THE BANK OF KOREA

Interest Rate-Oriented Monetary Policy Framework and Financial Procyclicality

(with Byoung-Ki Kim and Hail Park)

Kyungsoo Kim

Institute for Monetary and Economic Research,

The Bank of Korea

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Introduction

- A Lesson of the Global Financial Crisis
  - Importance of financial intermediaries: Blanchard et al. (2010), Adrian and Shin (2009) and many others
- Central bank's high-powered money: one of the most important but neglected funding source
  - Under current interest rate-oriented monetary policy framework
  - Credit supply to the ultimate borrowers (domestic households and firms) is dependent upon three key attributes of FI's B/S: equity, leverage and funding sources

Central Bank's Money as a Funding Source

- Consider an economy composed of:
  - a central bank
  - n banks: indexed from 1 to n
  - ultimate borrowers (households and firms)
  - and foreign creditors

- Then B/S identities lead to

$$\sum_{i=1}^{n} y_i = \sum_{i=1}^{n} e_i + \sum_{i=1}^{n} x_i z_i + \sum_{i=1}^{n} f_i.$$

Loans = equity + private deposits + foreign deposits

  - But this misses another major funding source in interest rate-oriented monetary policy framework

- Recall

$$\sum_{i=1}^{n} R_i = r\left(\sum_{i=1}^{n} x_i z_i\right) = \sum_{i=1}^{n} L_i,$$

Reserves = Avg Reserve Ratio x Deposits = CB Loans

- Then

$$\sum_{i=1}^{n} y_i = \sum_{i=1}^{n} e_i + \frac{1}{r}\sum_{i=1}^{n} L_i + \sum_{i=1}^{n} f_i.$$

  - CB's high-powered money can be used as a funding source if banks are willing to pay the policy rate under the current interest rate-oriented monetary policy framework.

- Flow concept with two banks

Bank 1		Bank 2	
y_1	D_1	y_2	D_2
m_2	m_1	m_1	m_2
R_1	L_1	R_2	L_2
	e_1		e_2

y_i: Bank i's loans to ultimate borrowers

D_i: Bank i's deposit liabilities

R_i: Bank i's reserves;

L_i: Bank i's borrowings from the central bank

m_i: Bank i's interbank liabilities

e_i: Bank i's equity.

- Consider interbank transactions:

$$\Delta y_1 + \Delta m_2 = \Delta m_1, \qquad \Delta y_2 + \Delta m_1 = \Delta m_2.$$

Adding the two yields:

$$\Delta y_1 + \Delta y_2 = 0.$$

→ Interbank transactions itself cannot increase the loans to the ultimate borrowers.

- Spse Bank1 has excess reserves and use them up:

$$\Delta y_1 + \Delta y_2 + \Delta R_1 = 0.$$

→ Banks can exploit the excess capacity to increase the loans to the ultimate borrowers.

- Similarly Banks can borrow from the central bank:

$$\Delta y_1 + \Delta y_2 = \Delta L_1 + \Delta L_2 = \Delta R_1 + \Delta R_2 .$$

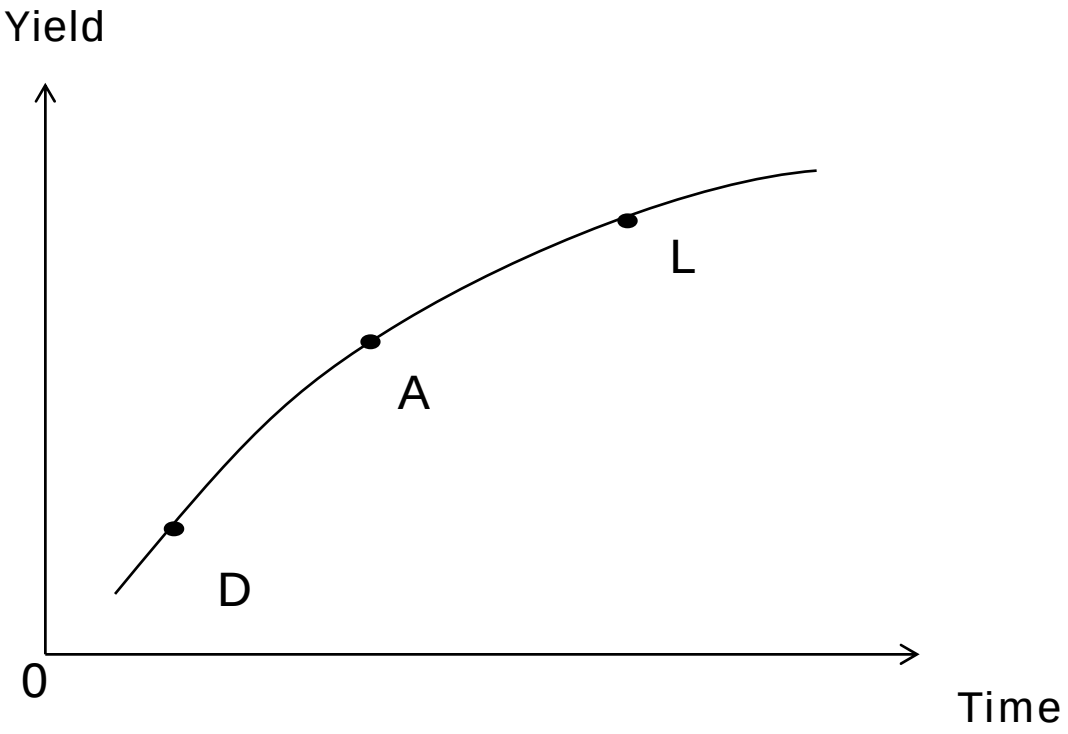
→ Banks can use the central bank's money as a funding source if they are willing to pay the policy rate.

- This is due to current interest rate-oriented monetary policy framework: CB decides the price of the funds (CB's money) and banks decides the quantity of the funds.

