



## Macroprudential Policies: Korea's Experiences

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Governor of the Bank of Korea

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THE BANK OF KOREA

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- II** Macroprudential Policy Measures
- III** Estimated Policy Effects
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**I**

## **Background: Targeted Risks**

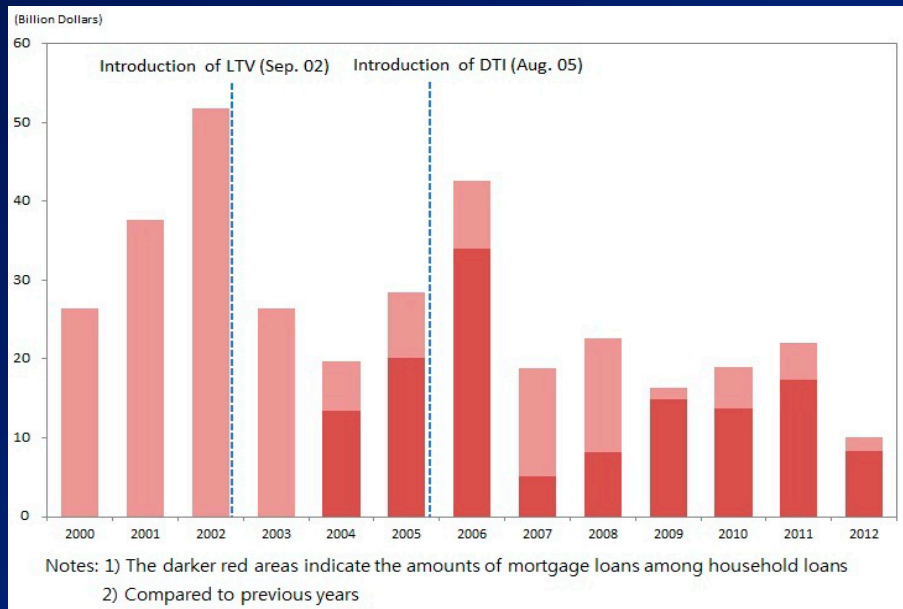
- 1. Housing sector related risks**
- 2. FX related risks**



# Housing Booms and Bank Lending

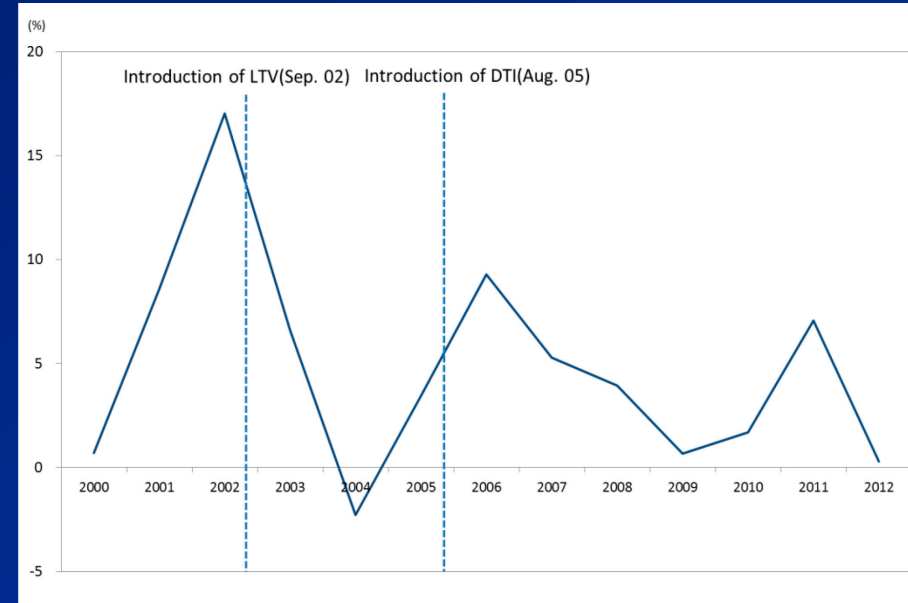
- Housing booms in the early and mid 2000s were fueled by rapid increases in home mortgage lending by banks

## Household Loans and Home Mortgage Loans



Source: Bank of Korea

## Housing Price

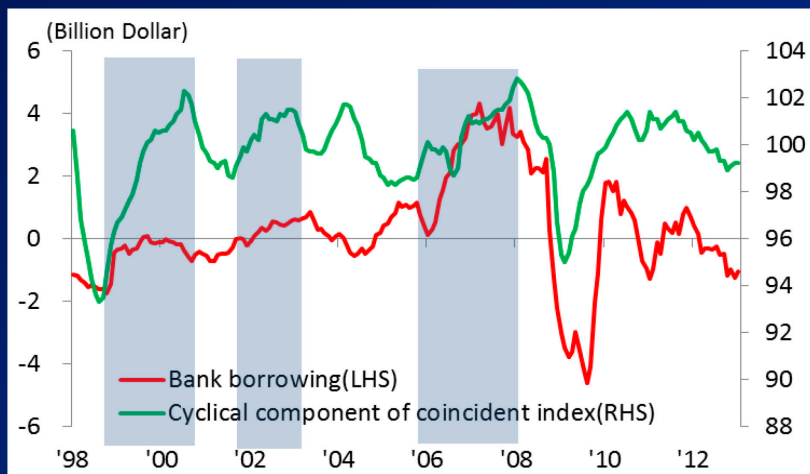


Source: Bank of Korea

# Capital Flow Volatility and Procyclicality

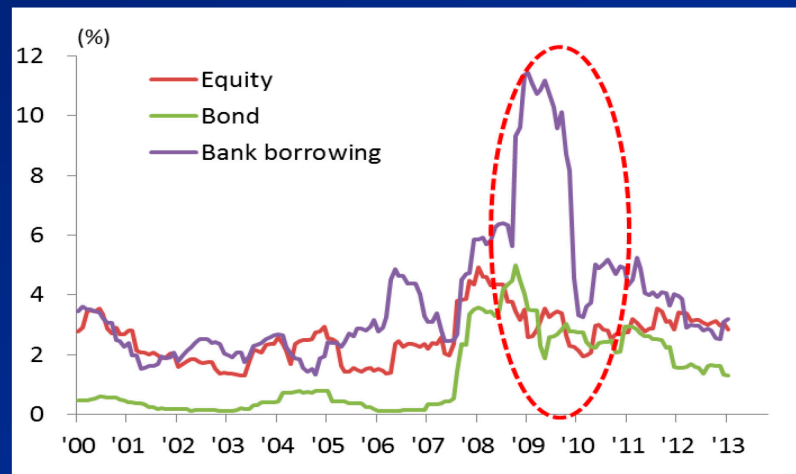
- Capital flows have been volatile and pro-cyclical at the back of high trade and financial openness

