

Evaluation on the usefulness of the loan-to-deposit ratio regulation - From the macroprudential policy perspective -

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<Abstract>

This paper adopts a macroprudential policy perspective to evaluate the effectiveness of the loan-to-deposit ratio, the regulation that the supervisory authorities have introduced to improve domestic banks' liquidity conditions and curb bank competition to enlarge their sizes based on wholesale funding.

We conduct an empirical analysis of the usefulness of the loan-to-deposit ratio using panel data regression model. The results of cross-sectional analysis indicate that as a bank's share of wholesale funding declines, the indicator (Δ CoVaR value) of interconnectedness among financial institutions is reduced. From a times series perspective, if a bank's share of wholesale funding declines, then the procyclicality of bank lending is reduced as the linkage between the rates of increase in GDP and lending weakens. This is believed to show that the loan-to-deposit ratio regulation has served as an effective macroprudential policy tool by weakening the interconnectedness among financial institutions and the procyclicality of bank lending.

Meanwhile, analysis of the loan-to-deposit ratio regulation's effects on the monetary policy transmission channels suggests that, among the various transmission channels, the loan-to-deposit ratio influences the effectiveness of the bank lending channel, by changing bank conditions for asset management and funding. This implies that the supervisory authorities and the central bank, which are in charge of the loan-to-deposit ratio regulation, need to maintain a closer cooperative relationship.

I . Introduction

1. The Korean supervisory authorities included the loan-to-deposit ratio (Korean won loans/ Korean won deposits \times 100) among their bank management evaluation criteria in November 2008, right after the global financial crisis, and in December 2009 drew up the proposal for a loan-to-deposit ratio regulation requiring banks to maintain this ratio at 100% or below. The proposal was drawn up after the possibility of its destabilized banking sector liquidity was raised, amid a situation in which domestic banks were increasing their lending with funds raised wholesale, which are non-deposit liabilities¹⁾. At the end of 2008, the loan-to-deposit ratio of domestic banks in Korea stood at a relatively high level of 135.8%²⁾, and deep concerns about this situation were being expressed in the international media.³⁾

2. The introduction of the regulation⁴⁾ generated the expected policy effects (e.g. a decline in the share of banks ' wholesale funding). The regulation has the nature of a macroprudential policy, which aims to curb systemic risks. This paper will evaluate the usefulness of the loan-to-deposit ratio regulation from the macroprudential policy perspective. Chapter II covers the main details of the regulation, and the changes in domestic banks' loan-to-deposit ratios, wholesale funding, deposits and lending since its introduction. Chapter III assesses the impacts of the resulting declines in wholesale funding on the interconnectedness among financial institutions and on the pro-cyclicality of bank lending. Chapter IV looks at some problems that can be caused

1) Wholesale funding is a method by which banks issue CDs, RPs, bank debentures, etc. to raise funds on a large scale. The amount of such funding changes greatly depending upon conditions in the money or capital markets.

2) 135.8% in Korea (domestic bank basis), 75.0% in China, 59.0% in Japan, 99.8% in the US, 103.0% in Germany, 53.1% in Hong Kong, 246.9% in Spain, 52.3% in Brazil, and 112.7% in the UK

3) According to the *Financial Times* (Oct. 14, 2008), the high loan-to-deposit ratio of Korean banks was the result of Korean banks raising and operating funds with a heavy dependence on wholesale funding, unlike banks in other Asian countries. *The Wall Street Journal* (Oct. 15, 2008) reported that the loan-to-deposit ratio of Korean banks was 136% on average, greatly exceeding the average of banks in other Asian countries (82%).

4) In December 2009 the supervisory authorities required banks to comply with the regulation by end-2013, but in June 2011 brought forward the date for meeting the requirements to the end of June 2012.

by this regulation, Chapter V finally summarizes.

II. Trends of Bank Deposits and Loans since Introduction of the Loan-to-Deposit Ratio Regulation

A. Main Details of Loan-to-Deposit Ratio Regulation

3. The loan-to-deposit ratio regulation is basically an instrument for managing banks' liquidity, by limiting the sizes of their loans to within a certain ratio to their deposits. During a period of economic expansion, however, this regulation is used to curb any expansion in lending (CGFS 2012).

4. In November 2008 the Korean supervisory authorities included the loan-to-deposit ratio among its quantitative evaluation criteria for the liquidity section of their bank management evaluations.⁵⁾ In December 2009, they drew up a proposal to introduce a loan-to-deposit ratio regulation requiring banks to maintain the average balances of their Korean won loans at 100% or less of the average balances of their Korean won deposits excluding CDs.⁶⁾⁷⁾ Implementation of the regulation was originally scheduled for the end of 2013, but as part of the government's comprehensive measures for a soft landing of household debt announced in June 2011 it was then moved forward to end-June 2012.

5. Considering that domestic banks began endeavoring to reduce their wholesale funding from December 2009, after the proposal was first drawn up, we have

5) Under the Banking Supervision Regulation banks were originally required to maintain loan-to-deposit ratios of 100% or less, but this provision was scrapped as part of financial regulatory easing in November 1998.

6) This regulation is applied to commercial banks (including local branches of foreign banks) having Korean won loans of 2 trillion won or more, and in the cases of specialized banks is applied only to NH Bank while excluding the KDB, IBK and Suhyup Bank in consideration of the specializations of their lending tasks.

