

# Assessing the Impact of FX-related Macroprudential Measures in Korea

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Disclaimer: The views expressed herein represent those of the author, not necessarily those of the Bank of Korea.

# This Paper

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- Objective

- Provide a preliminary empirical assessment of the impact of macroprudential measures (MPMs) introduced since 2010 aimed at moderating the procyclical fluctuations in capital flows to the banking sector
- Leverage cap on FX derivatives position  
Macroprudential stability levy (MSL) on non-core FX liabilities

- Approach

- The conceptual framework is based on the cross-border banking flows (Bruno and Shin, 2013; Cetorelli and Goldberg, 2011)
- Estimate Bayesian VAR models of bank's FX borrowings
- Conduct counterfactual analysis associated with the implementation of each macroprudential measure (Kapetanios et al., 2012; Lenza et al., 2010)

# This Paper

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- Findings

- Both MPMs caused a sizeable reduction in short-term FX borrowings, while causing much smaller or nearly no reduction in long-term FX borrowings
- Thus MPMs may have helped to improve the FX funding structure of the banking sector
- Substantial uncertainties regarding the precise estimates

- Literature

- Study on the impact of Korean FX-related MPMs  
Bruno and Shin (2014)
- Study on the impact of capital controls  
Earlier studies (De Gregorio et al., 2000; Magud et al., 2011)  
Recent studies (Ostry et al., 2010, 2011)

# **I. Background**

## II. Transmission Channel

## III. Model and Data

## IV. Empirical Results

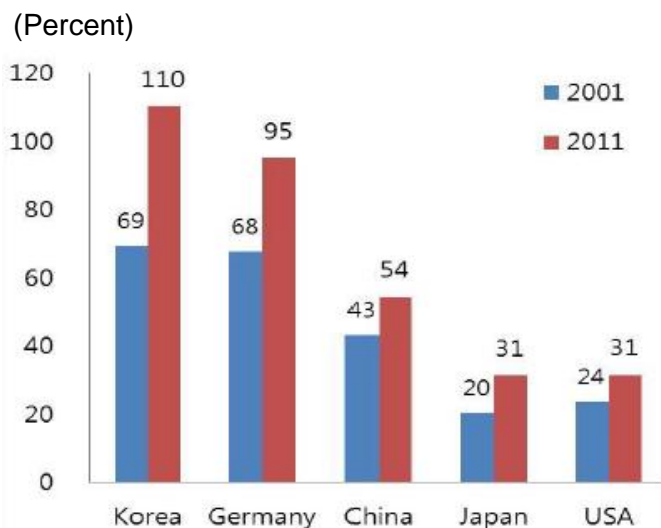
## V. Conclusion

# Key Features of Capital Flows

- Openness

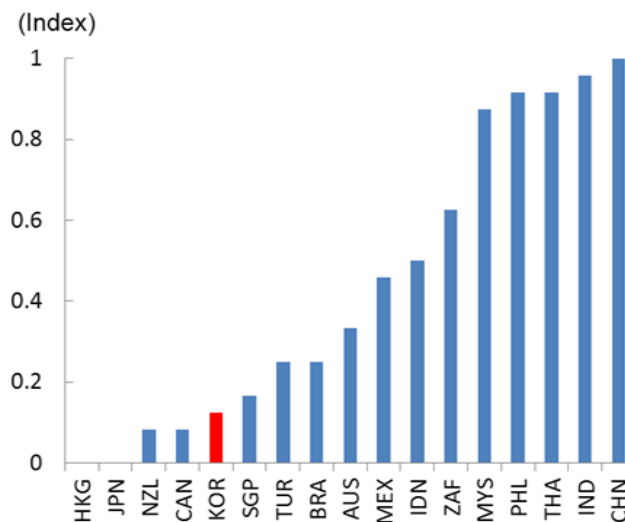
- High level of trade and financial openness

Trade/GDP ratio



Source : IMF IFS

Capital account restrictions index



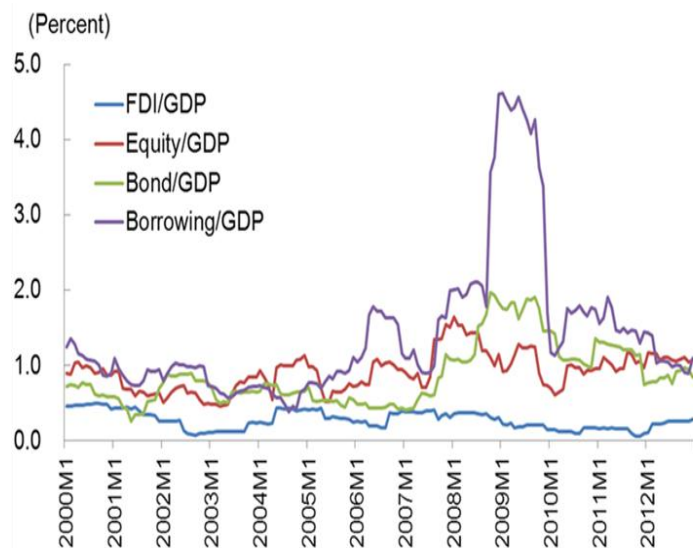
Source : Overall restrictions index for 2005 from Shindler (2009)

# Key Features of Capital Flows

- Volatility and Pro-cyclicality of Capital Flows

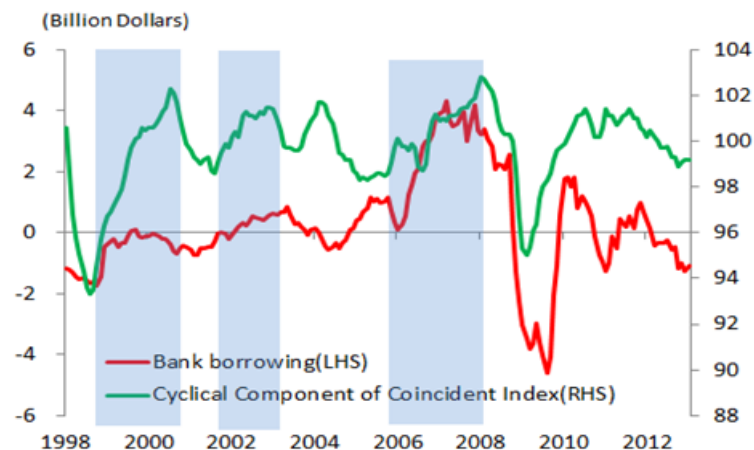
- High volatility for bank flows and portfolio investments
- Strong pro-cyclicality for bank flows

