Capital Requirements, Bank Behavior and Fair Value Accounting: Evidence from Japanese Commercial Banks

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Abstract

Using data from Japanese commercial banks during 2002-2012, we explore the relationship between banks' choice of capital buffers and prevailing macroeconomic conditions. We find a positive relationship between capital buffers and the phase of the business cycle, and further find that this positive relationship was weakened after the implementation of Basel II. We also examine whether the gap between desired and actual capital buffers, as well as the phase within the business cycle, affected banks' balance sheet management behavior and lending activities. We find that during periods of economic upturn, banks increased capital more than they increased lending. These results are consistent with the countercyclical capital management behavior exhibited by commercial banks. Moreover, we find that banks which adopting fair value accounting (FVA) intend to behave more counter cyclically in their capital management practice as compared to domestic banks.

JEL classification: G21; G28
Keywords: Capital buffers; Bank regulation; Procyclicality; Fair Value

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1. Introduction

There has been much debate over the "procyclical" nature of bank capital requirements since the 2004 release of Basel II guidelines by the Basel Committee on Banking Supervision. During economic upturns, bank capital requirements would be reduced, which would facilitate banks taking on risk. This resulted in banks extending credit without building up sufficient capital for potential future losses. This is despite the fact that during economic upturns, increasing profits is relatively easy and raising external capital is cheaper. During economic downturns, borrowers are more likely to be downgraded, so bank capital needs to be increased. Since it is difficult for banks to raise external capital during recessions, they would reduce loans and dispose of assets. These interactions between financial and real sectors, referred to as procyclicality, can amplify business fluctuations and exacerbate financial instability. Therefore, addressing procyclicality in the financial system is thought to be essential to strengthening regulatory frameworks.

In academia, however, evidence surrounding procyclicality is rather mixed. Some previous works provide evidence which is consistent with procyclical capital management, (e.g., Bikker and Metzemkers, 2004; Ayuso et al., 2004; Linquist, 2004; Stoolz and Wedow, 2005; Jokipii and Milne, 2009; Francis and Osborne, 2009), while others provide evidence which is contrary to procyclical capital management, (e.g., Linquist, 2003; Ayuso, 2004; Bikker and Metzemkers, 2004; Stolz and Wedow, 2005; Francis and Osborne, 2009; Jokipii and Milne, 2009). These existing works use data from different countries or regions in the U.S. and Europe, but not much has been studied using data from Asian countries. Furthermore, most of these studies source data from the period before the 2006 implementation of Basel II.

Besides the issue of procyclical capital management practice, the recent financial crisis has also triggered doubts on accounting practice as one of the factor in contributing to the exacerbation of the procyclicality problem. Some criticized that FVA standard reflect the market value which is considered misleading, as the market prices do not accurately reflect the fundamental value of the assets, especially during recession. This will lead to tight liquidity spiral in the balance sheet of financial institutions, and potentially provoke the procyclicality problem.

However, opponents are disagreed, and claim that FVA standard provide timely information, increasing transparency and stimulate prompt corrective actions. This will help investors and policy makers to better evaluate their risk profile and undertake corrective actions.

Although some studies provide evidence that FVA contribute to the procyclicality problem, but, it is still unclear whether there is any significant relationship between mark to market accounting and procyclicality. New accounting standard that integrates best features in each of the current accounting standard, the FVA standard and historical accounting standard are being considered as one of the best alternative. Hence, further research on this issue is undeniable needed to improve the recent accounting standard and to foster financial stability.

The purpose of this paper is to address this gap (procyclicality or counter cyclical capital management practice) and provide additional evidence on the procyclicality issue using data from Japanese commercial banks during 2002–2012. In particular, we explore the relationship between banks' choice of capital buffers (the gap between the actual and the minimum regulatory capital ratios) and macroeconomic conditions, while controlling for other factors affecting bank capital management practices. We further investigate whether the application of FVA affect the counter cyclical effect in Japanese commercial banks which we found in the first part of the result. We also examine whether the gap between the actual and desired capital buffers, as well as the phase within the business cycle, affects banks' balance sheet management behavior and lending activities.

The major results of this paper are summarized as follows. First, we find evidence that is consistent with countercyclical capital management behavior by commercial banks. That is, we see a positive relationship between capital buffers and the phase within the business cycle. We also find that this positive relationship weakened after the implementation of Basel II norms. This result is consistent with the conventional argument that the Basel II capital requirements caused an amplification affect since its primary objective was to introduce a closer link between capital ratios and bank risks than was the case with Basel I. Second, using full sample data our results provide evidence that banks which adopting FVA standard have lead to stronger counter cyclical effect in their capital management practice as compared to the domestic banks. Although we find no evidence when we

separate the sample to Basel I and Basel II period, but as in overall no negative relationship that indicate the procyclical found in our sample. Our results provide implication that FVA promote counter cyclical behavior in capital management practice, and provide some imply that FVA in certain level promote the market discipline and corrective actions. As a conclusion, we find that during periods of economic upturn, banks increase capital more than they increase lending. This result suggests that banks raise sufficient capital for potential future losses when external capital is cheaper. It is also consistent with the countercyclical capital management behavior exhibited by commercial banks. No procyclical effect revealed when we included the FVA dummy.

The remainder of this paper is organized as follows. Section 2 provides the institutional background of the Japanese financial system concerning bank capital requirements. Section 3 reviews related studies and Section 4 develops our hypotheses. Section 5 describes the sample selection procedure, and Section 6 presents empirical methods and results. Section 7 summarizes our findings and concludes the paper.

2. Institutional background of Japanese financial system concerning bank capital requirements

Banks can make adjustments towards their optimum level of capital ratio through the following options. Capital ratio can be boosted through numerator adjustment, which means the raising of capital by issuing new equities, subordinated debt and preferred stock, or by increasing its loan loss reserves. Alternatively, banks can also use denominator adjustment through the risk-weighted asset side by reducing or shifting their asset portfolio into lower risk-weighted asset categories. For instance, they can decrease their lending and shifting asset portfolio to the level of government bonds, which carry a lower risk weighting, or do the adjustment by altering both. As referred to by Ito and Sasaki (2002), Japanese banks with lower risk-based capital ratio tended to grow loans at a relatively slower pace; moreover, Japanese banks with lower capital also tended to issue more subordinated debts and reduced lending.

Figure 1 shows the capital buffer for all Japanese commercial banks and the percentage of GDP growth for the period of 2002h1 to 2012h1 on a half yearly basis. Note that the capital buffer is defined as the Basel capital ratio minus 8% for international banks and 4% for purely domestic business banks. First of all, Figure 1 shows that Japanese commercial banks have built up a thick capital buffer since the implementation of Basel I. Capital buffers as a whole are an increasing trend that rose steadily in the first half year of 2005 to 2006, which is the period that is characterized by relatively robust economic conditions and healthy bank earnings in Japan. By 2007, the capital buffers were still increasing steadily, which may be due to the adoption of Basel II in March 2007 in Japan. Capital buffers dropped slightly from 2008 to 2009, which was due to the global recession. Despite changes in Japan's economy, the capital buffers of the financial institutions in Japan, overall, are on an upward trend.

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To gain more of an insight into what drives the capital ratio trend, figure 2 was plotted. It shows the capital buffer growth and the risk-weighted asset growth in percentages for the period of 2002h1 to 2011h2. In the early 2000s, the growth in capital buffers and risk-weighted assets was very similar. After 2008, capital buffers grew at a faster speed compared to risk-weighted assets. Figure 2 also shows that, at least broadly, there is little difference between capital buffers and risk-weighted asset growth, which means that these instances are closely correlated, suggesting that Japanese commercial banks

are actively managing their capital and assets in order to fulfill the capital requirements.