7) Article 26 of the Banking Supervision Regulation

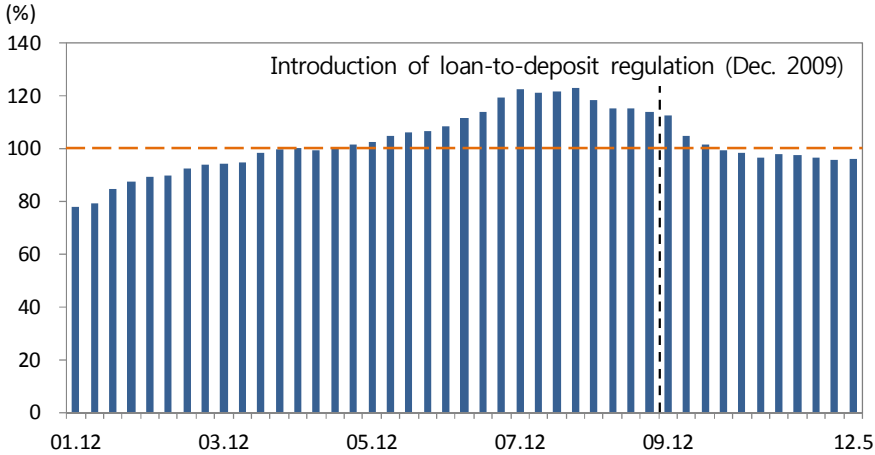
analyzed the regulation's impacts by assuming December 2009 as the time of its introduction.

B. Trends in Loan-to-Deposit Ratios of Domestic Banks

6. Domestic banks (based on those subject to the regulation) had maintained low loan-to-deposit ratios after the Asian currency crisis, by improving their capital adequacy ratios and refraining from extending corporate loans so as to avoid credit risks. In the course of economic recovery their loan-to-deposit ratios increased steadily, however, and peaked at 122.9% in September 2008, the month when the global financial crisis broke out.⁸⁾

7. The domestic bank loan-to-deposit ratio has fallen steadily since introduction of this regulation, and stood at 96.0% as of end-May 2012.

<Graph 1> Loan-to-deposit ratios of domestic banks¹⁾



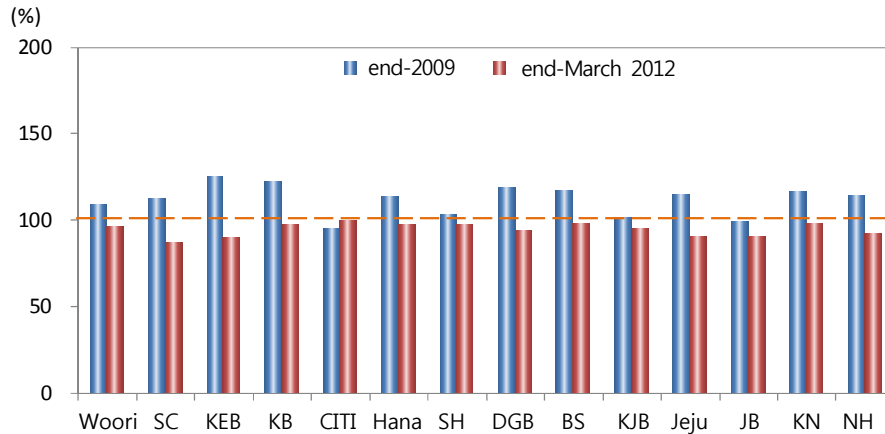
Note : 1) Based on commercial banks and NH NongHyup Bank subject to the LTD regulation

Sources : Banks' business reports

8) Based on banks (commercial banks and NH Bank) subject to the regulation (with all domestic banks considered the ratio is 135.8%).

8. All banks subject to the regulation saw their loan-to-deposit ratios falling to below 100% from October 2011. Specialized banks, which are not subject to the regulation, have meanwhile maintained relatively high loan-to-deposit ratio levels, reflecting the specializations of their operations.

<Graph 2> Bank loan-to-deposit ratios



Sources : Banks' business reports

C. Trends in Loans, Deposits and Liquidity

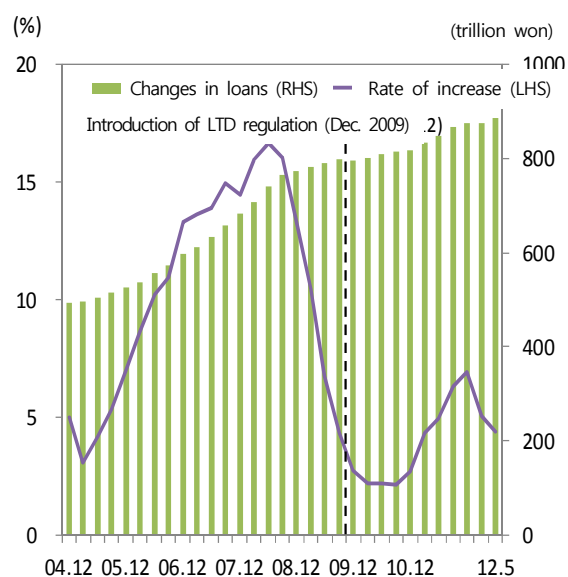
9. Looking at the changes in funding of domestic banks since introduction of the regulation, deposits have increased led by time deposits⁹⁾, while marketable deposits (CDs, RPs, cover bills and bank debentures) have declined significantly. The share of deposits in total funding by domestic banks rose from 55.9% at the end of November 2009 to 68.6% at end-May 2012. The share of wholesale funding in contrast declined from 21.0% to 9.4% during the same period.

10. On the asset management side, after having shown high rates of increase before introduction of the regulation, bank lending has since slowed. From 2005 through 2009 the rate of increase in lending averaged 10.1% annually, but it then fell sharply to

9) The increase in deposits at banks since the global financial crisis has occurred because, given the increasing uncertainties, economic agents have preferred bank deposits, which are relatively safer than marketable financial (wholesale funding) products.