Bank Borrowing<sup>1)</sup> and Business Cycle



Notes: 1) 12-month moving average  
2) Shaded area for cyclical upswings  
Source: Bank of Korea

Capital Flow Volatility<sup>1)</sup>



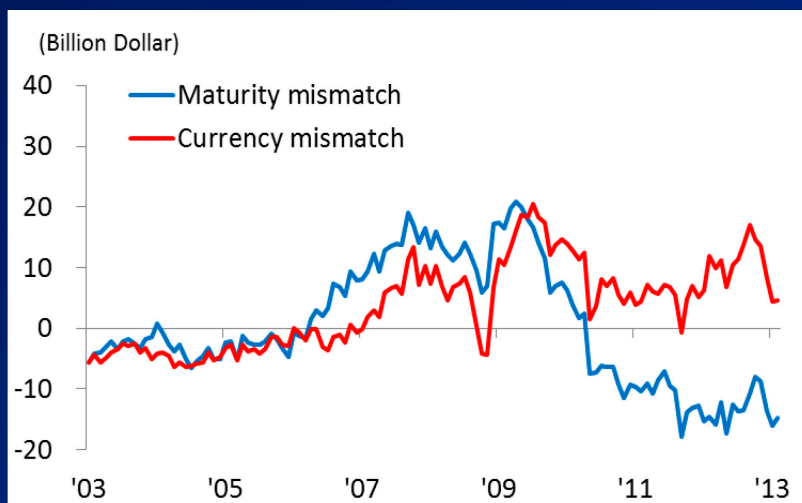
Note : 1) 12-month moving standard deviation of capital flows in percent of GDP (annualized)  
Source: Bank of Korea

# Currency/Maturity Mismatches

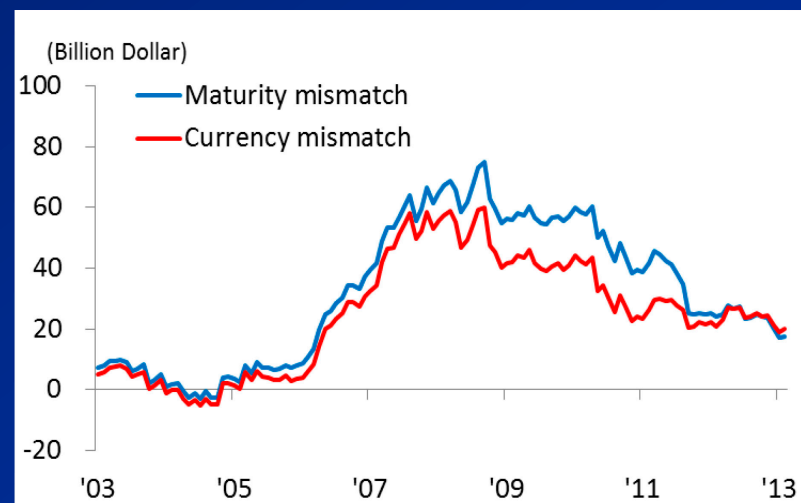
- Large currency and maturity mismatches prior to GFC were key source of systemic risk

## Currency and Maturity Mismatches

### Domestic Banks



### Foreign Bank Branches



Notes: Currency mismatches = foreign liabilities – foreign assets

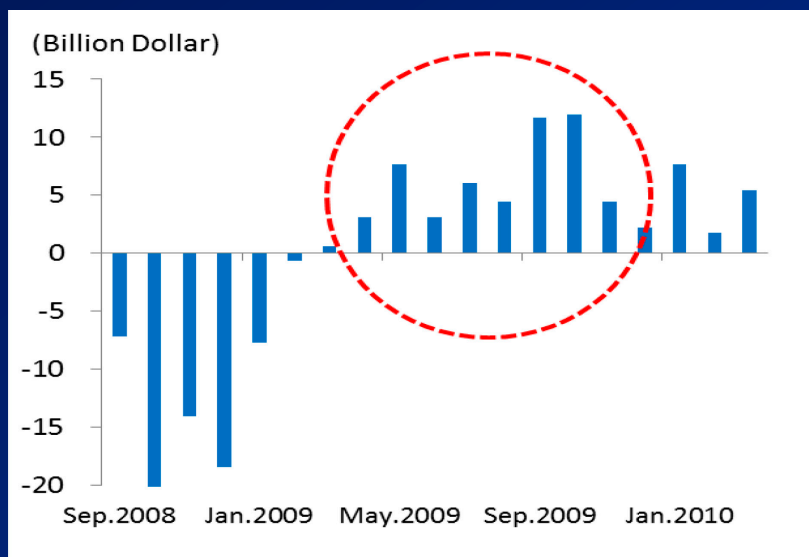
Maturity mismatches = short-term foreign liabilities – short-term foreign assets

Source: Bank of Korea

# Post-GFC Inflow Surge

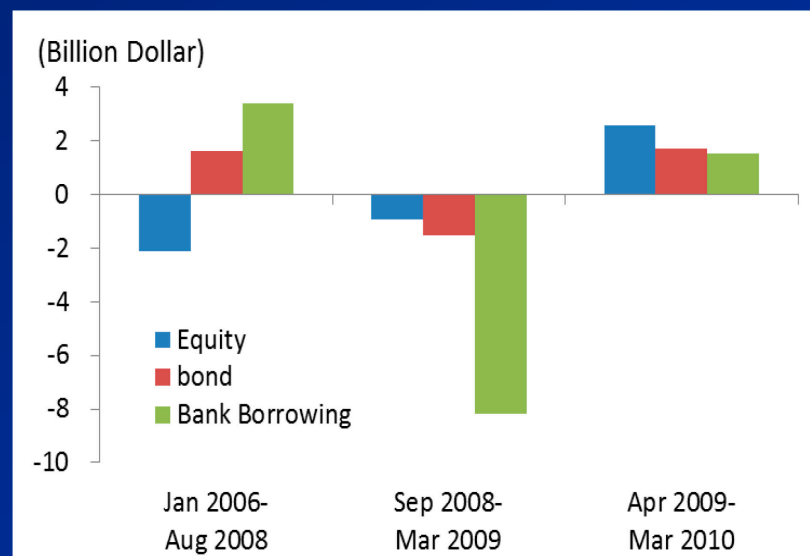
- Resumed inflow surge after GFC (fueled by abundant global liquidity) amid weak domestic recovery

Net Non-FDI Liability Flows



Source : Bank of Korea

Pre- and Post-Crisis Capital Flows  
(Monthly average)