3. Review of related studies

Robustly significant negative relationship between the position in the cycle and the capital buffers in banks of 29 OECD countries, Spanish, Norwegian and German banks were found. (Bikker and Metzemakers (2004) Ayuso et al. (2004), Linquist (2004) and Stolz and Wedow (2005)) They interpret this result as evidence that the capital management practices of banks may be procyclical. Moreover, using an international bank database, Jokipii and Milne (2009) found a similar relation in 15 EU countries in 2004.

The signs of procyclical behavior exist with respect to these studies; however, it is still doubtful whether these interpretations hold in general. In contrast to the above studies, Ayuso et al. (2004) found some evidence that the capital buffers of commercial banks are less procyclical than those of savings banks. These suggest that commercial banks in Spain may increase buffers during economic expansion and reduce capital buffers during downturns. In addition, Stolz and Wedow (2005) also pointed out that low capitalized German banks do not reduce their loan supply during economic downturns. This behavior is in divergence with procyclical behavior. Additionally, despite Jokipii and Milne (2009) using an international bank database to find a significant negative relationship between capital buffers and the business cycle in 15 EU countries in 2004, at the same time an opposite relation (a positive relationship between economic condition variables and capital buffers) was also found in the RAM10 (10 countries that joined the European Union in 2004). In addition, based on Bikker and Metzemakers' (2004) study, a negative significant association was found when they used the whole sample. However, when they only focused on data from the UK and the US, no significant association was found between risk-based capital and business cycle proxies. This heterogeneous finding led to the conclusion that capital management practice may be only moderately procyclical.

Thus, with these mixed results, the question of whether the capital management practice that is adopted by banks are procyclical or counter cyclical, and also whether procyclical effects occur under Basel II, is still

ambiguous. Hence, more evidence is needed in order to gain a clearer picture on this issue. Moreover, the investigation of to what extent procyclical effects exist in capital management practice should also be examined.

Banks face different types of trade-offs in maintaining certain levels of capital or capital management practices. Estrella (2004) has developed a theoretical explanation for banks' choice of capitalization, and presents a dynamic model of optimal bank capital in which the bank optimizes its capital over the cost that is associated with failure, capital holding and flows of external capital. Following Estrella (2004) and Ayuso (2004), banks face three types of capital-related costs: the cost of holding capital, the cost of failure, and the adjustment cost. As such, a bank's objective is to minimize a function of the three types of costs over an infinite horizon, given some dynamic identities.

FVA accounting rules have been blamed as a cause in contributing to the exacerbation of the recent financial crisis. Whether FVA plays a role as a messenger that convey timely, relevant information to the investors and promote corrective actions or as one of the contributor that bring contagion to the financial crisis, is seen as a hot bed of debate in the group of politicians, economists, business leaders and professional association. In academic field, analytical research and empirical research have been carried out to get more understanding on this accounting practice. Securities and Exchange Commission (SEC) (2008) concluded in their report to congress, although FVA did significantly affect financial institutions' reported income, FVA did not appear to play a meaningful role in bank failures in the financial crisis of 2008. In other words, FVA did not promote procyclical behavior during downturn and no evidence support that FVA caused contagion. Besides that, IMF has conducted a study concerning the procyclical effect of FVA in the period of 2007 and 2008. Their paper included three types of banks, the European banks, U.S. commercial banks and U.S. investment banks. Their study period was based on the 2006 financial results. They concluded that fair value may amplify the cyclical volatility of capital. However, they just utilize the model to predict the impact, and their study's results were just based on hypothetical scenarios. Laux and Leuz (2009) has proposed some views on the FVA, and concluded that the recent FVA practice is clearly not perfect and claimed that further research to understand the effects of FVA in booms and busts is needed to guide efforts to reform the rules.

For empirical study, although still limited, there are some study could provide us insight on the procyclical issue of FVA. In the study of Shaffer (2010), using a sample of 14 large bank holding companies, he found that FVA only have a minimal impact on regulatory capital. Moreover, he found no evidence on the procyclical behaviors of banks, namely the fire sales of assets. This is inconsistent with the assumption that banks increase distressed sales of assets at fire sales price in order to boost their capital ratio during recession. On the other hand, using the sample of 150 bank holding companies, Badertscher et al. (2012) investigate the impact of FVA specifically, Other-than-temporary impairment (OTTI) on regulatory capital. However, they found that there is only minimal impact of OTTI on regulatory capital. Moreover, banks with low capital ratios actually tend do less selling and this result is contrarily with the prediction that FVA encourages fire sales of asset and affect the regulatory capital. Their result providing no evidences showing FVA caused fire sales of assets. They concluded that FVA does not contribute to the procyclical behavior.

Cost of holding capital

Holding capital is a direct cost for banks, as it has to be remunerated. According to Campbell (1979) and Myers and Majluf (1984), in the context of asymmetric information, capital may be even more costly than alternative bank liabilities such as depositors or debt.

Cost of failure

Holding capital has the effect of reducing the probability of bankruptcy. Following Acharya (1996), the cost of failure includes the loss of charter value, reputational loss and the legal costs of bankruptcy process. Higher capital levels will actually reduce the probability of breaching the capital requirements, which will reduce the cost of failure. However, as a statement of fact, before regulatory limits are breached, supervisory authorities will usually execute some restrictions or commands on the activities of banks.

Adjustment cost

To avoid the cost falling below the regulatory standards, banks will usually maintain a cushion of capital. Bank capital ratios may be affected by unexpected opportunities in positive net present value projects. However, offsetting these opportunities through equity adjustment will actually have a negative impact on banks' common stock value. Apart from the transaction cost, in the context of information asymmetries, whereby the issuers are

better informed than the potential buyers in the market, issuing stocks may convey a negative message to the market as a signal that the bank considers the market cost to be overpriced (higher than the true share value). According to Myers and Majluf, (1984), equity issues may, in the case of information asymmetries, convey negative information to the market in regard to the bank's economic value. Hence, with the existence of information asymmetries, the cost of the desired adjustment will increase.

Profit maximizing banks will balance the cost of holding capital buffers to the extent of the likelihood of facing the costs associated with failure. However, banks may maintain a lower capital ratio when the opportunity cost of financing the capital is expensive. On the other hand, as low capital buffers will increase the probabilities of breaching regulations and bankruptcy, banks with riskier portfolios should hold larger capital buffers. Therefore, under the trade-off theory, the return of equity (ROE) can be used as a proxy of the cost of remunerating the equity. In addition to the opportunity cost of funding the capital buffers, especially during a period of recession, due to the existence of signaling effects, the signaling cost of issuing equity is pronounced.

One of the important determinants that Estrella (2004) considered is the cost of holding capital. Based on prior studies, Ayuso et al. (2004), Bikker and Metzemakers (2004), Stolz and Wedow (2005) and Jokipii and Milne (2008) considered using ROE as a proxy for the direct cost of holding capital. Thus, under this interpretation, a negative relationship between capital buffers and ROE is expected. Milne (2004) suggests that, for financially strong banks, the revenue impact will generate a negative relationship between ROE and capital buffers. According to Jokipii and Milne (2008), ROE may exceed the remuneration demanded by shareholders and to this extent it is to be considered as a measure of revenue rather than cost. A higher level of profits has a function in the substitution of capital as a cushion against unexpected losses. Moreover, raising capital through the market might be costly; thus, retained earnings are often used to increase the capital buffers. Hence, the expected sign for ROE might be negative or positive (refer to Nier and Baumann (2006)).Nier and Baumann (2006) and D'Avack (2007) also found a significant positive relationship in their studies. With the existence of information asymmetries, a significant portion of bank earnings will be kept as retained earnings in order to anticipate the unexpected losses. As

such, an increase in earnings will lead to an increase in capital ratio.

