Determinants of the capital level of banks in Hong Kong

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Banks in Hong Kong generally maintain capital adequacy ratios well above the regulatory requirement. The buffers are largely determined by the internal considerations of the banks, their responses to market discipline, and the regulatory framework.

Despite the presence of excess capital, banks still respond to changes in capital requirements, and the buffer will only partially absorb a change in the regulatory requirement. The minimum capital requirement, therefore, remains an effective policy instrument.

To the extent that part of the high capital buffer is due to the agency problem, information asymmetries, or a mismatch between the expectation of the regulator and banks over the approach to maintaining a capital buffer to prevent a breach of capital requirements, action could be taken to improve the use of capital. In this connection, the initiative under Basel II is expected to help address some of these issues.

Introduction

Banks incorporated in Hong Kong generally maintain a capital adequacy ratio (CAR) well above the regulatory requirement.[1] For example, the average CAR of licensed banks was 28.3 per cent in the second quarter of 2004, against an average required minimum of just 10.3 per cent.[2] This phenomenon is also common in other economies.[3] It raises the question of what factors determine the actual amount of capital held by banks and, specifically, whether changes in regulatory requirements can affect the level of bank capital.[4]

Following the approach of Alfon et al. (2004), we examine the behaviour of licensed banks in Hong Kong towards their capital adequacy decisions. A qualitative analysis is carried out and an econometric model is constructed to assess the relevance of hypotheses made in various studies.[5] The qualitative analysis is based on the results of a survey on banks' opinions of what govern the decisions on desired capital (that is, the amount or a range of capital that banks would like to hold) and the level of actual capital. In the quantitative analysis, we estimate an empirical model which relates CAR to a number of possible determinants using a panel data set on licensed banks incorporated in Hong Kong.

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[1] The method and components used in the calculation are specified in the Third Schedule to the Banking Ordinance.

[2] According to the Banking Ordinance, all authorized institutions (AIs) incorporated in Hong Kong are required to adhere to the minimum 8% CAR. This is in accordance with the 1988 Basel Capital Accord. However, the HKMA may increase it to not more than 12% for a licensed bank (raised to 16% pursuant to the Banking (Amendment) Ordinance 2005); or not more than 16% for a restricted licence bank or deposit-taking company. In other words, regulatory capital requirement can be bank-specific.

[3] In the UK, the assets-weighted average CAR of banks was 14.16% for the period from 1997 to 2002, while the assets-weighted average required minimum was only 9.42% (see Alfon et al., 2004).

[4] A number of studies have addressed this question, although not for the case of Hong Kong. See, for example, Ediz et al. (1998).

[5] See, for example, Marcus (1983), Lindquist (2004), Ayuso et al. (2004) and Alfon et al. (2004).

Possible determinants of capital holdings of banks

In this section, we evaluate the relevance to Hong Kong's banking sector of the possible determinants suggested by the previous studies. The assessments are based on the results of our quantitative analysis and survey,[6] details of which are presented in Annexes A and B respectively. Following Alfon et al. (2004), we classify the possible determinants into three categories: banks' internal considerations, market discipline and the regulatory framework. They correspond to the three parties involved in determining banks' capital structure: the bank itself, the market and the regulator.

Banks' internal considerations

These internal factors include the risk level of the banks, the effects of economic cycles, the agency problem, banks' business strategies and the opportunity cost of capital.

The risk level of banks

It is widely recognised that capital can serve as a buffer to absorb unexpected losses, reducing the probability of insolvency and, therefore, the expected bankruptcy cost. However, the level of minimum CAR set by the regulator may not fully capture banks' risks. There could also be risks that do not concern the regulator, but affect banks' capital holding decisions, including financial distress caused by a loss of franchise value.[7] As such, banks' views on the appropriate level of capital may differ from the minimum level set by the regulator.

Our evidence on the relevance of banks' own risk assessment for capital decisions seems to support the view that risk is a determinant of the level of CAR

held by banks. All respondents to the survey (24 banks) said the cushion effect against unexpected losses arising from material risks was an important determinant in their desired capital ratio. The majority of banks (14) formed their views by first assessing how much capital was needed to run the business and then verifying whether it met the regulatory requirement. An important consideration in setting the desired capital for three quarters of the banks was that the regulatory capital underestimated the risks it was intended to capture. Nineteen banks even said that assets attracting zero risk weight in the calculation of the risk-weighted assets (RWA) also needed capital.

