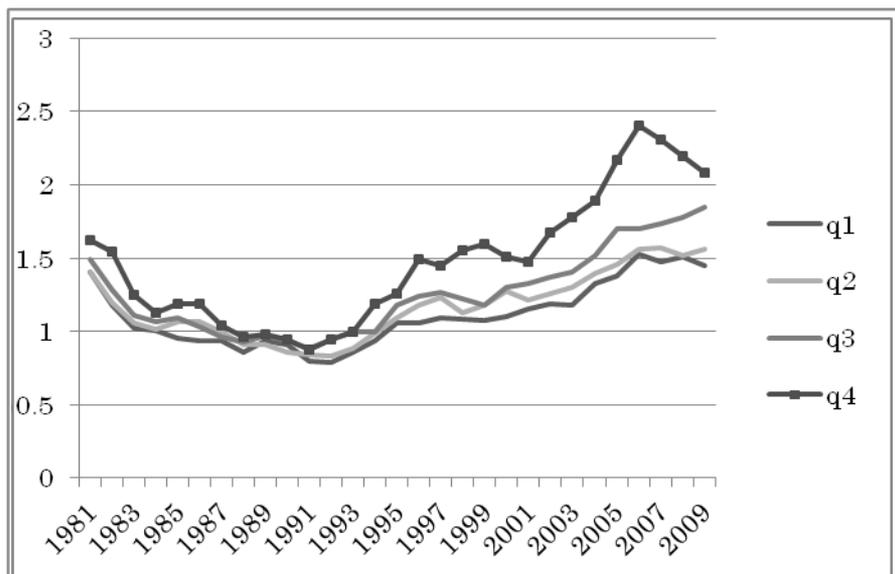
(C) Median LTV by sales quartiles
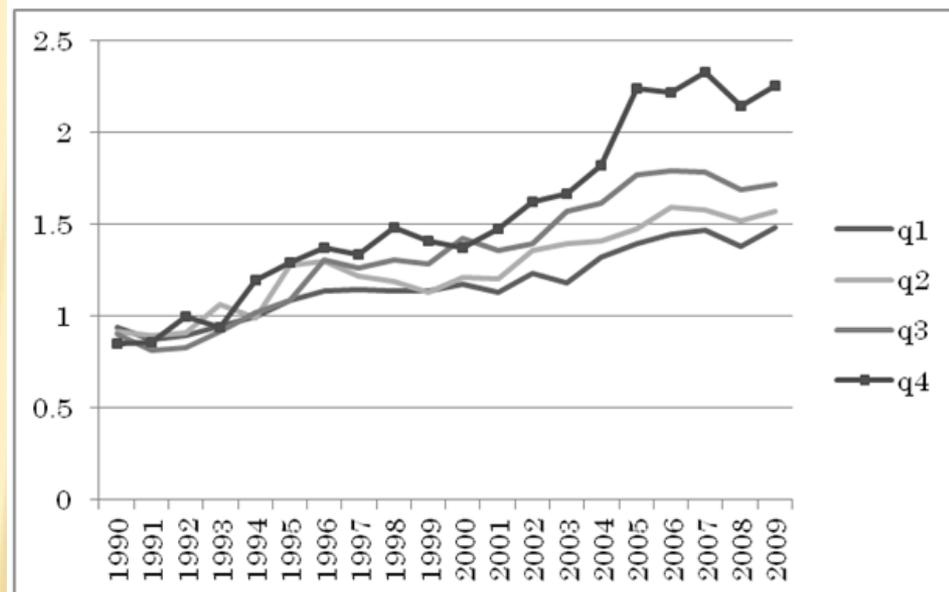
× Finding

+ Higher LTV ratio for larger firms, especially from the mid 2000s

  (Interpretation: large firms less financially constrained)

+ Smaller difference by firm size in pre-bubble period

LTV by firm characteristics

* Sec. 3.2.5 (Figure 13 (D)): LTV by ROA

(D) Median LTV by ROA quiartiles
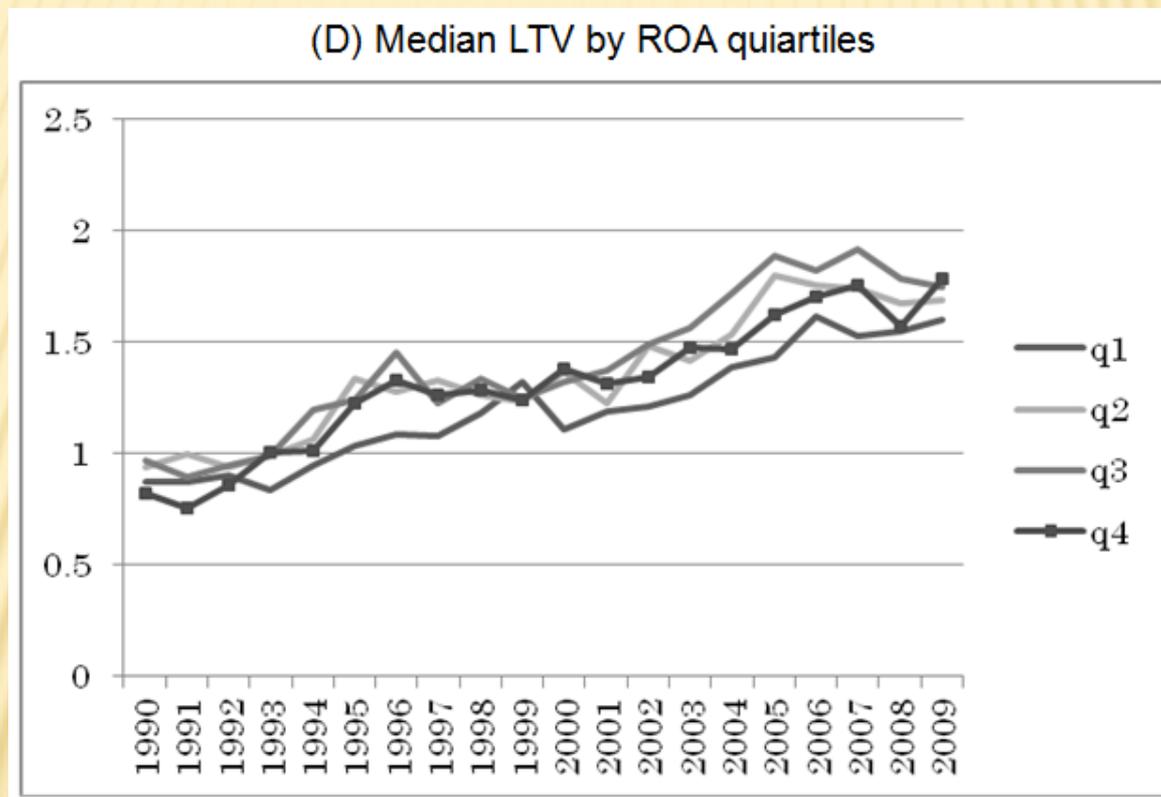
* Finding
  + No clear relationship between LTV and profitability