Capital reduces the likelihood of bankruptcy and financial distress costs, including both the legal bankruptcy process and the loss of charter value (Keeley, 1990). Cost of failure is one of the key determinants in bank capital management practices, as identified by Estrella (2004). Cost of failure depends on the likelihood of banks' failure. Because the likelihood of failure is reflected by banks' risk profile, several measures were used as proxy for the cost of failure. Total risk-weighted assets over total assets (RISK) were adopted by Stolz and Wedow (2005) and Francis and Osborne (2009) in their studies. The greater the coefficient of the proxy variable for the cost for failure indicated the higher than expected cost of failure. Finding a negative relationship between the proxy variable for cost for failure and capital buffers can be interpreted as proving the existence of moral hazard behavior.

Moreover, following Francis and Osborne (2009), if the capital is slow to adjust to the changes in risk weighted assets, a negative association between RISK and capital buffers may be found. Thus, in order to examine this probability, lagged RISK was included in their study. Banks make loan loss provisions against the expected losses of their portfolio. In addition, loan loss provision is also considered as an indicator of banks' own internal estimation of risk and reflects their managerial assessment towards losses embedded in their portfolio. In reference to Francis and Osborne (2009), provision is closely aligned with the banks' own perception of risk, where a relatively higher (lower) ratio suggests more (less) risk. Finding a negative association with capital buffers may be indicative of moral hazard behavior, whereas in contrast a positive association may imply the evidence of market discipline.

According to the hypothesis of being too big to fail (TBTF), big banks will keep relatively a lower level of capital buffers compared to small banks, as they will receive rescue measures from public government when they are facing difficulties. In general, larger banks have greater investment and better diversification opportunities in their portfolios. Thus, with the power of diversification, the capital needed is lesser compared to small banks and, as a consequence, this may reduce the cost in the financing of capital. Additionally, big banks can take advantage of the perception that depositors have of the safety net, which allows them to maintain lower levels of capital ratio or capital buffers. Numerous examples of past literature, for instance Ayuso et al. (2004), Francis and Osborne (2009) and Jokipii and Milne (2008),

have used a log of total assets to represent the size of banks when testing the too big to fail hypothesis. Even though the sign of SIZE can be either positive or negative, the negative relationship between SIZE and capital buffer has been proven by a great deal of past literature.

In reference to Estrella (2004) and Ayuso (2004), adjustment cost is considered to be one of the major costs affecting buffer holding. Banks face adjustment costs in the process of adjustment towards their optimum level of capital buffers. Estrella (2004) and Ayuso (2004) tested this cost by using a lag of capital buffers as a proxy for this cost. If the bank is facing adjustment costs when they adjust toward the optimum level of capital buffers, a significant and positive relationship between capital buffers and lag capital buffers should be found. The composition of capital will actually influence the ability of loss absorption. Thus, the ratio of tier 1 capital to total capital (TIER 1) as a proxy for banks' capital quality was included in Francis and Osborne's (2009) study.

After reaching conclusions on the determinants that influence capital buffers, GDP growth (GDPG) is considered to be the cyclical indicator that is used by much previous research. Past literature, although is still limited, has tried to answer the question of whether banks' capital management practices behave in a procyclical or counter cyclical way in regard to the business cycle. In order to investigate the feature of capital management practice, capital buffers were used to regress with GDPG. However, the evidence is currently ambiguous. Significant associations between the banks' capital buffers and the macroeconomic variables suggest that the business cycle may significantly impact the banks' behavior and this negative sign indicates the short-sightedness of banks' capital management.

4. Hypotheses

In our analysis, we examine the capital management practice of Japanese commercial banks, the determinants that influence the capital buffer level and the adjustment of balance sheet elements toward target capital buffer level. The main focus is to be placed on whether Japanese commercial banks are adopting procyclical capital management practice. If banks are forward looking and adopting prudent behavior in their capital management practice, positive association between capital buffer and GDP growth should be

expected. This positive relation implied that during an economic upturn, when banks tend to expand their asset portfolio, at the same time the potential risks tend to rise, banks increase their capital buffers in response to the increment of risks. Banks increase their capital buffers more than average or beyond the optimal level of capital buffer in order to account for the risks arising from their expansion in lending and also to attenuate the loss effect that potentially incur during downturn. Thus, during an economic downturn, when risk (credit risk) materializes, banks can utilize these higher capital buffers to maintain the stability of its capital buffer level. In such scenario, capital management practices are to be said counter cyclical.

By contrast, if Japanese commercial banks are short-sighted in their capital management practices, a negative association between capital buffer and GDP growth should be observed. During an economic downturn, when the sources are scarce and the cost of financing is expensive, in order to meet the capital requirement standard, banks build up their capital buffers actively during hard times. These behaviors are to be said that banks are shortsighted in their capital management practices. Banks that undertake this myopic capital management will greatly expand their asset portfolio but build their capital buffers less or below the average level during economic expansion, which is not enough to commensurate with the increment of their risks. This type of capital management practice is to be defined procyclical. Moreover, in order to test whether Japanese commercial banks behave differently in their capital management practice, with the substitution of Basel II to Basel I, we conduct our analysis in two time frames, the implementation period of Basel I and Basel II. Even though Basel I actually brought in the cyclical effects, but Basel II is always being criticized of its obvious procyclical features as it creates closer link to the economics condition. Thus, we expect to find a negative association between capital buffer and GDP growth that indicate the procyclical capital management practice in the sample period of Basel II, or if positive association which implied the counter cyclical capital management practice is being found, the magnitude of the coefficient and the significant level should be weaker as compared to the sample period of Basel I.

$H_{1a}: \beta_8 > 0$: The capital buffer is positively correlated with the cyclical indicator implied countercyclical management practice.

$H_{1a}: ß_8 < 0$: The capital buffer is negatively correlated with the cyclical indicator implied procyclical capital management practice.

5. Sample selection

The data was mainly sourced from the Nikkei financial request database. Our data spanned 2002 to 2012 on a half-yearly basis. The period of analysis covers 21 half yearly data, from the first half of 2002 to the first half of 2012. The period of our study cover the implementation period Basel I and Basel II. Our data was restricted to unconsolidated reports, as observed banks' behavior on a solo basis is one of the main objectives in this study. The data set consists of half-yearly information on 100 Japanese commercial banks. Our data consists of city banks, regional banks and tier-two regional banks. We do not include credit associations and credit cooperatives for this study due to the problem of data availability. Institutions subject to government intervention, involve in M&A activities, liquidation processes and those with less than five observations within the period were removed from the sample. Therefore, we have a sample size with 1877 observations. The data of GDP growth and CPI was taken from the Department of National Accounts Japan's quarterly estimation report and the prime rate was sourced from the Bank of Japan.

6. Empirical Analyses

6.1 Empirical methods

In this research, the determinants of capital buffers are tested through a dynamic model. This simple partial adjustment model has been adopted many researchers, including Ayuso et al. (2004), Estrella (2004), Jokipii and Milne (2008) and Francis and Osborne (2009), and will be used in this research.

$$BUF_{i,t} - BUF_{i,t-1} = \theta\left(BUF^{*}_{i,t} - BUF_{i,t-1}\right) \quad (1)$$

Where θ is positive adjustment parameter, i indexes banks and t indexes time. Under this partial adjustment model, consider that banks take time to

adjust their capital buffer level, which means that the adjustment of banks is not instantaneous. Hence, bank i only partially reaches its optimal capital buffer $BUF^{*}_{i,t}$, during the period between t-1 to t. The speed of adjustment will be reflected by θ. If θ equals zero, it indicates that no adjustment is being made, and if θ is equal to 1, then the full adjustment is being made with the 1 time period of time (because we are using half yearly data, the one time period is half yearly in this analysis). A faster speed of adjustment (the greater value of θ) will lower the cost of adjustment.