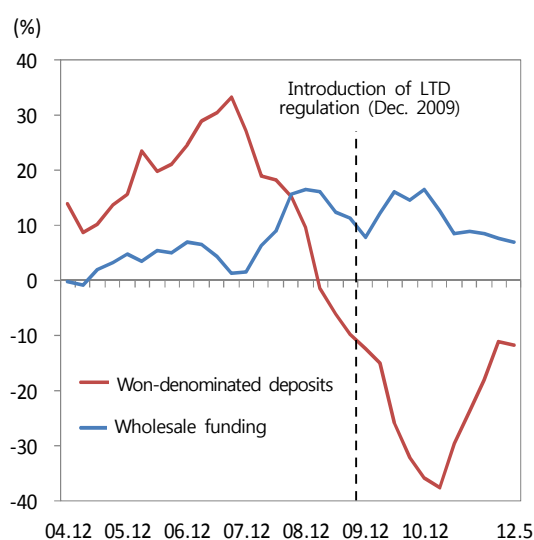
4.1% from 2010 to 2011. This slowdown in lending since 2010 is attributable to various factors — such as the loan-to-deposit ratio regulation, the strengthening of credit management by banks after the financial crisis, the contraction in lending demand with the sluggishness of the economy, and the measures undertaken by the government to curb household lending.

<Graph 3>
Rate of won-denominated loan increase¹⁾



Note : 1) Year-on-year
 Sources : Banks' business reports

<Graph 4>
Rates of wholesale funding and won-denominated deposit increase¹⁾

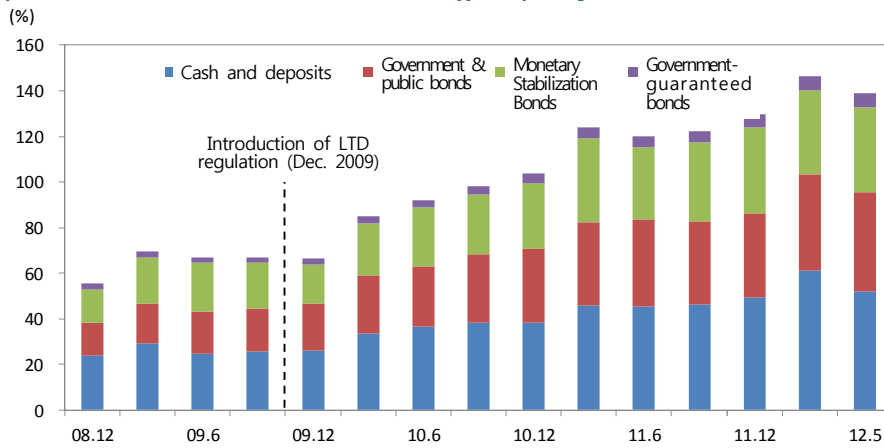


11. Liquidity conditions meanwhile seem to have improved since the loan-to-deposit ratio regulation was introduced, with the volume of wholesale funding with its high refinancing risk at maturity declining and the volume of high-quality liquidity assets, such as cash, deposits and government and public bonds, increasing. The ratio of high quality liquidity assets relative to wholesale funding¹⁰⁾ has risen significantly, from

10) This shows the holdings of high quality liquidity assets relative to the holdings of wholesale funds with

66.6% at the end of November 2009 to 138.9% as of end-May 2012.

<Graph 5> Domestic bank¹⁾ ratios²⁾ of high liquidity assets to wholesale funds



Notes : 1) Based on banks subject to LTD regulation

2) High liquidity assets (cash and deposits, government & public bonds, Monetary Stabilization Bonds and government-guaranteed bonds) / Wholesale funding

Sources : Banks' business reports

12. To summarize the results of this chapter's analysis, the loan-to-deposit ratio regulation has had a direct influence on banks' fund raising and management behaviors by making banks restrict their loans to within their deposit limits. Since introduction of the regulation banks' wholesale funding has declined significantly and their rate of lending increase has slowed. Liquidity conditions have in consequence also improved.

their high run-off rates.

III. Usefulness of the Loan-to-Deposit Ratio Regulation as a Macroprudential Policy Tool

13. This paper will now analyze whether the loan-to-deposit ratio regulation, which regulates the relationship between deposits and loans, is useful as a macroprudential policy tool for curbing systemic risk by reducing domestic banks' reliance on wholesale funding to finance their lending.

14. The objectives of a macroprudential policy are to curb systemic risks accumulating from a time dimension and from a cross-sectional dimension (IMF 2011)¹¹. The loan-to-deposit ratio regulation's usefulness as a macroprudential policy instrument can thus be assessed depending upon whether it can curb 1) the interconnectedness among financial institutions, a cross-sectional systemic risk, and 2) procyclicality, a time dimensional systemic risk.

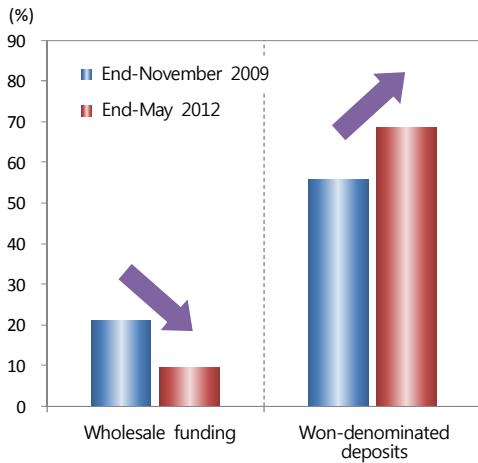
A. Financial Institution Interconnectedness

15. As shown in <Graph 6>, since introduction of the loan-to-deposit ratio regulation the share in total bank funding of wholesale funds has declined sharply, while the share of deposits has climbed sharply, due mainly to the movement of CDs reaching maturity into time deposits and to the attraction of corporate deposits. Among wholesale funding, the pace of decline in CDs, whose maturities are relatively shorter, has been the fastest, while bank debenture issuance has also fallen greatly:

11) "Macroprudential policy seeks to address two specific dimensions of systemic risk: the time dimension and the cross-sectional dimension" (IMF 2011, p. 8).