These results indicate that banks have their own assessments of risk that may be different from the assessment embedded in the calculation of RWA under the current Basel Capital Accord. Their view that regulatory capital is inadequate for insuring against risks possibly causes them to hold a capital buffer.

The fact that the actual CARs maintained by large banks are, in general, lower than those of smaller banks seems to support the hypothesis that risk is a relevant criterion. The general view is that larger banks tend to face a lower risk than smaller banks. First, a given amount of investment constitutes a smaller portion of the overall portfolio of a large bank than of a smaller one, so the portfolios of large banks can be better diversified. Second, large banks tend to have better risk management and controls than smaller banks, because scale economies exist in screening borrowers and monitoring loans. If this is the case, other things being equal, the amount of capital needed for covering the risks of an asset portfolio will be larger for small banks than for large banks.[8]

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[6]   The survey is basically a replication of the survey adopted in Alfon et al. (2004), with appropriate modifications to reflect the environment of Hong Kong's banking industry.

[7]   Demsetz et al. (1996) found that banks having a lower franchise value behave more aggressively.

[8]   Another possible reason that could generate a negative correlation between CAR and bank size is that larger banks may be more aggressive and tend to take more risk with a specific amount of capital.

To examine the validity of this claim, Chart 1 plots the combinations of CARs and banks' total assets observed in the sample covering the period from the first quarter of 1992 to the third quarter of 2004. A clear negative relationship is observed, suggesting that large banks tend to maintain a lower level of CAR.

CHART 1

CAR and bank size
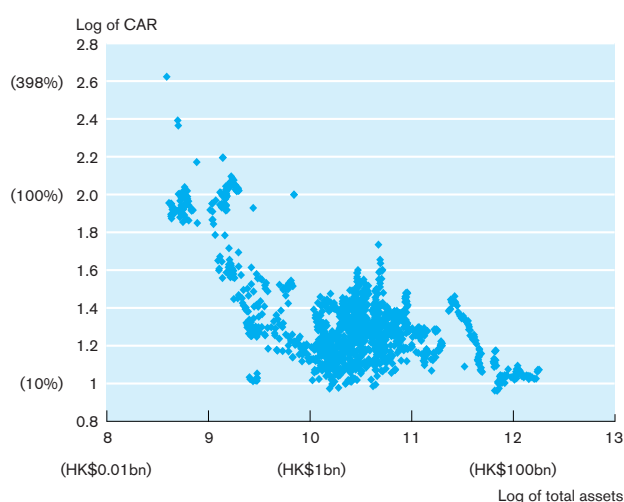
Notes: (a) Quarterly data are used.
        (b) The logarithms are to the base 10.

Source: HKMA.

It should be pointed out that this observation alone is not sufficient for concluding that large banks' maintain a lower CAR due to their lower risk based on their own assessment. This is because the negative relationship displayed in Chart 1 may stem from the fact that larger banks may hold riskier assets

with the same amount of capital than smaller banks, which could also result in a lower CAR. In our econometric estimation, to test how the risk perceived by banks affects CAR, we include in our regression a bank asset size variable, which is used to represent indirectly each bank's perceived risk level. To control for the factor that large banks may hold riskier assets, we also incorporate a variable measuring the relative riskiness of the assets held by different banks: the ratio of risky assets to total assets.[9]

The estimation results show there is a statistically significant negative relationship between CAR and bank size. However, the estimated coefficient of the risky asset ratio is statistically insignificant. This may reflect that the risky assets ratio is not a good proxy to represent the risk level of banks, and the variable is removed finally by our model selection procedure.[10] Our quantitative analysis cannot, therefore, distinguish the contributions of the two hypotheses. The negative relationship between CAR and bank size is consistent with the hypothesis that CARs are positively correlated with the risk level perceived by banks. Alternatively, it is also in line with the hypothesis that larger banks may tend to be more aggressive in risk taking.[11, 12] Nevertheless, both hypotheses support that banks' risk is a relevant factor. The estimated coefficient of bank size implies that a 10 per cent higher asset value will result in a 0.35 per cent decline in CAR in the short run, and a 2.58 per cent reduction in the long run.[13]

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[9] This variable is the ratio of the amount of assets having 100% risk weight to the total assets. Using alternatively the ratio of RWA to the total assets gives a similar result. However, the fact that RWA is the denominator of CAR, the dependent variable in our regression analysis, makes the use of such a ratio less desirable.