LTV by firm characteristics

✕ Sec. 3.2.5 (Figure 13 (E)): LTV by capital asset ratio

(E) Median LTV by capital ratio quartiles
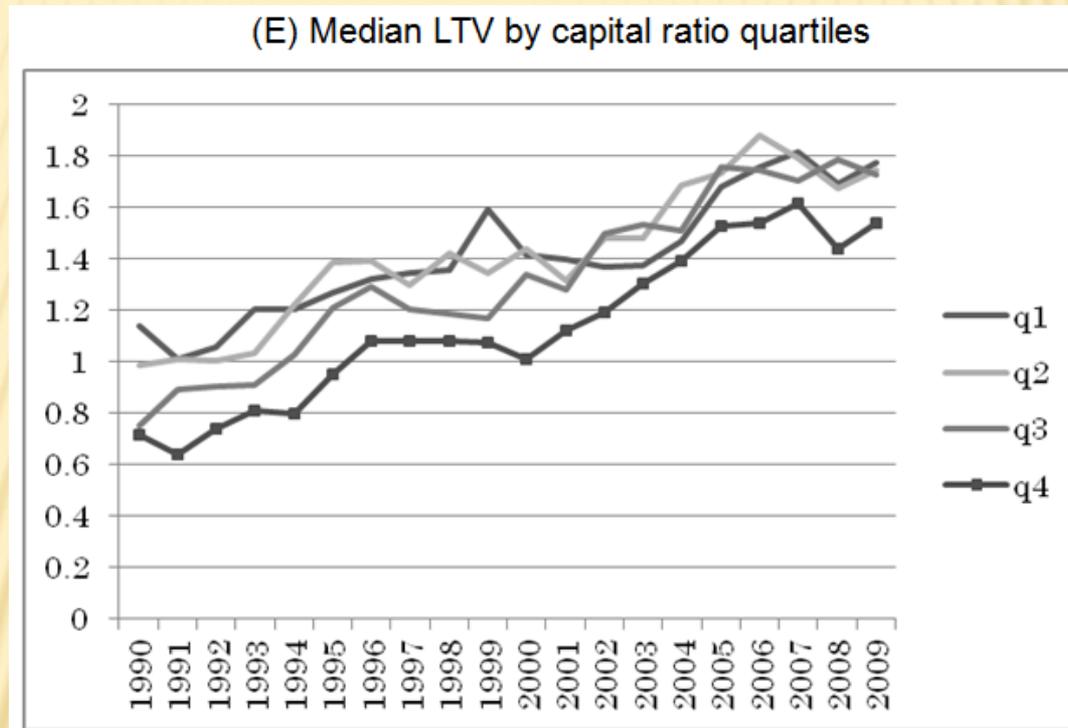
✕ Finding

+ Lower LTV for higher capital-asset ratio firms (4th q.)

+ (Interpretation: lower loan demand for lower-leverage firm)