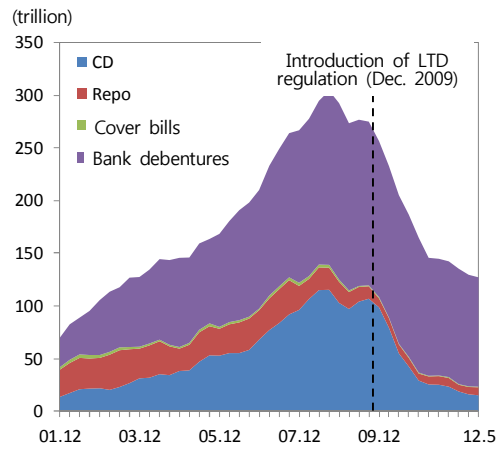
<Graph 6>

Ratios of wholesale funding and won-denominated deposits¹⁾



<Graph 7>

Wholesale funding composition¹⁾ trends



Note : 1) Based on banks subject to LTD regulation
 Sources : Banks' business reports

16. The significant decrease in bank wholesale funding can be interpreted as indicating that the exposures to transactions among financial institutions, i.e. their interconnectedness, has declined in that wholesale funding is made up mostly of liabilities from financial institutions¹²⁾. Particularly, as there is a higher likelihood in times of financial unrest of bank runs on wholesale funding¹³⁾ than on other deposits, the decrease in the share of wholesale funding may slow the pace of propagation of a crisis.

17. This paper empirically analyzes the relationship between wholesale funding and the interconnectedness among financial institutions, by applying the method of analysis of Lopez-Espinosa et al. (2012). In the following formula (1), an individual bank (i)'s $\Delta CoVaR$ value at time t , a proxy for the interconnectedness among financial institutions, is determined based upon the values of $\Delta CoVaR$ and VaR at time $t-1$,

12) In September 2008, when the scale of wholesale funding hit its highest level, 72.0% of the total amount of bank debentures issued was held by financial institutions (31.3% by banks, 20.2% by securities companies, 10.9% by insurance companies, and 9.6% by asset management companies).

13) Wholesale funding, a method of raising large-value funds in the capital and short-term financial markets, has relatively large flow volatility depending upon not only financial market conditions but also the soundness of the financial institutions concerned.

the share of wholesale funding¹⁴), and the bank's other financial characteristics (leverage, asset size, share of liquid assets, and capital adequacy ratio):

$$|\Delta CoVaR_{it}| = \mu_i + \beta_i |\Delta CoVaR_{it-1}| + \gamma_i |VaR_{it-1}| + \delta_i WSF_{it-1} + \theta_i Z_{it-1} + \epsilon_{it} \dots\dots\dots(1)$$

- i* : cross-sectional dimension (banks), *t* : time series (quarterly)
- CoVaR_{it}* : Bank *i*'s *CoVaR* at time *t*
- VaR_{it}* : Bank *i*'s *VaR* at time *t*
- WSF_{it}* : Bank *i*'s share of wholesale funding at time *t*
- Z_{it}* : Bank *i*'s characteristic variables (leverage (assets/capital), asset size, share of liquid assets, capital adequacy ratio) at time *t*
- ϵ_{it} : random error with mean of 0 and variance of σ^2 .

18. An individual bank's $\Delta CoVaR$ value, the proxy indicator of interconnectedness, refers to the influence of that bank's risk on the risks of all banks subject to analysis.¹⁵ The individual bank's *CoVaR* and *VaR* values used the results of an analysis by Lee, Ryu and Tsomocos (2012).

19. Model estimation shows that the higher the share of a bank's wholesale funding, the greater the interconnectedness among financial institutions, as illustrated in <Table 1> below. The coefficient of the share of wholesale funding is seen to have a positive (+) sign, implying that the greater the share of wholesale funding gets, the greater the absolute value of $\Delta CoVaR$ (difference in loss) becomes:

14) Since the CDs at banks held by companies have been shifted into corporate deposits since introduction of the loan-to-deposit ratio regulation, the actual decline in wholesale funding seen from the perspective of funding stability can be said to be less than the statistical figures for wholesale funding used in this analysis. Taking this point into account, we have also carried out an empirical analysis by adding the scale of decline in CDs held by companies to wholesale funding, but there is no difference from the initial results. This seems to be because the share of decline in corporate CDs in the overall decline in wholesale funding (about 34%) since introduction of the loan-to-deposit ratio regulation has not been large.

15) Adrian and Brunnermeier (2009) measured the influence of an individual bank's risk on the risk of all financial institutions based on the value of $\Delta CoVaR$, i.e. the difference in loss. This means that the greater the absolute value of the loss is, the greater the interconnectedness becomes. The value of $\Delta CoVaR$ is represented as ' $CoVaR_{system | i=1\%(at\ risk)} - CoVaR_{system | i=50\%(normal)}$ ', which is the difference between the influences of bank *i*'s risks on the risks of all financial institutions in crises and in normal situations.

<Table 1>
Estimation of effects on interconnectedness ($\Delta CoVaR$)¹⁾

dependent variable	independent variables	coefficient	t-value
$ \Delta CoVaR_{it} $	$ \Delta CoVaR_{it-1} $	0.2610	5.26 ^{***}
	$ VaR_{it-1} $	0.0201	1.10
	WSF_{it-1}	0.6883	2.09 ^{**}
	Lev_{it-1}	-0.0220	-1.42
	$Size_{it-1}$	0.6370	2.70 ^{***}
	Liq_{it-1}	0.0367	1.23
	BIS_{it-1}	-0.1002	-2.75 ^{***}
	adjusted R ² =0.9047		

Notes : 1) Analysis period : Q1 2003 ~ Q4 2011

Analysis targets : Ten banks (Woori, Korea Exchange, Kookmin, Hana, Shinhan, Daegu, Busan, Jeju, Chunbuk, Industrial Bank of Korea)

2) *** and ** indicate rejection of the null hypothesis, that the estimated coefficient is zero, at the 1 and 5 percent levels of significance respectively.