[10] Alternatively the insignificance of the coefficient may suggest that, given a particular value of total assets, the change in capital base and the change in RWA are at a similar rate. This could be because the bank's assessment of how much the capital base should be increased to buffer against the heightened risk as a result of a change in the portfolio composition, is similar to that as implied by the associated change in RWA. In other words, the assessments of the banks and the regulator on the relative riskiness between different assets are similar.

[11] Note that as mentioned later in this paper this could support the hypothesis that small banks have larger adjustment costs and thus choose to hold more capital. The finding is also consistent

with the hypothesis that small banks need to maintain excess capital to finance their long-term strategies and to rely more on excess capital in signalling financial strength. Our quantitative analysis cannot distinguish the contributions of these hypotheses.

[12] We have also assessed directly the impact of risk on banks' capital decisions by studying how the simple ratio of capital base to total assets is affected by the relative amount of risky assets held (the proportion of the bank's total assets that attracts a risk weight of 100%). Such analytical method is also adopted by Ediz et al. (1998). A positive and significant coefficient is obtained, suggesting a positive correlation between the amount of capital and risk level. However, the way the CAR ratio may respond to any change in risk perceived by banks cannot be derived simply by such a relationship.

[13] Short term changes refer to the response of the endogenous variable in the immediate period, whereas long term changes refer to its cumulative response when the adjustment process is complete.
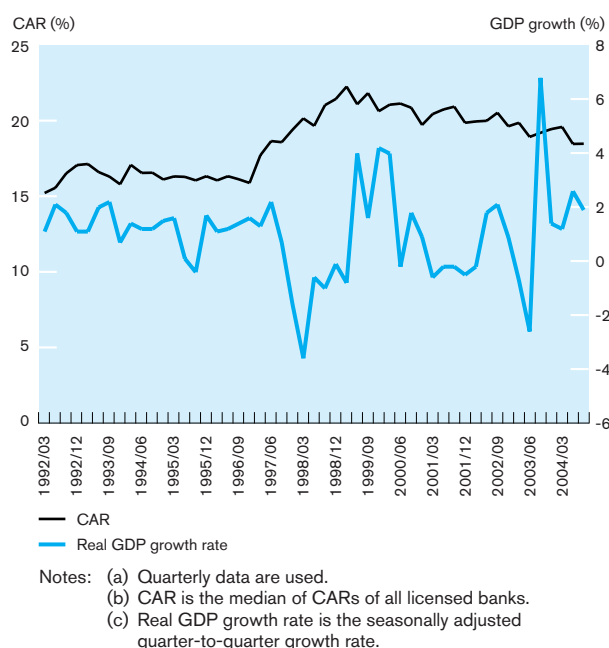
Economic cycles

Economic cycles may affect the level of CAR, as capital holdings may change over time to accommodate fluctuations in risk arising from variations in the economic environment that are not captured by the fixed risk weights attached by the regulator to the assets. In an economic downturn, the likelihood of a fall in capital increases as a result of possible increases in the write-offs and provisions. Banks may therefore take precautionary measures by holding more capital, and those relying on credit rating to gain access to capital markets may also need to raise their capital holdings to maintain their ratings during a downturn. In an upturn, risks are less likely to materialise and banks can safely hold less capital. One could then expect that during a downturn banks would hold higher CARs than during an upturn.

Chart 2 depicts the time series of the median of the CARs of licensed banks in Hong Kong, together with Hong Kong's real GDP growth rates.[14] As shown by the chart, the median of the CARs remained fairly stable around 16 per cent before the third quarter of 1997. But it started to climb during the Asian financial crisis which caused a sharp decline in Hong Kong's real GDP growth. The median of the CARs decreased gradually in the latter sample period as the economy recovered. The chart suggests that the level of CAR chosen by banks may be related fairly closely to Hong Kong's macroeconomic performance.[15]

Evidence from our survey indicates that the level of CAR indeed relates to economic cycles. All 24 banks regarded insuring against the impact of economic downturn as an important or a very important consideration in deciding their desired capital. Twenty of them thought that actual capital could fall below the desired level as a result of unexpected

Notes: (a) Quarterly data are used.
(b) CAR is the median of CARs of all licensed banks.
(c) Real GDP growth rate is the seasonally adjusted quarter-to-quarter growth rate.