LTV by lender type

× Sec. 3.2.6 (Figure 14 (A)): LTV by lender type

(A) Median LTV for private deposit-taking financial institutions
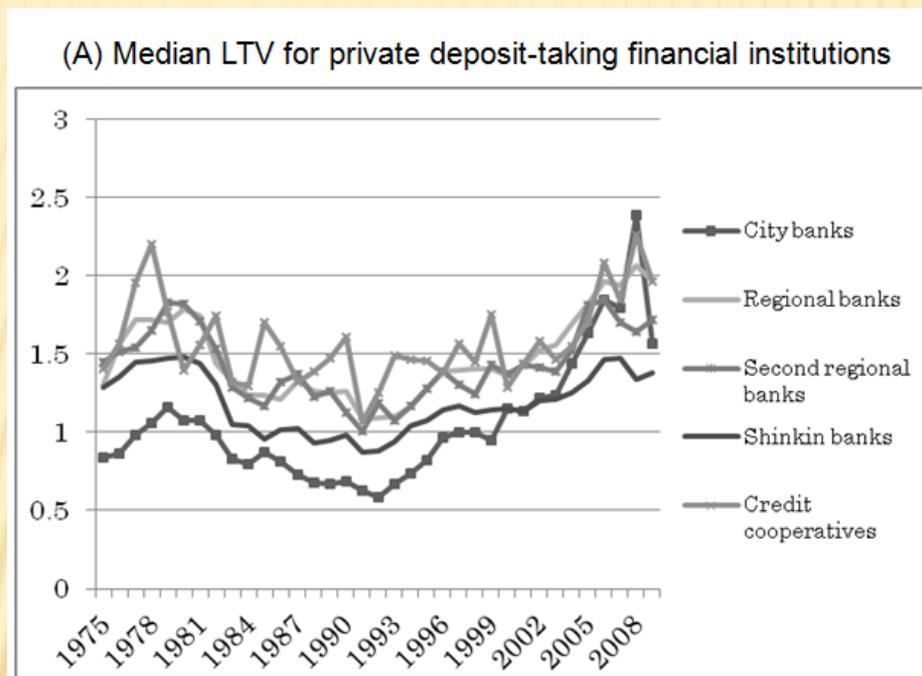
× Finding

+ Lower LTV for city (larger) banks before 2000

+ Stable and consistently low LTV for Shinkin banks (small-sized)

+ Note: Difference by lender type or difference by region?

× E.g., City banks lend to borrowers in rural areas

LTV by lender type

× Sec. 3.2.6 (Figure 15): Share of loans by lender type
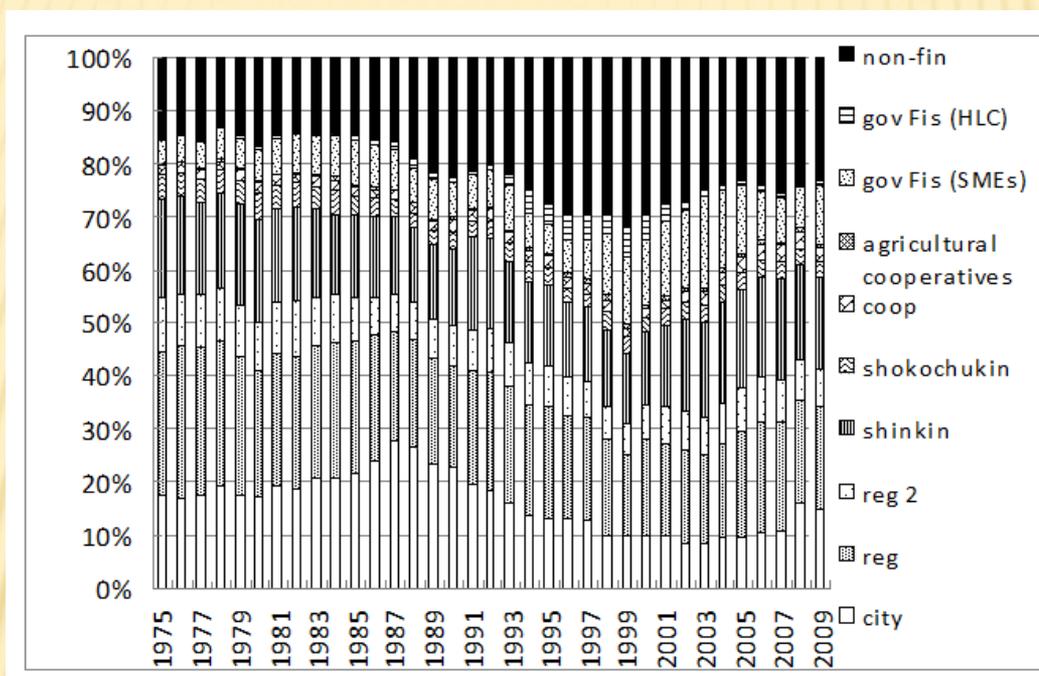
× Finding

+ Higher share for city banks during the mid 1980s

+ (Interpretation: boom-and-bust cycle of real-estate loans by city banks)

+ Maybe a consequence of financial disintermediation

× Large banks lend to "non-traditional" borrowers

LTV by lender characteristics

 × Sec. 3.2.8 (Figure 18 (A)): LTV by bank size

(A) Median LTV by banks' asset size quartiles
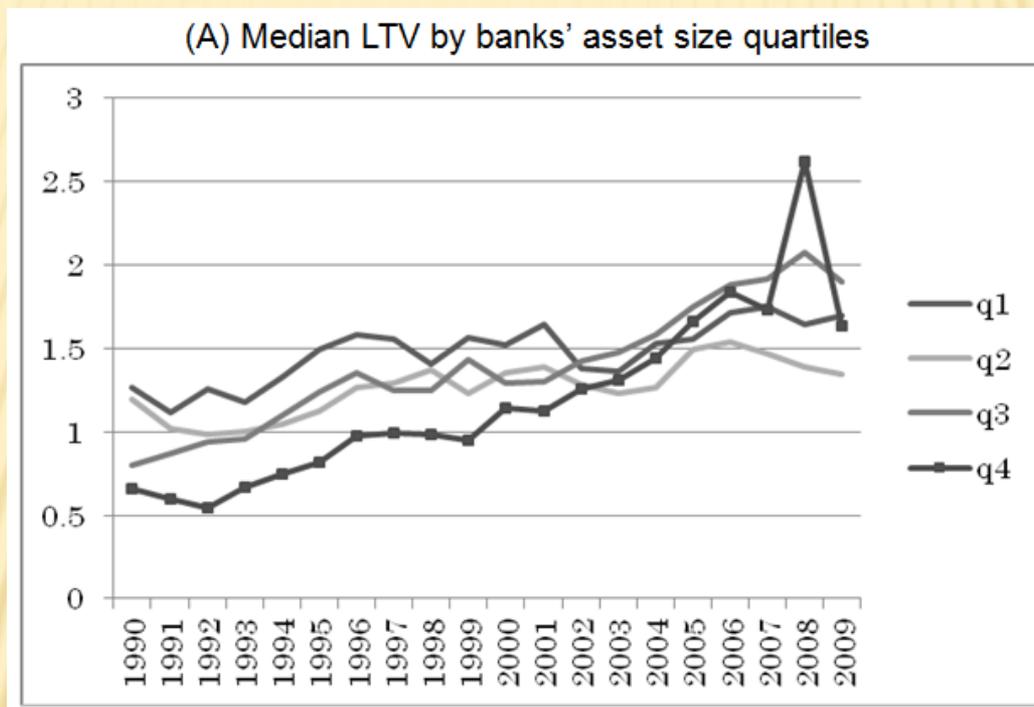
 × Finding