20. The results of estimation show that the higher the banks' shares in wholesale funding, the bigger their contributions in increasing risk in the financial sector as a whole. In this regard, the loan-to-deposit ratio regulation is regarded as an effective prudential policy tool for reducing the interconnectedness among financial institutions through a contraction in wholesale funding.

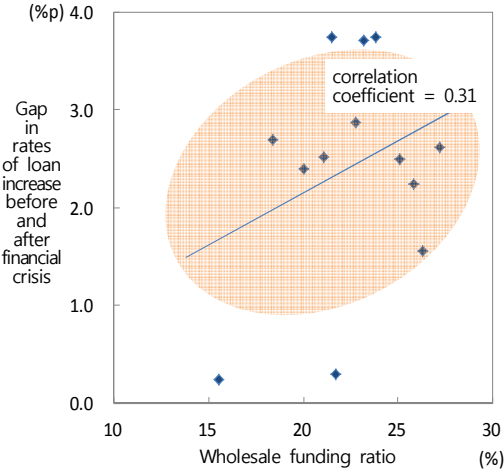
B. Pro-cyclicality aspect of bank lending

21. Bank loans show pro-cyclicality in terms of the amounts of their supply and demand. In particular, during times of economic expansion, when loan demand is extremely high, a bank's capability to mobilize funding in response to this need is a key factor determining the pro-cyclicality of its loans. The reason why Korean domestic banks were able to meet the heightened demand for loans in the run up to the global financial crisis was that, in addition to deposits, they were capable of mobilizing funds to meet this demand through wholesale funding. In this regard,

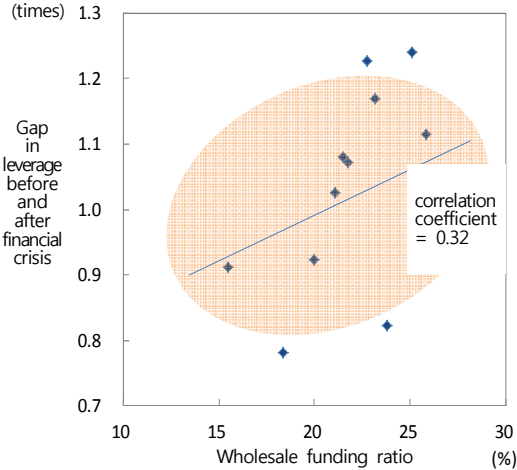
regulation of the loan-to-deposit ratio is thought to have an effect of restraining lending pro-cyclicality by reducing the dependence on wholesale funding.

22. Before moving in depth into our empirical analysis, we present a scatter diagram on the relationship between the wholesale funding ratio and lending pro-cyclicality. Pro-cyclicality is measured using the differences between loan growth and leverage (assets/equity) during the pre-crisis expansionary period (Q1 2006-Q2 2008) and the post-crisis period of contraction (Q3 2008-Q2 2009). As shown in Figures 8 and 9, the bank wholesale funding ratio and pro-cyclicality indicators (the differences in loan growth and leverage before and after the crisis (calculation of relative ratios)) are positively correlated. This implies that, for banks, the higher the share of wholesale funding, the higher the pro-cyclicality.

<Graph 8>
Relationship between wholesale funding ratio and gap¹⁾ in rates of loan increase before and after financial crisis



<Graph 9>
Relationship between wholesale funding ratio and gap²⁾ in leverage before and after financial crisis



Notes : 1) Rate of loan increase before financial crisis – rate of loan increase after financial crisis (%p)

2) Leverage before financial crisis – Leverage after financial crisis (times)

Sources : Banks’ business reports

23. In terms of pro-cyclicality, the relationship between wholesale funding and bank

lending is analyzed using a panel regression model¹⁶⁾ setting the rate of lending increase as the dependent variable and the wholesale funding ratio, macro-economic condition variables (GDP growth rate, treasury bond interest rate, rate of housing price increase) and bank-specific variables (BIS capital adequacy ratio, liquid assets ratio, loan loss provisioning ratio) as independent variables:

$$\Delta \ln x_{it} = \mu_i + \sum_{j=1}^3 \alpha_j \Delta \ln x_{it-j} + \sum_{j=1}^3 \beta_j \Delta GDP_{t-j} + \sum_{j=1}^3 \gamma_j WSF_{it-j} \Delta GDP_{t-j} + \sum_{j=1}^3 \delta_j HHI_{t-j} \Delta GDP_{t-j} + \sum_{j=1}^3 \theta_j Tre_{t-j} + \sum_{j=1}^3 \lambda_j House_{t-j} + \sum_{j=1}^3 \phi_j Z_{it} + \epsilon_{it} \quad \dots(2)$$

- i : Cross-section (banks), t : Time series (quarterly)
- $\Delta \ln x_{it}$: Rate of won loan increase of bank i in quarter t
- ΔGDP_t : Real GDP growth rate in quarter t
- WSF_{it} : Share of wholesale funding of bank i in quarter t
- HHI_t : Herfindahl-Hirschman Index
- Tre_t : Treasury bond yield (3-year) in quarter t
- $House_t$: Rate of housing price increase in quarter t
- Z_{it} : Specific variables of bank i in quarter t (BIS, LIQ, Prov)
- ϵ_{it} : Random error with average of 0 and dispersion σ^2

24. Among the independent variables, the cross-term between the proportion of wholesale funding and the rate of GDP growth is used as a major analysis variable so as to see whether the pro-cyclicality of loans rises hand-in-hand with the wholesale funding share. Meanwhile, the HHI (Herfindahl-Hirschman Index), which indicates the level of competition in the banking sector, is added to the independent variables given that bank lending can be affected by intensified banking sector competition¹⁷⁾.