The optimal capital buffer level $BUF^{*}_{i,t}$ is not observable. Thus, the approximation of the optimal capital buffer level $BUF^{*}_{i,t}$ is to be assumed as a function set of the N explanatory factors that are discussed in the last section.

$$BUF^{*}_{i,t} = \sum_{n=1}^{N} \delta_n . X_{n,i,t} \qquad (2)$$

Where X is a vector of N explanatory factors and δ is a vector of parameters. Combining (1) and (2), this gives us the following model of a bank's choice of capital buffer.

$$BUF_{i,t} = (1-\theta)BUF_{i,t-1} + \sum_{n=1}^{N} \delta_n . X_{n,i,t} \qquad (3)$$

Considering the described variables, as explained in the earlier section, the determinants of the capital buffer empirical model is composed as follows:

$$BUF_{i,t} = \beta_0 + \beta_1 L.BUF_{i,t} + \beta_2 ROE_{i,t} + \beta_3 RISK_{i,t} + \beta_4 L.RISK_{i,t} + \beta_5 PROVISION_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 TIER1_{i,t} + \beta_8 GDPG_t + \beta_9 Dum * gdpg_{i,t} + \varepsilon_{i,t} \qquad (4)$$

All of the bank-specific control variables are considered to be exogenous except for lagged buffer (LBUF) and lagged risk asset (LRISK).

As an extension to this research, the effects of bank capitalization and the impact of macroeconomic conditions on the balance sheet adjustment will also be estimated. We carry out this estimation by referring to the research of Francis and Osborne (2011). First, we calculate the bank capitalization to serve as one of the independent variables for the next stage of the analysis.

Bank capitalization is calculated as follows:

$$Z_{i,t} = 100^{*}(\frac{BUF_{i,t}}{BUF^{*}{}_{i,t}} - 1) \quad (5)$$

The calculation is slightly different compared to the Francis and Osborne (2011) research. Instead of capital ratio, capital buffers are used in the calculation of bank capitalization, where, $BUF_{i,t}$ is the capital buffer of bank i at time t and $BUF^{*}_{i,t}$ is the optimal capital buffer level of bank i at time t.

We then follow the model as used in Francis and Osborne's (2011) research. The major aim of this analysis is to assess how banks manage their balance sheets in order to maintain their target capital buffers and, in particular, to which extent banks tend to adjust their capital or lending side, or whether they adjust both at the same time in order to reach their optimal capital buffer level. In addition, the impact of macroeconomic conditions on banks' balance sheet adjustments will also be assessed. The estimated equations are divided into five; all of these equations reflect the available options that banks have for their adjustments.

The first three equations focus on how banks carry out their adjustments through the altering of the denominator of capital ratio, i.e. their asset portfolio. Banks can do these alterations through the adjustment of total assets (TA), risk-weighted assets (RWA) or loans (LOANS). The other two equations focus on how banks revise their capital buffer levels by altering the numerator of their capital ratio, which refers to their regulatory capital side. One of the capital equations examines the impact of bank choice in relation to overall regulatory capital (REGK) and the final one examines high quality capital (TIER1). The right hand side of the equation basically includes the macroeconomic conditions that are considered to affect bank adjustment in relation to their balance sheets. The general credit conditions proxy variables that included are GDP growth (GDPG), consumer price index

(CPI) and the changes of the prime rate (DPRIMERATE). Additionally, the change in the ratio of provision to asset at time t (DPROVISION) and the write-off over total assets at time t (WRITEOFF) will also be included.

The specifications for the three asset and two capital regressions are as follows:

The asset side

$$\Delta \ln LOANS_{i,t} = \propto_i + \beta_z Z_{i,t-1} + \sum_{j=1}^{2} \delta_{1,j} \Delta GDP_{t-j} + \sum_{j=1}^{2} \delta_2 \Delta PRIMER_{t-j} + \sum_{j=1}^{2} \delta_3 \Delta CPI_{t-j} + \delta_4 DPROVISION_{i,t} + \delta_5 WRITEOFF_{i,t} + \varepsilon_{i,t} \quad (6)$$

$$\Delta \ln TA_{i,t} = \propto_i + \beta_z Z_{i,t-1} + \sum_{j=1}^{2} \delta_{1,j} \Delta GDP_{t-j} + \sum_{j=1}^{2} \delta_2 \Delta PRIMER_{t-j} + \sum_{j=1}^{2} \delta_3 \Delta CPI_{t-j} + \delta_4 DPROVISION_{i,t} + \delta_5 WRITEOFF_{i,t} + \varepsilon_{i,t} \quad (7)$$

$$\Delta \ln RWA_{i,t} = \propto_i + \beta_z Z_{i,t-1} + \sum_{j=1}^{2} \delta_{1,j} \Delta GDP_{t-j} + \sum_{j=1}^{2} \delta_2 \Delta PRIMER_{t-j} + \sum_{j=1}^{2} \delta_3 \Delta CPI_{t-j} + \delta_4 DPROVISION_{i,t} + \delta_5 WRITEOFF_{i,t} + \varepsilon_{i,t} \quad (8)$$

The capital side

$$\Delta \ln REGK_{i,t} = \propto_i + \beta_z Z_{i,t-1} + \sum_{j=1}^{2} \delta_{1,j} \Delta GDP_{t-j} + \sum_{j=1}^{2} \delta_2 \Delta PRIMER_{t-j} + \sum_{j=1}^{2} \delta_3 \Delta CPI_{t-j} + \delta_4 DPROVISION_{i,t} + \delta_5 WRITEOFF_{i,t} + \varepsilon_{i,t} \quad (9)$$

$$\Delta \ln TIER1_{i,t} = \propto_i + \beta_z Z_{i,t-1} + \sum_{j=1}^{2} \delta_{1,j} \Delta GDP_{t-j} + \sum_{j=1}^{2} \delta_2 \Delta PRIMER_{t-j} + \sum_{j=1}^{2} \delta_3 \Delta CPI_{t-j} + \delta_4 DPROVISION_{i,t} + \delta_5 WRITEOFF_{i,t} + \varepsilon_{i,t} \quad (10)$$

6.2 Summary Statistics

Table 2 presents the descriptive statistics on the variables that adopted in our estimated equation (Eq.4) of the first analysis, bank capitalizations and growth of the balance sheet elements for the estimated equation (Eq.6-10) in the second analysis. Section A in table 2 reports information on the data adopted for estimation of equation 4. It shows that the average capital buffer for the entire sample is roughly 6%, which is significantly above the capital requirement of 8% for international banks and 4% for domestic banks. This is consistent with the idea that banks are generally maintaining considerable capital buffers level as a way to mitigate the regulatory intervention. Moreover, this high level of capital buffer maintained is consistent with the information that plotted in figure 1, which shows that, as

a whole, capital buffers of Japanese commercial banks are on an increasing trend. Section B of table 2 shows summary statistics on our measure of the bank capitalization (Z) calculated using the coefficients from table 6. The table shows that Z is on surplus, suggesting that Japanese commercial banks on average, held excess capital buffer relative to their target capital buffer level. Section C of table 2 reports descriptive statistics for the variable used in our balance sheet growth models. Except for the growth of risk weighted assets and tier 1 capital, the growth of each variables is around 0.7 to 1.0% on a half-yearly basis.

6.3 Empirical results

Table 3 presents the estimation results of Equation (4). With respect to the GDPG, we found a highly significant and positive coefficient in our sample. This result rejected the null hypothesis, and is in line with the hypothesis of H_{1a}. This implied that, when GDPG increases by 1.0 percentage point, the capital buffer will increase for Generalized Method of Moments, (GMM) results, despite there being little difference in the magnitude for the GDPG coefficient, whereby the coefficient of GDPG in Difference Generalized Method of Moments (DGMM) is 0.060 and 0.031 in System Generalized Method of Moments (SGMM), the sign of GDPG basically appears to be positive. This implied that, under the entire period of our analysis, the results support the hypothesis of H_{1a}. Additionally, the over identifying restrictions were tested by the Sargan test. Results showed that the null hypothesis is confirmed statistically, that the instrumental variable has passed the test and that it is considered to be an acceptable instrumental variable. In reference to the first columns of tables 3, we can conclude that, under Basel I and Basel II, Japanese commercial banks are adopting counter cyclical behavior in their capital management practices.