Source : Bank of Korea

## II Macroprudential Policy Measures

1. Housing Sector Related: LTV and DTI
2. FX Related: Leverage Caps and Levy

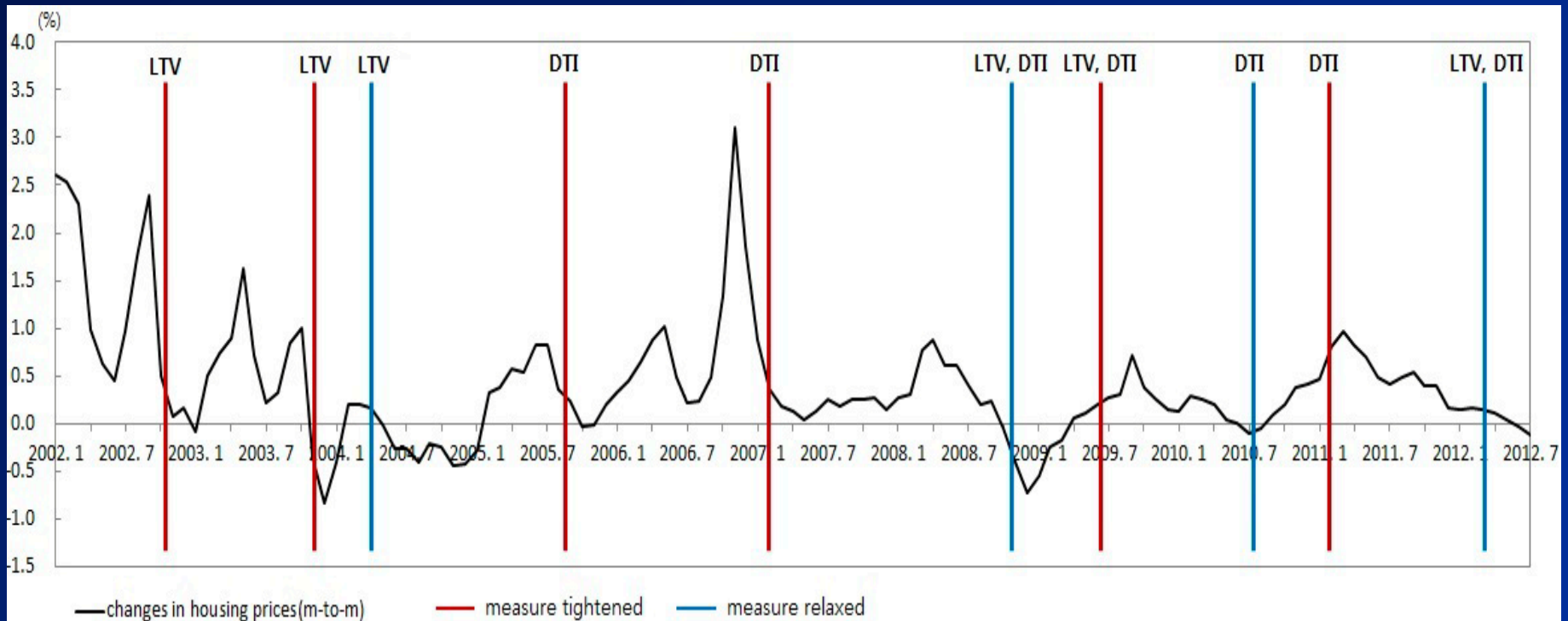
# Housing Sector Related Measures (1/2)

Measures	Time	Policy
LTV	Sep. 2002	Limit LTV ratio to under 60%
	Mar. 2004	Raise LTV ratio for installment loans: 60% → 70%
	Jul. 2009	Lower LTV ratio in Seoul Metropolitan area: 60% → 50%
DTI	Aug. 2005	Limit DTI ratio to under 40% for cases of single households under 30 years old or existence of loans by spouses within speculation areas
	Nov. 2006	Expand areas subject to DTI regulation (speculation-prone Seoul Metropolitan area)
	Sep. 2009	Expand areas subject to DTI regulation (non-speculation Seoul Metropolitan area)

\* Refer to Annex 1 and 2 for technical details of LTV and DTI regulations

# Housing Sector Related Measures (2/2)

## Evolution of LTV and DTI Regulations



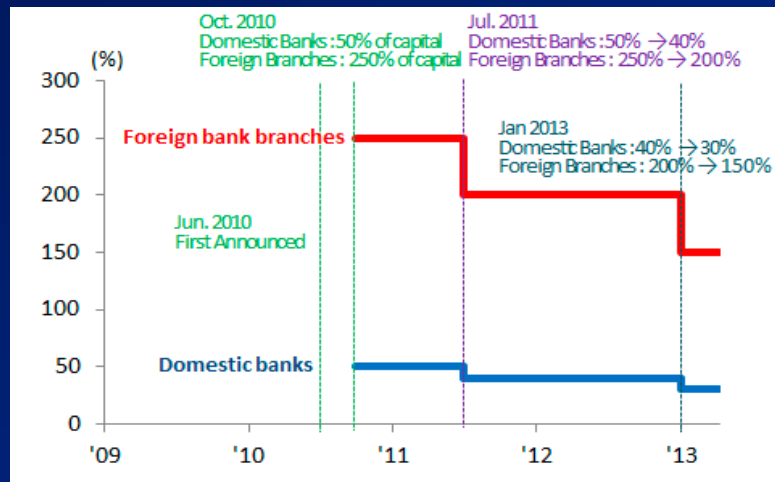
Source : Bank of Korea, Kookmin Bank



# FX Related Measures

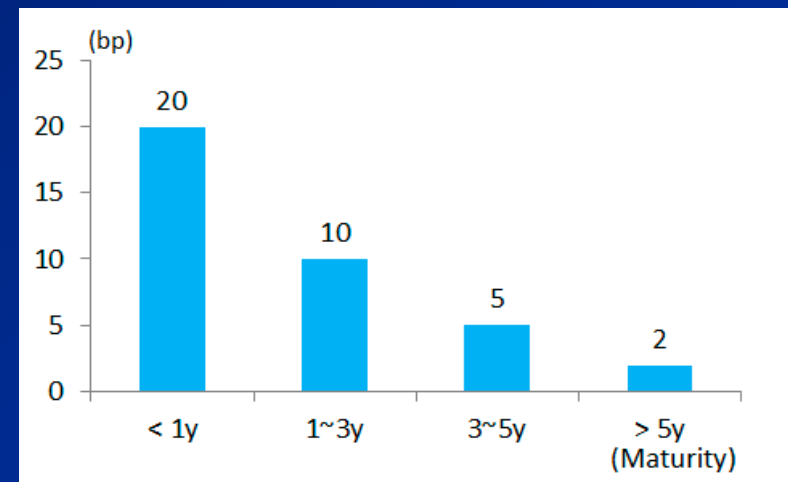
- Leverage caps (as % of bank capital) tightened recently
- Stability Levy imposed on banks' non-deposit FX liabilities