Sources: HKMA and Census and Statistics Department.

events in the economy that adversely affected the banking sector. To prevent this, banks may maintain a higher level of CAR during downturns. Quantitative evidence supports this. We found that CAR and the real GDP growth rate are negatively correlated, suggesting that the capital ratio could have a pro-cyclical effect on the economy. In other words, the CAR would have an amplifying effect on economic cycles. For example, in difficult times, the increase in CAR may be achieved through a tightening of lending, which could further depress the economy.[16] The estimates show that a 100 per cent decline in real GDP growth from, say, two per cent to zero per cent would cause the CAR to increase by 1.8 per cent (from, say, 12 per cent to 12.22 per cent) in the short term and by 13.3 per cent in the long term. In addition, CARs of small banks were found to be more responsive than large banks to economic cycles.[17] This may reflect that assets of larger banks

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[14] As shown in Chart 1, there are outlier observations in the sample, so median, instead of mean, is depicted in Chart 2.

[15] Similar patterns appear for the time series of the capital buffer as measured by the ratio of the difference between the actual CAR and minimum CAR to minimum CAR. This suggests that the relationship conveyed by the chart is not greatly altered even if the variations of regulatory minimum are taken into account.

[16] Similar results are obtained by Ayuso et al. (2004) and Alfon et al. (2004) for Spain and the UK respectively.

[17] The coefficient of the interaction between the size of banks (i.e. the variable BIG) and the economic growth (i.e. the variable GROWTH) is found to be positive and significant in Model A. Details of the estimation can be seen in Annex A.

are better diversified into other sectors that are affected differently by macroeconomic performance, and into a range of economies to be less susceptible to the condition of the local economy.

Agency problem

Jensen and Meckling (1976) pioneered the study of the agency problem stemming from the separation of ownership and control in modern organisational structure. This problem arises when the agent, who is hired by the principal, does not work in a way to achieve the principal's objective. In the context of this paper, the bank management can be viewed as the agent of the shareholders whose objective is to maximise the bank's value. However, the former may not want to pursue as high a leverage as desired by the shareholders because of the greater difficulty in managing the risk of a bank that is more leveraged.[18] As a result, excess capital may be held by bank management's pursuit of a "quiet life" at the sacrifice of the shareholders.[19]

Our survey result seems to suggest the existence of such a problem. Out of the 24 banks, 17 said that their actual capital was usually higher than the desired level. Sixteen attributed maintaining a higher-than-desired level of capital to "conventional practice". Only seven said they would reduce their actual capital to meet the desired level as quickly as possible even if they found the excess was not due to transitory factors. It should, however, be pointed out that such practice may not be entirely caused by the agency problem. It may also reflect the downward rigidity of CAR arising from strategic reasons, which will be discussed in the following subsection.

Hong Kong banks may not have a severe agency problem. First, competition in the banking sector has been intense making it difficult for bank management to adequately remunerate a higher ratio of capital simply by charging more for its services. Second, there are a number of banks with concentrated ownership and participation of major shareholders in management.[20] Third, banks with dispersed ownership are mostly listed on the stock market. Their greater susceptibility to hostile take-overs forces them not to be excessively capitalised.

Business strategy

Banks may hold more capital for strategic reasons. Three reasons identified by the literature - financing growth, adjustment cost and downward rigidity of capital - are examined in this section.

Financing business growth

Capital may be held to finance future business growth and exploit future business opportunities, such as mergers and acquisitions. Accumulating excess capital by retaining earnings could be a bank's business strategy, giving rise to the persistence of a capital buffer. Our survey found that excess capital may arise from the bank's need to finance its long-term strategy. All banks replied that this is either an important or very important determinant of desired capital. They regarded this as the second most important factor among the 13 possible determinants of desired capital given in the survey.[21] Evidence found in the quantitative analysis of a negative correlation between capital ratio and size can support the hypothesis that small banks need to maintain excess capital to finance their long-term strategies.[22]

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[18] Bris and Cantale (2004) emphasise that this agency problem should be taken into consideration in bank capital regulation because it would lead to banks taking too little risk (or creating too little credit).

[19] Poor cost efficiency is another manifestation of the agency problem (see Berger and Hannan, 1998).

[20] If there is no separation between ownership and control, the cost of holding more capital is entirely borne by the owner, and the agency problem becomes irrelevant.

[21] The importance may stem from the fact that financing the extra capital needed for business growth by retained earnings is generally perceived to be preferred by the market. Financing long-term strategy by capital could also improve operational flexibility, and the banks may wish to pre-fund future acquisitions.

[22] Note that this could also support other hypotheses, see footnote 11.