Our sample period spanned from 2002 to 2012, which covered the implementation period of Basel I and Basel II. In order to observe the effect separately, the sample has been divided into two sample periods: the Basel I period and the Basel II period. As explained earlier, Basel I initially brought in the cyclical effect, as it links the banks' capital and the investment or financial sectors. In addition, with the substitution of Basel I to Basel II, the latter is considered to have the tendency to provoke a higher level of amplification of the business cycle since it has a higher risk sensitivity

measure. Thus, Basel II is always criticized for its procyclical behavior.

Significant and positive coefficients of GDPG in DGMM (0.099) and SGMM (0.0827) were also found under the sample period of Basel I. It is interesting to note that, compared to the results of the entire sample period (Basel I and Basel II), the magnitude of the significant and positive coefficient of GDPG in the sample period of Basel I was larger. This shows that, under the sample period of Basel I, the counter cyclical effect in capital management practices was stronger.

In our further analysis, we found a highly significant positive coefficient of Dum*GDPG in our full sample data. This implied that, FVA do promote counter cyclical effect in capital management practice. Despite the significance level decreased, but we found no negative coefficient that showing procyclical effect in our analysis.

Under Basel II, again, we can still find a significant and positive coefficient of GDPG in GMM results (refer to the third column of table 3). However, The Sargan test in DGMM cannot be satisfied, and thus the result in DGMM should not be referred to. As we compared the SGMM results in the sample period of Basel II (refer to the third column of table 3) to the results in the sample period of Basel I (refer to the second column of table 3), we found that the magnitude of the GDPG coefficient is smaller and the significant levels are also lower (weaker) in the sample period of Basel II.

Hence, we can conclude that, basically, Japanese commercial banks are not myopic in their capital management practices. During an economic upturn, where the cost of capital financing is lower, Japanese commercial banks build up their capital actively. Even though the results in the sample period of Basel II show that the magnitude of GDPG coefficient was smaller and the significance level was also lower, which implied that there was a reduced counter cyclical effect in the sample period of Basel II compared to Basel I, at least broadly, no procyclical effect was found in Japanese commercial banks' capital management practices. Consequently, it can be concluded that Japanese commercial banks are forward-looking in their capital management practices. Banks hold a greater capital buffer during an economic upturn as a way to dampen the effect of losses during an economic downturn.

As in line with Estrella (2004) and Ayuso et al. (2004), a lag of dependent variable, the lag of capital buffer, was adopted in this study to be used as the

proxy of the cost of adjustment. Our results of all GMM specifications have shown a significant and positive relationship between the dependent variable and the lag capital buffer. These results are consistent with the expected positive sign showing the existence of the adjustment cost in capital buffers. As such, the speeds of adjustment are also reasonable in all results, whereby the speed of adjustment is within the range of 0 to 1.

ROE was used as the proxy of direct cost of remunerating the excess capital or the cost of holding capital in a great deal of previous research. Ayuso et al. (2004) and Jokipii and Milne (2008) found significant and negative relationships between ROE and capital buffers. Our result in the period of Basel I, in both DGMM and SGMM specifications (refer to the second column of table 3), showed that the coefficient of the variable of ROE was significance at 1% and has a negative sign, which was consistent with the previous studies. In that regard, ROE is considered as a cost of holding its capital to banks during the Basel I period.

On the other hand, in comparison to what is usually found in the past literature, during the period of Basel II, positive and significant relationships between ROE and capital buffers were found in SGMM specification. This result also shows statistical significance at the level of 1%, and this positive sign supports the idea of retained earnings as a source of recapitalization. The positive sign of the coefficient of ROE is in line with the Myers and Majluf (1984) pecking order theory, whereby retained earnings may be the main source of raising capital and may also be a signal of banks' solvency.

No significant relationship was found in most of the specifications, suggesting that SIZE is not an important determinant to capital buffers and that the TBTF hypothesis also cannot be rejected. The results of RISK, which represent the cost of failure, were mixed in the entire sample period. The positive sign of RISK in SGMM and the negative sign of RISK in DGMM in the entire sample period cannot provide us with the conclusion of whether moral hazards happened in Japanese commercial banks. However, the result of RISK in the Basel I period (refer to the second column of table 3) found a positive and very significant relationship between capital buffers and RISK in SGMM specification. This result can provide us with some insights detailing that banks respond to the increase of risk by building up their capital buffers at the same time, and thus no moral hazard behavior was

found under this result.

In contrast, under the period of Basel II (refer to the third column of table 3), in terms of RISK and lagged RISK (L.RISK), the measures of RISK were statistically significant and were negatively and positively correlated with capital buffers, respectively. This result is in line with the conjecture that banks respond to the increases of risk with a lag. Thus, based on these two results, we can conclude that Japanese commercial banks responded to the increase of risk simultaneously under the period of Basel I, but responded to the increases of risk with a lag under the period of Basel II.

The recent subprime crisis has revealed the ineffectiveness of low quality capital in its absorbency of losses. Thus, we follow the studies of Francis and Osborne (2009) to include TIER1, which is the proxy of capital's quality as one of the determinants of capital buffers in our estimation. Again, under the entire period, no significant relationship between capital buffers and TIER1 was found. Under the period of Basel I (refer to the second column of table 3), a highly statistically significant and positive relationship was found between capital buffers and TIER1 in both DGMM and SGMM specification. This result is consistent with the study of Francis and Osborne (2009) and suggests that Japanese commercial banks that rely on a relatively larger portion of higher quality tier 1 capital tend to maintain a higher level of capital buffers. In our sample, we included a considerable number of small banks with thick capital buffers to maintain. These types of banks actually face constraints in raising lower quality tier 2 capital, for example in the instance of subordinated debt. Thus, they can maintain a higher portion of higher quality tier 1 capital in their adjustment towards its desired capital buffer level.

The PROVISION was being interpreted as banks' own perception on its portfolio's risk. Our result show that, in the entire sample period, a statistically significant and negative relationship was found in both DGMM and SGMM specification (refer to the second and third columns of table 3). Moreover, this significant and negative association was also found in the period of Basel I (refer to the second column of table 3) under both DGMM and SGMM specification. This result was consistent with moral hazard behavior and suggests that banks do not increase their capital buffers when it is perceived that their portfolio has become more risky. However, in reference to the descriptive table, Japanese commercial banks have

successfully maintained a high level of capital buffers. Thus, the banks' management may consider that its present high level of capital buffers should be sufficient to cover the increase of the risk level.

On the other hand, a statistically significant and positive relationship was found between PROVISIONS and capital buffers under the period of Basel II, but this result was only statistically significant in the SGMM specification. This result is inconsistent with moral hazard behavior, suggesting that Japanese commercial banks hold higher capital buffers when they perceive that their asset portfolio has become more risky.

Table 4 presents the estimation results of Equations (6) to (10). The results show significantly positive associations between the measure of bank capitalization ($Z_{i,t}$) and each of the three balance sheet elements: the loan, total assets and risk-weighted assets. This finding was consistent with the findings in Francis and Osborne's (2011) study. Positive and statistically significant relationships between bank capitalization and the asset side of the balance sheet (for example, total lending, total assets and risk-weighted assets) support the idea that the balance sheet growth at the asset side is greater at banks with excess capital (the case whereby the current capital buffer level is above the desired capital buffer level). Moreover, this result is also consistent with the idea that banks with excess capital face fewer constraints in their ability to lend and grow their balance sheet compared to other banks that only maintain a deficit in their capitalization. It is interesting to note that these results suggest that lending and balance sheet growth on the asset side increase as banks' capitalization improves, and on the other hand, balance sheet growth decreases as bank capitalization worsens.