25. The analysis is conducted on 19 domestic banks¹⁸⁾ with the period set from 2002

16) This panel regression model is based on the “Bank loan decision model,” which is widely used for analyzing the changes in bank loans due to financial and real shocks, the effects on loans of the BIS regulations, etc. (Kashyap and Stein 2000, Gambacorta 2001, Davis and Zhu 2005, Berrospide and Edge 2010).

17) Refer to Bouvatier et al. (2011), Jeong (2009), and Berger and Udell (2004).

18) In cases of acquisitions, the banks in question are separately considered in the analysis. Banks exempt

onwards (Q4 2001~Q4 2011) when bank management stabilized after overcoming the 1997 foreign exchange crisis. With regard to the estimation method, a fixed effect model is used in accordance with the Hausman test results.

26. The results of estimation show that banks with higher shares of wholesale funding see closer links between their rates of lending increase and the rate of GDP growth. <Table 2> reveals the cross-term coefficient between the bank shares of wholesale funding and the GDP growth rate to be positive. This implies that the higher the wholesale funding share of banks, the more lending pro-cyclicality expands:

<Table 2>

Estimation of bank loan increase rate model

dependent variable	independent variable		coefficient	t-value
Rate of loan increase ($\Delta \ln x_{it}$)	GDP growth	ΔGDP_{t-1}	6.6349	3.42***
		ΔGDP_{t-2}	-3.1994	-2.23**
		ΔGDP_{t-3}	4.9321	3.95***
	Cross-product term between GDP growth and wholesale funding ratio	$WSF_{it-1} \Delta GDP_{t-1}$	2.1459	3.01***
		$WSF_{it-2} \Delta GDP_{t-2}$	-0.8818	-1.18
		$WSF_{it-3} \Delta GDP_{t-3}$	-0.4422	-0.66

Note : 1) *** and ** indicate rejection of the null hypothesis, that the estimated coefficient is zero, at the 1 and 5 percent levels of significance respectively.

27. The results of this empirical analysis confirm that domestic banks have increased their wholesale funding during times of economic expansion, in active response to rising private loan demand. Wholesale funding is considered a factor that expands the pro-cyclicality of lending, considering that during the economic expansionary (contractionary) phase the rate of lending increase rises (falls) as the wholesale funding ratio falls (rises). This indicates that the contraction in wholesale funding

from the loan-to-deposit ratio regulation, such as the Industrial Bank of Korea, Korea Development Bank, and the Export-Import Bank of Korea, are not included.

driven by the loan-to-deposit ratio regulation has contributed to an alleviation of lending pro-cyclicality, and that the loan-to-deposit ratio regulation is a useful macro-policy tool.

IV. Considerations

28. As explained earlier, the loan-to-deposit ratio regulation is a macroprudential policy instrument designed to curb systemic risks. The regulation is not only useful but also actually brings about ring-fencing between retail and wholesale financing by encouraging banks to extend loans within the limits of their deposits. Given however that this regulation is a powerful policy tool, that puts direct constraints on banks' core businesses of deposits and loans, some unintended consequences could be created.

A. Effects on banks' financial intermediary function

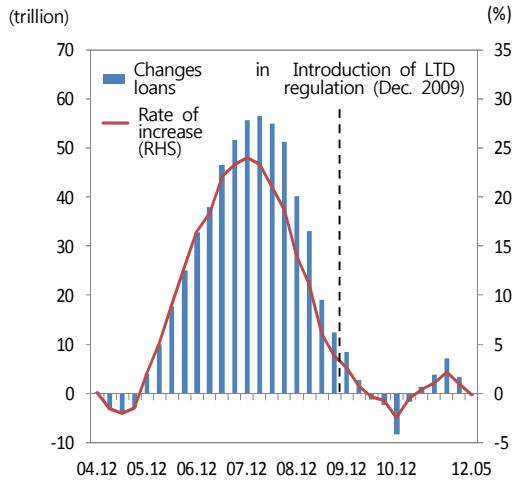
29. The loan-to-deposit ratio regulation could affect banks' function of financial intermediation by hindering their flexible use of wholesale funding as assets for bank lending. Facing restraints on their assets for lending, banks generally tend to first reduce their lending to SMEs whose credit ratings are relatively low. As illustrated in <Graph 11>, bank lending to large corporations and households has continued to rise since introduction of the loan-to-deposit ratio regulation, whereas their lending to SMEs has stagnated or declined. We therefore conduct an empirical analysis to examine whether this decrease in bank lending to SMEs has been influenced by the reduction in wholesale funding following introduction of the regulation.

30. Using a panel regression model, we analyze whether the reduction in wholesale funding has affected SMEs and large corporations differently. We change Formula (2), which analyzed the effects of wholesale funding on bank lending procyclicality using the rate of increase in banks' total loans as the dependent variable, so that the dependent variable is now the rate of increase in banks' SME lending. We then compare the two, and find the effect of eased procyclicality with a reduced share of wholesale funding to be greater in the latter case¹⁹⁾ (when the dependent variable is

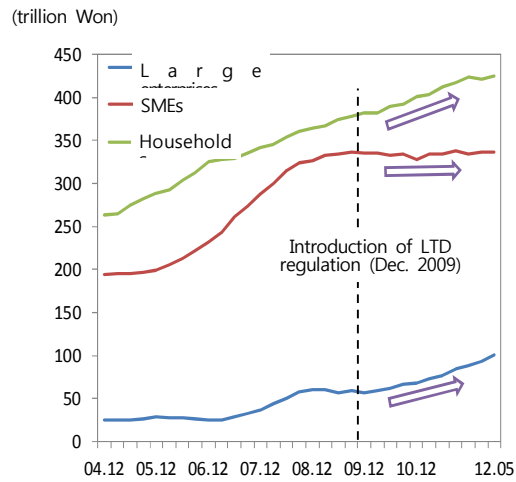
19) The cross term coefficient between wholesale funding and the GDP growth rate is estimated to be 2.1459 in Formula (2) and 2.5214 in Formula (2)'. This means that the proportion of wholesale funding

SME lending).