Adjustment cost

Adjusting the levels of capital to accommodate unexpected changes in market conditions could be costly to banks because of the time lag between the decisions to adjust the capital level and the completion of the transactions for such adjustments. Among the factors making banks susceptible to a time lag are the possible need for legal, regulatory and procedural work. Transaction costs, including fees to investment banks and lawyers, will also be incurred. Information asymmetries between bank management and investors could give rise to indirect costs. An issuance of new capital or a disposal of existing capital may be seen by investors as a signal the bank considers the market price to be above (or below) its intrinsic value. The share price may move unduly, thus raising the cost of adjustment.

Our empirical findings provide some support to the hypothesis that adjustment costs are a determinant of the observed capital buffers. Half of the respondents in our sample considered the cost of raising extra capital was an important reason for banks to stay with a lower-than-desired capital. (Given that banks generally maintain a higher-than-desired capital level, the existence of adjustment cost implies that this may be a factor for holding such a capital buffer.) Our econometric analysis investigates the existence of adjustment costs by examining the effect of the lagged CAR. Its coefficient was found to be positive and significant, indicating that the full adjustment in CAR does not occur instantaneously. This is consistent with the existence of adjustment costs.[23]

An excess, or a deficiency, of capital can arise as a result of the difficulties in capital adjustment. However, the consequence of falling short of capital is probably more serious, so banks are more likely to be "over-capitalised" than "under-capitalised". In

other words, a part of the observed capital buffer may be held for precautionary purposes, due partly to frictions in adjusting capital level.

Downward rigidity of capital

Another possible strategic reason for holding excess capital, even in the absence of profitable opportunities, is that banks may refrain from returning surplus capital to shareholders in case the action generates undesirable market signals to the banks' earning abilities. This consideration would lead management to simply follow the past practice of choosing the level of CAR, resulting in a downward rigidity of the capital ratio. In our qualitative analysis, we found that most banks considered high actual capital reflected conventional or market practice. This is in line with another survey result of the actual capital usually exceeding the desired capital for most banks.[24] The econometric result that the current CAR depends positively on the past CAR also supports the hypothesis of the existence of downward stickiness of capital.

Cost of capital

When the return on equity is high, it is costly to hold excess capital. In this case, a profit-maximising bank may maintain a lower CAR (probably through taking more risk) when the opportunity-cost of capital is high. In our econometric study, we use the inflation-adjusted return on equity to approximate the opportunity cost of capital. The estimation obtains a negative correlation between CAR and the return on equity, suggesting that banks would reduce capital holding when the cost of capital is high.[25] The estimate shows that a 10 per cent rise in return on equity would result in an immediate decline in CAR by 0.87 per cent. The decrease would be 6.41 per cent in the long term.

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[23] In our survey, the banks are asked whether the cost of adjusting capital might induce them to keep their CARs lower than the desired level. Opinions are somewhat diverse, with half of the respondents giving a firm "yes" reply. This could be due to the fact that the banks generally maintain a CAR that is above the desired level and, therefore, have not experienced capital deficiency.

[24] As indicated in a previous part of this paper, the evidence also supports the agency-problem hypothesis.

[25] The possible endogeneity of the return on equity (ROE) due to the effect on leverage (and hence ROE) of changes in CAR is handled by an instrument-variable technique in the quantitative analysis.

Market discipline

This section reviews the role that market discipline can play in the determination of capital holdings. In other studies, the main focus is on the relevance of the role of market discipline exerted through credit rating, uninsured funding and peer group pressure. However, instead of studying uninsured deposits, as Hong Kong's deposit insurance scheme is not yet in place, we look at whether market discipline arises from the wholesale funding market and how this may affect banks' capital level.[26]

Credit rating and wholesale funding

Creditors and depositors will demand higher interest rates or withdraw funds when they perceive a bank is risky. Their assessment of a bank's risk may differ from the regulator's, as they do not have the same access to its information. Therefore, they may force the bank to hold capital different from that required by the regulator. In response, the bank may choose to hold a higher level of capital.

Rated banks are probably disciplined by the market to a larger extent, with rating agencies acting as intermediaries in the disclosure process. Banks may also hold higher levels of capital to get a rating that facilitates their access to specific capital markets (for example, subordinated debt). Thus, a dependency between capital levels and ratings may be expected.

In our qualitative analysis, we explore the role that market discipline and ratings can play in determining capital. All respondents to our survey considered banks' risks as perceived by the market to be an important or very important determinant of desired capital. And all rated banks said that maintaining or improving their credit ratings by external credit rating agencies was an important or very important factor. These two factors were ranked respectively as the third and fifth most important determinants (among the 13 factors) by banks.