 + LTV lower for larger banks (4th q.) until early 2000s

 + (Interpretation: larger clients for larger banks and/or larger banks more risk-averse)

Univariate analysis

✖ However, these are after all univariate analyses

   ✚ To examine determinants of LTV, unsuitable

✖ → Regression analysis (sec. 3.3)

RESULT 3
REGRESSION (SEC. 3.3)

Regression

- ✖ Dependent variable: LTV ratio
- ✖ Independent variables:
    - ✚ Loan characteristics: Revolving or not, priority
    - ✚ Borrower characteristics: Sales, ROA, capital asset ratio, age, industry, region
    - ✚ Lender characteristics: Main bank status, bank type, asset size, ROA, capita asset ratio
    - ✚ Action program dummy: = 1 if *year>=2004* and lender is *regional or Shinkin bank, or credit cooperative*
        - ✖ Effect of ***Action Program on Relationship Banking*** by the Financial Services Agency (FSA) from 2003
            - ✶ requested regional lenders (regional, Shinkin, and credit cooperatives) to avoid an "excessive" reliance on collateral and personal guarantees
        - ✖ Expected impact: positive
    - ✚ Registration year dummies: represents unexplained cyclicality

Regression

- Results: Table 2 (pls. see p.41)

- LTV lower for revolving mortgages
  - Lenders cautious for revolving mortgages that do not specify maturity

- LTV lower for senior loans

- LTV higher for larger firms
  - Smaller financial constraints for large borrowers

- LTV lower for sounder and older firms
  - Interpretation: no need to raise funds and/or sufficient assets to pledge

- LTV higher for Real estate, Retail and restaurants, and Services firms
  - Int.: lax lending for Real estate firms
  - Int.: insufficient properties to pledge for Retail/restaurants and Services

Table 2　Regression results

Estimation method: Median regression	Panel (A): w/o lender financial variables				Panel (B): w/ lender financial variables			
Dependent variable: LTV	Coef.	Std. Err.	t	P>|t|	Coef.	Std. Err.	t	P>|t|
Loan characteristics								
L_REV	-0.053 ***	0.012	-4.52	0.000	-0.034 *	0.020	-1.69	0.090
L_PR1	-0.801 ***	0.021	-37.96	0.000	-0.602 ***	0.034	-17.81	0.000
L_PR2	0.159 ***	0.022	-7.12	0.000	0.006	0.036	0.18	0.859
L_PR3	0.097 ***	0.026	3.78	0.000	0.189 ***	0.042	4.53	0.000
L_PR4	0.100 ***	0.031	3.23	0.001	0.121 **	0.050	2.40	0.017
Firm characteristics								
F_LN_SALES	0.178 ***	0.004	40.42	0.000	0.219 ***	0.007	31.36	0.000
F_ROA	0.189 ***	0.025	7.73	0.000	0.417 ***	0.090	4.63	0.000
F_CAP	-0.049 ***	0.005	-9.33	0.000	-0.098 ***	0.019	-5.08	0.000
F_AGE	-0.008 ***	0.000	-21.62	0.000	-0.007 ***	0.001	-13.04	0.000
F_IND1	0.665 ***	0.027	24.23	0.000	0.644 ***	0.046	14.13	0.000
F_IND2	0.568 ***	0.029	19.32	0.000	0.537 ***	0.048	11.14	0.000
F_IND3	0.493 ***	0.029	17.13	0.000	0.474 ***	0.047	9.98	0.000
F_IND4	0.876 ***	0.034	25.66	0.000	0.917 ***	0.055	16.63	0.000
F_IND5	1.141 ***	0.035	32.76	0.000	1.222 ***	0.055	22.15	0.000
F_IND6	0.527 ***	0.039	13.61	0.000	0.493 ***	0.062	7.98	0.000
F_IND7	0.809 ***	0.032	25.58	0.000	0.823 ***	0.051	16.07	0.000
F_REG1	-0.623 ***	0.032	-19.54	0.000	-0.699 ***	0.051	-13.80	0.000
F_REG2	-1.131 ***	0.017	-65.27	0.000	-1.094 ***	0.029	-37.63	0.000
F_REG3	-0.305 ***	0.024	-12.87	0.000	-0.310 ***	0.038	-8.08	0.000
F_REG4	-0.717 ***	0.021	-33.87	0.000	-0.677 ***	0.034	-20.00	0.000
F_REG5	-0.898 ***	0.019	-46.82	0.000	-0.884 ***	0.032	-27.53	0.000
F_REG6	-0.515 ***	0.044	-11.75	0.000	-0.495 ***	0.072	-6.91	0.000
F_REG7	-0.490 ***	0.024	-20.52	0.000	-0.450 ***	0.039	-11.42	0.000
F_REG8	-0.734 ***	0.035	-20.96	0.000	-0.731 ***	0.054	-13.54	0.000
F_REG9	-0.459 ***	0.022	-21.20	0.000	-0.393 ***	0.034	-11.55	0.000