<Graph 10>
Rate of SME loan increase¹⁾



<Graph 11>
Loans to Households, large enterprises and SMEs



Notes : 1) Based on banks subject to LTD regulation
Sources : Banks' business reports

In light of these results, the reduction in bank wholesale funding is estimated to have affected mainly their financial intermediation to SMEs.

<Table 3>
Comparison between estimation results of Total won-denominated loan model and SME loan mode

dependent variable	independent variable	coefficient	t-value
Won-denominated loan increase rate($\Delta \ln x_{it}$)	$WSF_{it-1} GDP_{t-1}$	2.1459	3.01***
	$WSF_{it-2} GDP_{t-2}$	-0.8818	-1.18
	$WSF_{it-3} GDP_{t-3}$	-0.4422	-0.66
SME loan increase rate($\Delta \ln SME_{it}$)	$WSF_{it-1} GDP_{t-1}$	2.5214	1.83*
	$WSF_{it-2} GDP_{t-2}$	-1.4004	-0.99
	$WSF_{it-3} GDP_{t-3}$	1.2989	1.08

note : 1) ***, * represent significance to reject the hypothesis that the estimated coefficient is zero level at the 1 and 10 percent levels respectively.

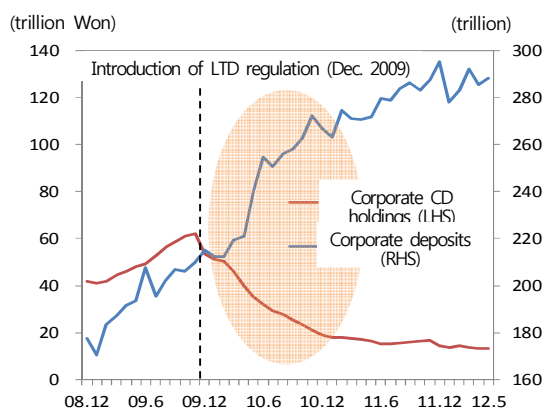
has larger effects on lending procyclicality when it involves SME loans.

B. Increased proportion of corporate deposits at banks

31. Since introduction of the loan-to-deposit ratio regulation, banks have moved²⁰⁾ funds out of their wholesale funding CDs and into corporate deposits to be able to comply with the regulation. The proportion has thus increased of corporate deposits, whose run-off rates²¹⁾ in times of crisis are relatively higher than those of personal savings, and as of end-May 2012 stood at 29.9% of banks' total deposits, up from 28.1% at the end of November 2009 prior to the regulation's introduction. Given that corporate deposits are less stable than personal deposits, it is assessed that one of the purposes of regulating the loan-to-deposit ratio, i.e. to enhance the stability of bank debt structures, has to some extent not been achieved as intended.

<Graph 12>

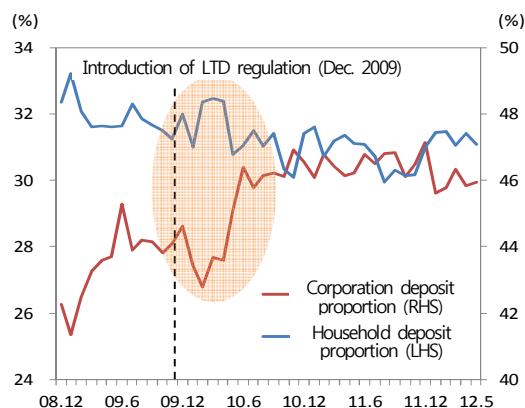
Bank issued CDs and deposits held by Corporations¹⁾



Note : 1) Based on deposit banks
Source : The Bank of Korea

<Graph 13>

Proportions of banks' corporate and household deposits¹⁾



20) Corporate deposits, which totaled 209.9 trillion won at the end of November 2009 right before the loan-to-deposit ratio regulation was announced, had risen to 288.3 trillion won as of end-May 2012. CDs held by banks had in contrast fallen steeply from 62.2 to 13.1 trillion won over the same period.

21) When calculating the Liquidity Coverage Ratio (LCR), Basel III applies run-off rates of from 5 to 10% to household retail deposits and of 5 to 100% to corporate and financial institution retail deposits. Basel III thus appraises the risks of corporate deposit refinancing at maturity to be high.

32. Meanwhile, the contraction in issuance of CDs in line with the loan-to-deposit ratio regulation has also reduced the role as a price index of the CD rate, which has been used as a benchmark rate for mortgage loans and financial derivatives transactions.

C. Effects on Monetary Policy Transmission Channels

33. The changes in the overall financial environment, such as financial globalization and capital market development, have had diverse effects on the monetary policy transmission channels. In regard to this, there have been many studies showing that the monetary policy effects transmitted through the bank lending channel²²⁾ are weakened if banks can easily raise funds for lending through wholesale funding such as bank debentures and CDs (Gambacorta 2001, Kashyap and Stein 2000).

34. Considering these effects of wholesale funding on monetary policy, if banks face difficulties in wholesale funding due to the loan-to-deposit ratio regulation, then among the monetary policy transmission channels the bank lending channel is likely to work more effectively than in the pre-regulation period. To verify this, a panel regression model, widely applied for analysis of the bank lending channel, is used to analyze²³⁾ the effects of changes in the wholesale funding ratio on the effectiveness of the bank lending channel in monetary policy transmission.

35. In Formula (3) below, an individual bank's rate of lending increase is determined by explanatory variables including its rates of lending growth from one to

22) The bank lending channel works effectively only when, after a central bank policy rate hike has led to reductions in banks' reserves, banks facing reserve requirement limits reduce their lending since they cannot increase their non-deposit liabilities (e.g. CDs) instead of deposits to maintain their lending at appropriate levels. Therefore, whether the bank lending channel works or does not work depends upon whether or not banks can raise non-deposit liabilities in the market.

