Lending Pro-Cyclicality and Macro-Prudential Policy: Evidence from Japanese LTV Ratios

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* Views expressed are those of the authors and do not necessarily reflect the views of the institutions with which they are affiliated

Motivation

- **Considerable interest in the efficacy of countercyclical macro-prudential policy levers**

- **We focus on one policy lever, *LTV Caps***

- **We use a unique large data set on Japanese real estate-based business lending from 1975 to 2009 to examine:**

  - whether LTV ratios in business lending were **pro-cyclical**,
  - whether there is a **negative relationship** between **LTV ratios and firm performance**, and
  - whether <u>simple</u> LTV caps would have worked in Japan

LTV Caps (cont.)

- **LTV caps are mostly focused on residential housing**

- **LTV caps could also be applied to many different kinds of loans besides residential mortgages**
  - **Commercial mortgages (e.g., India, Singapore)**
  - **Other consumer loans, e.g.,**
    - **Auto loans**
    - **RVs**
  - **Business loans, especially to SMEs**
    - **Equipment loans**
    - **Accounts receivable ABL loans (i.e., advance rates)**
    - **Inventory ABL loans (i.e., advance rates)**
    - **Real estate-based loans**

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  Short answers: No!

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  - **whether there is a negative relationship between LTV ratios and firm performance, and**
  - **whether <u>simple</u> LTV caps would have worked in Japan**

Countercyclical Macro-prudential Policy Tools (CMPPT)

- **Japanese and the recent global financial crises have prompted a search for countercyclical macro-prudential policy tools (CMPPT) to contain the build-up of system-wide financial risk**
  - Quite distinct from micro-prudential (institution-level) policies
  - Institutional risk can be low while systemic risk is rising

- **CMPPT "toolkit" contains a number of different tools, including but not limited to (CGFS 2012, Lim et al. 2011):**
  - Countercyclical capital buffers (Basel III Capital Framework)
  - Dynamic loan loss provisioning
  - Debt-to-income (DTI) standards
  - LTV caps

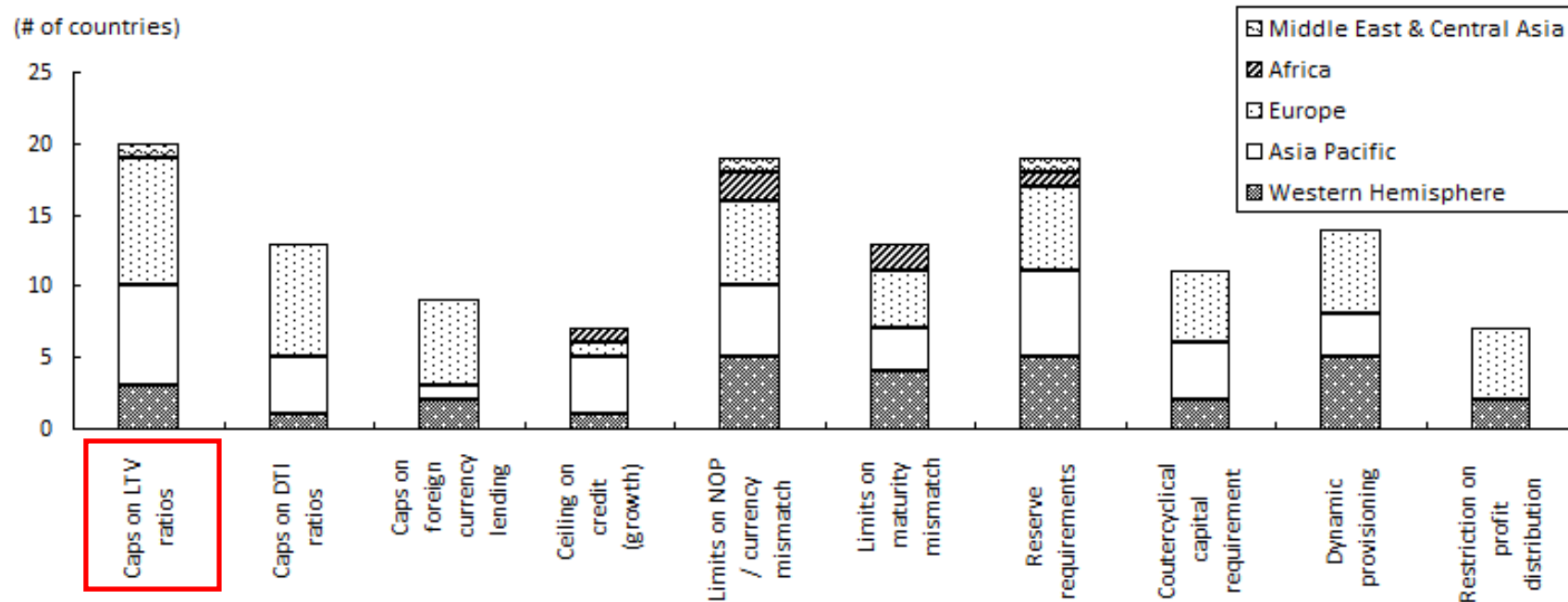# Countercyclical Macro-prudential Policy Tools (CMPPT)