**Volatility of capital flows**



Source : ECOS, Bank of Korea

**Bank flows over the business cycle**

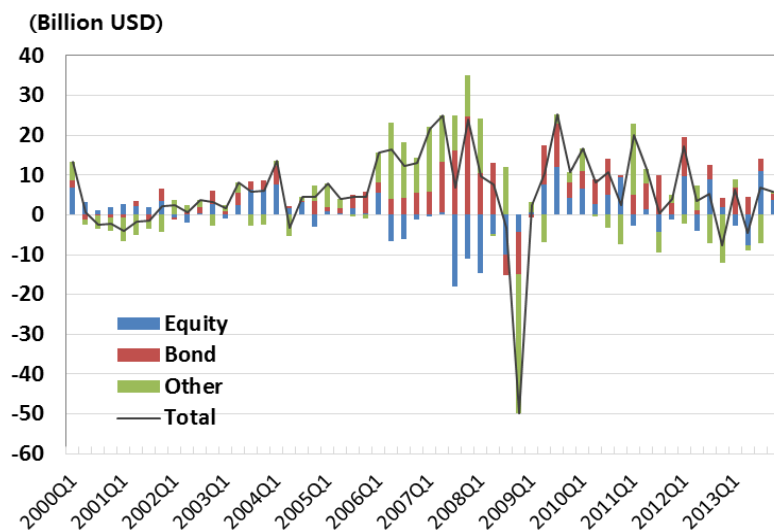


Source : ECOS, Bank of Korea

# Key Features of Capital Flows

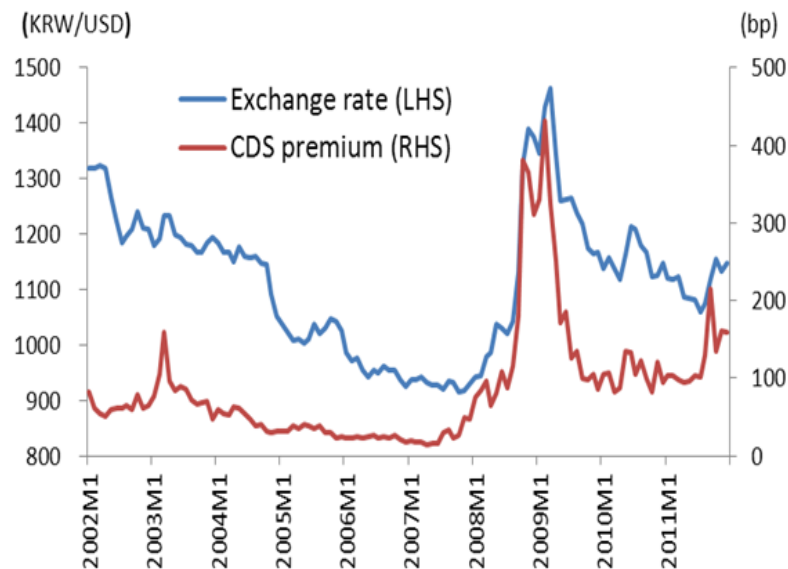
- Unprecedented scale of surges and reversals
  - Pre-crisis surge followed by sharp reversals in the crisis
  - Sudden stop led to severe financial distress
  - Inflow surge resumed since 2009Q2

## Capital inflows



Source : ECOS, Bank of Korea

## Exchange rate and CDS premium

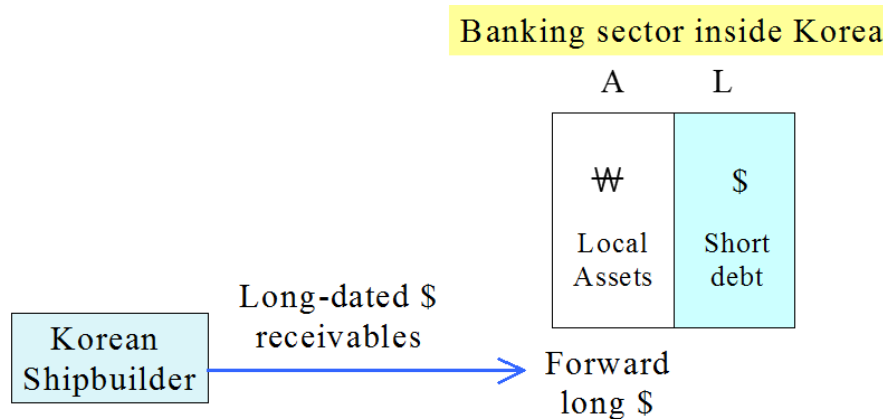


Source : Bloomberg

# Source of Risks

- Interaction between currency risk hedging demand by firms, short-term external debt by banks, and exchange rate changes
  - Exporters and asset managers with long-term dollar receivables hedge risks of currency appreciation by selling forward dollars to banks
  - Banks hedge long dollar position with foreign currency borrowings (mostly at short maturities) or with hedging transactions with another bank in Korea

