Countercyclical tools: a comparative assessment

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1. Introduction

Since procyclicality has diverse sources and mechanisms, we also need a variety of countercyclical tools. We may categorise them in accordance with the asset, liability and capital sides of the balance sheet that they primarily affect.

This paper provides a comparative assessment of countercyclical tools through the establishment of an assessment criterion: controllability, which we think is most relevant to policy objectives. We select a representative tool from each side of the balance sheet and conduct an assessment. We show that the assessment results vary depending upon the financial conditions of financial institutions and markets, and that different tools may be more effective under different conditions. Given a certain set of financial conditions, therefore, multiple tools may be deployed in a complementary fashion.

This paper is organised as follows. First, we examine the countercyclical tools proposed from the perspective of the balance sheets of financial institutions. Second, we discuss the assessment standards. Third, we compare and evaluate the effectiveness of these countercyclical tools, based upon their ability to control financial institutions' assets. Fourth, we conduct a comparative assessment of various countercyclical tools with data on financial institutions in Korea. Finally, we explore some policy implications.

2. Countercyclical policy tools

The procyclicality inherent in the financial system may be exacerbated by various microprudential regulations and accounting standards. Minimum capital requirements, loan loss provisioning, liquidity regulations and fair value accounting can be pointed to as examples. It is therefore necessary to come up with various tools to counter and mitigate procyclicality originating from different sources. Since factors affecting procyclicality bring about changes in the balance sheets of financial institutions, we may categorise countercyclical tools based upon the sides of the balance sheet they primarily target, that is, capital, liabilities and assets.

In our paper, we select a representative tool from each side of the balance sheet (Table 1). We choose the capital buffer, a countercyclical tool from the capital side, to reduce procyclicality arising from regulatory capital and loan loss provisioning. As a tool to counter the procyclicality originating from liquidity regulation, through fluctuations in funding, the liquidity buffer is selected on the liability side. Finally, for procyclical movements in asset values, particularly in relation to fair value accounting, we choose the asset-based reserve requirement (ABBR), which directly targets the asset side.

[1] Bank of Korea. The views expressed in this paper are those of the authors, and are not necessarily the views of the Bank of Korea.

Table 1

Countercyclical policy tools

Funding perspective	Capital side	• Capital buffer
	Liquidity side	• Liquidity buffer
Investment perspective	Asset side	• ABRR

The capital buffer is a policy tool that can alleviate procyclicality through the accumulation of additional capital countercyclically, in addition to the minimum capital ratio. In other words, the authorities increase the capital reserve burdens of financial institutions by raising the capital buffer ratio requirement during economic booms, and by doing so deter credit expansion in the financial system. During an economic recession, the authorities can then lessen the extent of deleveraging by reducing the capital buffer ratio to allow a decline in financial institutions' total capital ratio requirement.

$$K = (1 + \alpha)K^* \quad (1)$$

$$K^* = \frac{E}{w \cdot A}$$

where K stands for the total capital requirement ratio, K* the minimum capital requirement ratio, α the buffer ratio, E regulatory capital, w the average risk weight, and A total assets.

The liquidity buffer is a tool that regulates a liquidity coverage ratio (LCR)[2] countercyclically, mandating that a financial institution holds high-quality liquid assets against the possibility of massive funding outflows under an acute short-term stress scenario. The way in which the liquidity buffer is managed is similar to that with the capital buffer. Credit expansion during an economic boom is curbed by setting the LCR higher than 100%, while a credit crunch during a downturn is prevented by setting it lower than 100%.

$$L = (1 + \beta)LCR \quad (2)$$

$$LCR = \frac{A^h}{s \cdot D} \geq 100\%$$

where L stands for the overall liquidity ratio, β the buffer ratio, A^h high-quality liquid assets, s the run-off rate, and D net cash outflow for 30 days.

The ABRR is a tool by which reserve requirements are imposed on total assets or specific assets of financial institutions when asset prices in the financial markets fluctuate sharply. It is similar to the loan-to-value (LTV) ratio in that it aims to control financial institutions' assets directly, but different from the capital and liquidity buffers that seek to control assets indirectly through restricting the capital and liquidity ratios.

$$R = r \cdot A^{NR} \quad (3)$$

$$A^{NR} = f(P - P^*);\ f' > 0$$

where R stands for reserve requirements, r the reserve requirement ratio, A^{NR} non-reserve requirement assets (total assets or specific assets), P the asset price growth rate, and P* the long-term average asset price growth rate.