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  - Debt-to-income (DTI) standards
  - **LTV caps** ← *Our focus*

LTV Caps

- **LTV caps have been implemented in a number of countries**
  - **2010 IMF survey found that 20 out of 49 countries use LTV caps (Crowe et al. 2013, Lim et al. 2011)**

(# of countries)

Legend:
- ⊠ Middle East & Central Asia
- ▨ Africa
- ⊡ Europe
- ☐ Asia Pacific
- ▩ Western Hemisphere

Categories: Caps on LTV ratios; Caps on DTI ratios; Caps on foreign currency lending; Ceiling on credit (growth); Limits on NOP / currency mismatch; Limits on maturity mismatch; Reserve requirements; Countercyclical capital requirement; Dynamic provisioning; Restriction on profit distribution

Sources: IMF Financial Stability and Macroprudential Survey 2010 (Lim et al. 2011)

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LTV Caps (cont.)

- **Explicit use of LTV caps rare before the crisis in developed economies**

    - **Canada and Denmark being the only exception (IMF 2011)**

    - **LTV caps incentivized through lower capital requirements for low LTV loans (FSB 2011)**

- **Some countries have introduced new LTV limits since this crisis (Canada, Malaysia, South Korea and Sweden)**

LTV Caps (cont.)

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    - Inventory ABL loans (i.e., advance rates)
    - **Real estate-based loans** ← **Our Focus**

LTV Caps (cont.)

- **As a CMPPT, LTV caps are designed to accomplish two objectives:**

  1. Dampen the acceleration of asset prices during a bubble period – *pricing channel*
  2. Limit the build-up of systemic risk in the financial system due to highly leveraged loans – *risk channel*

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    1. Dampen the acceleration of asset prices during a bubble period – *pricing channel*

    2. **Limit the build-up of systemic risk in the financial system due to highly leveraged loans – *risk channel***

    Our Focus

LTV Caps (cont.)

- **Effectiveness of LTV caps is unsettled in the theoretical literature (e.g., Suh 2013 vs. Goodhart, Kashyap, Tsomocos, & Vardoulakis 2012)**

- **Empirically the "effect of LTV ratios … is difficult to assess due to data limitations" (IMF 2011)**

  - **"That said, the existing empirical literature tentatively supports the effectiveness of LTV ratios in taming housing booms" (IMF 2011)**

  - **However, IMF also concludes "that there is no international consensus on the role and the design of limits to LTV and one should use the LTV-ratios with care."**

Our Context: Japan

- **We look at an alternative (counterfactual) application of LTV ratios in the special case of Japan**

  - **Business loans secured by real estate**

    - **Including both entrepreneur's residence and business real estate**

  - **Excessive real estate-based business lending in 1980s considered one of the primary causes of the bad loans in 1990s**

    - **Bad loan problems shared many similarities to other countries**

  - **Ours is first study to analyze LTV ratios in business lending using disaggregated data**

    - **We focus on the "risk channel" (➔)**

Data and LTV Definition

- **Main dataset constructed from Teikoku Databank (TDB)**
  - **Largest credit information provider in Japan**
  - **Detailed info on business loan collateral registered during the period 1975 to 2009**
  - **TDB gets real estate data from the official real estate registry in Japan**
    - **Property characteristics (e.g., acreage, land and bldg type)**
    - **Ownership**
    - **Security interests and loan amounts when registered**

Data and LTV Definition (cont.)

- **Prices from Public Notice on Land Prices (PNLP) data compiled by the Japanese government**

  - **Estimate hedonic model of land prices as a function of property characteristics using observations of about 25,000 places/year**

  - **Apply coefficients on characteristics to the TDB data to estimate property value *at origination***

- **Origination LTV ratios**

  - **Relevant to the loan underwriting decision**

  - **Most LTV caps imposed at the time of origination**

Data and LTV Definition (cont.)