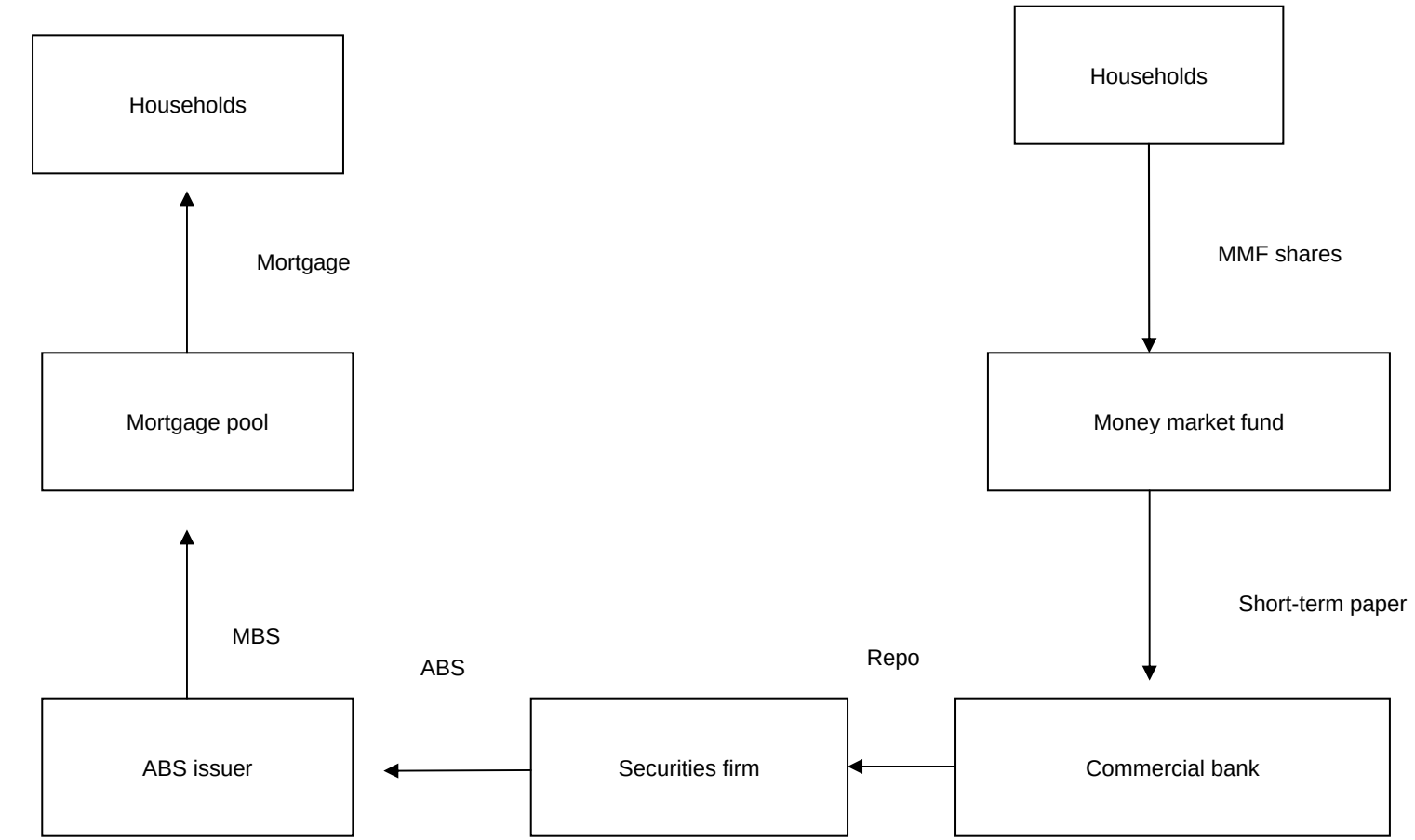
If CB does not provide the quantity the Banks need, short term market interest rates overshoot.

In that case, CB injects high-powered money into the financial system through OMOs.