In reference to the result of risk-weighted assets, the significant level and the magnitude of risk-weighted assets is greater than the adjustment in total assets. This result implied that Japanese commercial banks reduce their portfolio's risk when they are adjusting toward their desired capital buffer level. In such circumstances, this suggests that, during the process of adjustment, Japanese commercial banks tend to shift out their relatively higher risk-weighted assets, including loans toward the lower risk-weighted asset categories. Additionally, bank capitalization is statistically significant and negatively correlated with regulatory capital and tier 1 capital. These results suggest that, when banks have excess capital, the growth in capital is

lower.

GDPG is statistically significant in the two capital growth model. These positive and significant relationships between capital growth and GDPG suggest that, during an economic upturn, when the cost of raising the capital is relatively low, banks increase their growth in capital. Moreover, in reference to the result of Panel A, a positive and significant relationship between capital or tier 1 capital and GDPG was found, which suggests that Japanese commercial banks are adopting counter cyclical behavior in their capital management practice: to put it plainly, we can say that Japanese commercial banks are prudent and far-sighted in their capital management practices.

During an economic upturn, banks increase their capital in order to anticipate the probability of default or attenuate the loss effect that incurs from the materialization of credit risk that is likely to increase during a downturn. On the other hand, out of the three asset models, GDPG is only statistically significant on the total asset model. This positive and significant relationship between GDPG and the total assets suggests that, during an economic upturn, as a response, Japanese commercial banks tend to expand their asset portfolios.

However, the magnitude of total asset is relatively smaller than the magnitude of regulatory capital and tier1 capital. These results suggest that, during an economic upturn, Japanese commercial banks tend to expand their asset portfolio, but at the same time, where the potential risks tend to rise, banks also increase their capital buffers in response to the increment of risks accordingly. The results showed that the increment in the capital model (the regulatory capital and the tier 1 capital) is greater than in the asset models, which further confirms our result in panel A. These results evidence the counter cyclical behavior of Japanese commercial banks in terms of their capital management practices.

One of the control variables accounting for the credit conditions in a bank's portfolio is charge offs. Negative and significant associations were found in total assets and risk-weighted assets. These results suggest that the deterioration in the credit quality of borrowers will lead to a decrease in the growth of credit, which was consistent with the previous studies. A negative and statistically significant relationship was also found between charge offs and regulatory capital. This result showed that the increase of charge off

erodes the regulatory capital. Under Basel I and Basel II, loan loss provision is part of regulatory capital; it counts toward regulatory capital up to a limit, and the increase of charge off will reduce the bank loan loss provision, therefore reducing the regulatory capital. The increase of charge offs will decrease the banks' capital and reduce credit formation.

Inflation and provision are not important determinants of bank balance sheet growth, since a mixture of positive and negative results could be seen on the Consumer Price Index (CPI) and no statistically significant relationship was found on bank loan loss provision except in the case of risk-weighted assets. The increase of the prime rate may suppress asset growth, as the increment of interest rates will be passed on to customers, and lending will be reduced. Thus, a negative and significant relationship should have been expected. However, the opposite results were observed in this study.

7. Concluding remarks

Overall, Japanese commercial banks maintain capital ratios that are well above the level that is required by their capital requirements. Banks maintain capital buffers with the aim of anticipating unexpected losses or shocks and avoiding the breaching of regulatory minimums, which may incur huge costs in the case of regulatory intervention. Financial intermediaries also face some constraints and trade-offs in their capital adjustment process. Moreover, financial intermediaries are exposed to external pressures from market and economic conditions, which may influence their behavior.

In this research, we employed a dynamic empirical model that has been previously adopted by many researchers in order to analyze the determining factors in banks' capital buffers. One of the main focuses of this study was to examine how the capital buffers of Japanese commercial banks fluctuate over the business cycle. We found strong evidence that capital buffers were positively correlated with the proxy variable of the business cycle, the GDPG. These results gave us insights into the fact that Japanese commercial banks are prudent and behave in a counter cyclical way in their capital management practices. Regardless, the counter cyclical effect deteriorated in the sample period of Basel II, at least broadly, whereby no significant and negative correlation that indicated the procyclical effect was found in our

study. This means that, during an economic upturn, when the cost of capital financing is inexpensive, banks increase their capital buffers to anticipate these losses, which are likely to increase during an economic downturn. Thus, during economic downturns, banks can utilize the capital that has built up during favorable economic conditions to cover for their losses, or we can say that the effect of the losses has been attenuated.

Our results also suggest that: (i) the adjustment cost significantly influence capital buffers. The lagged dependent variable, which we used for the proxy of adjustment, was statistically significant in all models. (ii) The cost of holding capital is significant in banks' capital buffers. Profitability positively impacts banks' capital buffers, which was shown in the sample period of Basel II, thus providing us with the evidence that banks may follow a pecking order theory, whereby the retained earnings are a source of capital financing. In contrast, in the sample period of Basel I, the profitability negatively influenced banks' capital buffers, thus showing the existence of the cost of holding capital. (iii) The cost of failure is also significant in banks' capital buffers. During the sample period of Basel I, a positive correlation was found between the proxy variable of cost of failure and capital buffers, showing that banks respond to the increase of risk by building up their capital buffers simultaneously. However, we found that, during the sample period of Basel II, banks respond to the increase of risk with a lag. The three main costs that were mentioned in Estrella's (2004) study were also found to be statistically significant in our study.

Regarding the second part of our analysis, we again found that the adjustment of the balance sheet in capital is positively correlated with the GDPG, which further confirms our results in the earlier section. The adjustment of the balance sheet on the asset side is also positively associated with the GDPG, but the magnitude of the coefficient is relatively smaller compared to the capital models. These provide us with the conclusion that, during economic expansion, Japanese commercial banks tend to expand their asset portfolio where the risks tend to increase, while at the same time banks also build up their capital buffers sufficiently in order to compensate for the increase of risks. We also found that those banks with excess capitalization will lead to greater expansion of their assets compared to others, which shows that banks with excess capitalization face fewer constraints to their portfolio expansion. On the other hand, when the banks'

capitalizations improve, the growth in capital decreases.

As discussed earlier, the procyclical problems amplified the business cycle especially during the downturn, and prolong the recovery of financial stability from crises. Thus, regulators, policymakers, and academics around the world are still searching ways to dealing with it. Our paper provides some useful information toward the understanding of procyclicality problem in Japan, at least the information on the behavior that banks undertake in their capital management practice. This will help the policymakers and regulators to have a clearer picture, which may be helpful in their ongoing effort of designing the more efficient regulations to deal with procyclicality problem. Moreover, our results show the banks' behavior in their capital management practice under the regime of Basel 1 and also Basel II, which help us to shed light on how banks' capital management practices developed during the previous economic cycle in Japan. Since we examined the impact of economic conditions on the capital management practice under Basel I and the more risk-sensitivity Basel II, these might provide us some benchmark for understanding the going forward behavior of banks' capital management practice and how banks react in their capital management practice with the revision of regulations.

FVA practice has been carried out for about 10 years, but full support still has not been received. Particularly, the banking regulatory and supervisory bodies have strongly opposed this approval for financial stability concern, in particular, the procyclicality problem. Many scholarly analyses have proved the procyclical behavior of FVA. The main concern is whether FVA do promote excessive upswing during the upturn of the economy or induce downward spiral during the recession. Our study, at least suggests that FVA practice promote counter cyclical effect in banks' capital management practice and it may propose new perspective and information on accounting standard setting.