Regression

- Results: Table 2 (pls. see p.41)

- LTV lower for urban areas
  - Even after controlling for other borrower/lender characteristics
  - Interpretation: Merit of agglomeration
  - Int.: lenders cautious for revolving mortgages that do not specify maturity

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Regression

- ✖ Results: Table 2 (pls. see p.41)
- ✖ LTV higher for regional lenders (regional, Shinkin and credit cooperatives) and other lenders
  - ✖ Compared with city banks
- ✖ LTV lower for lenders subject to Action Program (to reduce dependence on collateral)
  - + Inconsistent with prior prediction
  - + Int.: to reduce NPLs (also aim of Program)
  - + Int.: non-secured lending increased
- ✖ LTV exhibit counter-cyclicality!
  - + Positive compared with y1990
  - + Even after controlling for various factors
  - + Even after controlling for bank financial variables
  - + No lax lending standard during the bubble

Table 2   Regression results

Lender characteristics								
BK_MAIN	-0.007		0.013	-0.54	0.592	-0.029 *	0.017	-1.73	0.084
BK_TYPE1	0.186 ***	0.019	9.84	0.000	0.158 ***	0.038	4.14	0.000
BK_TYPE2	0.126 ***	0.021	6.08	0.000	-0.004	0.055	-0.08	0.939
BK_TYPE3	0.207 ***	0.042	4.90	0.000				
BK_TYPE4	-0.006	0.019	-0.32	0.747				
BK_TYPE5	0.163 ***	0.047	3.46	0.001	0.284 ***	0.093	3.06	0.002
BK_TYPE6	0.004	0.019	0.21	0.832				
BK_POLICY	-0.075 ***	0.020	-3.68	0.000	-0.107 ***	0.038	-2.81	0.005
BK_ROA					-0.287	1.498	-0.19	0.848
BK_LN_ASSET					-0.024 **	0.011	-2.25	0.024
BK_CAP					-1.617 **	0.716	-2.26	0.024
Registration year								
YEAR1991	-0.036	0.038	-0.95	0.343	-0.057	0.057	-1.00	0.317
YEAR1992	0.002	0.038	0.05	0.960	-0.051	0.058	-0.89	0.373
YEAR1993	0.078 **	0.038	2.04	0.041	0.084	0.059	1.42	0.156
YEAR1994	0.201 ***	0.039	5.12	0.000	0.120 **	0.061	1.96	0.050
YEAR1995	0.403 ***	0.039	10.29	0.000	0.346 ***	0.062	5.60	0.000
YEAR1996	0.503 ***	0.039	12.86	0.000	0.460 ***	0.063	7.28	0.000
YEAR1997	0.471 ***	0.038	12.33	0.000	0.409 ***	0.062	6.61	0.000
YEAR1998	0.473 ***	0.038	12.51	0.000	0.438 ***	0.063	6.90	0.000
YEAR1999	0.508 ***	0.038	13.29	0.000	0.446 ***	0.067	6.68	0.000
YEAR2000	0.587 ***	0.037	15.70	0.000	0.587 ***	0.063	9.36	0.000
YEAR2001	0.608 ***	0.037	16.48	0.000	0.577 ***	0.063	9.22	0.000
YEAR2002	0.660 ***	0.037	18.03	0.000	0.652 ***	0.060	10.92	0.000
YEAR2003	0.763 ***	0.036	21.14	0.000	0.775 ***	0.058	13.28	0.000
YEAR2004	0.883 ***	0.037	23.89	0.000	0.937 ***	0.061	15.47	0.000
YEAR2005	1.014 ***	0.037	27.51	0.000	1.119 ***	0.060	18.60	0.000
YEAR2006	1.083 ***	0.037	29.66	0.000	1.193 ***	0.060	19.98	0.000
YEAR2007	1.069 ***	0.036	29.34	0.000	1.154 ***	0.059	19.47	0.000
YEAR2008	0.978 ***	0.036	27.02	0.000	1.029 ***	0.059	17.49	0.000
YEAR2009	0.983 ***	0.037	26.60	0.000	1.051 ***	0.060	17.40	0.000
constant	-0.813 ***	0.072	-11.24	0.000	-1.120 ***	0.211	-5.32	0.000
Number of Observations	71,751				38,017			
Pseudo R2	0.0197				0.0216			

EX POST PERFORMANCE (SEC. 4)

Ex post performance

- Prior prediction for ex post performance of high LTV borrowers
  - At first glance, POOR
    - High LTV ratio loans are riskier
      - high credit-risk exposure for the lender
    - (= reason for the ceilings on LTV)
      - To curb the riskiness of the lender
      - To prevent their excessive risk taking
  - But maybe NOT POOR
    - LTV is determined by various factors
      - Higher LTV ratio might be set for safer borrowers
      - (→ LTV cap might prevent creditworthy borrowers from borrowing)