- Interbank transactions involving maturity transformations

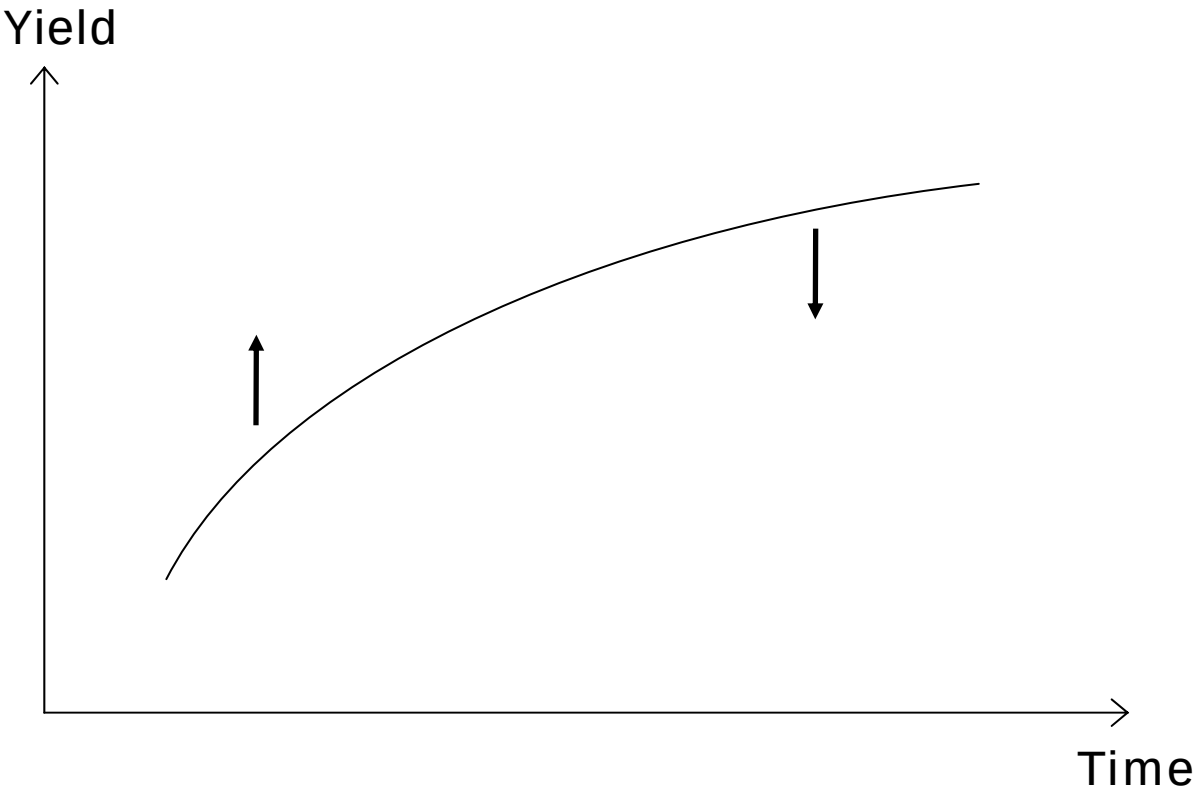


- Chain of Financial Intermediation

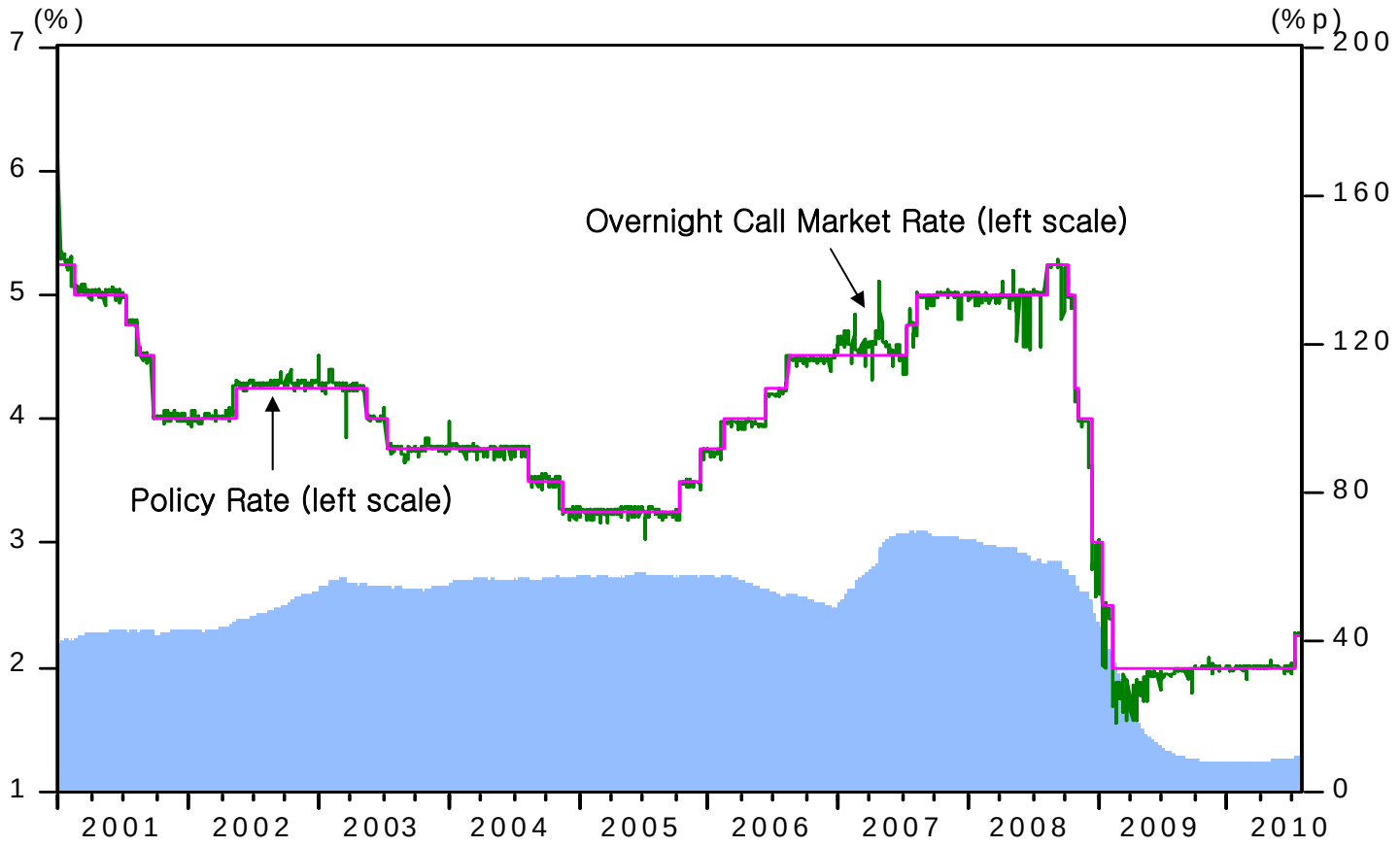


Source: Shin and Shin (2010)