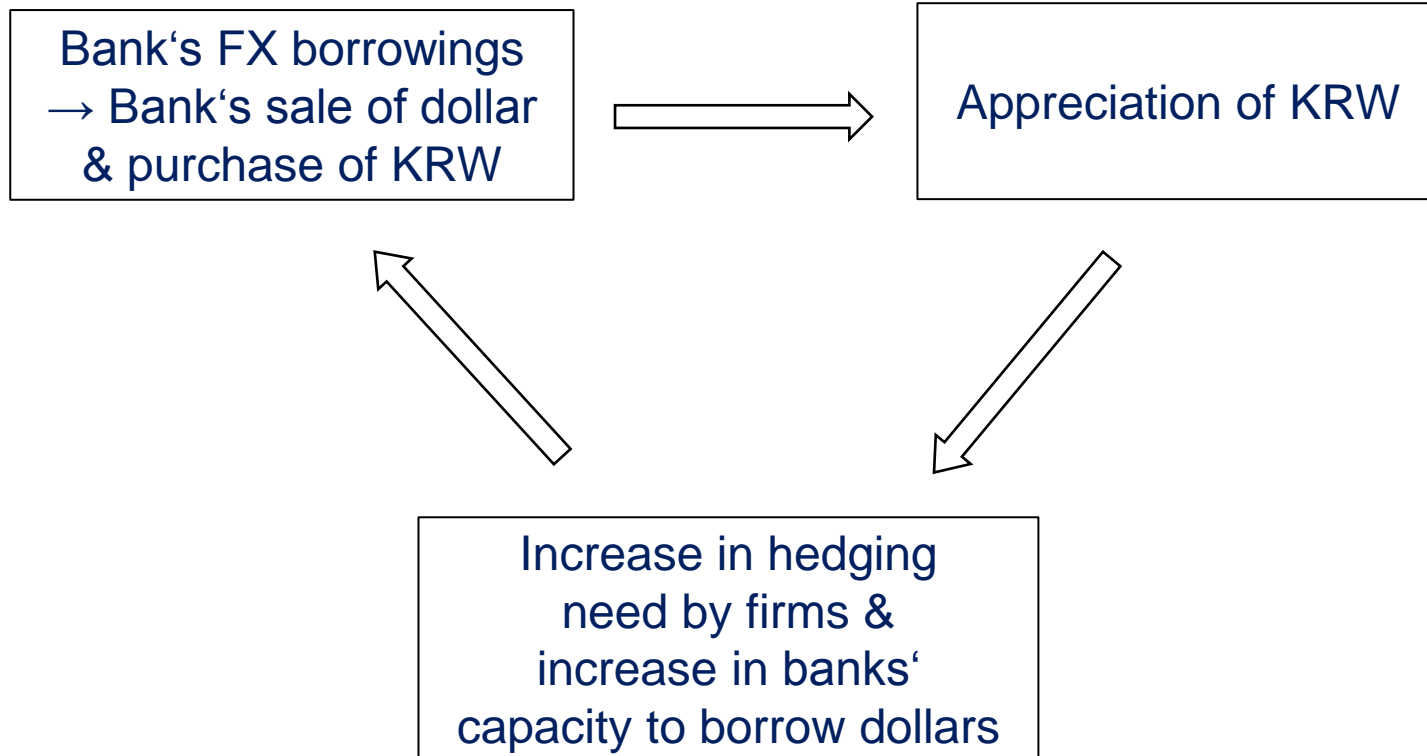
## Aggregate B/S of banking sector





# Source of Risks

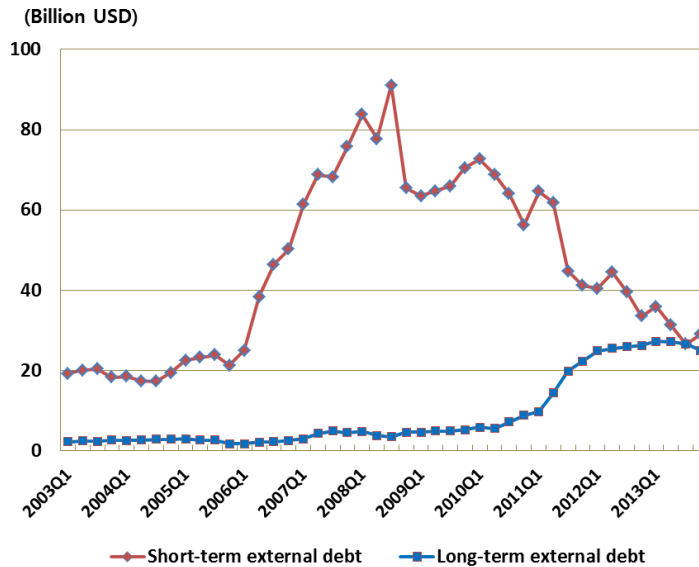
- Feedback loop



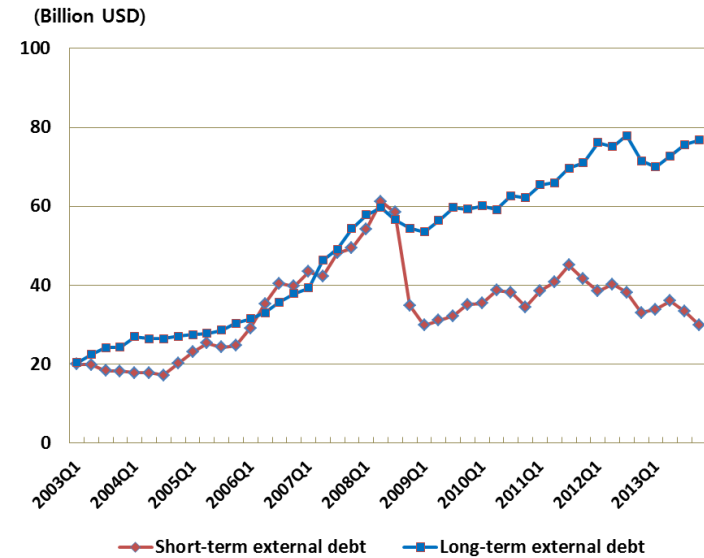
# Source of Risks

- Consequence was a rapid increase in short-term FX liabilities and rollover risks, which left the banking sector vulnerable to the crisis

### External debt by foreign bank branches (FBBs)



### External debt by domestic banks (DBs)



# FX-related Macprudential Measures (MPMs)

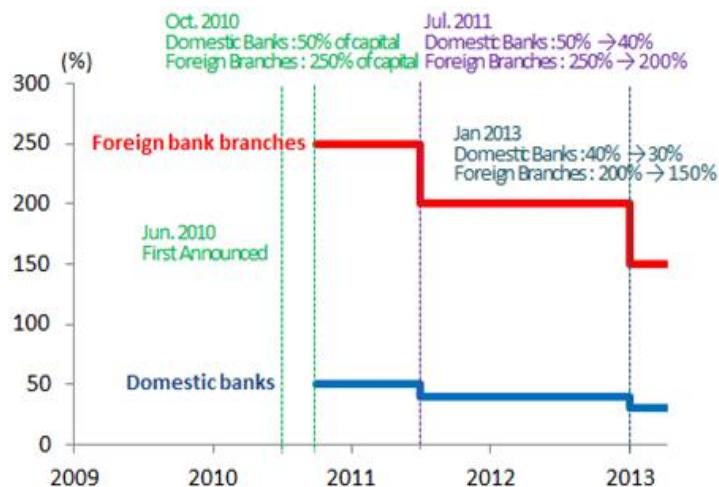
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- FX risks are a main source of financial instability in Korea
- Domestic financial markets are liquid but limited in scope for risk hedging and transfer
- Lessons from GFC — prudential regulation at micro level are not enough to address systemic risks
- Monetary policy may not be an appropriate tool to address this type of systemic risks in EMEs
- New thinking on capital flow management, e.g. IMF's institutional view

# FX-related Macprudential Measures (MPMs)

- Leverage cap on FX derivatives position
  - Put ceilings on the net position of FX derivatives contract at or below a targeted level (which is specified as a proportion of bank equity capital)
  - Designed to curb short-term FX borrowings of banks by requiring them to put up more equity capital if they increase FX derivatives and short-term FX debt
  - Introduced in Oct. 2010, and tightened twice in Jul. 2011 and Jan. 2013
  - Different ceilings applied to FBBs and DBs

**Leverage caps by bank group**

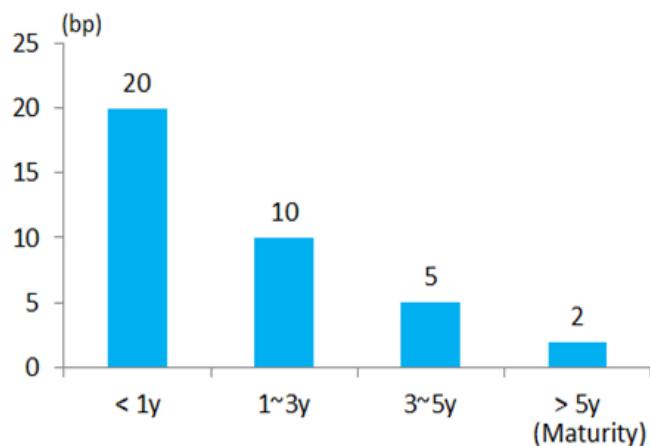


# FX-related Macprudential Measures (MPMs)

- Macroprudential Stability Levy (MSL)

- Apply levy to non-deposit foreign currency liabilities of banks
- Introduced in Aug. 2011
- 20 bp charge on non-core FX liabilities of up to one year maturity, and lower rates applied in a graduated manner to maturities of over one year
- Financial stability measure rather than fiscal measure

MSL by maturity



I. Background

**II. Transmission Channel**

III. Model and Data

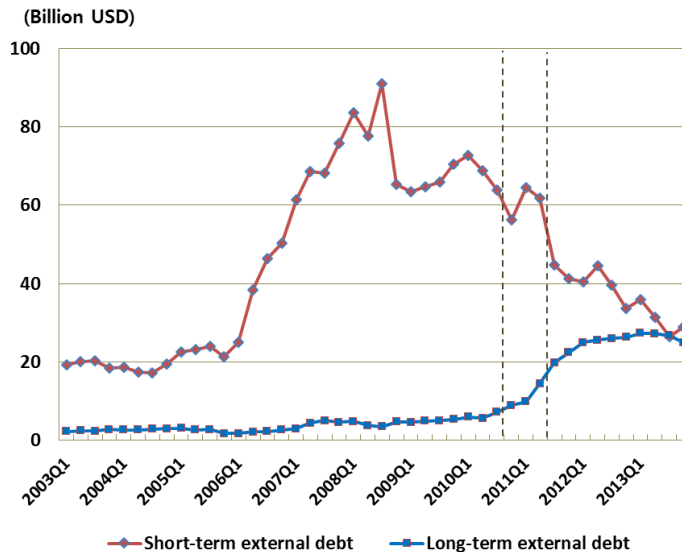
IV. Empirical Results

V. Conclusion

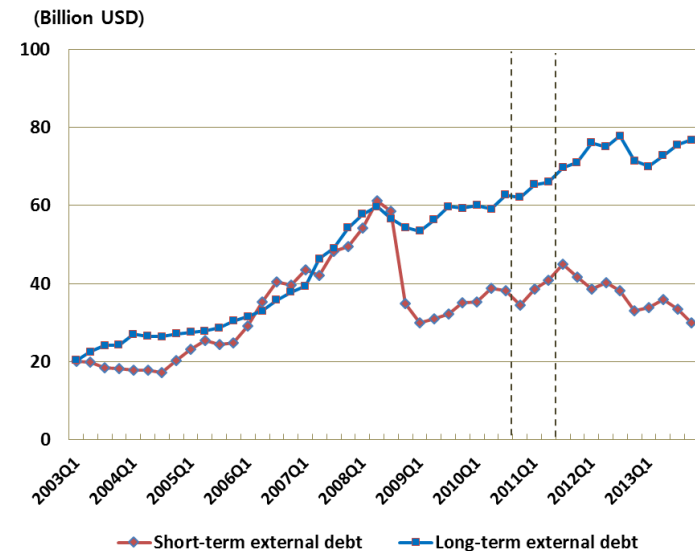
# Cursory Look

- Following the introduction of MPMs, ST external debt appeared to decrease, while LT external debt showed a steady increase
- However, counterfactual analysis is necessary in order to identify the effects of MPMs from other forces