## Leverage Cap on FX Derivatives Position



Source : Bank of Korea

## Macprudential Stability Levy



Source : Bank of Korea



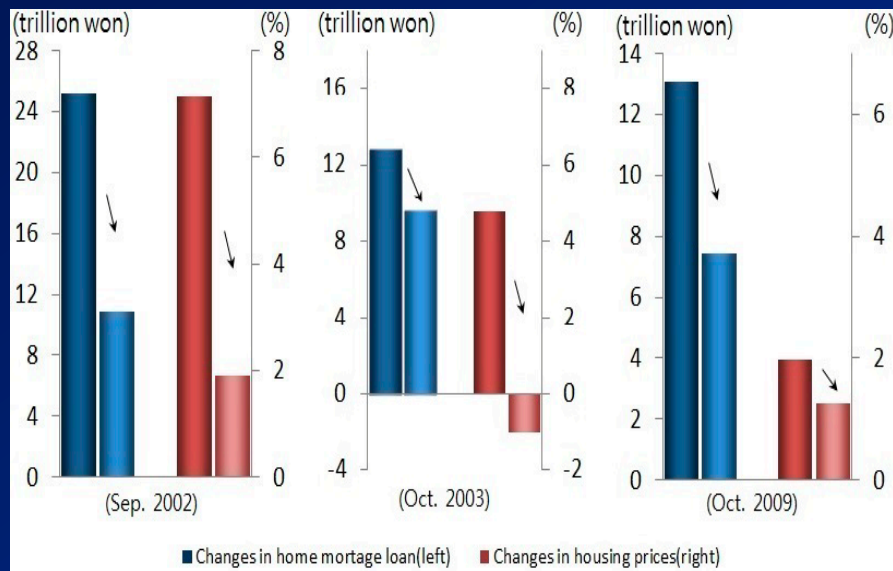
**III**

## **Estimated Policy Effects**

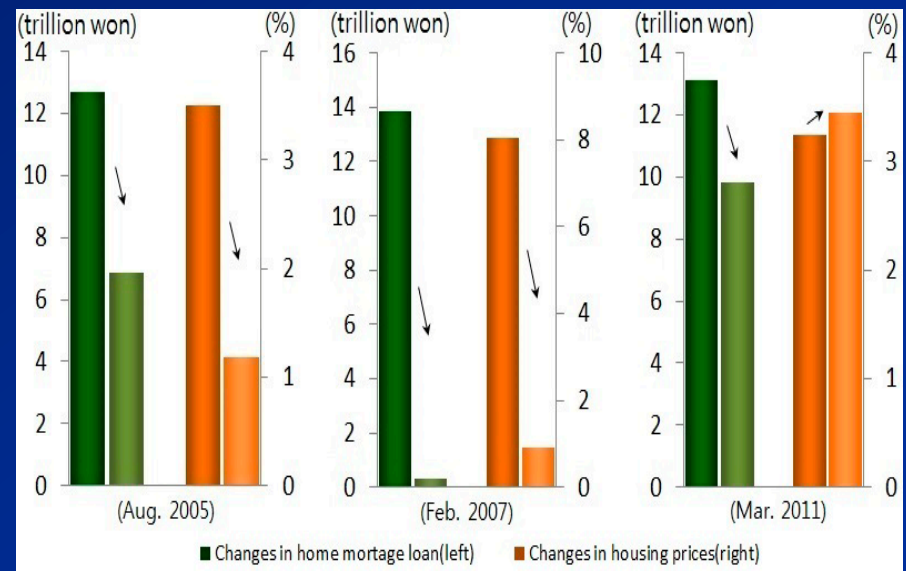
# Policy Effects: Cursory Look (1/4)

- LTV and DTI regulations appear to have had intended effects on housing prices and mortgage lending

**Potential Effects of LTV**  
(six months before and after tightening)



**Potential Effects of DTI**  
(six months before and after tightening)

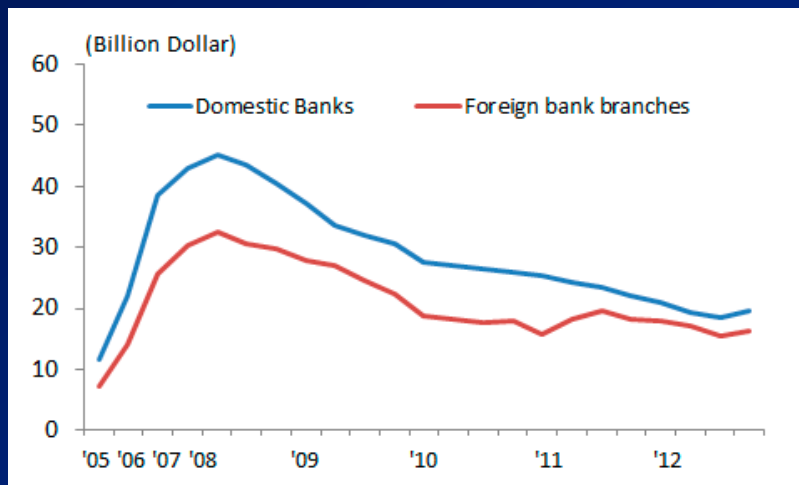


Source : Bank of Korea, Kookmin Bank

# Policy Effects: Cursory Look (2/4)

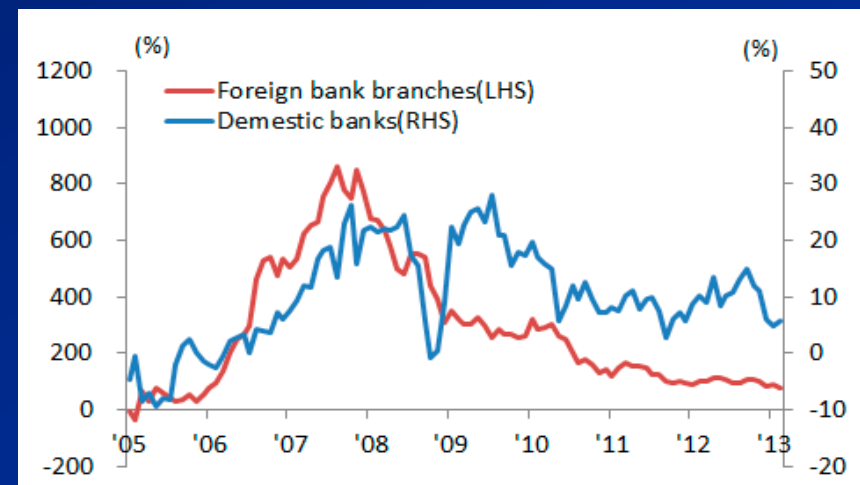
- Leverage caps appear to have had effects even before actual implementations (as they were pre-announced)