- Twist of Yield Curve



Policy Rate and Overnight Call Market Rate

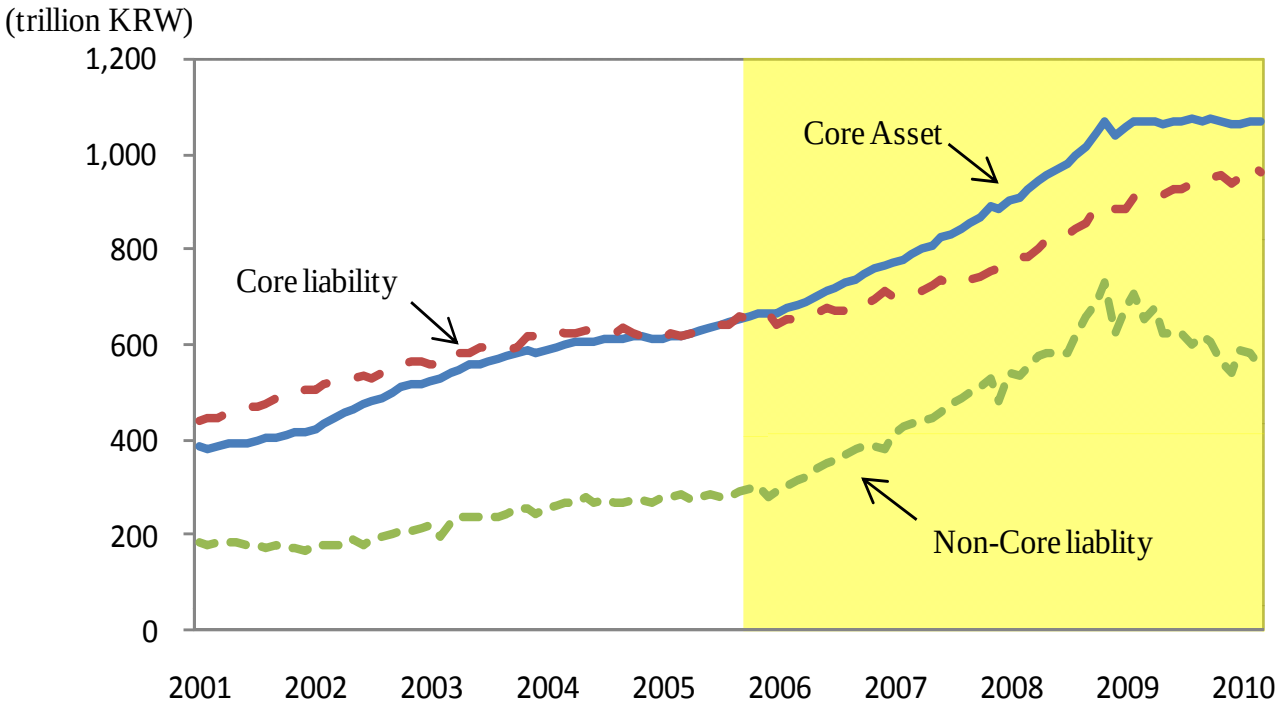


Note : shaded area is cumulative spreads between overnight call market rate and policy rate (right scale)

Source : BOK

Credit Supply in the Korean Banking Sector

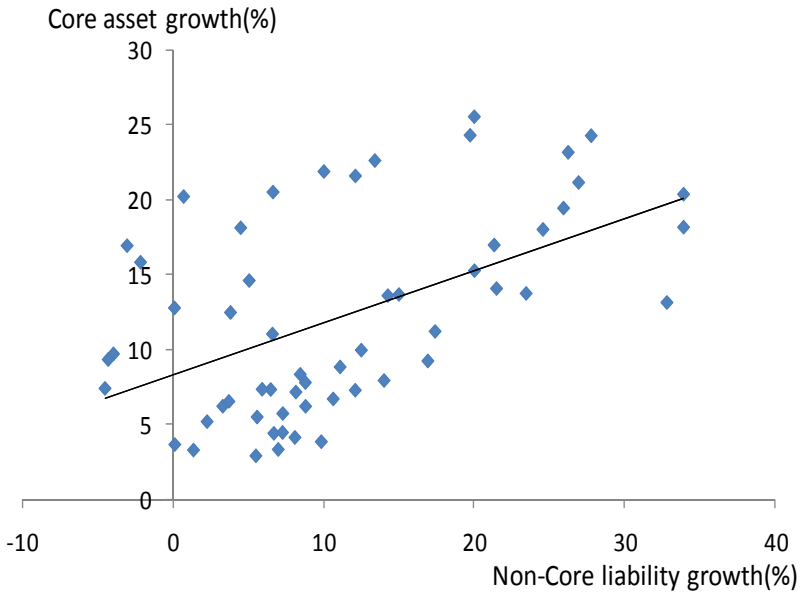
- From the 4th quarter of 2005 through onset of the global financial crisis in 2008, non-core liabilities increased rapidly.
- Core assets remain above the level of core liabilities ⇒ Loan-to-deposit ratio exceeds 1.



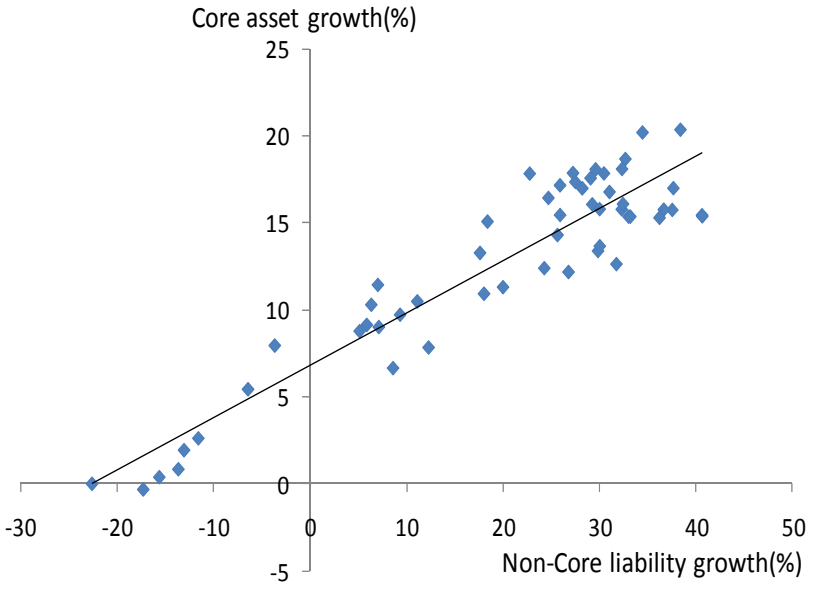
Relationships of Core Assets and Non-Core Liabilities

- In particular, core asset growth and non-core liability growth show a strong linear relationship from October 2005 to March 2010.