External debt by FBBs



External debt by DBs



# FX balance sheets of DBs at end 2010

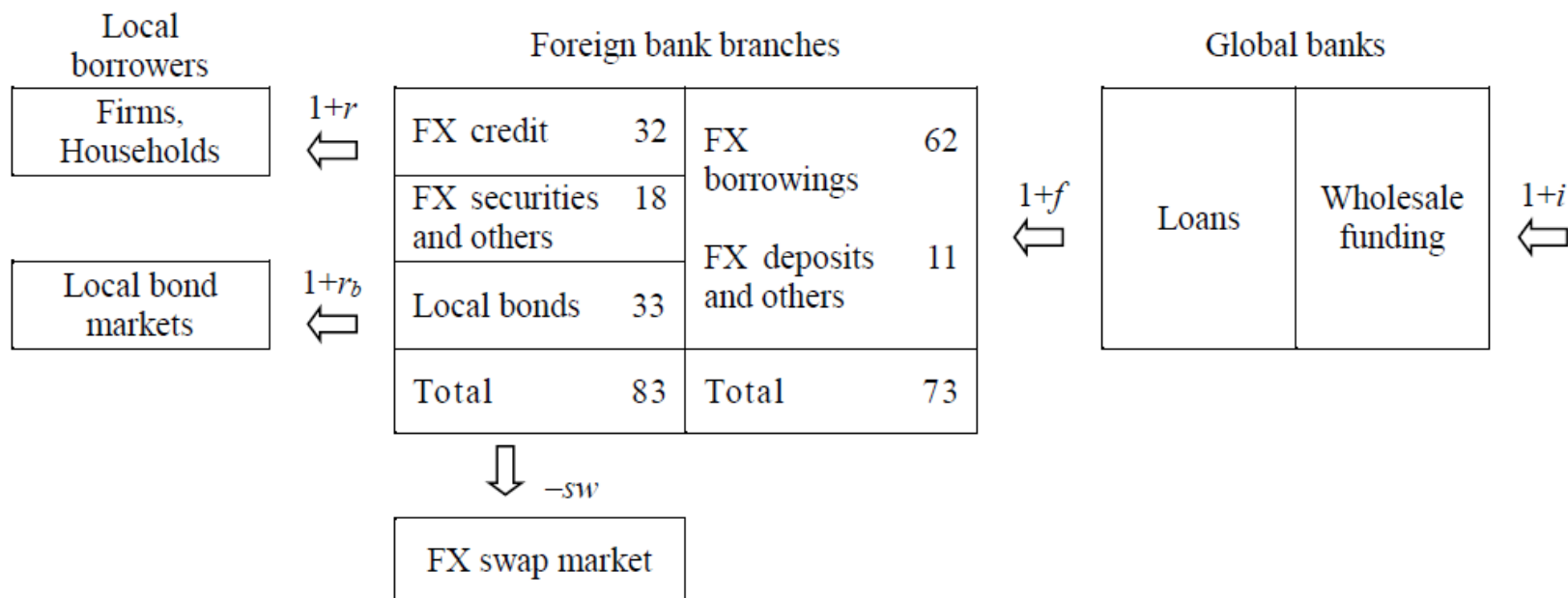
- DBs provide FX credit to private borrowers financed by non-core FX liabilities drawn from the global banks
- Capital inflows to DBs are determined by the interplay between supply push and demand pull factors
- Borrowing spread  $\beta$  appears in supply and demand for FX borrowings by DBs

Local borrowers		Domestic banks				Global banks		
Firms, Households	$1+r$ ←	FX credit	132	FX Borrowings	125	Loans	Wholesale funding	$1+i$ ←
		FX securities and others	36	FX deposits and others	51			
		Total	168	Total	176			

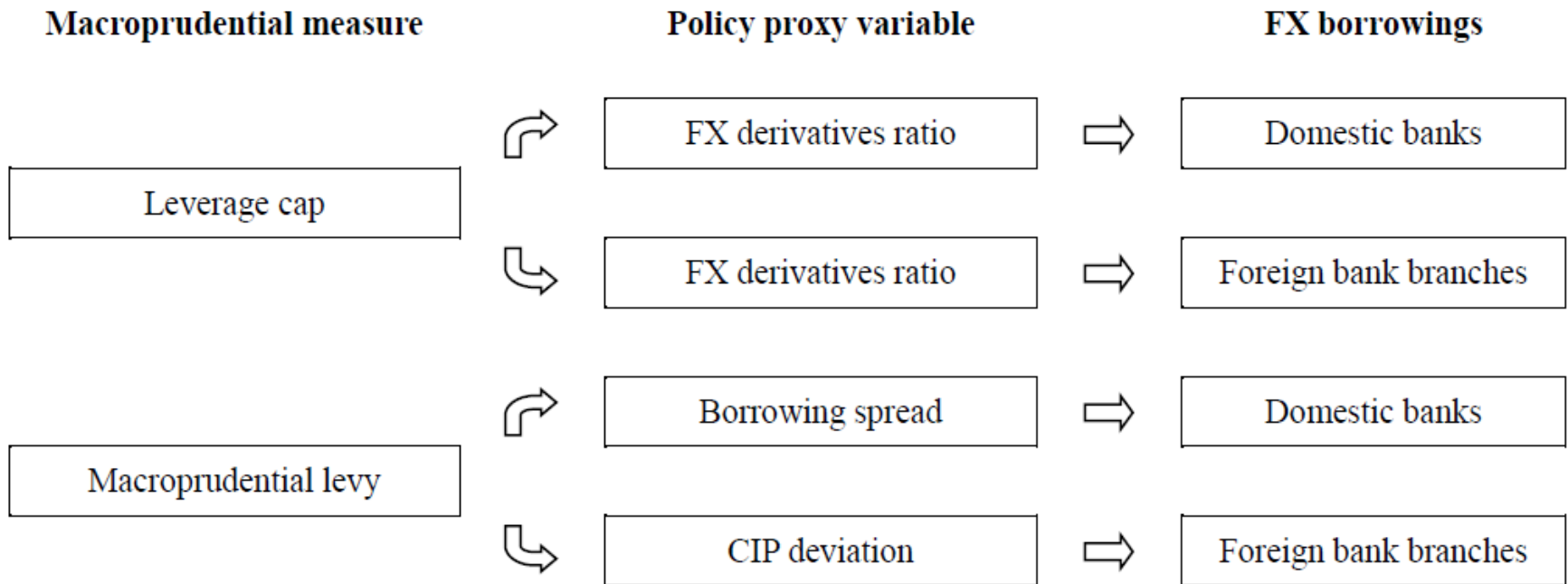


# FX balance sheets of FBBs at end 2010

- FBBs borrow the U.S. dollars from the global banks, swaps the U.S. dollars into KRW, and invest the proceeds in local bonds
- FBBs are the outposts of the global banking organizations, and their liabilities are the main instruments for cross-border funding to the Korean financial markets
- CIP deviation ( $r_b$ -Libor-sw) is a representative cost of cross-border funding required by the global banking organizations