[2] LCR is the global liquidity standard that has been introduced by the BCBS, based upon the assumption of a stressed period continuing for 30 calendar days.

3. Assessment framework

3.1 Criteria for countercyclical tool assessment

We may assess countercyclical tools in terms of their cost-effectiveness. For effectiveness, the assessment criteria may include the controllability over financial institutions' assets – the direct source of credit in the financial system – and the implementability of tools through lower resistance from financial institutions. Meanwhile, countercyclical regulations also entail costs to both financial institutions and markets, because they limit business activities and distort market prices.

In our study, however, we assess countercyclical tools based solely upon their effectiveness in controlling asset fluctuations at individual financial institutions. Above all, countercyclical policy tools should be effective in achieving the policy goal, ie leaning against the excessive build-up of lending and investment in assets by financial institutions, which is the culprit behind asset price and credit aggregate fluctuations in the financial system, so as to alleviate credit and business cycle amplitude. Controllability over the assets of financial institutions should therefore be the main assessment criterion.

3.2 Framework

In order to assess the controllability of countercyclical tools, we need to set up a framework for analysing the response function of financial institutions. The effects of countercyclical regulations may vary depending upon how financial institutions respond to them. We assume that financial institutions maximise economic value added (EVA)[3] and derive optimal levels of assets (A), liabilities (D), and capital (E) at equilibrium as follows:

$$\text{Max EVA} = rA - (c_1D + c_2E) \tag{4}$$

$$\text{In equilibrium : } EVA^* = rA^* - (c_1D^* + c_2E^*)$$

where r stands for the return on assets, A assets, c_1 the unit cost of debt, c_2 the unit cost of equity, rA net operating profits after taxes, c_1D the cost of debt, and c_2E the cost of equity. We treat as given the market conditions: r, c_1 and c_2.

When regulations are imposed, financial institutions have to make portfolio adjustments in their balance sheets. This causes assets, liabilities and/or capital to deviate from their optimal levels. They then have an EVA lower than EVA^* and incur adjustment costs. If different options for responding to the regulations are available to financial institutions, for instance if they either raise capital, lower assets or lower risk weights in response to the imposition of a capital buffer, they will choose the option with the lowest adjustment costs.

$$\text{Min Adjustment Cost}(\kappa) = \{EVA^* - EVA(\kappa)\} \tag{5}$$

where κ is the option chosen by the financial institutions.

Table 2 shows the EVA for each option that financial institutions can take in response to the impositions of higher capital buffers, liquidity buffers and reserve requirements during an economic boom. Notice that three options are available for responding to a capital buffer: ΔE, ΔA and Δw. Financial institutions can lower the average risk weight w by reducing the proportion of risky assets A_2. In order to meet a higher liquidity buffer requirement, they may either increase high-quality liquid assets A_h, or decrease net cash outflows by reducing the

[3] EVA, a measure of economic profit, is calculated as the difference between net operating profit after taxes and the opportunity cost of invested capital. This opportunity cost is determined by the weighted average cost of debt and equity (WACC). See www.sternstewart.com and Salmi and Virtanen (2001).

average net run-off rate s, which can be done through shifting wholesale funding D_2 to retail deposits D_1. For ABRR, the only option available is to reduce non-reserve requirement assets A^{NR} in proportion to the reserve ratio α. We exclude the possibility of raising liabilities to fund higher reserves ΔR, because it also increases A^{NR} and hence ΔR.

Table 2

EVAs of financial institutions' options

regulation	**κ (option)**	**EVA(κ)**	
		Revenue	**Cost**
capital buffer	ΔE^{1}	$r(A^* + \Delta E)$	$c_1 D^* + c_2(E^* + \Delta E)$
	ΔA^{2}	$r(A^* - \Delta A)$	$c_1(D^* - \Delta A) + c_2 E^*$
	$\Delta w^{3,4}$	$r_1(A_1^* + \Delta A_2) + r_2(A_2^* - \Delta A_2)$	$c_1 D^* + c_2 E^*$
liquidity buffer	ΔA_h^{5}	$r_h(A_h^* + \Delta A_h) + r_o(A_o^* - \Delta A_h)$	$c_1 D^* + c_2 E^*$
	Δs^{6}	rA^*	$c_{11}(D^* + \Delta D_2) + c_{12}(D_2^* - \Delta D_2) + c_2 E^*$
ABRR	ΔA_{NR}^{7}	$r_R(A_R^* + \Delta A_{NR}) + r_{NR}(A_{NR}^* - \Delta A_{NR})$	$c_1 D^* + c_2 E^*$