<2001.1 – 2005.9>

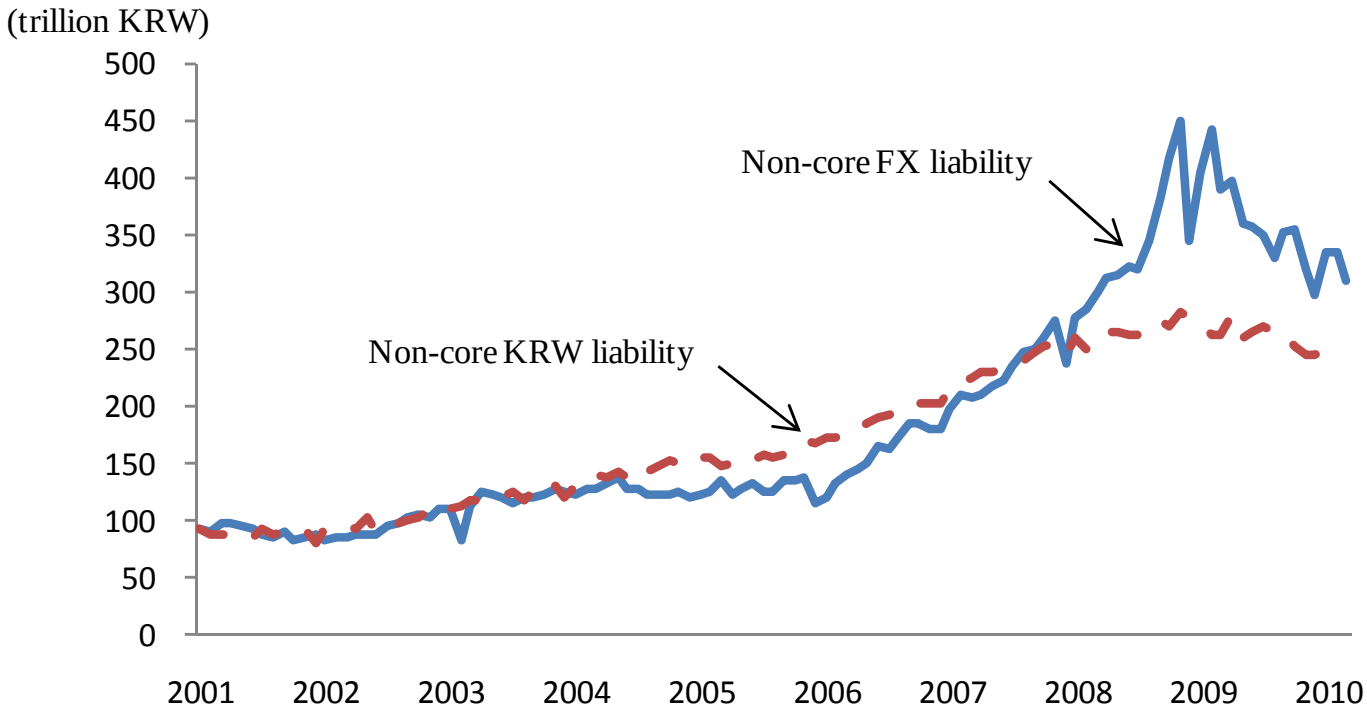


<2005.10 – 2010.3>



Two Major Sources of the Increase in Non-Core Liabilities

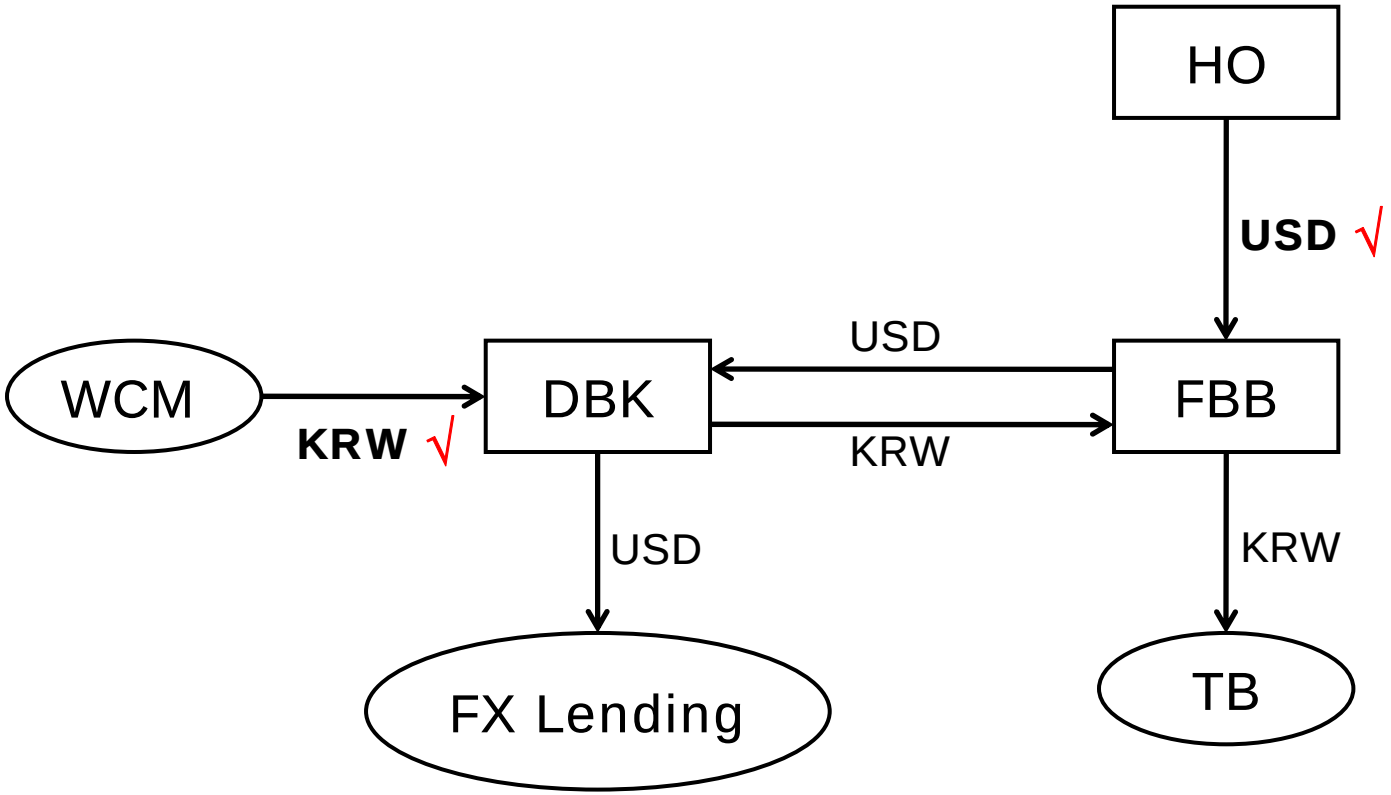
- Lending competition among domestic banks : CDs and commercial bank debentures
- Fx borrowings of foreign bank branches : funded from their headquarters