# Transmission Channel of FX-related MPMs



I. Background

II. Transmission Channel

**III. Model and Data**

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# Model

- Bayesian VAR models consisting of banks' FX borrowings and other financial variables

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

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

# Identification

- Impose a combination of sign and exclusion restrictions as suggested by economic theory and institutional features of banks' FX operations
- Identify 4 structural shocks for 4-variable model, and 3 structural shocks for 3-variable model

Shocks\Variables	$vix$	$\beta$ or $cid$	$k^d$ or $k^f$	$fd^d$ or $fd^f$
Risk perception shock	*	*	*	*
Supply shock	0	$\geq$	$\leq$	$\leq$
Demand shock	0	$\geq$	$\geq$	$\geq$
FX derivatives ratio shock	0	0	0	*

# Data

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- Quarterly data for 2003Q1 – 2012Q2 (baseline sample)  
Monthly data for 2003M1 – 2012M6 (sensitivity check)
- FX borrowings  
Quarterly data from IIP and monthly data from BOP
- Price measures  
Borrowing spread is a weighted average of 8 major commercial banks  
CIP deviation is (3M CD rate – 3M Lbor rate – 3M swap rate)
- FX derivatives position ratio is the net position of the notional value of FX derivative contract as a fraction of equity capital
- VIX index is the implied volatility of S&P 500 index options
  
- FX borrowings are normalized by nominal GDP
- VIX index, borrowing spread, and FX derivatives ratio are first differenced
- Lag length is 2 for quarterly data and 3 for monthly data

# Estimation Procedure

- Estimate a reduced-form BVAR model

$$Y_t = \Phi(L)Y_{t-1} + e_t \quad Y_t = [I - \Phi(L)L]^{-1}e_t \quad e_t = P\epsilon_t$$

- Consider an arbitrary lower triangular matrix R by Cholesky

$$e_t = Ru_t$$

- Introduce an orthonormal matrix Q( $\theta$ ) such that

$$Q(\theta)' Q(\theta) = Q(\theta) Q(\theta)' = I$$

- Obtain the structural MA representation

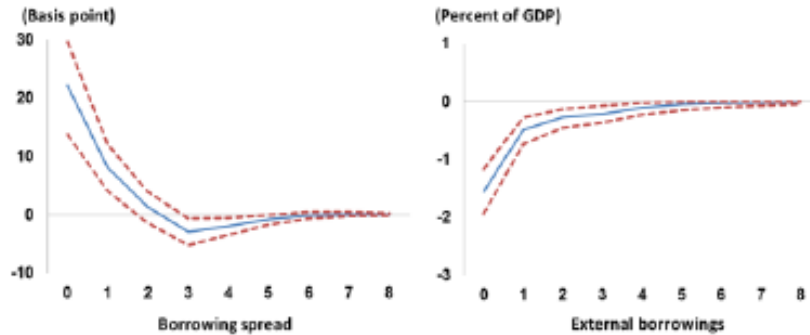
$$Y_t = [I - \Phi(L)L]^{-1}RQ(\theta)' Q(\theta)u_t$$

Then the valid rotation matrix is  $P=RQ(\theta)'$  and structural shocks are  $\epsilon_t=Q(\theta)u_t$  for  $\theta$  satisfying the sign restrictions