The qualitative analysis also found that securing wholesale funding — wholesale deposits or access to money markets or both — was regarded as an important determinant of desired capital. Of the 24 banks in the sample, 18 regarded wholesale deposits as either important or very important, while 19 considered interbank access as important or very important.

Our econometric analysis examines the market disciplinary role of the wholesale funding market by incorporating a variable representing the proportion of wholesale funding to total funding. Due to data limitations, the ratio of interbank deposits to total deposits is used as a proxy in the analysis.[27] A positive and statistically significant coefficient is obtained. So banks relying more heavily on the interbank market as a funding source choose to appear to be better capitalised. The estimates imply that a 10 per cent rise in this variable would increase CAR by 1.9 per cent and 13.9 per cent in the short and long terms respectively.

We found that all rated banks in the sample regarded the market's most likely reaction to an unexpected drop in capital as being a review of their rating (with a possible increase in funding costs), and 12 out of the 13 rated banks considered their shares would trade at a lower multiple of earnings as a likely outcome. A tightening of the terms of loans in the interbank market was considered likely by 19 out of the 24 banks, and a withdrawal of wholesale deposits was seen as a likely reaction by 13 banks. As such, banks appear to perceive there is a certain degree of market discipline exerted through credit rating and the wholesale markets.

In gathering further evidence on the ratings' role, we also asked banks to rank the likelihood of various reactions to a rating downgrade. We focus on the likelihood in the short to medium term of changes in desired capital, actual capital, and RWA (as a proxy to changes in the business). While seven out of the

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[26] We hypothesise that interbank lenders and wholesale depositors are more sophisticated in their assessment of banks' credit risk compared with their retail counterparts.

[27] No wholesale deposits data are readily available.

16 rated banks would raise the desired capital, 10 of them would raise the actual capital and 13 said they would reduce the actual RWA. These findings suggest that market discipline exerted through ratings plays a significant role in capital decisions.

Peer pressure

Peer group pressure in capital holding could also result from incomplete information. In appraising the financial strength of a bank, the market and rating agencies may assess how its CAR stands in relation to others. Banks may use capital as a signalling device by holding a higher level of CAR to differentiate themselves from their peers.

Our survey results show that 15 out of 24 banks regarded peer pressure an important factor in capital decisions. In our quantitative analysis, we include in our regression the average CAR of all other banks of similar size to the bank concerned to represent peer group pressure. The CAR was found to be positively correlated with the peer group pressure variable.[28] The result suggests that banks are using their capital as a signal for competition with similar banks in the market to appear well-capitalised in relation to their peers.

The regulatory framework

This section reviews the regulatory environment's role in determining capital holding. In particular, decisions on capital may be affected by how capital requirements are set by the regulator and perceived by banks, and by the supervisory approach on regulatory breaches.

Capital requirement as a minimum

In Hong Kong, the regulator sets individual capital requirements as minima with the expectation that banks' CARs will always exceed them. Our qualitative analysis reveals that two thirds of the banks form

their views on desired capital by first assessing how much capital is needed to run the business and then verifying whether it meets the regulatory requirement. The rest assess how much additional capital is needed on top of the regulatory capital requirements. Holding capital above the minimum is thus in line with the regulator's supervisory approach.

Banks' responses to our question about their potential reaction to changes in their own individual capital requirements show that even when their CARs are above the adjusted requirements, some would still react to the changes. More than half of the banks answered that they would change the amount of desired capital in the short to medium term, while 10 banks would change their actual capital. Only six banks indicated they would change their business (as represented by actual RWA), but more than half of them would change the portfolio composition to reduce the risk level.

Our econometric results indicate that individual capital requirements are a significant factor in capital decisions. We obtain a positive and significant correlation between actual CARs and regulatory requirements, indicating that the higher the required CAR, the higher the actual CAR. In addition, we found the response to a regulatory change is significantly larger when a bank's actual CAR is close to the regulatory minimum.[29] The estimates suggest that on average about 12 per cent of changes in individual capital requirements is translated into a change in the actual capital in the immediate period, and the translation is 89 per cent in the long term. In other words, the buffer only partially absorbs changes in individual capital requirements.

Regulatory rules and supervisory behaviour

In addition to adjusting the minimum capital ratio, the regulator may affect banks' capital level in other ways. For example, depending on the regulatory rules

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[28] The estimated coefficient is small, suggesting that the peer pressure in capital holding is moderate.