Ex post performance

* Methodology
 + <u>DID</u> (difference-in-differences) comparison
    1. X : performance variable
       * Firm size or growth: # of employees (y1981-), sales (y1989-)
       * Firm profitability: ROA (y1989-)
       * Firm soundness: capital-asset ratio (y1989-)
    2. Take 5 year difference in X : $(X_{t+5} - X_t)$
       * to eliminate time invariant firm-fixed effects
    3. Compare the 5 year difference by LTV ratio

DID measure $= (X_{t+5} - X_t \text{ for } high\ LTV\ firms) - (X_{t+5} - X_t \text{ for } low\ LTV\ firms)$

Ex post performance

- Sec. 4 (Figure 19 (A)): Median DID in employee size

$$(X_{t+5} - X_t \text{ for high LTV firms}) - (X_{t+5} - X_t \text{ for low LTV firms})$$
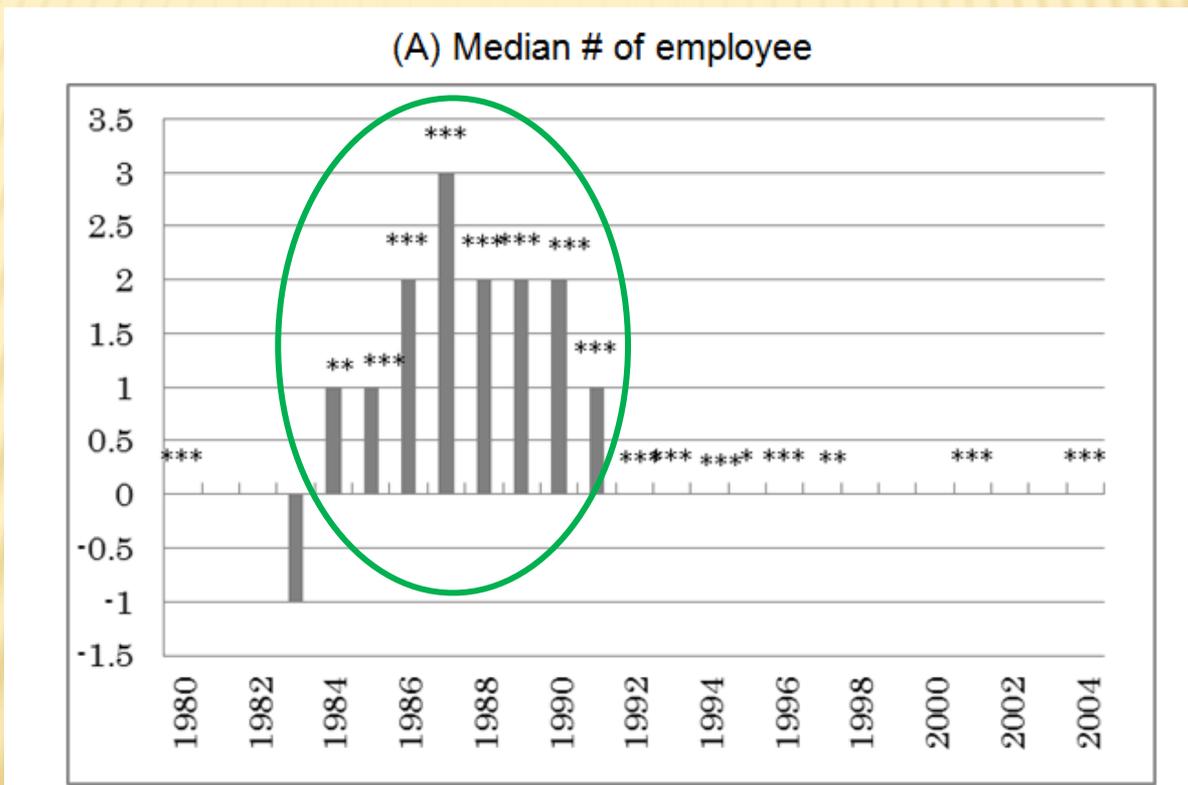
(A) Median # of employee

- Finding: Better performance for high LTV ratio firms during the bubble in terms of firm growth