Capital Flow by a Foreign Bank Branch in Korea

- Foreign exchange swaps are a prevalent form of foreign liquidity funding by the banking sector

- FBB obtains capital gains without risk
- Maturity transformation



Empirical Evidences

- Regression model

$$CA_t = \alpha + \beta_1 CA_{t-1} + \beta_2 NCL_t + \beta_3 Z_t + \varepsilon_t$$

$$M_t = \alpha + \beta_1 M_{t-1} + \beta_2 NCL_t + \beta_3 Z_t + \varepsilon_t$$

- Core asset growth, monetary base growth, and M2 growth are regressed on non-core liability growth and other explanatory variables

Regression of Core Asset Growth on Non-Core Liability Growth

Sub-sample period 1 (2001.1 ~ 2005.9)

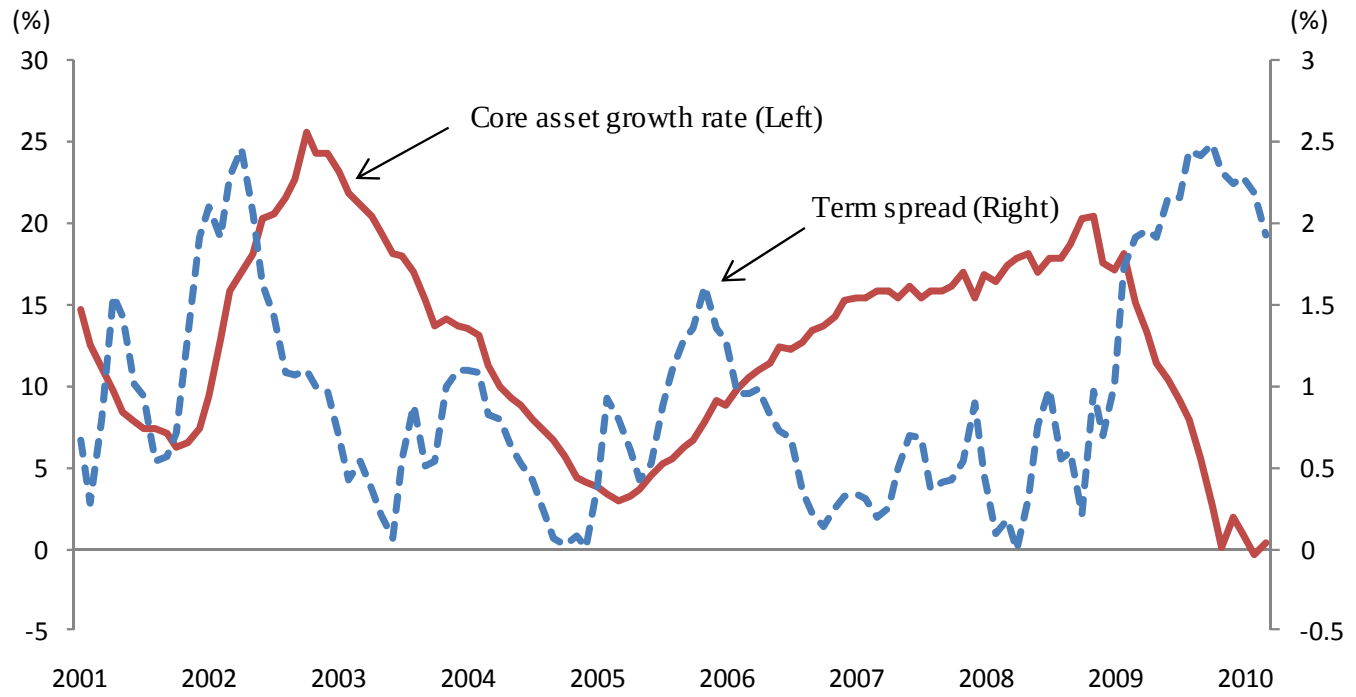
Dependent variable : **Core Asset growth**	Model 1	Model 2	Model 3
Core Asset growth(-1)	0.763**	0.981***	0.944***
	[0.352]	[0.033]	[0.038]
Non-core Liability growth	0.023	-0.003	0.016
	[0.014]	[0.024]	[0.016]
Term spread		0.013***	0.011***
		[0.003]	[0.004]
Call rate			0.007
			[0.009]
Constant	0.023	-0.011***	-0.006
	[0.032]	[0.004]	[0.005]
Adjusted R-squared	0.982	0.979	0.983

Sub-sample period 2 (2005.10 ~ 2010.3)

Dependent variable : **Core Asset growth**	Model 1	Model 2	Model 3
Core Asset growth(-1)	0.636***	0.764***	0.758***
	[0.083]	[0.075]	[0.081]
Non-core Liability growth	0.128***	0.069*	0.069*
	[0.026]	[0.035]	[0.035]
Term spread		-0.006*	-0.006*
		[0.003]	[0.003]
Call rate			-0.002
			[0.004]
Constant	0.020***	0.022***	0.023***
	[0.006]	[0.005]	[0.006]
Adjusted R-squared	0.972	0.972	0.971

Core Asset Growth and Term Spread of the Yield Curve

- Term spread is unlikely to reflect real activity of the Korean economy due to the active maturity transformations and some other reasons.