Note [1] $\Delta E = (wA)\Delta K$

[2] $\Delta A = -(A/K)\,\Delta K$

[3] $\Delta w = -(w/K)\,\Delta K$

[4] $A = A_1(\text{riskless assets}) + A_2(\text{risky assets}), \Delta A_2 = \gamma\Delta w$

γ: conversion factor $(\Delta w \rightarrow \Delta A_2), \gamma = f(w_1 - w_2),\ f' < 0$

r_1: return on riskless assets, r_2: return on risky assets

[5] $A = A_h(\text{high} - \text{quality liquid assets}) + A_o(\text{other assets}),\ \Delta A_h = (sD)\Delta L$

r_h: return on high − quality liquid assets, r_o: return on other assets

[6] $\Delta s = -(s/L)\Delta L, \Delta D_2 = \delta\Delta s$

$D = D_1(\text{core liabilities}) + D_2(\text{noncore liabilities})$

c_{11}: cost of debt on core liabilities, c_{12}: cost of debt on noncore liabilities

[7] $A = A_R(\text{reserve assets}) + A_{NR}(\text{non} - \text{reserve assets}),$

r_R: return on reserve requirement assets, r_{NR}: return on non − reserve requirement assets

* Asterisks indicate optimal portfolio balances of financial institutions before regulation.

Table 3 shows the adjustment costs, the difference between EVA* and EVA, for each option for responding to the different policy tools. They are the product of adjustment size and unit cost. The adjustment size is determined by the structure of the balance sheets of financial institutions and the unit cost by market conditions. Looking at the capital buffer, for instance, the adjustment costs of the three options depend on the adjustment sizes – ΔE, ΔA, and ΔA_2 – and the unit costs – r, c_1, c_2, r_1 and r_2. We therefore argue that financial conditions, which determine the adjustment costs facing financial institutions in their response to regulations, are key to the effectiveness of tools in controlling asset fluctuations. Figure 1 provides an illustration of the responses of financial institutions to regulations depending upon financial conditions.

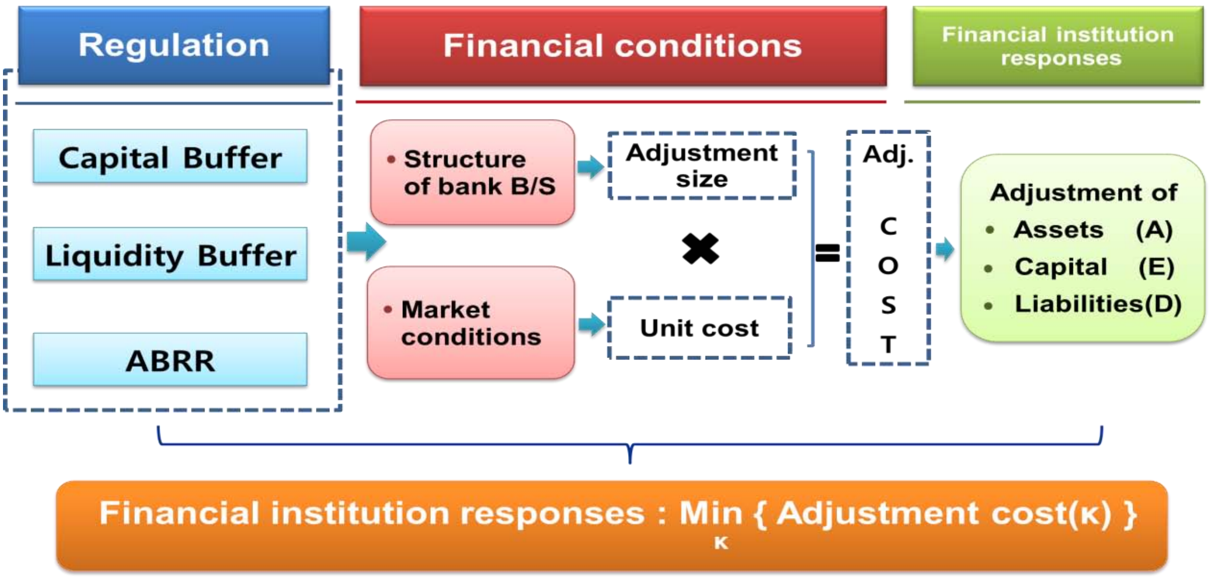
Table 3

Adjustment costs (EVA*– EVA)