- **How do we obtain *L* (loan amounts)?**

【担保権等の設定状態】

《根抵当権》　　　A 印　　2 点　　登記年月日　　平　2 年　2 月　4 日
　　　　　　　　　　　　　　　　　設定年月日　　平　2 年　1 月 3 1 日
　　　　　　　　　　　　　　　　　債　権　者　　みずほ銀行（銀座）
　　　　　　　　　　　　　　　　　債　務　者　　帝国テクノツール（株）
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　　　　　　　　　　　　　　　　　債　権　者　　三井住友銀行（銀座）
　　　　　　　　　　　　　　　　　債　務　者　　帝国テクノツール（株）
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Data and LTV Definition (cont.)

- **How do we obtain *V* (value of land)=acreage*estimated unit price?**

【物　件】

《所有者》　帝国テクノツール（株）　（東京都港区南青山２－５－２０）

【符号】	【物件の所在地】 【物件の種類・構成】	【家屋番号】 【面積㎡】
ＡＣ	東京都板橋区大谷口上町１０（一四） 宅地 昭和５０年６月２０日　売買取得	119.68
ＢＣ	東京都中央区銀座２－１（一） 宅地 平成３年３月３日　売買取得	482.40

Our Analysis

- **<u>Three parts</u>**

    1. LTV Cyclicality (Univariate Analysis):

    - *Are LTV ratios pro-cyclical?*

    2. LTV Cyclicality (Multivariate Analysis):

    - *Are LTV ratios pro-cyclical controlling for loan, borrower and lender characteristics?*

    3. Ex post performance of high-LTV loans (firms):

    - *Do high-LTV loans (firms) perform worse?*

Some Data Limitations

- **Only information on firms in the TDB database between 2008-2010**
  - Loans stay in database if unpaid or if permanent W/C lien
  - Survivorship bias (➔)

    Solution ➔ *Controls in multivariate analysis*

- **Control variables only since 1990 (firm characteristics/financials, industry, lender identity)**

    Solution ➔ *Multivariate analysis limited to post bubble*

- **No information on seniority (➔)**

    Solution ➔ *Use registration date*

- **No subsequent information on loan performance**

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Sample

- **Final sample**

  - **420,889 total observations on collateral registrations originated between 1975 to 2009**

  - **For 297,692 firms from 1990 to 2009**
    - **Basic firm characteristics, e.g., no. of employees**
    - **Industry**
    - **Location**
    - **Lender identity**

  - **For subset of 59,125 firms we also have financial statements**

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LTV Cyclicality: Univariate Analysis

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  LTV Cyclicality:
  Multivariate Analysis