Regression of Monetary Base Growth on Non-Core Liability Growth

Sub-sample period 1 (2001.1 ~ 2005.9)

Dependent variable : **Monetary base growth**	Model 1	Model 2	Model 3
Monetary base growth (-1)	0.678***	0.663***	0.663***
	[0.124]	[0.095]	[0.098]
Non-core Liability growth	-0.011	-0.014	-0.013
	[0.055]	[0.057]	[0.057]
Call rate		-0.051	-0.052
		[0.094]	[0.092]
Industrial production growth			-0.361
			[0.418]
Constant	0.030**	0.030**	0.031**
	[0.013]	[0.014]	[0.014]
Adjusted R-squared	0.115	0.107	0.099

Sub-sample period 2 (2005.10 ~ 2010.3)

Dependent variable : **Monetary base growth**	Model 1	Model 2	Model 3
Monetary base growth (-1)	0.563***	0.547***	0.492***
	[0.105]	[0.095]	[0.084]
Non-core Liability growth	0.108**	0.092**	0.109**
	[0.043]	[0.044]	[0.054]
Call rate		-0.070	-0.098*
		[0.048]	[0.056]
Industrial production growth			0.572
			[0.511]
Constant	0.030**	0.034***	0.033**
	[0.013]	[0.013]	[0.013]
Adjusted R-squared	0.352	0.363	0.378

Regression of M2 Growth on Non-Core Liability Growth

Sub-sample period 1 (2001.1 ~ 2005.9)

Dependent variable : **M2 growth**	Model 1	Model 2	Model 3
M2 growth (-1)	0.921***	0.922***	0.920***
	[0.054]	[0.055]	[0.056]
Non-core Liability growth	-0.020	-0.020	-0.019
	[0.019]	[0.020]	[0.020]
Call rate		-0.001	-0.001
		[0.014]	[0.014]
Industrial production growth			-0.048
			[0.072]
Constant	0.008*	0.008*	0.009*
	[0.005]	[0.005]	[0.005]
Adjusted R-squared	0.852	0.849	0.847

Sub-sample period 2 (2005.10 ~ 2010.3)

Dependent variable : **M2 growth**	Model 1	Model 2	Model 3
M2 growth (-1)	0.835***	0.844***	0.858***
	[0.045]	[0.046]	[0.047]
Non-core Liability growth	0.016**	0.016**	0.017**
	[0.006]	[0.006]	[0.007]
Call rate		0.003	0.001
		[0.003]	[0.004]
Industrial production growth			0.065
			[0.046]
Constant	0.015***	0.014***	0.012**
	[0.005]	[0.005]	[0.005]
Adjusted R-squared	0.812	0.809	0.812

Empirical Evidences

- VAR model

$$\begin{bmatrix} NCL_t \\ F_t \end{bmatrix} = \Phi(L) \begin{bmatrix} NCL_{t-1} \\ F_{t-1} \end{bmatrix} + v_t$$

- Stack Non-core liability growth, the common factor between monetary base growth and M2 growth into a traditional VAR system.

- Impulse response, Variance decomposition

Parameter Estimates of VAR model

- Full-sample Period: 2001.1~2010.3

$$F_t = \underset{[0.103]}{-0.094} + \underset{[0.068]}{0.690^{***}} F_{t-1} + \underset{[0.508]}{0.769} NCL_{t-1} \qquad Ad.R^2 = 0.538$$

$$NCL_t = \underset{[0.009]}{0.008} - \underset{[0.006]}{0.004} F_{t-1} + \underset{[0.043]}{0.940^{***}} NCL_{t-1} \qquad Ad.R^2 = 0.829$$

- Sub-sample Period 1: 2001.1~2005.9

$$F_t = \underset{[0.132]}{-0.008} + \underset{[0.097]}{0.720^{***}} F_{t-1} - \underset{[0.864]}{0.854} NCL_{t-1} \qquad Ad.R^2 = 0.483$$

$$NCL_t = \underset{[0.013]}{0.025^{*}} - \underset{[0.009]}{0.002} F_{t-1} + \underset{[0.084]}{0.785^{***}} NCL_{t-1} \qquad Ad.R^2 = 0.605$$

- Sub-sample Period 2: 2005.10~2010.3

$$F_t = \underset{[0.164]}{-0.113} + \underset{[0.109]}{0.576^{***}} F_{t-1} + \underset{[0.705]}{1.506^{**}} NCL_{t-1} \qquad Ad.R^2 = 0.481$$

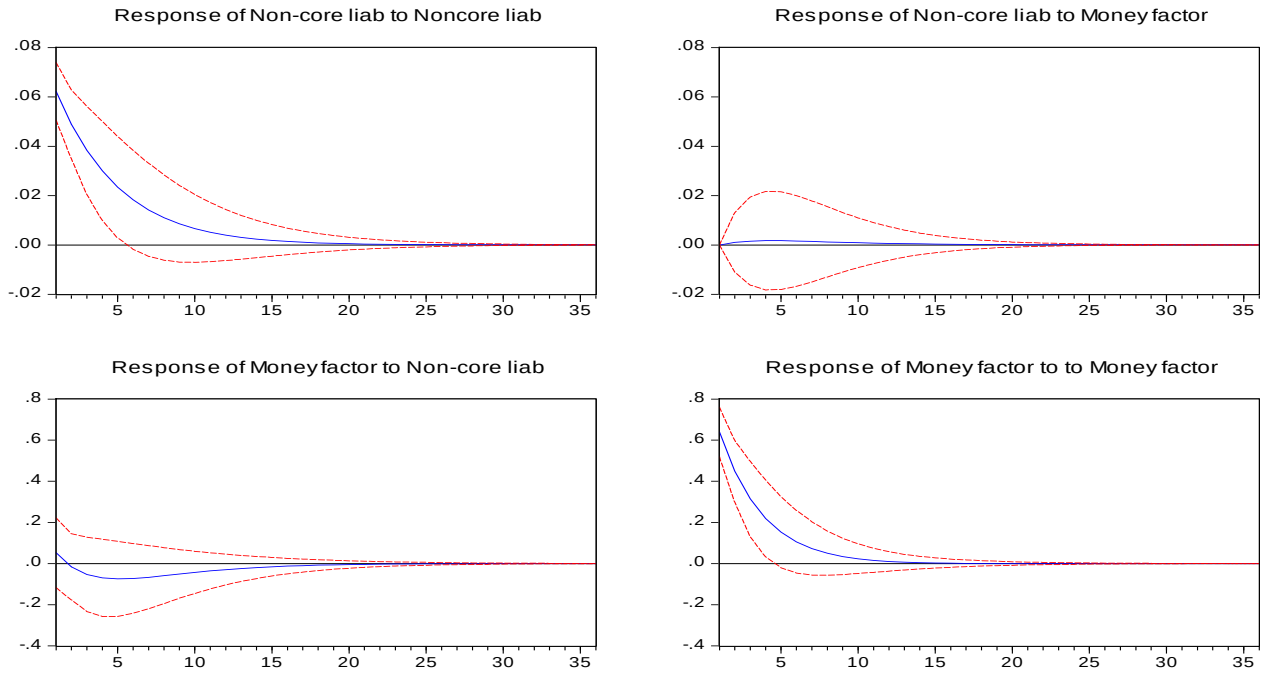
$$NCL_t = \underset{[0.011]}{-0.002} - \underset{[0.008]}{0.159^{**}} F_{t-1} + \underset{[0.049]}{1.026^{***}} NCL_{t-1} \qquad Ad.R^2 = 0.902$$

VAR model : Impulse Response

- The initial responses of non-core liability growth to the money growth factor shock are insignificant regardless of the sample periods.