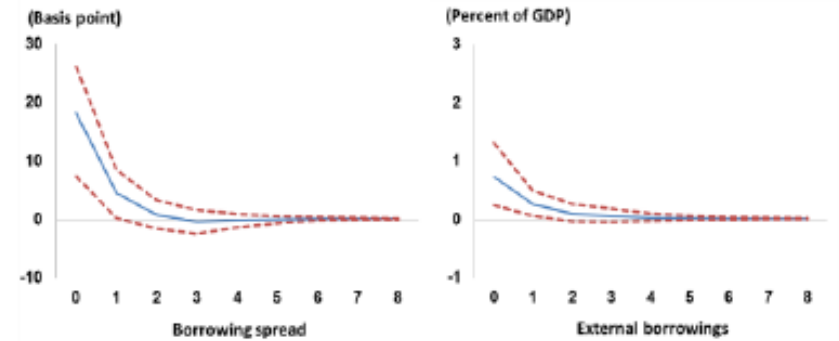
# Impulse Responses for DBs

## A. Short-term borrowings

### Supply shock

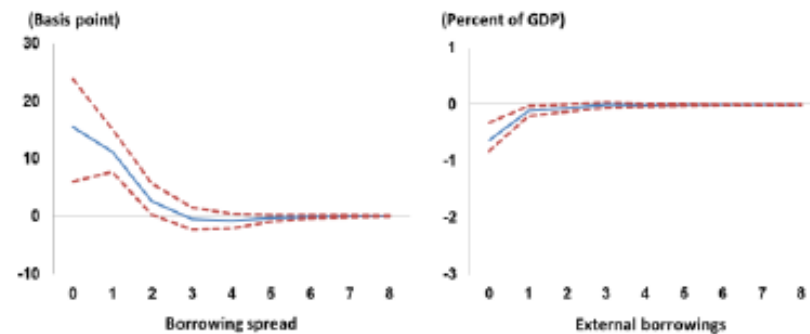


### Demand shock

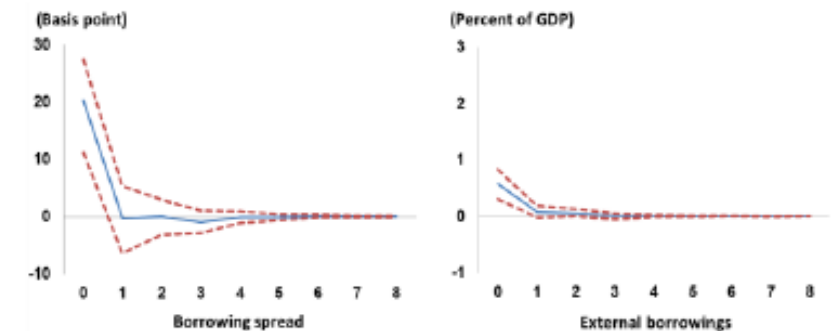


## B. Long-term borrowings

### Supply shock



### Demand shock

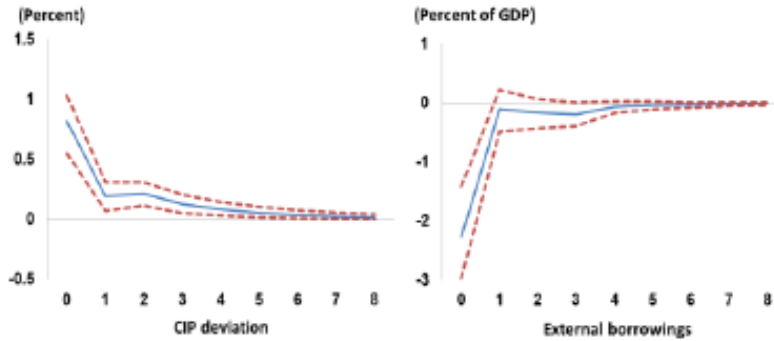




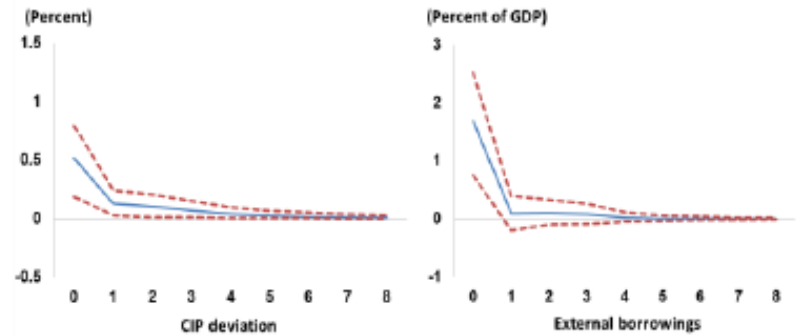
# Impulse Responses for FBBs

## A. Short-term borrowings

### Supply shock

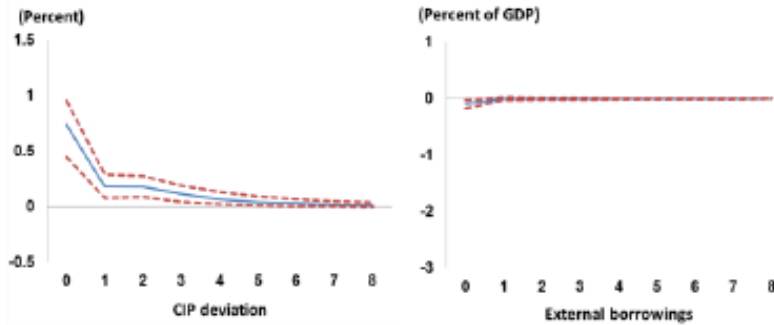


### Demand shock

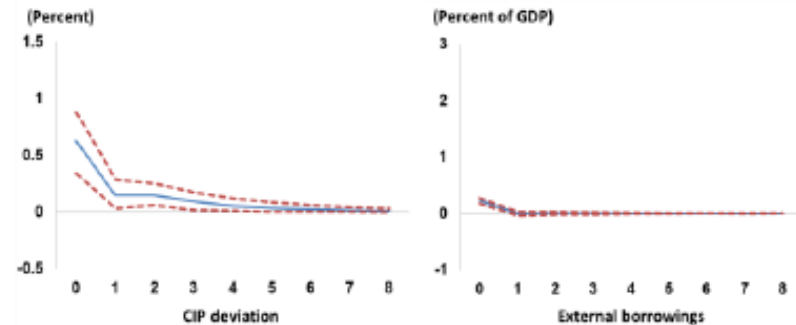


## B. Long-term borrowings

### Supply shock



### Demand shock



# Forecast Error Variance Decomposition of FX borrowings

Forecast horizon	Short-term borrowings		Long-term borrowings	
	Push factor	Pull factor	Push factor	Pull factor
<b>A. Domestic banks</b>				
Q1	0.931	0.069	0.597	0.403
Q2	0.894	0.106	0.815	0.185
Q3	0.948	0.052	0.494	0.506
Q4	0.970	0.030	0.609	0.391
<b>B. Foreign bank branches</b>				
Q1	0.794	0.206	0.314	0.686
Q2	0.988	0.012	0.907	0.093
Q3	0.831	0.169	0.084	0.916
Q4	0.938	0.062	0.432	0.568

- I. Background
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# Counterfactual Assumptions

- Policy scenario

Produce a counterfactual forecast taking the actual levels of policy proxy variables (FX derivatives ratio, borrowing spread, or CID) that were observed over the forecast horizon as conditioning assumptions

$$E [k_{T+h} | \Omega_T, z_{T+1}^P, \dots, z_{T+H}^P]$$

- No policy scenario

Policy variables would have followed a different path

(Leverage cap) the FX derivatives ratio would have been higher over the forecast horizon had the leverage cap not been implemented

The size of the increase is higher for FBBs than for DBs

(MSL) the borrowing spread or the CID would have been lower over the forecast horizon had the MSL not been implemented

The size of the decrease is 20 bp for ST and 10 bp for LT

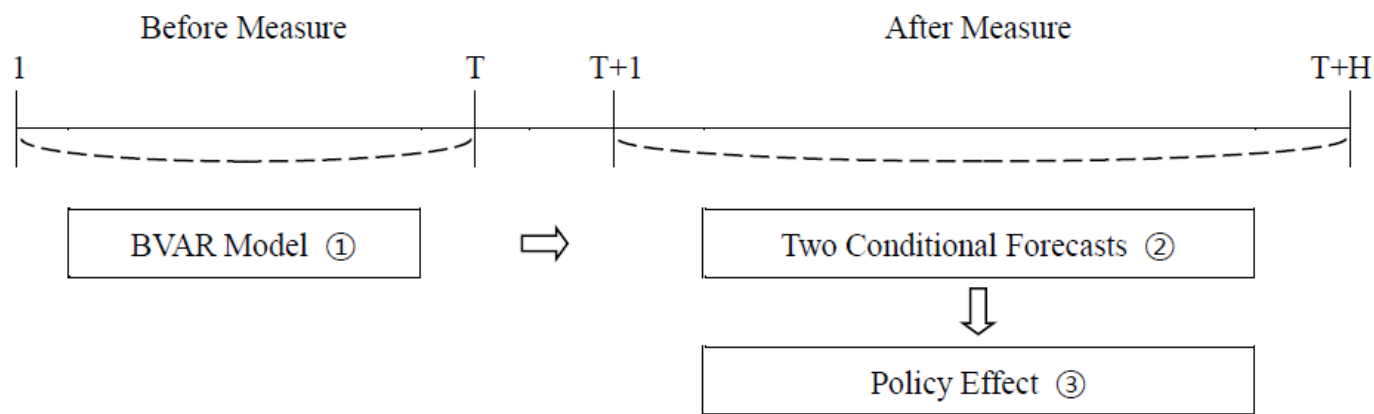
$$E [k_{T+h} | \Omega_T, z_{T+1}^{NP}, \dots, z_{T+H}^{NP}]$$

# Empirical Strategy

- STEP 1. Estimate BVAR model using data prior to MPMs

$$Y_t = \Phi(L) Y_{t-1} + e_t$$

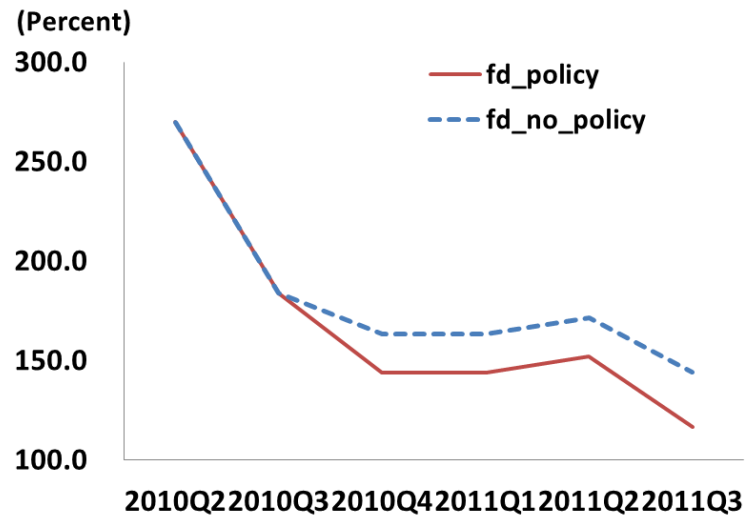
- STEP 2. Produce the two conditional forecasts of FX borrowings (both policy and no policy scenario)
- STEP 3. Measure the policy impact as the difference between the two forecasts