[29] The coefficient of the interaction between the regulatory requirement (i.e. the variable REG) and the closeness of CAR to regulatory requirement (i.e. the variable CLOSE) is found to be significantly positive in Model B. Details of the estimation are in Annex A.

and the supervisor's reaction to a breach of the capital requirement, and how serious the regulatory interventions may be, banks may choose to hold a CAR higher than required to reduce the risk of an accidental breach.[30]

The survey results found that avoiding the consequences of a potential breach of regulatory capital was regarded as very important by all banks. It is also ranked top of the most important determinants for capital decisions. This suggests the supervisory approach regarding a breach of regulatory capital is stringent, as perceived by banks, and may have induced them to hold a higher level of CAR.

Conclusions

In line with the experience in other economies and consistent with findings in banking literature, the CAR levels of banks in Hong Kong are determined by a number of factors, in addition to the regulatory requirements. While banks generally hold a CAR well above the regulatory requirement, the buffers are, in most cases, deliberately maintained and reflect banks' internal considerations, their responses to market discipline and the regulatory framework.

Among banks' internal factors, risk appears to be highly relevant. It was found that banks' own assessments of risk, which may be different from that of the regulator, could have resulted in banks' holding a high level of capital. This could be partly due to the fact that the capital requirements under the current Capital Accord do not fully capture all risks that are being taken into account by banks or the variations in the risks arising from changes in prevailing macroeconomic conditions. In addition, banks' strategic considerations in relation to the existence of adjustment costs, the market's perceived preference of financing growth by capital, and the trade-off between holding excess capital and the sending of undesirable signals to the market by returning surplus capital to shareholders, may have contributed to the

high capital ratio. The presence of the agency problem could also lead to banks holding a higher CAR than required. However, given the competitive environment of the banking sector, the impact of this problem is likely to be modest.

Our analysis also indicates that banks perceive a degree of market discipline, in addition to regulatory discipline, exerted through the wholesale funding markets, credit rating agencies and peer group pressure, to be contributing factors. These disciplinary forces stem largely from imperfect information and the need for banks to compete for funding resources, and could be partly responsible for banks maintaining the capital buffer.

While the holding of excess capital may be largely in line with the regulator's expectations, banks appear to be very concerned about the adverse implication of a breach of the regulatory minimum. How this may have led to banks holding a large capital buffer is difficult to quantify. Notwithstanding the presence of excess capital, we found that banks still respond to changes in capital requirements, and the capital buffer will only partially absorb a change in the regulatory requirement. The minimum capital requirement, therefore, remains an effective policy instrument.

Action could be taken to improve the use of capital to the extent that part of the high capital buffer is due to the agency problem, information asymmetries, or a mismatch between expectation of the regulator and banks regarding the approach to maintaining a capital buffer to prevent a breach of capital requirements. In this connection, the initiative under Basel II is expected to help address some of these issues. Our analysis also confirms that banks tend to hold a higher CAR in economic downturns, but a lower capital ratio in upturns. The implications of such a pro-cyclical nature of the capital ratio on the economy, and how it may be affected by the forthcoming changes in the more risk-sensitive approach under Basel II, are worth exploring.

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[30] Milne (2002) suggests that capital requirements act as an incentive mechanism in which a breach gives rise to a penalty. It is then shown that banks would want to hold more capital than the regulatory minimum.

ANNEX A

A quantitative analysis of determinants of bank capital in Hong Kong

Model specifications

The general form of the panel data model adopted to examine the relevance of the various possible factors governing capital decisions in Hong Kong is defined in equation (1):

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\begin{aligned}
\text{CAR}_{it} = \ & \alpha_0 + \alpha_1 \text{REG}_{it} + \alpha_2 \text{RISK}_{it} + \alpha_3 \text{SIZE}_{it} + \\
& \alpha_4 \text{GROWTH}_{it} + \alpha_5 \text{ROE}_{it} + \alpha_6 \text{PEER}_{it} \\
& + \alpha_7 \text{WF}_{it} + \alpha_8 \text{CAR}_{i,t\text{-}1} + \alpha_9 \text{AFC}_t \\
& + \eta_i + \varepsilon_{it},
\end{aligned}
\tag{1}
$$

where subscripts i and t denote bank and time respectively.[31] The variables in (1) are specified in natural logarithm. The coefficient vector $\alpha = (\alpha_0, \alpha_1, \ldots, \alpha_8)'$ is fixed across banks and over time by assumption.[32] η_i are the individual effects

capturing the unobserved idiosyncratic features of different banks. They are assumed to remain the same over time. ε_{it} are the disturbances. The estimated α reflects influences stemming from both differences across banks and temporal changes that they experienced.