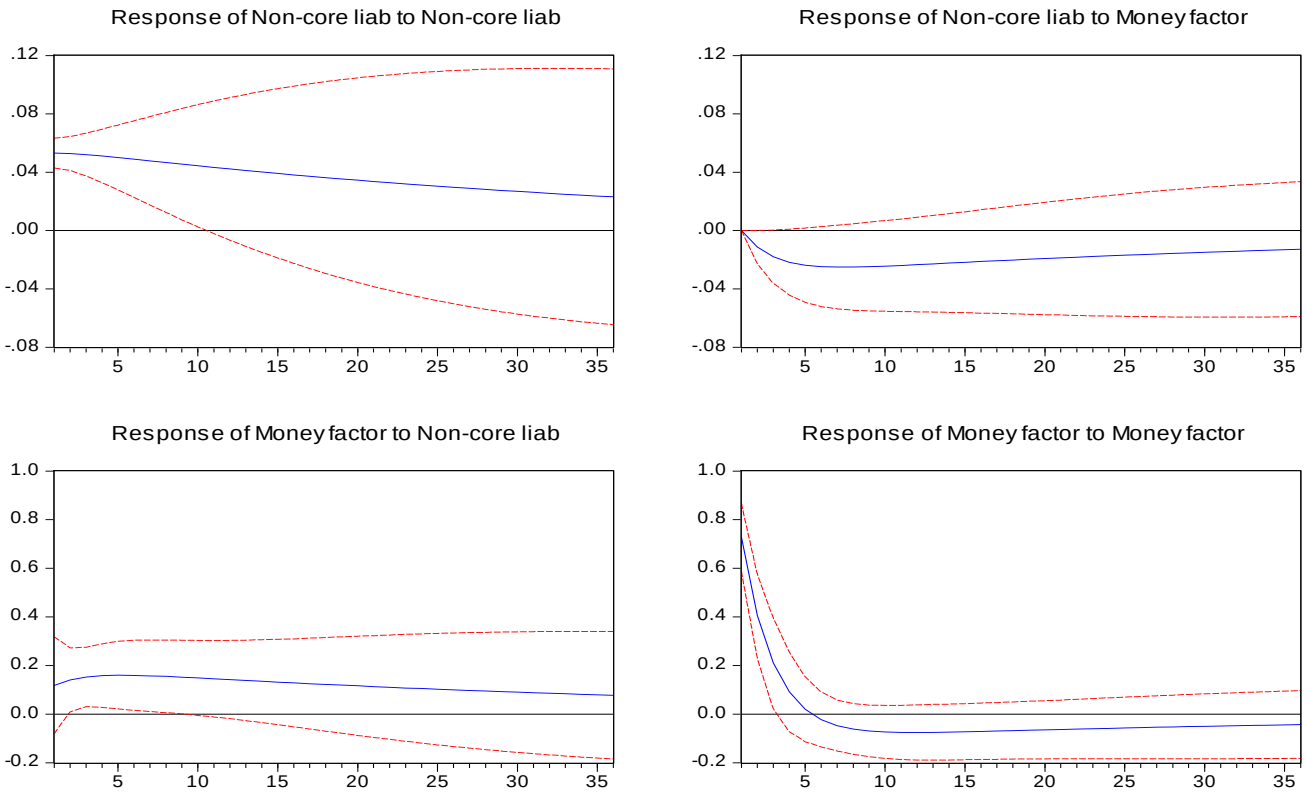
- In the second sub-sample period, a non-core liability growth shock has an impact on the dynamics of the money growth factor.

Sub-sample period 1 (2001.1 ~ 2005.9)



VAR model : Impulse Response

Sub-sample period 2 (2005.10 ~ 2010.3)



VAR model : Variance Decomposition

- During boom and bust period, the considerable portion of the variance decomposition for the money growth factor is attributable to non-core liability growth.

Horizon (month)	Non-Core liability		Money factor	
	Non-Core liability	Money factor	Non-Core liability	Money factor
Full-Sample Period (2001.1 ~ 2010.3)				
1	100.00	0.00	2.83	97.17
6	99.12	0.88	9.49	90.51
12	98.47	1.53	14.53	85.47
24	98.14	1.86	17.37	82.63
36	98.09	1.91	17.81	82.19
Sub-Sample Period 1 (2001.1 ~ 2005.9)				
1	100.00	0.00	0.68	99.32
6	99.88	0.12	2.65	97.35
12	99.82	0.18	4.30	95.70
24	99.81	0.19	4.48	95.52
36	99.81	0.19	4.48	95.52
Sub-Sample Period 2 (2005.10 ~ 2010.3)				
1	100.00	0.00	2.56	97.44
6	88.20	11.80	15.10	84.90
12	83.02	16.98	25.70	74.30
24	80.45	19.55	34.92	65.08
36	79.73	20.27	38.66	61.34

Conclusion with Policy Implications

- Our findings:
  - Combination of sophisticated interbank transactions and interest rate-oriented monetary policy framework can accelerate financial procyclicality.
  - Empirical evidences using Korean financial data.
- Meaning
  - Monetary policy and financial stability policy are inseparable.
  - CB should consider endogeneity of credit supply.
  - CB should concern about asset price misalignments and financial stability.

(End of Presentation)