Ex post performance

- Sec. 4 (Figure 19 (B)) : Median DID in sales

$$(X_{t+5} - X_t \text{ for high LTV firms}) - (X_{t+5} - X_t \text{ for low LTV firms})$$
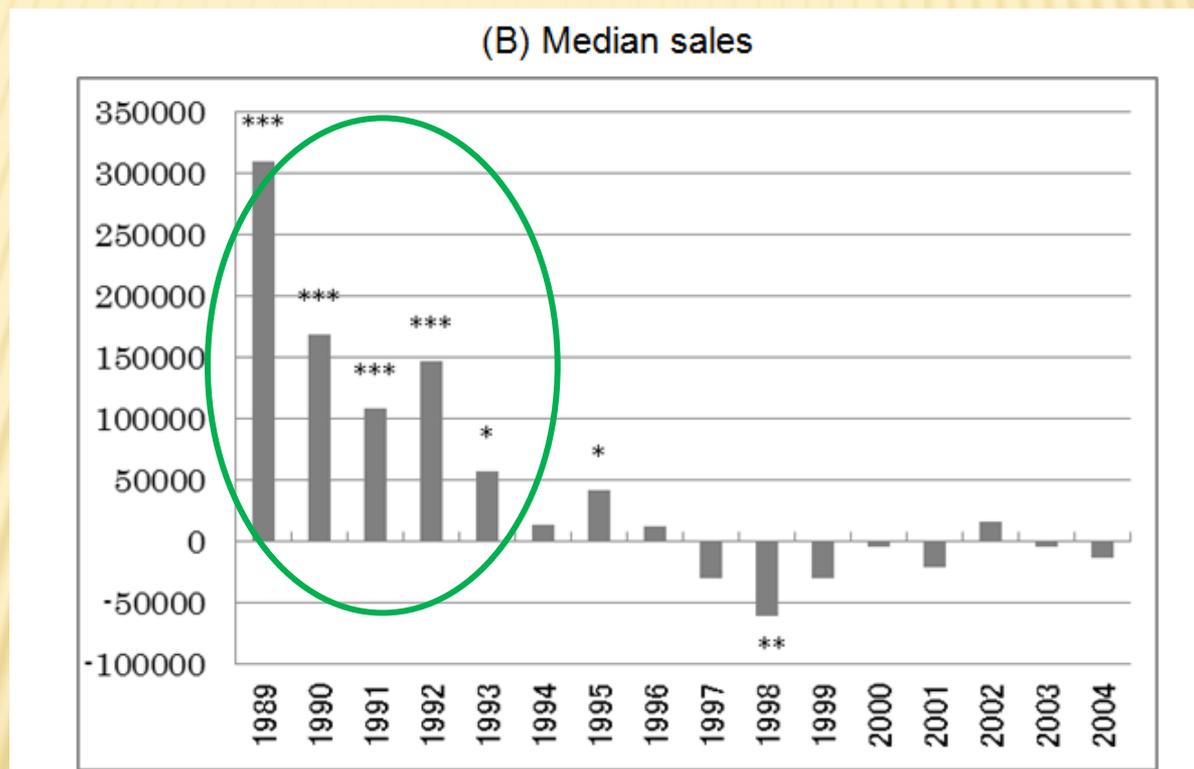
(B) Median sales

- Finding: Better performance for high LTV ratio firms during the bubble in terms of firm growth

Ex post performance

- Sec. 4 (Figure 19 (C)) : Median DID in ROA

$$(X_{t+5} - X_t \text{ for high LTV firms}) - (X_{t+5} - X_t \text{ for low LTV firms})$$

(C) Median ROA
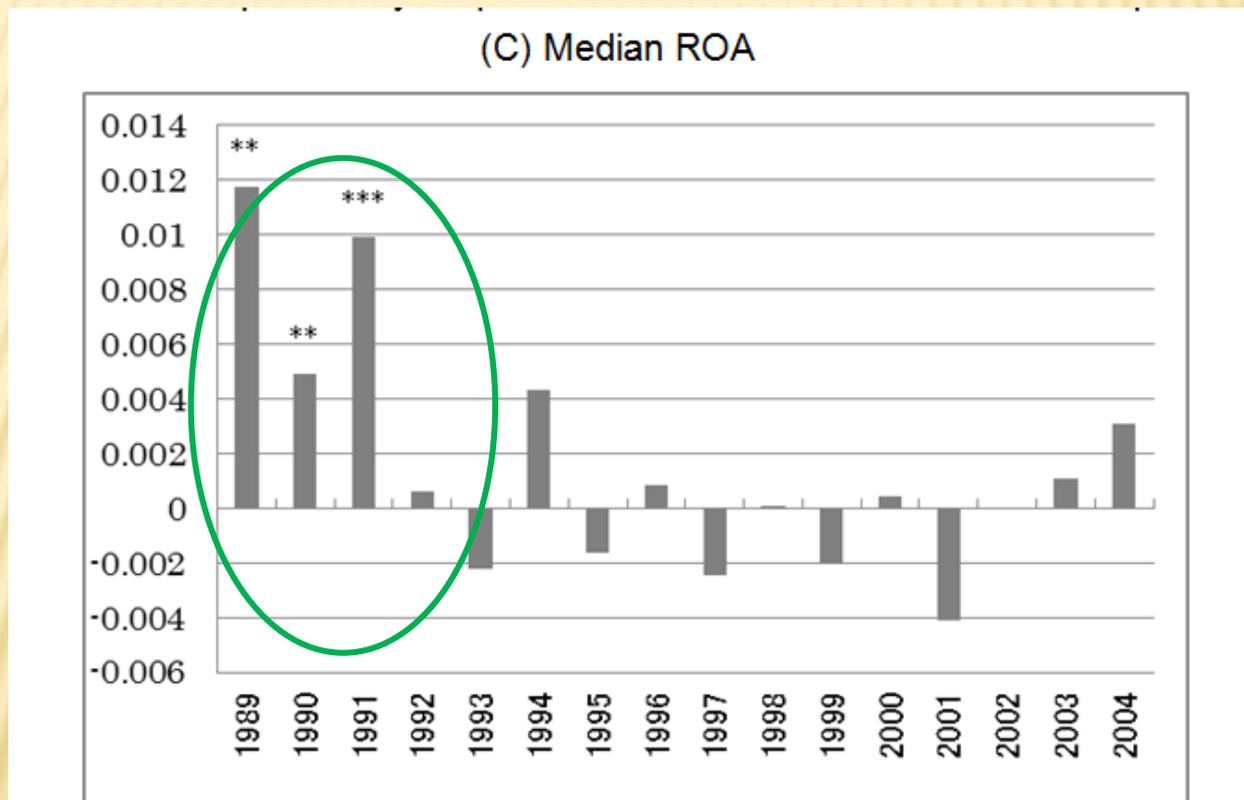
- Finding: Better performance for high LTV ratio firms during the bubble in terms of profitability