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  Ex Post Performance

Cyclicality of LTV Ratios

- **Background: The business cycle and the bubble in Japan:**
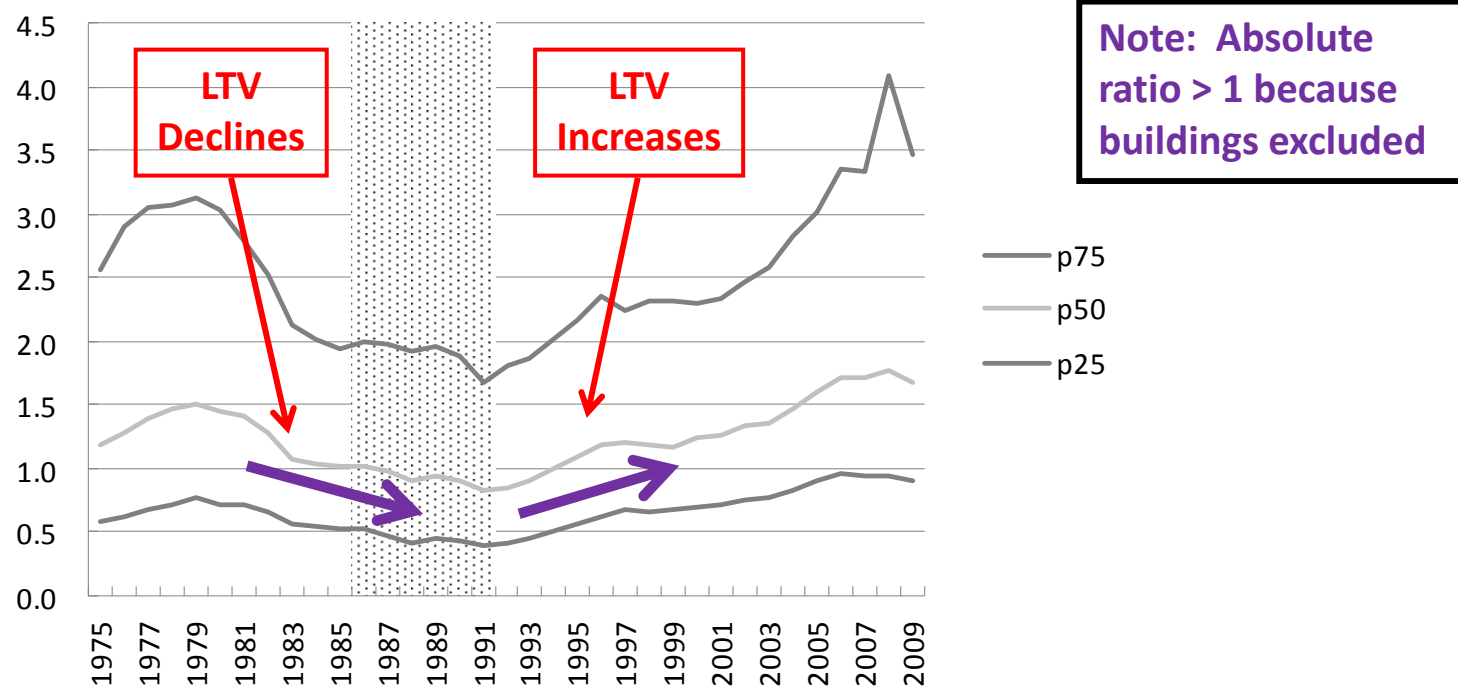 - **Real GDP, the average land price, and bank loans outstanding**
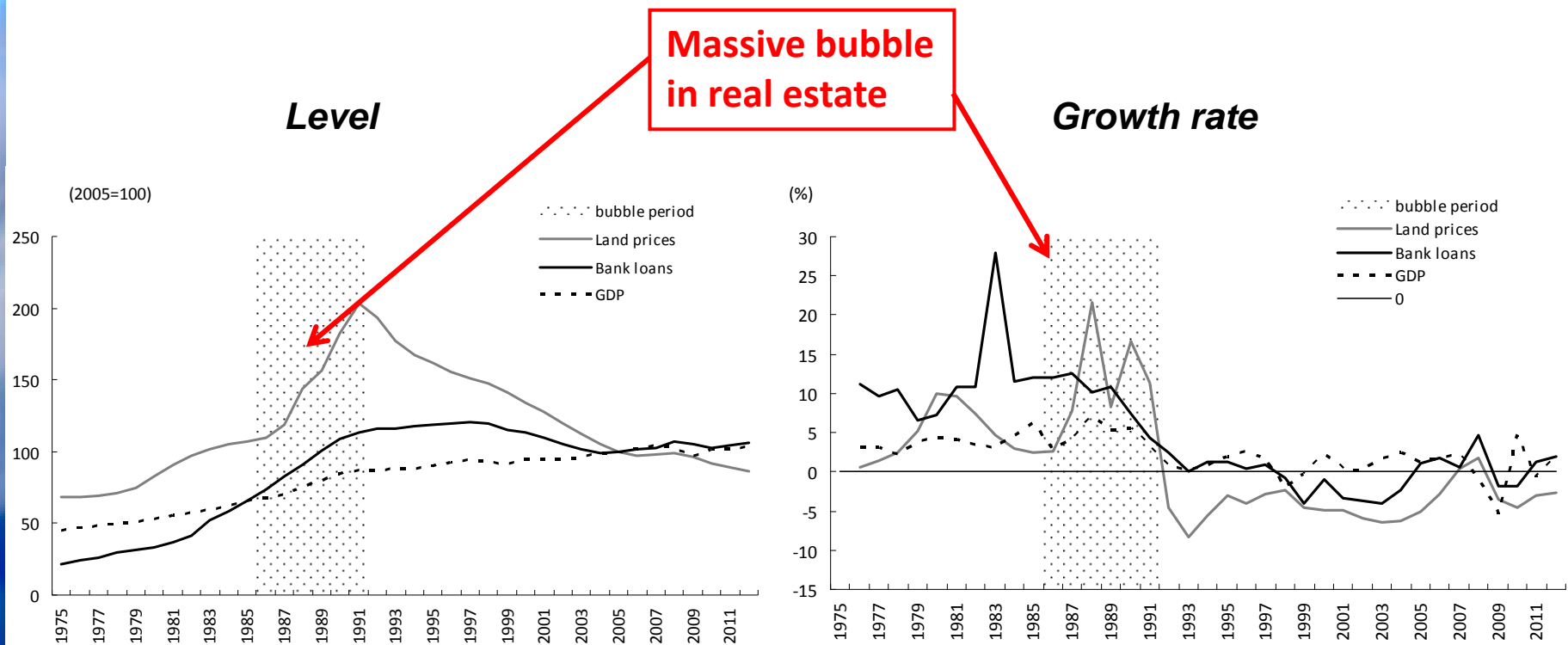
Cyclicality of LTV Ratios (cont.)