Tool	capital buffer			liquidity buffer		ABRR
Adjustment size (a)	ΔE	ΔA	ΔA_2	ΔA_1	ΔD_2	ΔA_{NR}
Unit cost (b)	$c_2 - r$	$r - c_1$	$r_2 - r_1$	$r_o - r_h$	$C_{11} - C_{12}$	$r_{NR} - r_R$
Adjustment cost (a*b)	$\Delta E(c_2 - r)$	$\Delta A(r - c_1)$	$\Delta A_2(r_2 - r_1)$	$\Delta A_h(r_o - r_h)$	$\Delta D_2(c_{11} - c_{12})$	$\Delta A_{NR}(r_{NR} - r_R)$

Figure 1

Financial institutions' responses to imposition of regulations



4. Comparative assessment of tools in controlling the target

In accordance with the criterion and the framework set up above, we would like to assess the controllability of each policy tool over the asset side of financial institutions' balance sheets.

The controllability over financial institutions' assets may differ depending upon the type of policy tool being employed. That is, depending upon whether the policy tool can control assets directly or indirectly, and upon how many variables are subject to control, financial institutions can make choices differently from the authorities' intentions. For instance, the less directly assets are controlled by using capital and liabilities, and the larger the number of variables subject to control, the less the degree of controllability. However, the specific ability to control may also differ depending upon the financing and investment structure of each individual financial institution, as dictated by financial conditions.

4.1 Capital buffer imposition

We would like to consider how far the authorities can control the assets of financial institutions effectively when it adjusts the capital buffer ratio countercyclically.

In Equation (1), when the authorities choose the policy of revising up K, the aggregate regulatory capital ratio, a financial institution may increase its K by reducing A. However, it can also increase K by expanding E or by reducing w. In the latter case, the assets of the financial institution do not decrease, while when E is expanded its assets could rather rise.

Which variables among A, E, and w that financial institutions choose in response to an upward revision of the aggregate regulatory capital ratio may differ, depending upon the financing and investment structures of the financial institutions and the cost of capital. We would like to examine this in detail below.

4.1.1 Adjustment cost comparison: expanding E and reducing A

First, we investigate which method financial institutions would select for responding to capital buffer imposition, between a capital increase and an asset reduction. Using the adjustment cost as summarised above in Table 3, financial institutions could compare the adjustment cost of a capital increase with that of an asset reduction.

$$\text{①adjustment cost of } \Delta E - \text{②adjustment cost of } \Delta A = (c_2 - r)\Delta E - (r - c_1)\Delta A \qquad (6)$$

$$\therefore \text{ ①} < \text{②}, \qquad \text{if } \frac{(c_2 - r)}{(r - c_1)} < \frac{\Delta A}{\Delta E}$$

In Equation (6), we can see that the higher the leverage (A/E) of financial institutions and the lower the risk premium ($(c_2–r)/(r–c_1)$) in the financial market[4], the more likely financial institutions are to choose the capital increase instead of the asset reduction.

4.1.2 Adjustment cost comparison: reducing w and reducing A

In the same way, in response to a rise in the capital buffer ratio, financial institutions could compare the adjustment cost of a decrease in risk weightings with that of an asset reduction:

$$\text{①adjustment cost of } \Delta A - \text{②adjustment cost of } \Delta w = (r - c_1)\Delta A - (r_2 - r_1)\Delta A_2 \qquad (7)$$

$$\therefore \text{ ①} > \text{②}, \qquad \text{if } \frac{(r - c_1)}{(r_2 - r_1)} > \frac{\Delta A_2}{\Delta A} (= \gamma \frac{w}{A})$$

In Equation (7), we find that the smaller γ, ie the bigger the difference between riskless assets and risky assets, and the smaller w/A, then the smaller $\Delta A_2/\Delta A$, and the more likely financial institutions are to choose to reduce w. Meanwhile, looking at the relative adjustment cost ($=(r–c_1)/(r_2–r_1)$), we can see that the lower the risk premium ($=r_2–r_1$) in the financial markets, and the higher the rate of return on assets against the cost of debt ($=r–c_1$), the more likely financial institutions are to take actions to reduce their risk weights by changing asset composition (eg cutting down SME loans and attracting more mortgage loans) rather than to reduce assets.