# Impact of Leverage Cap

- FBBs

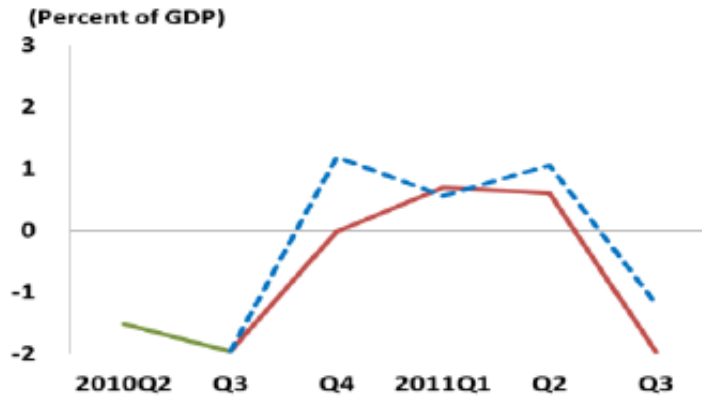
Counterfactual assumptions about of FX derivatives ratio for FBBs



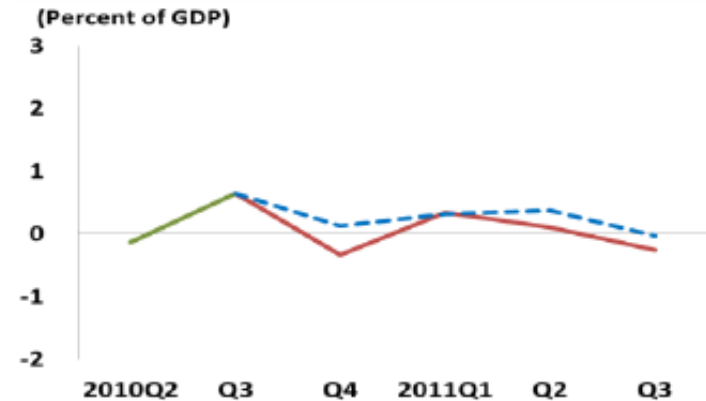
# Impact of Leverage Cap

- FBBs

A. Short-term borrowings



B. Long-term borrowings

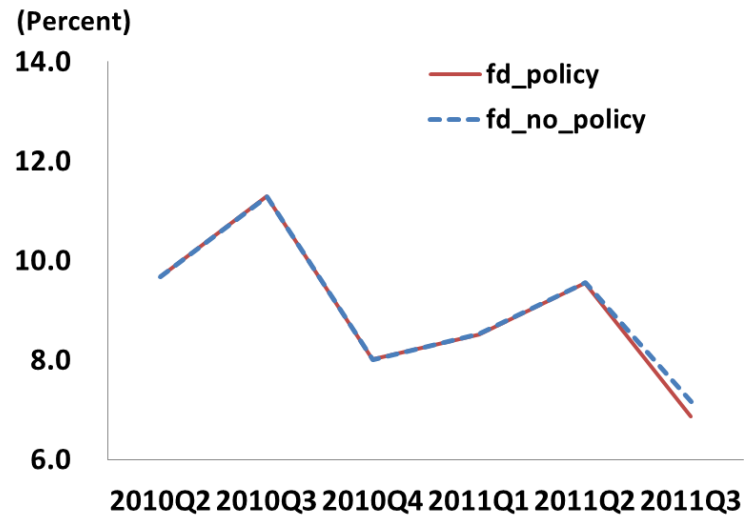


Notes: Solid red lines (broken blue line) represent conditional forecasts under the policy scenario (the no policy scenario); solid green lines represent actual values.

# Impact of Leverage Cap

- DBs

Counterfactual assumptions about of FX derivatives ratio for DBs





# Impact of Leverage Cap

- DBs

A. Short-term borrowings



B. Long-term borrowings



Notes: Solid red lines (broken blue line) represent conditional forecasts under the policy scenario (the no policy scenario); solid green lines represent actual values.

# Impact of Leverage Cap

- Summary

(Percent of annual GDP)

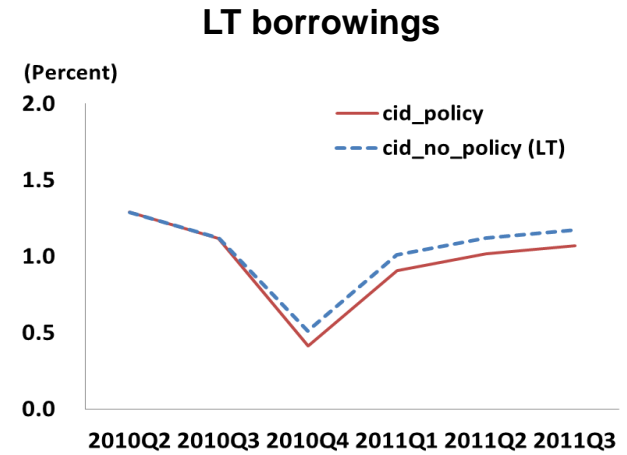
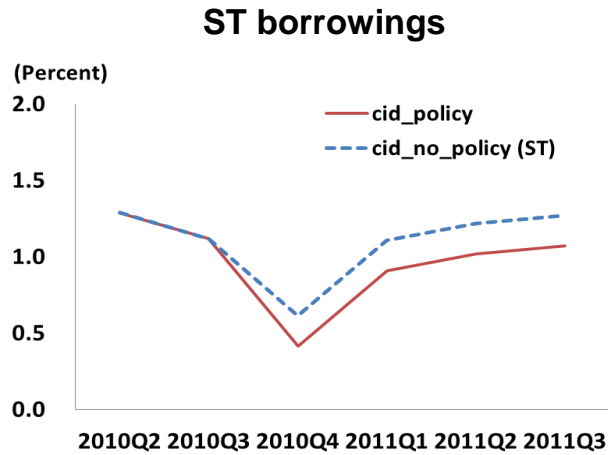
	Foreign bank branches		Domestic banks	
	Short-term borrowings	Long-term borrowings	Short-term borrowings	Long-term borrowings
Four-variable model	0.57	0.23	0.05	0.02
Three-variable model	0.50	0.24	0.04	0.02

Notes: Cumulative effects on FX borrowings are measured as the decline in FX borrowings cumulated over the one-year period divided by annual GDP.

# Impact of MSL

- FBBs

## Counterfactual assumptions about of CIP deviation for FBBs



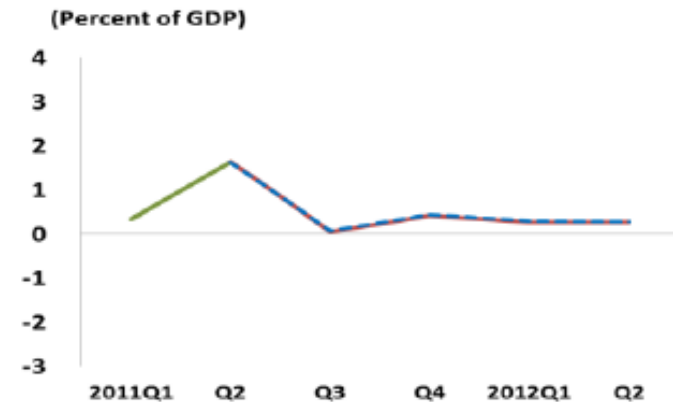
# Impact of MSL

- FBBs

A. Short-term borrowings



B. Long-term borrowings



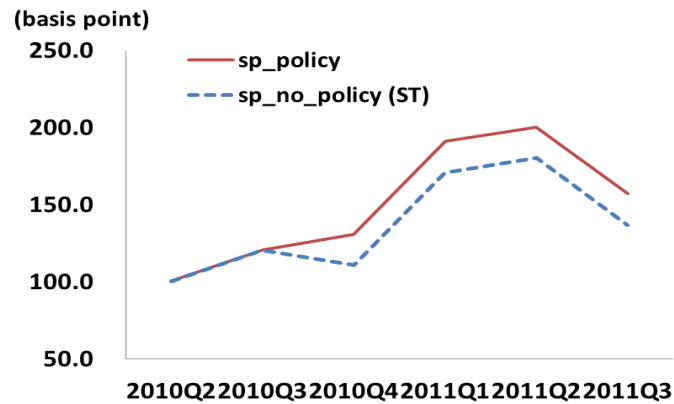
Notes: Solid red lines (broken blue line) represent conditional forecasts under the policy scenario (the no policy scenario); solid green lines represent actual values.