- **LTV cyclicality - 25, 50, and 75 percentile of over the business cycle**

Cyclicality of LTV Ratios (cont.)

- **LTV cyclicality - 25, 50, and 75 percentile of over the business cycle**

Note: Absolute ratio > 1 because buildings excluded
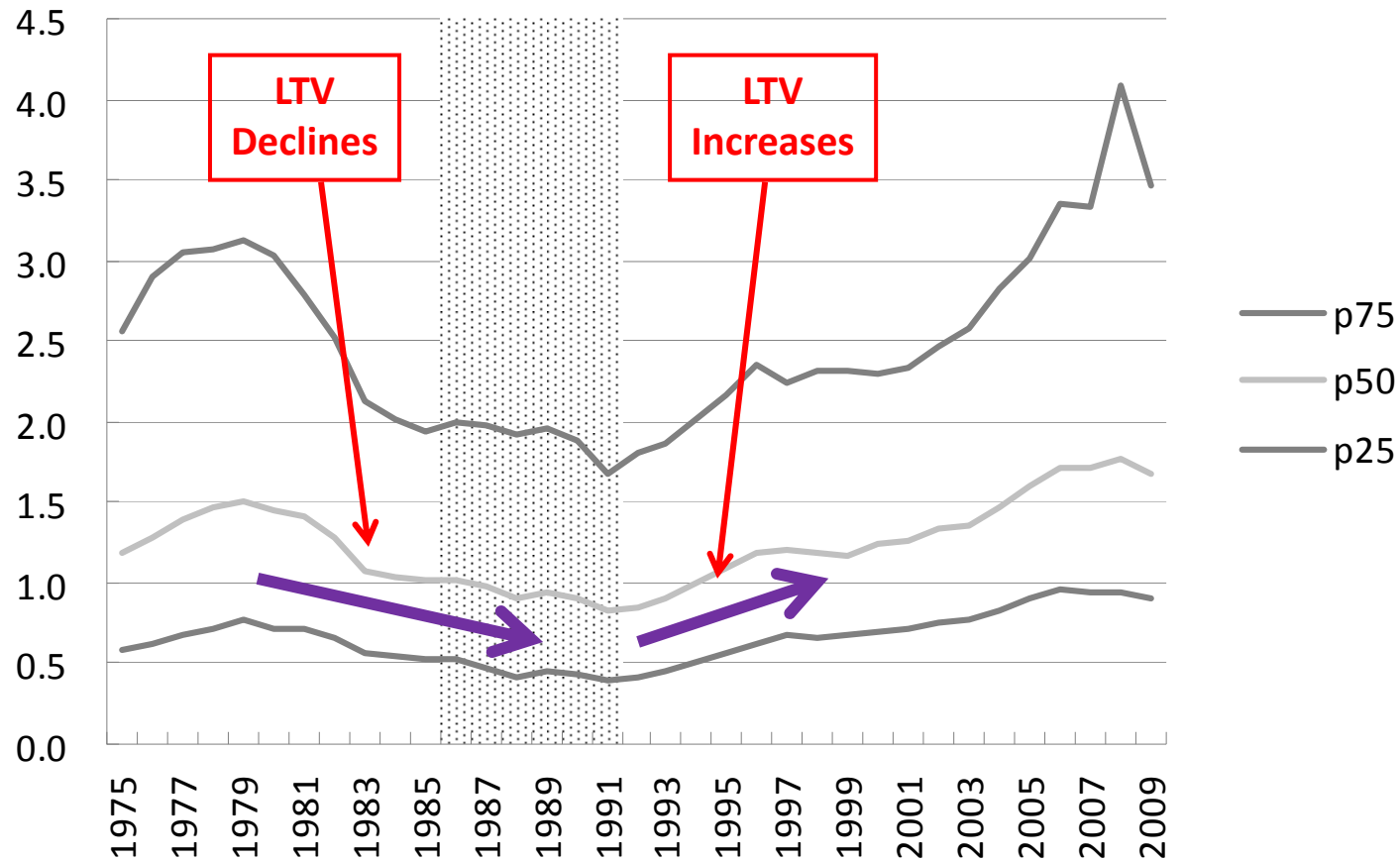
- **Finding: counter-cyclicality, at least until early 2000s**
  - **Increase in L during the bubble more than offset by increase in V**
  - **Banks' exposure did not increase proportionately during the bubble**
  - **Simple LTV cap might not have been effective during the bubble**