FX Derivatives Position  
(vis-à-vis Shipbuilders)



Source : Bank of Korea

Total FX Derivatives Position  
(% of bank capital)



Source : Bank of Korea

# Policy Effects: Cursory Look (3/4)

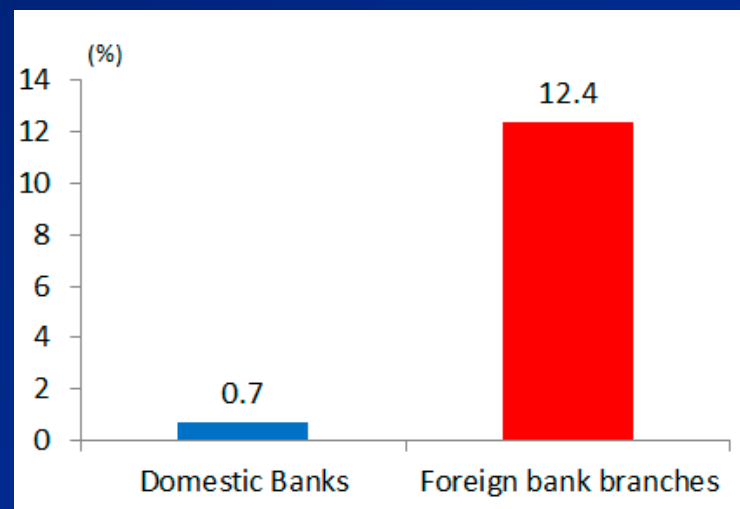
- Stability levy has reduced arbitrage margin and raised FX funding cost

Incentives for Arbitrage Transaction<sup>1)</sup>  
(Foreign bank branches)



Notes : 1) Interest differential (3M)-Swap rate (3M)  
Source : Bank of Korea

Ratio of Levy to Net Profit  
(As of end 2012)



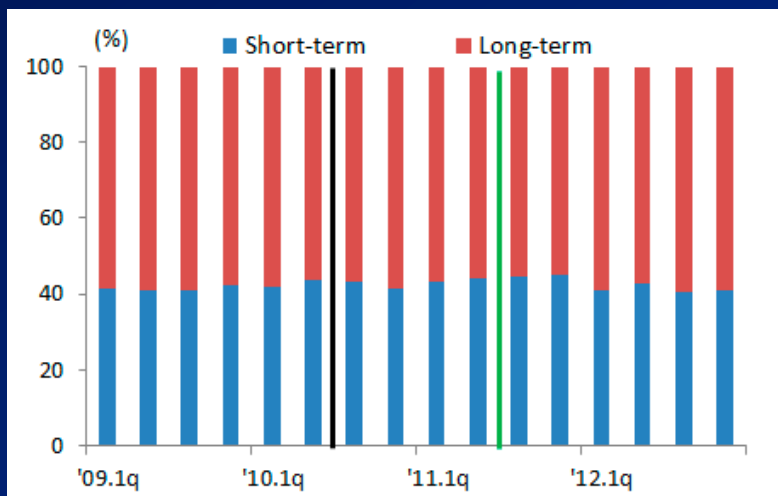
Notes : 1) Estimated ratio  
Source : Bank of Korea

# Policy Effects: Cursory Look (4/4)

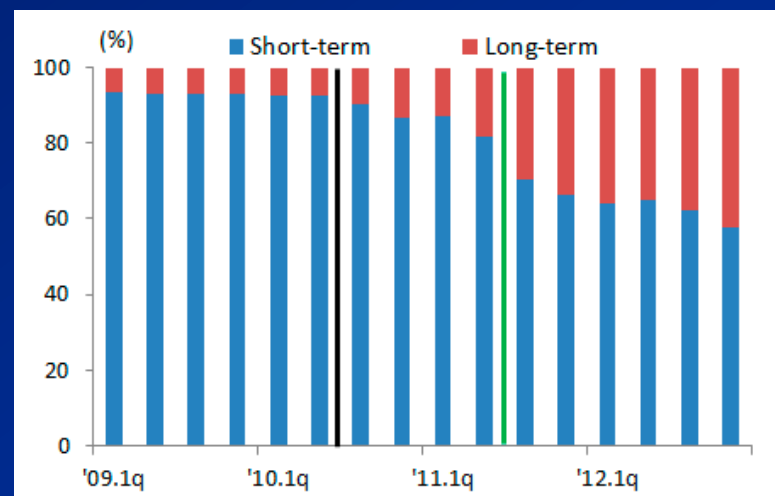
- Banks' external debt structure improved after introducing FX-related macroprudential measures

## Maturity Composition of External Debt

(Domestic banks)



(Foreign bank branches)



Note : 1) Black and green vertical lines refer to the dates of the introduction of Leverage Cap and Stability Levy.

Source : Bank of Korea

# Policy Effects: Empirical Analysis

- **Highly preliminary and subject to limited data availability—particularly FX-related macroprudential policies**
- **LTV and DTI regulations: Dynamic simulation based on Panel VAR for housing price and home mortgage/equity loans (43 areas over the period of 2003.II-2012.II)**
- **Leverage caps and stability levy: Conditional forecasting (with or without policy measures) based on estimated capital flow equations**
- **See Annex 3-7 for further detail**

# LTV and DTI Regulations: Panel VAR

- LTV and DTI dummies are of expected sign and significant

\* See Annex 7 for full results

## Regression Results

	Mortgage Loan	Housing Price
<i>LTV40(-1)</i>	-3.157***	-1.587***
<i>LTV50(-1)</i>	-2.056***	-0.954***
<i>DTI40(-1)</i>	-0.346	0.178
<i>DTI50(-1)</i>	0.128	-0.370
<i>DTI60(-1)</i>	-0.191	-1.241***
<i>call rate(-1)</i>	-0.251**	-0.255***
<i>Tax(-1)</i>	-1.650***	0.781***

Note: 1) \*, \*\*, and \*\*\* refer to 10%, 5%, and 1% significance level respectively

