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

Arito Ono, Hirofumi Uchida, Gregory Udell, and Iichiro Uesugi

Presented at

HIT-TDB-RIETI International Workshop on the Economics of Interfirm Networks
November 30, 2012

Hirofumi Uchida
Graduate School of Business Administration, Kobe University

[Views expressed in this paper are those of the authors and do not necessarily reflect the views of the institutions with which they are affiliated]
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

+ \( \frac{\text{amount of a loan}}{\text{value of assets pledged as collateral}} \)
  - represent lenders’ risk exposure
  - decrease in V by 1-LTV percent \( \rightarrow \) debtor is in negative equity \( \rightarrow \) lender may suffer from losses (given default)
Background and Motivation

- LTV ratios are important in shock amplification mechanism within an economy
    - 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?”
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
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 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)

   - 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)
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
Evolution of LTV

- Figure 4: 25, 50, and 75 percentile of our LTV through 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)

- Consistent evidence: counter-cyclicality of LTV for *housing* loans
Evolution of LTV

- Robustness

  + Figure 6: Median LTV under different definition of \( V \) (denominator)
    - Perfect foresight: \( V(t+1) \)
    - Naïve interpolation: \( V(t-1) \cdot \{V(t-1)/V(t-2)\} \)
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))

Finding
- Panel (A): more land price surge $\rightarrow$ lower LTV $\rightarrow$ (interpretation) reluctant to lend more (given V)
- Panel (B) Counterfactual LTV (L(91)/V(86)): land price surge $\rightarrow$ 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
Sec. 3.2.2 (Figure 9): Median LTV by mortgage priority

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

- Sec. 3.2.3 (Figure 11): Median LTV by industry

- Finding
  - Higher LTV for Real estate, Services, and Retail and restaurants
  - Higher LTV for Construction before the bubble
  - Volatile LTV for Real estate
Sec. 3.2.4 (Figure 12): LTV by region

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

- 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)

- 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

- Finding
  - No clear relationship between LTV and profitability
LTV by firm characteristics

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

- 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

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
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

- 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 \( year \geq 2004 \) 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
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

![Table 2: Regression results]

**Table 2** Regression results

<table>
<thead>
<tr>
<th>Loan characteristics</th>
<th>Panel (A): w/o lender financial variables</th>
<th>Panel (B): w/ lender financial variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable: LTV</td>
<td>Coef.</td>
<td>Std. Err.</td>
</tr>
<tr>
<td>L_REV</td>
<td>-0.053***</td>
<td>0.012</td>
</tr>
<tr>
<td>L_PR1</td>
<td>-0.010***</td>
<td>0.021</td>
</tr>
<tr>
<td>L_PR2</td>
<td>-0.159***</td>
<td>0.022</td>
</tr>
<tr>
<td>L_PR3</td>
<td>0.097**</td>
<td>0.026</td>
</tr>
<tr>
<td>L_PR4</td>
<td>0.100**</td>
<td>0.031</td>
</tr>
<tr>
<td>Firm characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F_LN_SALES</td>
<td>0.178***</td>
<td>0.004</td>
</tr>
<tr>
<td>F_ROA</td>
<td>0.189**</td>
<td>0.025</td>
</tr>
<tr>
<td>F_CAP</td>
<td>-0.049***</td>
<td>0.005</td>
</tr>
<tr>
<td>F_AGE</td>
<td>-0.008</td>
<td>0.000</td>
</tr>
<tr>
<td>F_IND1</td>
<td>0.665**</td>
<td>0.027</td>
</tr>
<tr>
<td>F_IND2</td>
<td>0.568**</td>
<td>0.029</td>
</tr>
<tr>
<td>F_IND3</td>
<td>0.493**</td>
<td>0.029</td>
</tr>
<tr>
<td>F_IND4</td>
<td>0.876**</td>
<td>0.034</td>
</tr>
<tr>
<td>F_IND5</td>
<td>1.141**</td>
<td>0.035</td>
</tr>
<tr>
<td>F_IND6</td>
<td>0.527**</td>
<td>0.039</td>
</tr>
<tr>
<td>F_IND7</td>
<td>0.809**</td>
<td>0.032</td>
</tr>
<tr>
<td>F_REG1</td>
<td>0.623**</td>
<td>0.032</td>
</tr>
<tr>
<td>F_REG2</td>
<td>-1.131</td>
<td>0.017</td>
</tr>
<tr>
<td>F_REG3</td>
<td>-0.305**</td>
<td>0.024</td>
</tr>
<tr>
<td>F_REG4</td>
<td>0.217**</td>
<td>0.021</td>
</tr>
<tr>
<td>F_REG5</td>
<td>-0.398**</td>
<td>0.019</td>
</tr>
<tr>
<td>F_REG6</td>
<td>-0.515**</td>
<td>0.044</td>
</tr>
<tr>
<td>F_REG7</td>
<td>-0.490**</td>
<td>0.024</td>
</tr>
<tr>
<td>F_REG8</td>
<td>-0.734**</td>
<td>0.035</td>
</tr>
<tr>
<td>F_REG9</td>
<td>-0.459**</td>
<td>0.022</td>
</tr>
</tbody>
</table>
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
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)
Methodology

**DID (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** = $(X_{t+5} - X_t$ for *high LTV* firms) − $(X_{t+5} - X_t$ for *low LTV* firms)
Ex post performance

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

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

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

- 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

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

- 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

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

- 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 \(\rightarrow\) 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
  - \(\rightarrow\) 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 \( \rightarrow \) risky loans curbed \( \rightarrow \) 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