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Cyclicality of LTV Ratios: Multivariate Analysis

- **Dependent variable: LTV ratio**

- **Key independent variables: year dummies (default: 1990)**

- **Purpose**

  - **Does counter-cyclicality hold after**

    - **controlling for a variety factors, and**

    - **at least partially controlling for survivorship bias?**

    Note: To the extent that counter-cyclicality disappears, our prior univariate finding was an artifact of differences in loan-, borrower- and/or lender characteristics in different years part of which might have stemmed from survivorship bias.

- **Quantile (median) regression**

  - **Due to data limitations, sample period begins with 1990**

  - **As robustness: OLS regression w/o 1% tails**

Cyclicality of LTV Ratios: Multivariate Analysis (cont.)

Estimation method: Quantile regression	(A) Median (p50)		(B) p10		(C) p90	
Devendent variable: *LTV*	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
Registration year						
YEAR1991	-0.019	(0.045)	-0.054 **	(0.023)	-0.015	(0.224)
YEAR1992	0.003	(0.045)	-0.032	(0.023)	-0.157	(0.224)
YEAR1993	0.055	(0.046)	0.001	(0.023)	0.000	(0.228)
YEAR1994	0.212 ***	(0.047)	0.070 ***	(0.024)	0.632 ***	(0.233)
YEAR1995	0.403 ***	(0.046)	0.151 ***	(0.024)	0.870 ***	(0.233)
YEAR1996	0.531 ***	(0.046)	0.207 ***	(0.023)	0.959 ***	(0.231)
YEAR1997	0.451 ***	(0.045)	0.213 ***	(0.023)	0.959 ***	(0.226)
YEAR1998	0.465 ***	(0.044)	0.219 ***	(0.022)	0.890 ***	(0.222)
YEAR1999	0.506 ***	(0.045)	0.262 ***	(0.023)	0.896 ***	(0.225)
YEAR2000	0.606 ***	(0.044)	0.283 ***	(0.022)	1.031 ***	(0.222)
YEAR2001	0.617 ***	(0.043)	0.297 ***	(0.022)	1.275 ***	(0.218)
YEAR2002	0.690 ***	(0.043)	0.353 ***	(0.022)	1.152 ***	(0.217)
YEAR2003	0.791 ***	(0.042)	0.362 ***	(0.021)	1.380 ***	(0.214)
YEAR2004	0.884 ***	(0.043)	0.414 ***	(0.022)	1.947 ***	(0.217)
YEAR2005	1.030 ***	(0.043)	0.457 ***	(0.022)	1.772 ***	(0.217)
YEAR2006	1.079 ***	(0.042)	0.490 ***	(0.021)	2.152 ***	(0.215)
YEAR2007	1.048 ***	(0.042)	0.476 ***	(0.021)	2.253 ***	(0.213)
YEAR2008	0.995 ***	(0.042)	0.439 ***	(0.021)	2.282 ***	(0.214)
YEAR2009	0.985 ***	(0.043)	0.434 ***	(0.022)	2.227 ***	(0.216)

Cyclicality of LTV Ratios: Multivariate Analysis (cont.)