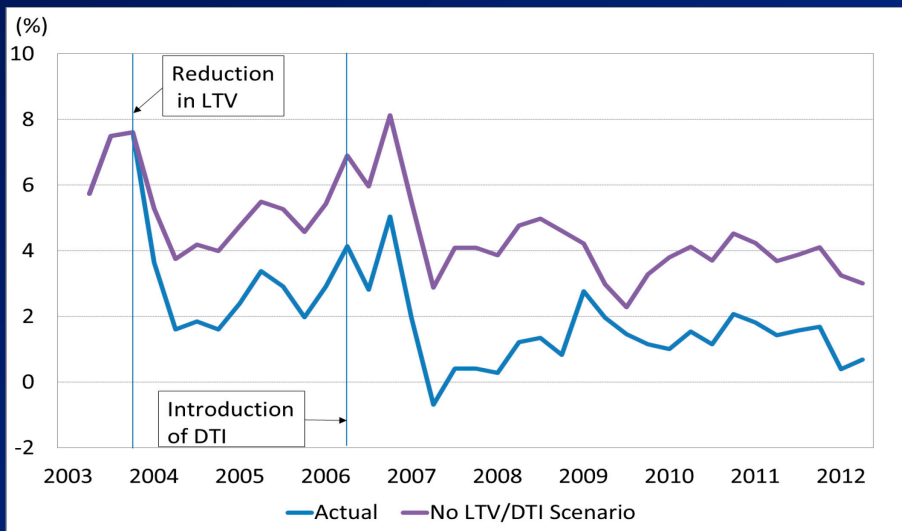
2) Other explanatory variables not reported



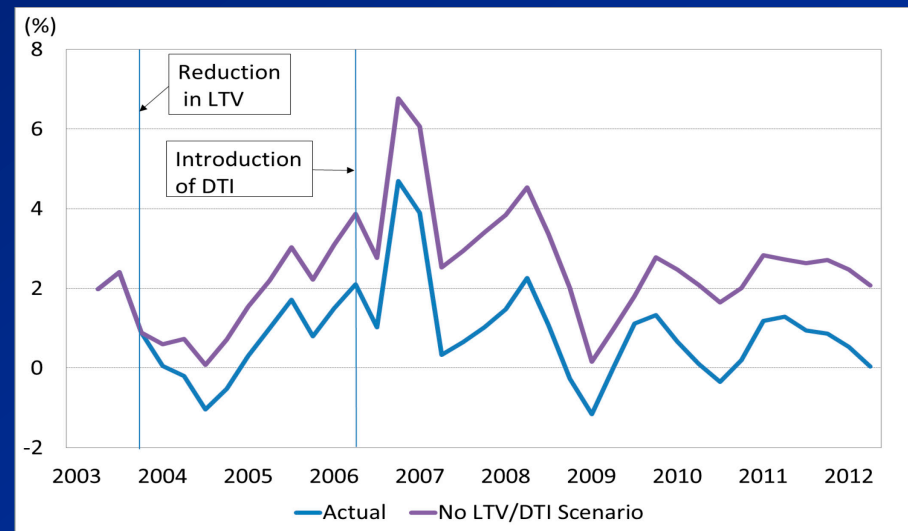
# LTV and DTI Regulations: Dynamic Simulation

- LTV and DTI both put brake on housing price (H) and bank mortgage lending (L)
- With no LTV and DTI in place, H and L would have been 75% and 137% higher than actual by 2012

Growth Rates of Mortgage Loan



Growth Rates of Housing Price



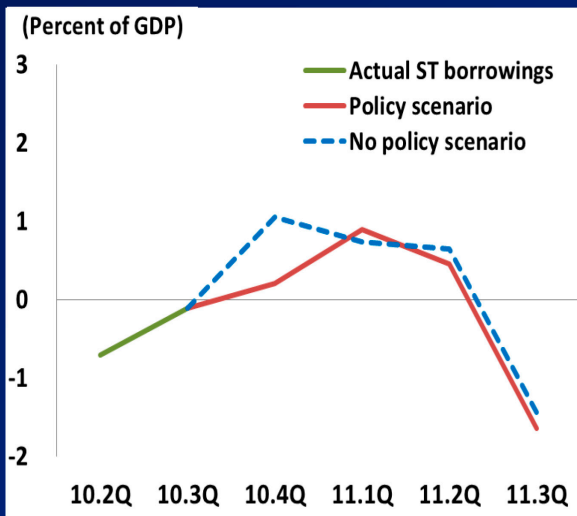


# Leverage Caps/Stability Levy: Conditional Forecast

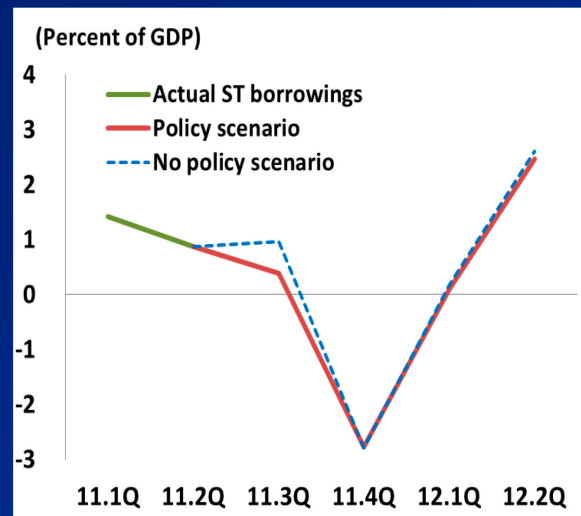
- Both leverage caps and financial stability levy helped reduce short-term FX borrowings and improve maturity structure