23) The panel regression model is that suggested by Kashyap and Stein (1995), and analyzes 19 banks for the period since 2002 when bank management began to stabilize after the 1997 foreign exchange crisis.

three quarters previously, monetary policy variables (call rates), the bank's capital ratio, macroeconomic conditions (GDP growth rate, CPI), and the amount of the bank's assets. In addition, by adding to the explanatory variables a cross-term between the monetary policy variables and the individual bank's wholesale funding ratio, we estimate whether the bank lending channel strengthens or weakens in accordance with the wholesale funding ratio:

$$\begin{aligned} \Delta \ln x_{it} = & \mu_i + \sum_{j=1}^3 \alpha_j \Delta \ln x_{it-j} + \sum_{j=1}^3 \beta_j \Delta MP_{t-j} + \sum_{j=1}^3 \gamma_j WSF_{it-j} \Delta MP_{t-j} \\ & + \sum_{j=1}^3 \delta_j BIS_{it} \Delta MP_{t-j} + \sum_{j=1}^3 \eta_j BIS_{it-j} + \sum_{j=1}^3 \theta_j \Delta GDP_{t-j} \\ & + \sum_{j=1}^3 \lambda_j BIS_{it-j} \Delta GDP_{t-j} + \sum_{j=1}^3 \phi_j \Pi_{t-j} + \rho \ln(Asset)_{it-1} \Delta MP_{t-1} + \epsilon_{it} \quad \dots(3) \end{aligned}$$

i : cross section (banks), t : time series (quarterly)

$\Delta \ln x_{it}$: bank i 's rate of won lending increase during period t

ΔMP_t : monetary policy variable (change in call rate during period t)

WSF_{it} : bank i 's wholesale funding ratio during period t

BIS_{it} : bank i 's BIS capital adequacy ratio during period t

ΔGDP_t : real GDP growth rate during period t

Π_t : inflation during period t (CPI)

$Asset_{it}$: bank i 's asset amount during period t

ϵ_{it} : random error with average 0 and variation σ^2

36. As seen in <Table 4>, the results of estimation show the cross-term coefficient between the wholesale funding ratio and changes in monetary policy (call rate) to be positive at a statistically significant level. These results can be understood to mean that the lower the wholesale funding ratio is, the larger the effect that monetary policy has on bank lending (call rate coefficient (-)).

<Table 4>

Estimation of wholesale funding ratio effects on credit channel of
monetary policy¹⁾

dependent variable	independent variables	coefficient	t-value
Rate of lending increase ($\Delta \ln x_{it}$)	ΔMP_{t-1}	-0.8974	-0.82
	ΔMP_{t-2}	-2.6007	-2.16**
	ΔMP_{t-3}	0.1555	0.15
	$WSF_{it-1}\Delta MP_{t-1}$	-1.7845	-1.27
	$WSF_{it-2}\Delta MP_{t-2}$	0.8980	0.54
	$WSF_{it-3}\Delta MP_{t-3}$	3.3008	2.27**

Note : 1) ** indicates rejection of the null hypothesis, that the estimated coefficient is zero, at the 1 and 5 percent levels of significance respectively.

D. Relationship with Basel III liquidity regulations

37. The introduction of the Basel III liquidity regulations is underway, to induce stable funding structures for banks to help equip them with sufficient resilience to liquidity shocks in times of crisis.

38. The loan-to-deposit ratio regulation has likewise been introduced to curb wholesale funding and thus limit increases in lending in times of economic expansion and prepare banks for liquidity shortages during crises. Since both of these regulations aim at inducing stable funding structures, in order to help banks facing liquidity problems to strengthen their resilience in emergencies, the regulatory effects can overlap.

39. Meanwhile, the Basel III liquidity regulations take into consideration the stability of bank assets and liabilities by major item and by maturity, and apply different run-off rates to liabilities²⁴⁾. The loan-deposit ratio regulation in contrast does not accurately reflect the differences in liquidity risks of individual items among assets

24) In the Basel III LCR calculation, run-off rates of from 5 to 10% are applied to households' retail deposits and of from 5 to 100% to wholesale deposits of corporations and financial institutions.

and liabilities. For instance, since implementation of the loan-to-deposit ratio regulation the share of more stable household deposits with higher stability has declined, while that of less stable corporate deposits has increased (28.1% in November 2009 → 29.9% in May 2012), which works as a factor causing liquidity risk to increase. This suggests that the loan-to-deposit ratio regulation alone cannot have the precise policy effects that the Basel III liquidity regulations have. And considering this, the latter can be said to be a more precise instrument for liquidity regulation than the former.

V. Conclusion

40. The loan-to-deposit ratio regulation was introduced for the purposes of 1) curbing the incentives for excessive competition among domestic banks dependant upon wholesale funding to increase their business sizes before the global financial crisis, and 2) improving liquidity conditions during crises.

41. Since introduction of the regulation, the effects that the regulatory authorities intended have been found — banks' wholesale funding has declined and liquidity conditions have improved. Empirical analysis shows that the loan-deposit ratio regulation is also effective as a macroprudential policy instrument; it reduces banks' dependency on wholesale funding to thereby curb the interconnectedness among financial institutions, a systemic risk on the cross-sectional side, and also reduces the procyclicality of lending, a systemic risk on the time-series side.

42. It should be noted, however, that the loan-to-deposit ratio regulation is a strong but not precise policy instrument that directly limits the ratio of deposits to loans, two core business areas of banks, and may overlap with the Basel III liquidity regulations. In addition, the regulatory authorities and the central bank need to work in close cooperation when making changes in policies regarding this regulation, given that the loan-to-deposit ratio regulation can affect banks' intermediary role and the channels of monetary policy transmission.

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