- **LTV ratios still exhibit counter-cyclicality**

  – **Positive after 1994 compared with 1990**

  – **Simple LTV cap might not have been effective during the bubble**

- **Robustness (p10, p90)**

  – **Counter-cyclicality is preserved**

  – **Larger (smaller) coefficients for p90 (p10)**

    - **Counter-cyclicality of LTV ratios is amplified for high LTV loans**

    - **→ Effectiveness of simple LTV caps is doubtful**

Ex Post Performance

- **Methodology**
  - **First step**: Construct treatment and control groups
    - Treatment group: Firms that obtained **high-LTV loans** (**4th quartile** of entire sample)
    - Control group: 2 alternative procedures
      1. **Unmatched**: firms obtaining non high-LTV loans
      2. **Matched** control group: propensity score matched firms
  - **Second step**: Compare subsequent performance 1 to 5 years later in **DID (difference-in-differences)**
    - Firm size
    - Firm profitability
    - Firm risk

Ex Post Performance (cont.)

(1) Unmatched control

High LTV (treatment) better

(1) Unmatched control

		(A) Entire sample			(B) 1990-1994			(C) 1995-1999			(D) 2000-2004		
		Treatment	Control	DID	Treatment	Control	DID	Treatment	Control	DID	Treatment	Control	DID
d_F_EMP	t+1	0.417	0.217	0.200 ***	1.463	0.673	0.789 ***	-0.022	-0.155	0.133	0.165	0.087	0.078
	t+2	0.487	0.283	0.204 **	2.070	1.001	1.069 ***	-0.477	-0.575	0.098	0.387	0.288	0.100
	t+3	0.278	0.137	0.141	2.128	0.817	1.311 ***	-1.497	-1.252	-0.246	0.459	0.486	-0.027
	t+4	0.194	0.054	0.140	2.074	0.402	1.672 ***	-2.472	-1.857	-0.614 *	0.640	0.809	-0.169
	t+5	0.108	-0.136	0.244	1.427	-0.337	1.764 ***	-3.009	-2.326	-0.682	0.816	1.042	-0.226
d_F_lnSALES	t+1	0.008	0.007	0.001	0.027	0.002	0.025 ***	0.001	0.003	-0.002	0.014	0.019	-0.006
	t+2	0.010	0.008	0.002	0.031	-0.005	0.036 ***	-0.018	-0.007	-0.011	0.036	0.038	-0.002
	t+3	0.008	0.009	-0.001	0.048	-0.004	0.052 ***	-0.043	-0.029	-0.014 *	0.049	0.057	-0.009
	t+4	0.005	0.008	-0.003	0.047	-0.008	0.055 ***	-0.074	-0.051	-0.023 **	0.059	0.080	-0.021 ***
	t+5	-0.003	0.002	-0.005	0.029	-0.023	0.052 ***	-0.085	-0.059	-0.026 **	0.042	0.072	-0.030 ***
d_F_ROA	t+1	-0.005	-0.005	0.000	-0.007	-0.007	0.001	-0.002	-0.003	0.001	-0.003	-0.002	-0.001
	t+2	-0.005	-0.006	0.001	-0.010	-0.013	0.003 *	-0.001	-0.002	0.001	-0.001	-0.002	0.000
	t+3	-0.006	-0.008	0.001 **	-0.012	-0.017	0.005 ***	0.000	-0.002	0.002	-0.003	-0.002	-0.001
	t+4	-0.006	-0.008	0.002 **	-0.014	-0.019	0.005 ***	0.000	-0.002	0.002	-0.003	-0.002	-0.001
	t+5	-0.007	-0.009	0.003 ***	-0.018	-0.022	0.004 **	0.001	-0.001	0.002	-0.006	-0.006	0.000
d_F_LEV	t+1	-0.003	-0.002	-0.001	-0.003	-0.001	-0.002 *	0.001	0.000	0.002	0.000	0.000	0.000
	t+2	0.001	0.002	-0.001	0.001	0.004	-0.003	0.009	0.005	0.004 **	0.004	0.004	0.000
	t+3	0.006	0.007	-0.001	0.007	0.008	-0.001	0.015	0.012	0.003	0.008	0.008	0.000
	t+4	0.013	0.013	-0.001	0.012	0.014	-0.002	0.023	0.020	0.003	0.013	0.012	0.000
	t+5	0.020	0.019	0.001	0.019	0.019	0.000	0.032	0.026	0.006 **	0.018	0.017	0.001

Ex Post Performance (cont.)