Although our results offered some directions for the new capital requirement which mainly focused on macro prudent and counter cyclical capital requirement, our study still have some limitations. First, our study only focuses on the influence of shocks to banks' capital adequacy on a solo basis. The analysis that focuses on feedback effect which captures the impact from the real economy back onto the balance sheets was excluded in this study. Second, even though we include the sample period of Basel I and Basel

II, but it is remarkably different from the Basel III, which has a stricter definition on capital, and tier 1 capital. Lastly, although our analysis results provide the information of FVA on capital management practice, the procyclical behavior, namely the fire sale assets sale during downturn are not explore in this study. Our analysis did not cover the details, for example, whether distressed asset sales increased in order to protect their capital ratio, or do OTTI affects regulatory capital etc. are beyond the analysis covered in this research. Hence, whether FVA played a role in promoting distress sale, or the impact of OTTI on regulatory capital, no doubt, further analysis is needed. In the future research, we contemplate an extension of the study relating to this topic. For instance, employ the Vector Auto Regression (VAR) for the test of the feedback effect. Cross country analysis, especially in the area of Asia is plan to be conducted.

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Figure 1: GDP growth and capital buffer of Japanese commercial banks, 2002h1 to 2012h1

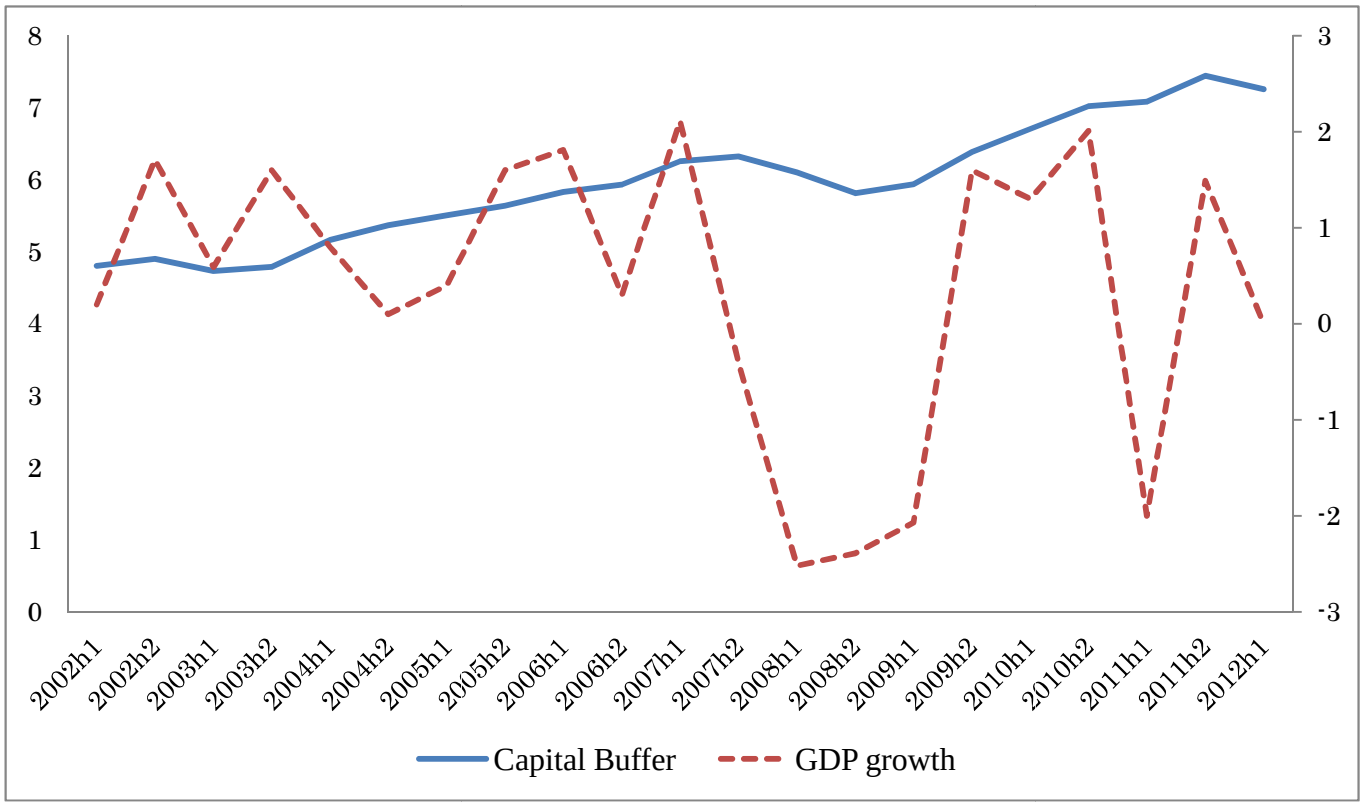

Figure 2: Growth in capital buffers and risk-weighted assets of Japanese commercial banks, 2002h1 to 2011h2