# Impact of MSL

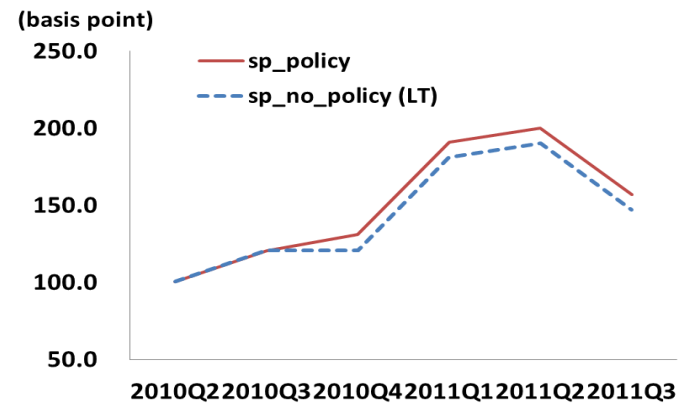
- DBs

## Counterfactual assumptions about of borrowing spread for DBs

### ST borrowings



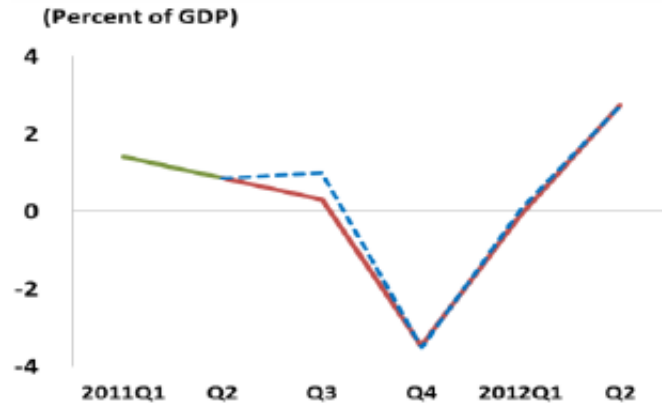
### LT borrowings



# Impact of MSL

- DBs

A. Short-term borrowings



B. Long-term borrowings



Notes: Solid red lines (broken blue line) represent conditional forecasts under the policy scenario (the no policy scenario): solid green lines represent actual values.

# Impact of MSL

- Summary

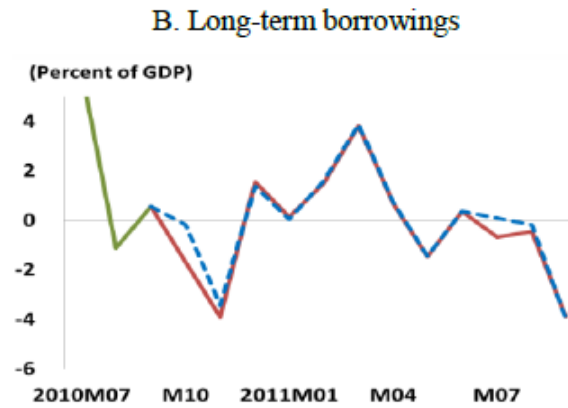
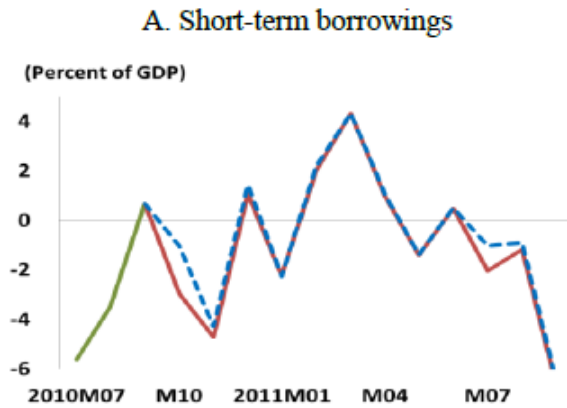
(Percent of annual GDP)

	Foreign bank branches		Domestic banks	
	Short-term borrowings	Long-term borrowings	Short-term borrowings	Long-term borrowings
Four-variable model	0.18	0.02	0.20	0.01
Three-variable model	0.20	0.02	0.11	0.01

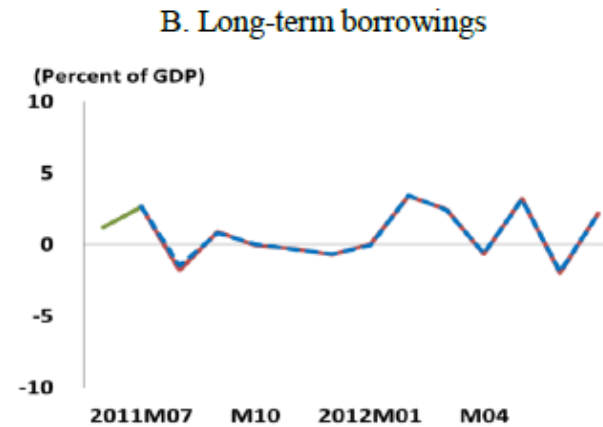
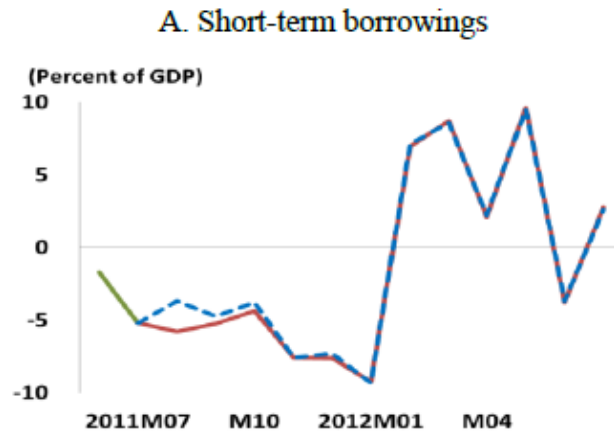
Notes: Cumulative effects on FX borrowings are measured as the decline in FX borrowings cumulated over the one-year period divided by annual GDP.

# Monthly Data

## Impact of leverage cap



## Impact of MSL





# Monthly Data

- Summary

(Percent of annual GDP)

	Leverage cap		Macroprudential levy	
	Short-term borrowings	Long-term borrowings	Short-term borrowings	Long-term borrowings
Four-variable model	0.37	0.24	0.29	0.02
Three-variable model	0.43	0.22	0.19	0.02

Notes: Cumulative effects on FX borrowings are measured as the decline in FX borrowings cumulated over the one-year period divided by annual GDP.

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# Conclusion

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## ● Findings

- Both MPMs caused a sizeable reduction in ST FX borrowings, while causing much smaller or nearly no reduction in LT FX borrowings
- Thus, the MPMs may have helped to mitigate the vulnerabilities to external financial conditions by improving the maturity structure of foreign currency funding by banks
- May be useful for other EMEs contemplating similar measures
- Substantial uncertainties regarding the precise estimates

## ● Further issues

- Issues of circumvention: bond and equity flows
- Institutional upgrade to deepen financial markets