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[4] c_2 (= cost of equity) can be estimated by using the Capital Asset Pricing Model. Looking at this framework, it can be seen that the expected return (ie the cost of equity) is a linear function of the risk premium.

4.2 Liquidity buffer imposition

Let us now look into how effectively countercyclical adjustment of the liquidity buffer ratio by the authorities can control financial institutions' assets. For convenience of analysis, we simplify the liquidity buffer as Equation (2); the only differences compared to the capital buffer ratio are that we impose weights on liabilities rather than assets, and that we hold high-quality liquid assets in order to absorb shock.

Looking at Equation (2), when the authorities raise L, financial institutions can respond by increasing A^h or decreasing s or D. One way of reducing s is to replace riskier liabilities such as wholesale funding with riskless ones including cash. If financial institutions increase A^h, they should reduce other assets (investments and loans), on the condition that A is constant. When they reduce D, A declines on the condition that E is constant. After considering the adjustment costs of these options, financial institutions will choose the option with the lowest cost.

Let us look at which strategy, between an increase in A^h or a reduction in s, financial institutions will choose in response to liquidity buffer imposition, depending upon financial conditions. In order to comply with this liquidity regulation, they can raise A^h or reduce s, and will as a result compare the adjustment costs of those two options:

$$\text{①adjustment cost of } \Delta A^h - \text{②adjustment cost of } \Delta s = (r_o - r_h)\Delta A^h - (c_{11} - c_{12})\Delta D_2 \qquad (8)$$

$$\therefore \text{①} > \text{②}, \qquad \text{if } \frac{(r_o - r_h)}{(c_{11} - c_{12})} > \frac{\Delta D_2}{\Delta A^h}\left(= \delta \frac{s}{A_1}\right)$$

The lower δ, which means the difference between the run-off rate of core liabilities and non-core liabilities, and the lower the average run-off rate s, the higher the possibility of reducing non-core liabilities rather than increasing high-quality liquid assets. Meanwhile, looking at the relative adjustment cost ($=(r_o–r_h)/(c_{11}–c_{12})$), the higher the opportunity cost of expanding liquid assets, and the larger the difference between the funding rates of core and non-core liabilities, the higher the possibility of reducing non-liabilities rather than increasing high-quality liquid assets. In this condition, the effectiveness of the liquidity buffer could be limited.

5. Empirical analysis

In Section 4 we made a comparative assessment of the effectiveness of countercyclical tools based upon this criterion: controllability over financial institutions' assets. We showed that this controllability varies with financial conditions including the cost of capital and the structure of funding and investment. In this section, we provide an empirical analysis on financial institutions' responses to capital buffer and liquidity buffer impositions in boom times, using the "minimisation of EVA adjustment costs" model and the data for financial conditions of banks in Korea at the end of 2009 (Table 4).[5]

[5] We compiled data for analysing the capital buffer from seven nationwide banks, six local banks and four special banks. For the liquidity buffer, we acquired data from the QIS conducted by the BCBS, which are from four nationwide banks, two local banks and two special banks.

Table 4

Data from banks in Korea

(at end-2009)

(won trillions)

Regulatory capital ratio (K)	Regulatory capital (E)	Assets (A)	Average risk weight (w)
11.9%	123	1,769	63.7%

L	High-quality liquid Assets (A^h)	Net run-off rate (s)	Net run-off liability (D)
100%	105.4	34.9%	302.5

Source: Financial Supervisory Service of Korea.

5.1 Capital buffer's controllability

We know that if the authorities adjust K upward, banks will choose to either reduce A, raise E, or reduce w – based upon the adjustment cost. As shown in Table 5, in the case where regulators increase K by 1%p, financial institutions should respond by either increasing E by 11.3 trillion won, decreasing A by 148.3 trillion won, or decreasing A2[6] by 104.9 trillion won. The unit cost of ΔE, measured by the difference between the cost of equity and the rate of return on assets, is at the 2.6%p level. The unit cost of –△A, the difference between the rate of return on assets and the cost of debt, is meanwhile approximately 0.2%p, and the unit cost of –Δw, the difference between the three-year corporate bond and three-year Treasury bond yields, is at the 1.1%p level.