Ex post performance

- Sec. 4 (Figure 19 (D)) : Median DID in capital asset ratio

$$(X_{t+5} - X_t \textit{ for high LTV firms}) - (X_{t+5} - X_t \textit{ for low LTV firms})$$

(D) Median capital asset ratio
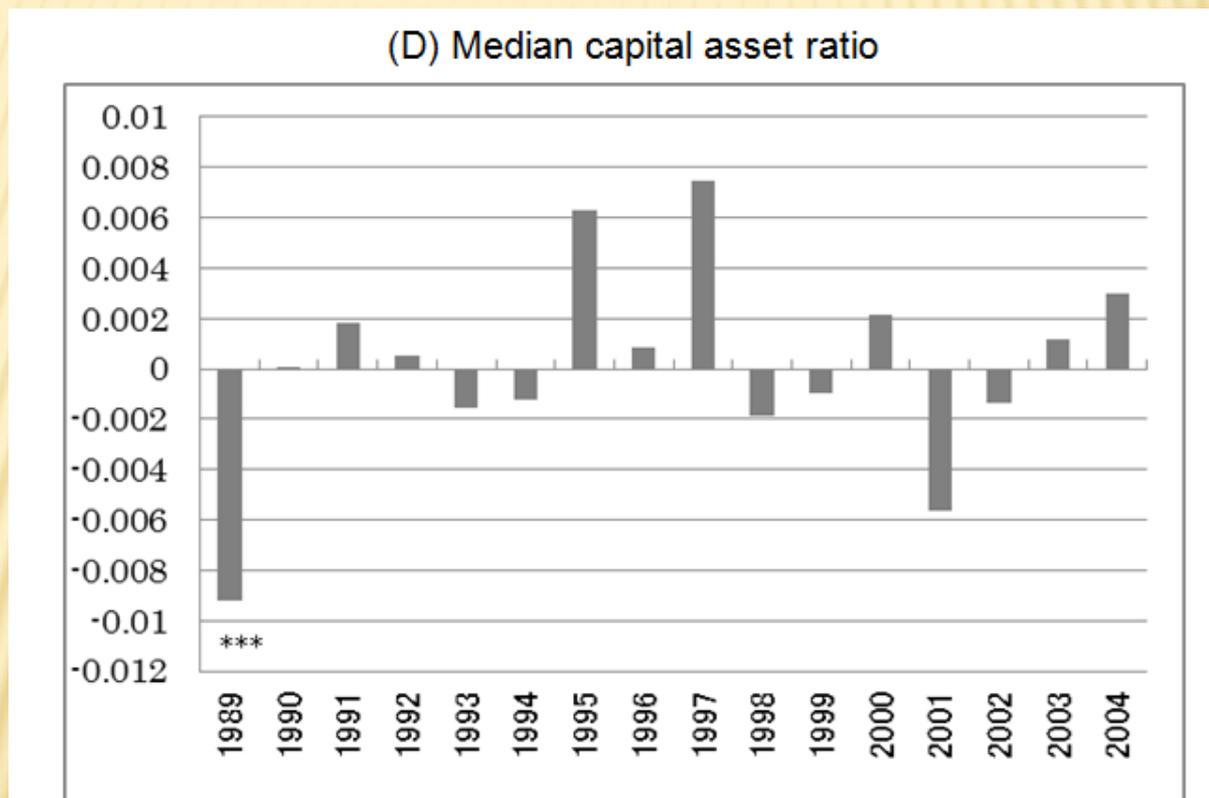
- Finding: No significant difference in terms of soundness

Ex post performance

- ✖ Results summary
  - ✚ In terms of size and profitability (first 3 panels)
    - ✖ Around the peak of the bubble
      - ★ Performance of high LTV firms (4th LTV quartile) better than that of low LTV firms (1st LTV quartile)
    - ✖ Other periods
      - ★ No such differences

SUMMARY AND CONCLUSION

Main findings

1. Sec.3.1: LTV ratio exhibits counter-cyclicality
   + Lower ratios during the bubble period (fig. 4)
     × Although L and V exhibit pro-cyclicality (fig. 3)
   + Robust to controlling for various loan-, borrower-, and lender-characteristics, and to the consideration for survival bias

2. Sec. 3.2, 3.3: LTV ratios associated with many loan-, borrower- and lender-characteristics
   + Various facts from univariate/regression analyses

3. Sec. 4: No worse ex post performance for high LTV firms
   + Rather better performance during the bubble period in terms of firm growth and profitability

Implication

- Conventional wisdom and our findings
  - Conventional wisdom
    - banks in Japan during the bubble lent with lax lending standards → bad loan problems
  - Inconsistent with our MAIN findings
  - But some of our findings are in support of the wisdom
    - Larger amount of loans with high LTV during the bubble when land price surged
    - More low-priority mortgages during the bubble
  - → At least more nuanced view of bank behavior during the bubble needed

Implication

- Policy implication
  - The cap on the LTV ratio as a macro prudential measure
    - Proponents
      - "Cap on LTV ratio → risky loans curbed → reduce bank risk"
    - Our findings
      - do not support this view
        - Low LTV ratios during the bubble period
        - No worse ex post performance for high LTV firms
      - Implication from our findings
        - Cap on the LTV ratio would be harmful for creditworthy borrowers

Extension

- Needed in many directions
  - Esp., need to focus on the margins of the LTV distribution

END OF PRESENTATION

THANK YOU