## Effect on Short-term Foreign Borrowing

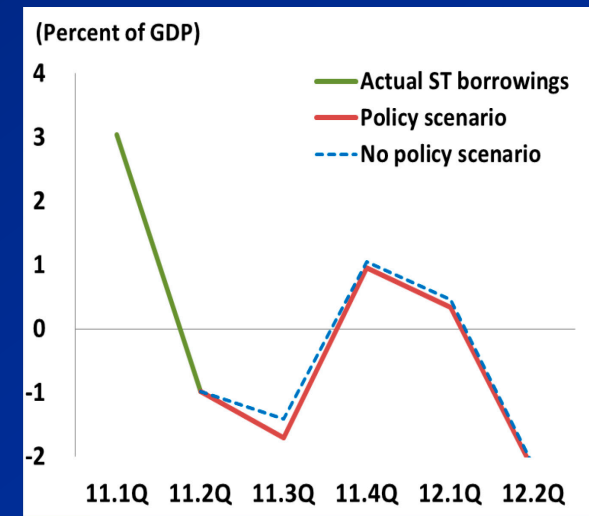
Leverage Cap on Foreign Bank Branches



Levy on Domestic Banks

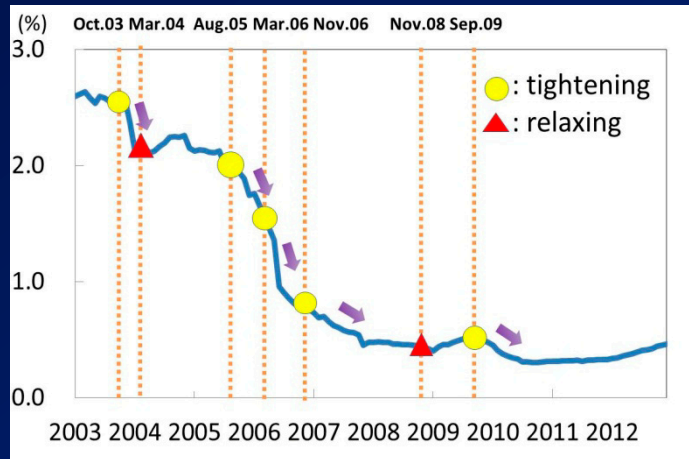


Levy on Foreign Bank Branches

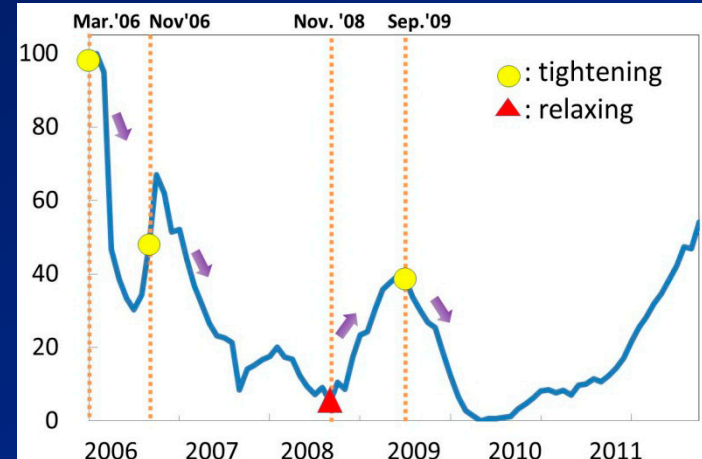


# Effects on Systemic Risk

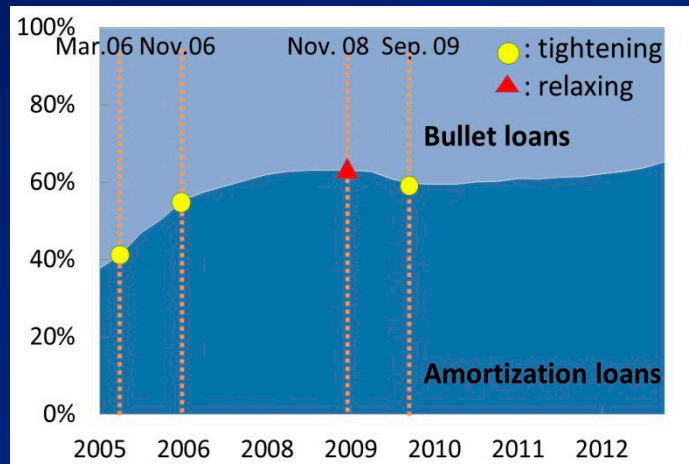
## Bank mortgage loan default rate



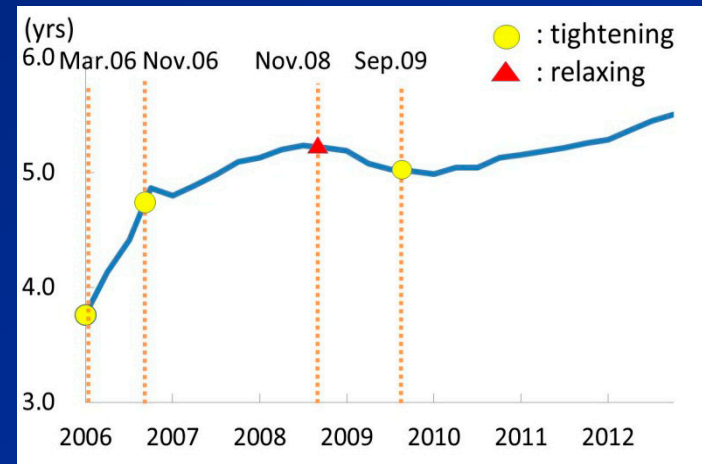
## Bank mortgage loan VaR



## Composition of mortgage loans by type



## Duration of mortgage loans



Source: Bank of Korea

## **IV** Concluding Remarks

# Key Take Away

- Broad evidence for Korea suggests that macroprudential policies could be a useful and effective tool to manage macro-financial stability
- Country-specific circumstances may matter in important ways for policy design and effectiveness
- Should be mindful of unintended consequences (e.g., procyclicality of LTV regulations, higher sensitivity to interest rate risk, circumvention, etc.)
- More study is needed to answer how best to combine macroprudential and monetary policies

Thank you!

# Annex 1: LTV regulation

- **LTV ratio** =  $\frac{\text{mortgage loan} + \text{unsubordinated debt} + \text{rental deposit}}{\text{collateral value}}$
- **Collateral value** of the property is based on housing prices collected by a major commercial bank (KB)
- **Regulated institutions:** Banks, insurance companies, savings banks, mutual CIs, credit-specialized FIs
- **Regulated loans:** All mortgage loans



## Annex 2: DTI regulation

- **DTI ratio : Ratio of annual repayment to debtor's annual income when loan offered**

✓ 
$$\frac{\text{annual repayment of principal and interest on mortgage} + \text{repayment of interest on other debt}}{\text{debtor's annual income}} \times 100$$

Bullet loans: annual interest + (principal/loan maturity)