Table 5

Adjustment cost comparison

(won trillions)

Option	ΔE	ΔA	Δw	ΔA_2
Adjustment size (a)	11.3[1]	–148.3[2]	–5.3%p[3]	–104.9[4]
Unit cost (b)	2.6%p	0.2%p		1.1%p
Adjustment cost (a*b)	0.2	0.3		1.2

[1] ΔE = (wA) ΔK = 63.7% x 1,769 trillion won x 1%p = 11.3 trillion won

[2] ΔA = –(A/K) ΔK = –(1,769 trillion won÷11.9%) x 1%p = –148.3 trillion won

[3] Δw = –(w/K)ΔK = –(63.7%÷11.9%) x 1%p = –5.3%

[4] $\Delta A_2 = \Delta w\{A/(w_2–w_1)\}$ = –5.3% x {1,769 trillion won÷ (1.0–0.1)} = –104.9 trillion won

[6] With the 1%p increase of K, banks should cut w by 5.75%p. To do so, they should replace risky with riskless assets.

Thus, the adjustment cost incurred by $\triangle E$ is 0.2 trillion won (= 11.3 × 2.6%p), that incurred by $-\triangle A$ is 0.3 trillion won (=148.3 × 0.2%p), and that incurred by $-\triangle w$ is 1.2 trillion won. $\triangle E$ is therefore the option with the lowest adjustment costs. Because of high leverage, "reducing assets" entails much larger adjustment sizes than the optimal option, despite the lower unit costs. Overall, for Korean banks, it is a rational choice to expand E instead of reducing either A or w.

5.2 Liquidity buffer's controllability

In response to an increase by the authorities in the level of L, financial institutions may either increase their proportions of A^h or reduce their s. In Korea, L has been under 100% – the minimum level required by the BCBS – and we thus adjust L to 100% by raising A^h, D and s proportionally. As shown in Table 4, A^h is 105.4 trillion won, D is 302.5 trillion won, and s is 34.9%. In the cases where the authorities increase L by 10%p, banks can respond by either increasing A^h by 10.5 billion won or reducing s by 3.2%p (Table 6). In order to reduce s, they should change their non-core liabilities, which have high run-off rates, into core liabilities such as deposits that have low run-off rates. The amount of x transferred into core liabilities in order to reduce s by 3%p can be calculated as follows:

$$\Delta s = 0.05\frac{x}{D} - 1.0\frac{x}{D} \tag{9}$$

In equation (9), the 0.05 and 1.0 are the run-off rates of core liabilities and non-core liabilities, respectively, estimated conservatively. x is then 10.1 trillion won. This amount is close to that of ΔA^h, and the choice of whether to increase ΔA^h or reduce s thus depends upon the adjustment costs of ΔA^h and of converting non-core into core liabilities.

The unit cost of ΔA^h, measured by the difference between the one-year Treasury bond yield and the one-year bank lending rate, is at the 1.1%p level. The unit cost of converting non-core liabilities with the one-year bank debenture rate into core liabilities with the one-year bank deposit rate is meanwhile around 0.4%p. Thus, the adjustment cost of ΔA^h is 11.6 trillion won (= 10.5 × 1.1%p), and that of converting non-core into core liabilities 4.0 trillion won (= 10.1 × 0.4%p). It is therefore more effective for financial institutions to choose reducing s over increasing ΔA^h, since the adjustment cost of ΔA^h is greater.

Table 6

Adjustment cost with LCR 10%p increase

(won trillions)

option	ΔA^h	Δs	ΔD_2
Adjustment size (a)	10.5[1]	–3.2%p[2]	–10.1[3]
Unit cost (b)	1.1%p		0.4%p
Adjustment cost (a*b)	11.6		4.0

[1] $\Delta A^h = sD\Delta L$ = 34.9% x 302.5 trillion won x 10%p = 10.5 trillion won

[2] $\Delta s = -(s/L)\Delta L$ = –(34.9%/110%) x 10%p = –3.2%p

[3] $\Delta D_2 = -(w/K)\Delta K$ = –(63.7%/11.9%) x 1%p = –5.3%

6. Policy implications

In this paper, we find that the effectiveness of countercyclical tools will vary depending upon financial institutions' responses to the regulations. Financial institutions have diverse options for dealing with charges for the capital buffer and the liquidity buffer.

Financial institutions aiming to maximise EVA will choose the option with the lowest portfolio adjustment costs. The portfolio adjustment costs depend upon the balance sheet structures of financial institutions and market conditions.

Countercyclical tools such as the capital buffer and the liquidity buffer could not work as expected when financial institutions, given all of the economic and financial conditions, choose the option with the lowest adjustment costs. Thus, in order to maximise the effectiveness of countercyclical tools, we should implement various tools in a complementary way, in consideration of financial conditions.

References

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