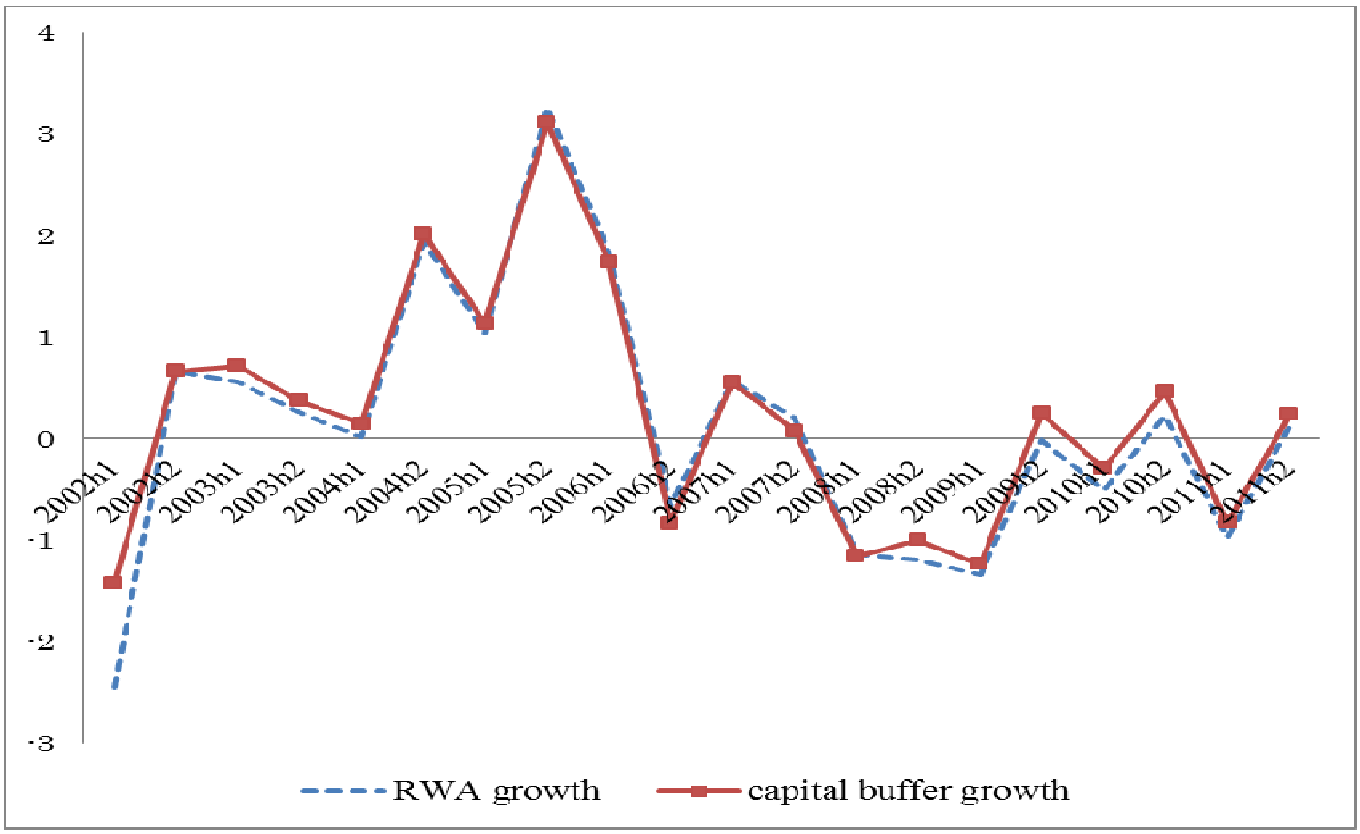

Table 1: Description of the variables used in this research

Variable	Definition	Rationale	Expected sign
BUF (Dependent variable)	Capital buffer	The capital buffer is defined as capital ratio minus 0.08 for internationally active banks and capital ratio minus 0.04 for banks that run purely domestic business.	+
L.BUF	Lagged capital buffer	Proxy for adjustment cost. The higher the capitalization costs, the lower the adjustment speed.	+
ROE	Return of equity (%)	Higher cost of capital. Retained earnings as an important source of capitalization.	- +
RISK	Ratio of risk-weighted assets to the sum of total assets.	Proxy for banks' risk exposure.	+/-
L.RISK	Lagged RISK	Proxy for banks' risk exposure.	+
PROVISION	Ratio of provisions to total assets	Proxy of banks' own view of its asset portfolio.	+/-
SIZE	Log of total asset	To verify the TBTF hypothesis, which shows the banks' opportunistic behaviors	-
TIER1	Ratio of TIER 1 capital to total capital	Proxy of higher quality capital.	+/-
GDPG	GDP growth	To verify the shortsighted capital management. Prudent capital management.	- +
FVAdum*GDPG	The cross-term of FVA variable and GDP growth	To further investigate the effect of FVA on capital management practice.	+/-

Table 2: Descriptive statistics for bank-level regression variables, 2002h1 – 2012h1

A. Bank characteristics

Variables	observations	mean	sd	min	max
Capital buffer	2046	5.94	2.11	-15.41	20.45
ROE	2063	1.32	10.37	-98.19	138.64
Size	2072	6.40	0.44	5.49	8.21
Risk asset	2014	53.26	7.51	27.20	83.82
Tier1	2040	89.86	22.56	2.10	615.03
Provision	2062	0.57	0.39	0.00	2.46
GDPG	2100	0.24	1.49	-2.52	2.11
N	2100				

B. Bank capitalization- Z variable (% deficit or surplus of capital buffer relative to target)

	observations	mean	Sd	min	max
z	1865	0.55	14.74	-49.19	201.49
N	1865				

C. Balance sheet growth variables

Growth in balance sheet element on half-yearly basis (%)

	count	mean	sd	min	max
Loan	1977	0.76	4.17	-23.01	57.01
Total Assets	1975	1.04	3.94	-14.77	57.66
Risk Weighted Assets	1911	0.03	4.4	-28.62	56.32
Regulatory capital	1977	0.72	16.19	-281.21	323.62
Tier 1 capital	1936	-0.15	10.78	-371.01	57.3
N	1979				

Table 2A presents summary statistics of the 2100 observations of Japanese commercial banks for 2002 to 2012 on a half yearly basis. The bank characteristics table reports the mean and standard deviation for bank characteristics. Capital buffer is defined as capital ratio minus 8% for internationally active banks and capital ratio minus 4% for banks that run purely domestic business.ROE is the return of equity, the ratio of post-tax earnings to book equity. Size is the log of total asset. Risk asset is the ratio of risk-weighted assets to the sum of total assets. Provision is the ratio of provisions to total assets. GDPG is the Gross Domestic Product's growth. Table 2B presents the information of bank capitalization, Z which calculated by using the coefficient derived from table 3. Z is the ratio of target capital buffer to capital buffer of banks i at time t minus 1.The figures showed in percentage. Table 2C presents the descriptive statistics of the growth in the balance sheet elements in percentage. The loan, total assets and risk-weighted assets are the options for banks to alter their capital buffer level through the denominator of capital ratio. On the other hand, the regulatory capital and the tier1 capital are the options for banks to revise their capital.

Table 3: Determinants of the capital buffer of Japanese commercial banks on the analysis of Difference GMM and System GMM

	DGMM	SGMM	DGMM	SGMM	DGMM	SGMM	DGMM	SGMM
	2002 to 2012		2002 to 2012		2002 to 2006		2007 to 2012	
	(BASEL I & II)		(BASEL I & II)		(BASEL I)		(BASEL II)	
L.buf	0.35**	0.93***	0.25**	0.83***	0.54***	0.85***	0.38*	0.83***
	-2.09	-9.04	(2.24)	(18.28)	-4.75	-21.71	-1.94	-3.14
riskasset	-0.06***	-0.25***	-0.06***	-0.22***	-0.01***	-0.01***	0.01***	0.02***
	(-5.39)	(-4.03)	(-5.89)	(-5.50)	(-3.65)	(-3.13)	-3.87	-3.38
L.riskasset	0.01	0.25***	-0.04	0.22***	0.66	0.04	0.16	0.25
	-0.33	-3.6	(-1.38)	(4.74)	-0.38	-0.58	-0.1	-0.93
roe	0	0	-0.00	0.00	0.01	0.13***	-0.07***	-0.40***
	(-0.28)	-0.8	(-0.58)	(0.92)	-0.4	-2.77	(-4.85)	(-3.21)
size	2.09**	0.05	1.53	0.13**	-0.25***	-0.15***	0	0.42***
	-2.02	-0.56	(1.53)	(2.37)	(-3.96)	(-3.05)	(-0.01)	-2.89
tier1	0	0	-0.00	0.00	0.04***	0.01***	-0.00*	0
	(-0.96)	(-0.52)	(-0.86)	(0.57)	-3.27	-3.97	(-1.83)	(-1.50)
provision	-1.19***	-0.18***	-1.17***	-0.20***	-1.50***	-0.35***	-0.16	0.23**
	(-6.97)	(-3.05)	(-7.04)	(-3.94)	(-5.85)	(-5.01)	(-0.51)	-2
gdpg	0.06***	0.04***	0.06***	0.04***	0.10**	0.08**	0.07***	0.04*
	-4.93	-2.62	(5.03)	(2.98)	-2.49	-2.06	-5.33	-1.73
FVAdum*gdpg			0.09**	0.03				
			(2.38)	(0.68)				
_cons		-0.14		0.41		1.23**		-1.32
		(-0.20)		(0.86)		-2.38		(-0.78)
N	1764	1877	1764	1877	746	850	831	932
AR(1)	0	0	0	0	0	0	0.02	0
AR(2)	0.03	0	0.07	0	0.75	0.41	0.8	0.09
Sargan Test	0.15	0.87	0.04	0.02	0.1	0.23	0	0.1

Table 4: Regression of balance sheet components on capital surplus/deficit and macroeconomic control variables

	Asset			Equity	
	Changes in				
	d.lnloan	d.lnta	d.lnrwa	d.lnregk	d.lntier1
L.z	0.0003**	0.0001*	0.0003**	-0.0003*	-0.0004**
	(2.40)	(1.72)	(2.49)	(-1.76)	(-2.29)
D.primerate	0.0312***	0.0183**	0.0376***	-0.0136	0.0358
	(3.53)	(2.14)	(4.47)	(-0.64)	(1.54)
D.gdpg	0.0001	0.0020***	0.0006	0.0086***	0.0083***
	(0.20)	(2.97)	(1.10)	(5.06)	(5.57)
D.cpilate	-0.0007	-0.0013	0.0040**	-0.0026	-0.0047
	(-0.57)	(-1.30)	(2.61)	(-0.74)	(-1.55)
D.provision	-0.0027	0.0220	-0.0123	-0.0619	0.0021
	(-0.08)	(0.94)	(-0.41)	(-1.31)	(0.06)
chargeoff	-0.0194	-0.0398**	-0.0344*	-0.1343*	-0.1264
	(-0.96)	(-2.38)	(-1.83)	(-1.82)	(-1.48)
N	1027	929	1020	1026	1120
adj. R-sq	0.037	0.019	0.053	0.034	0.043