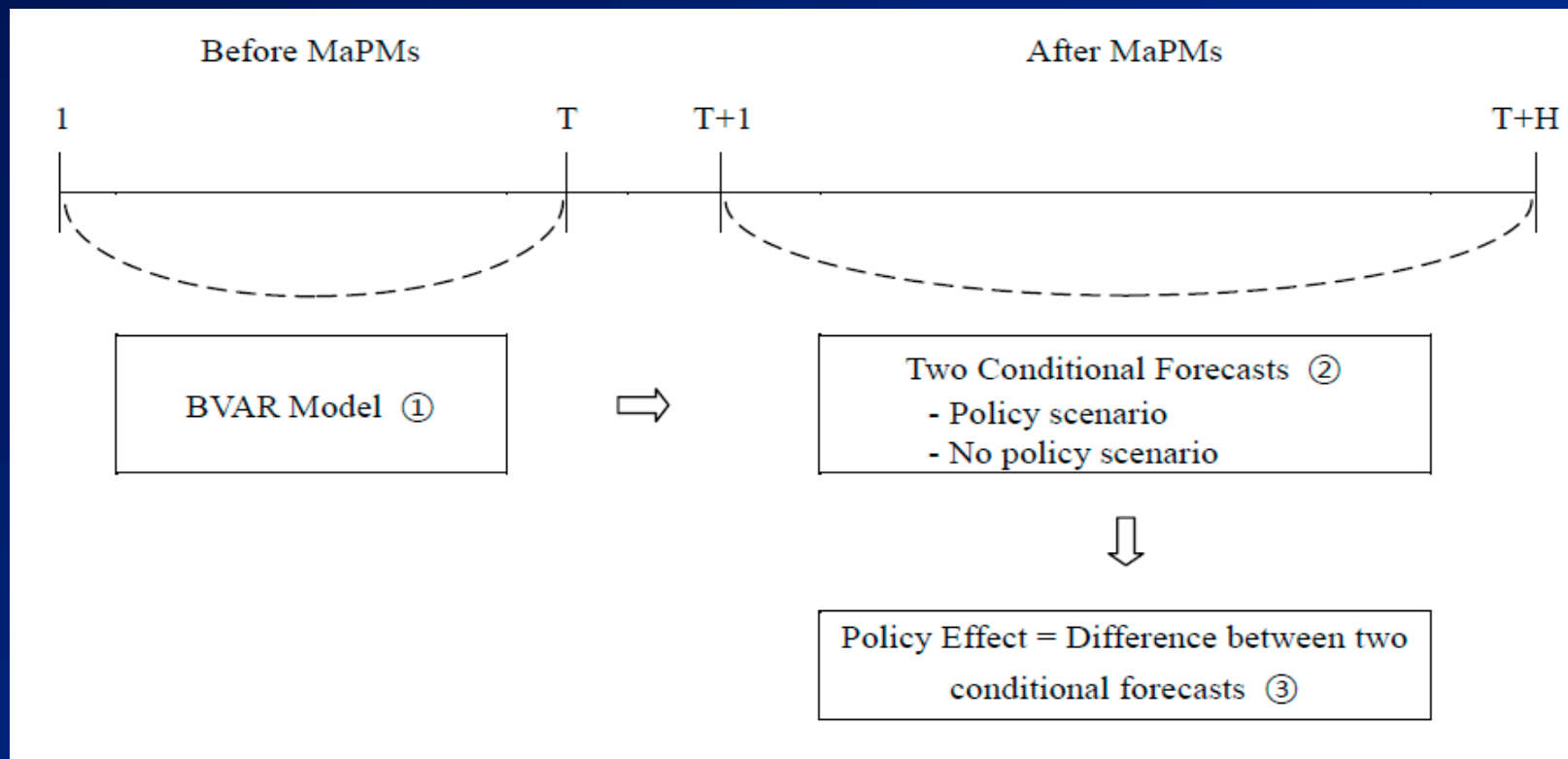
Installment loans: annual repayment of principal and interest (after grace period if any)

Debtors' annual income: annual composite income of the previous year

- **Regulated institutions: Banks, insurance companies, savings banks, mutual CIs, credit-specialized FIs**
- **Regulated loans: Mortgage loans in Seoul metropolitan area**

# Annex 3: Conditional Forecasting

- Counterfactual analysis: Estimate policy effects using conditional forecasts





# Annex 4: Conditional Forecasting Specification

- VAR models of banks' foreign borrowings

$$Y_t = \Phi_0 + \sum_{j=1}^p \Phi_j Y_{t-j} + e_t, e_t = P \varepsilon_t$$

- Variables for each model

Model		Variables
Foreign bank branches	4-variable model	VIX index, covered interest parity deviation, FBBs' foreign borrowings to GDP ratio, FBBs' FX derivative ratio
	3-variable model	Covered interest parity deviation, foreign borrowings to GDP ratio, FBBs' FX derivative ratio
Domestic banks	4-variable model	VIX index, borrowing spread, DBs' foreign borrowings to GDP ratio, DBs' FX derivative ratio
	3-variable model	Borrowing spread, DBs' foreign borrowings to GDP ratio, DBs' FX derivative ratio

## Annex 5: Panel VAR Specification

- Panel VAR model for mortgage loans (L) and housing prices (H)
- Control variables and policy dummy variables are all lagged once to control for endogeneity bias
- Lagged policy dummies (i.e., LTV and DTI dummies) are consistent with policy implementation (i.e., policy changes are pre-announced one month or earlier) and also with actual lending practice (i.e., processing loan applications takes 1-2 months on average)
- Effects of monetary policy (interest rates), tax policy, and specific areas where real estate market is plagued by speculation are controlled

## Annex 6: Panel VAR Data

- Panel sample consisting of 43 areas over the period of 2003.II~2012.II

### Definition of Variables

Name	Definition	Name	Definition
$L_{i,t}$	Growth rates of s.a. mortgage loans in 43 regions	$Call_t$	Interest rate in call market
$H_{i,t}$	Growth rates of s.a. housing prices in 43 regions	$dTax_t$	Dummy for 50% capital gains tax rate
$Y_t$	Growth rates of s.a. nominal GDP	$dLTV4_{i,t}$ ( $dLTV5_{i,t}$ )	Dummies for regions where LTV cap ratio is 40% (50%)
$dSPA_{i,t}$	Dummy for speculative areas	$dDTI4_{i,t}$ ( $dDTI5_{i,t}$ $dDTI6_{i,t}$ )	Dummies for regions where DTI cap ratio is 40% (50%, 60%)
$dCS_t$	Dummy for crisis period		

# Annex 7: Panel VAR Full Results

	$L_{i,t}$	$H_{i,t}$		$L_{i,t}$	$H_{i,t}$
$L_{i,t-1}$	0.228***(0.027)	0.042**(0.020)	$dLTV4_{i,t-1}$	-3.157***(0.805)	-1.587***(0.468)
$H_{i,t-1}$	0.052(0.038)	0.477***(0.024)	$dLTV5_{i,t-1}$	-2.056***(0.389)	-0.954***(0.248)
$Y_{t-1}$	-0.373***(0.056)	0.0790**(0.039)	$dDTI4_{i,t-1}$	-0.346(0.323)	0.178(0.189)
$dSPA_{i,t-1}$	2.211**(0.867)	1.694***(0.493)	$dDTI5_{i,t-1}$	0.128(0.335)	-0.370(0.233)
$dCS_t$	-0.880***(0.252)	-0.819***(0.167)	$dDTI6_{i,t-1}$	-0.191(0.552)	-1.241***(0.379)
$Call_{t-1}$	-0.251**(0.104)	-0.255***(0.069)	$C$	5.152***(0.602)	0.679*(0.385)
$dTax_{t-1}$	-1.650***(0.352)	0.781***(0.225)	$Obs$	1,505	1505