(2) Matched control

High LTV (treatment) better

(2) Matched control

		(A) Entire sample			(B) 1990-1994			(C) 1995-1999			(D) 2000-2004		
		Treatment	Control	DID		Treatment	Control	DID		Treatment	Control	DID	Treatment	Control	DID
d_F_EMP	t+1	0.417	0.257	0.160 *	1.463	0.821	0.642 **	-0.022	-0.283	0.261	0.165	0.117	0.048
	t+2	0.487	0.302	0.185	2.070	1.200	0.870 **	-0.477	-0.936	0.458	0.387	0.297	0.091
	t+3	0.278	0.165	0.113	2.128	1.026	1.103 **	-1.497	-1.884	0.386	0.459	0.468	-0.009
	t+4	0.194	-0.010	0.203	2.074	0.378	1.697 ***	-2.472	-2.883	0.411	0.640	0.790	-0.150
	t+5	0.108	-0.316	0.423	1.427	-0.806	2.233 ***	-3.009	-3.420	0.411	0.816	0.989	-0.173
d_F_lnSALES	t+1	0.008	0.004	0.005	0.027	0.005	0.023 ***	0.001	-0.003	0.003	0.014	0.015	-0.001
	t+2	0.010	0.005	0.005	0.031	0.001	0.030 ***	-0.018	-0.013	-0.004	0.036	0.031	0.005
	t+3	0.008	0.003	0.005	0.048	0.009	0.038 ***	-0.043	-0.039	-0.004	0.049	0.047	0.001
	t+4	0.005	0.006	-0.001	0.047	0.003	0.043 ***	-0.074	-0.065	-0.009	0.059	0.073	-0.014
	t+5	-0.003	0.000	-0.003	0.029	-0.006	0.035 ***	-0.085	-0.076	-0.009	0.042	0.052	-0.010
d_F_ROA	t+1	-0.005	-0.005	0.001	-0.007	-0.006	0.000	-0.002	-0.003	0.001	-0.003	-0.003	0.000
	t+2	-0.005	-0.005	0.000	-0.010	-0.012	0.002	-0.001	-0.001	0.000	-0.001	0.000	-0.001
	t+3	-0.006	-0.007	0.001	-0.012	-0.015	0.003	0.000	-0.001	0.001	-0.003	-0.001	-0.002
	t+4	-0.006	-0.007	0.000	-0.014	-0.017	0.003 *	0.000	-0.001	0.001	-0.003	0.000	-0.003 *
	t+5	-0.007	-0.008	0.001	-0.018	-0.020	0.002	0.001	0.000	0.001	-0.006	-0.007	0.000
d_F_LEV	t+1	-0.003	-0.002	-0.001	-0.003	-0.001	-0.002	0.001	0.000	0.001	0.000	-0.001	0.000
	t+2	0.001	0.002	-0.001	0.001	0.003	-0.002	0.009	0.006	0.004 *	0.004	0.004	0.000
	t+3	0.006	0.007	0.000	0.007	0.007	-0.001	0.015	0.012	0.002	0.008	0.006	0.002
	t+4	0.013	0.013	0.000	0.012	0.012	0.000	0.023	0.022	0.001	0.013	0.011	0.002
	t+5	0.020	0.017	0.003	0.019	0.017	0.002	0.032	0.025	0.007 **	0.018	0.014	0.004

Ex Post Performance (cont.)

- **Results:**
  - **Unmatched DID estimator**
    - Some evidence of *better* performance especially **in 1990-94**
    - No significant differences after 1994

  - **Matched DID estimator**
    - Similar to unmatched (some *better* performance but not after 1994)

- **Implications**
  - High LTV ratios do not reflect by themselves lax lending standards
  - Imposing a simple LTV cap might constrain lending to growing firms

Summary and Conclusion

Main findings:

1. LTV ratio exhibits **counter-cyclicality**, not pro-cyclicality

   – Lower ratios during the bubble period

     - Although L and V exhibit pro-cyclicality

   – Robust to different definitions, controlling for various loan-, borrower-, and lender- characteristics, and to the consideration of survivorship bias

2. **No worse ex post performance** for **high** LTV firms

   – Rather *better* performance during the bubble period in terms of firm growth

Summary and Conclusion

Policy Implications:

- **The cap on the LTV ratio as a macro prudential measure**
  - **Proponents**
    - **"Caps on LTV ratio → risky loans curbed → reduces bank risk"**
  - **Our findings**
    - **do not support this view**
    - **Implication from our findings**
      - **A simple cap on the LTV ratio would be ineffective in controlling risk and may be harmful for creditworthy borrowers**
      - **Efficacy of an LTV cap may depend crucially on how it is conditioned**

END OF PRESENTATION
THANK YOU