The dependent variable CAR is the capital adequacy ratio. The explanatory variables and the expected signs of their coefficients are described in Table A1. The adjustments for inflation (or deflation) in the SIZE and ROE variables are based on the GDP deflator. For the PEER variable, sampled banks are divided into three groups: large, medium and small according to their asset sizes in 2001 Q3.[33] Large banks refer to banks with total assets exceeding HK$130

Table A1: Description of the explanatory variables

Variable	Description	Expected Effect
REG	The specific regulatory capital requirement (that is, the minimum ratio of capital base to total risk-weighted assets) assigned to the bank.	+
RISK	The ratio of the bank's assets with 100% risk weight to its total assets.	+ / -
SIZE	The inflation-adjusted value of total assets of the bank.	-
GROWTH	Hong Kong real GDP growth rate.	-
ROE	The real return on equity (that is, inflation adjusted).	-
PEER	The average CAR of other banks in the same peer group as classified by asset sizes.	+
WF	The ratio of the interbank borrowing to the total borrowing which comprises "due to other banks", "due to the Exchange Fund", "deposits from customers", "amount payable under repos" and "negotiable debt instruments issued and outstanding".	+
CAR$_{t\text{-}1}$	The one-period lagged CAR.	+
AFC	Dummy for the Asian financial crisis.	+

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[31] The model can be generalised to test if CAR responds asymmetrically to positive and negative changes in the explanatory variables. This approach has been attempted, but no significant asymmetries are found. Thus, the model stated in equation (1) suffices.

[32] A more general empirical model which allows α to differ across banks may be used. But this would increase the

number of coefficients to be estimated by as many times as the number of banks in the sample. Given that our sample has only 51 time points but 31 cross sectional units, such procedure is inappropriate. For similar reasons, we do not assume a time-varying α.

[33] This quarter is used because all sampled banks existed.

billion. Those having total assets below HK$10 billion are classified as small banks. Others are classified as medium banks.

Data and estimation results

The data

Licensed banks incorporated in Hong Kong are the set of banks considered. The periodic returns submitted by them are the sources of banking data for the econometric analysis. Figures from the banking returns are on a combined basis.

The data are on a quarterly basis, covering the period from 1992 Q1 - 2004 Q3 and involving 31 banks. However, the three smallest banks are removed because their CARs were abnormally high and may potentially distort the estimation results. Due to activities like mergers and acquisitions, changes in the location of incorporation, etc, the number of locally incorporated banks considered in the study varies over the sample period, from 22 to 28. The data

set is thus an unbalanced panel. Moreover, some observations with dramatic fluctuations are excluded to avoid possible biases.

Table A2 reports some descriptive statistics about the data set, which includes 1,221 observations. Note that the required capital ratio does not change much over time. For most of the banks, it stayed at eight per cent before 1998 Q4 and remained at 10 per cent thereafter. Only three banks experienced changes in their required ratios more than once. On the other hand, cross sectional differences in capital requirements exist in each of the periods.

Estimation results and interpretations

Equation (1) is estimated by the generalised method of moments (GMM) because it involves variables that may be endogenous. ROE, WF and CAR_{t-1} are instrumented by their one-period lags, whereas other variables serve as their own instruments.[34] In the estimation, we apply the orthogonal deviation technique which transforms

Table A2: General features of the data (Sample period: 1992Q1-2004Q3; No. of banks: 28; No. of observations: 1,221)[a]

Variable	Mean	Median	Std. Dev.	Minimum	Maximum
CAR (%)	19.28	18.48	6.27	9.23	45.31
REG (%)	9.31	10.00	1.20	8.00	12.00
RISK	0.30	0.31	0.12	0.01	0.84
SIZE (in HK$ bn)	91	31	206	1	1590
PEER (%)	19.28	18.62	3.21	11.90	33.14
ROE	0.15	0.13	0.11	-0.55	0.88
WF	0.09	0.05	0.12	0.00	0.95
GROWTH (%)[b]	1.00	1.20	1.65	-3.60	6.80

Notes:
[a] Outlier observations are removed from the sample.
[b] Seasonally adjusted Hong Kong real GDP growth rates, obtained from the Census and Statistics Department.

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[34] Anderson and Hsiao (1981), Arellano and Bond (1991) and Arellano and Bover (1995) suggested alternative instrumental variable estimation methods that lead to consistent estimators. In this paper, we apply the procedure proposed by Arellano and Bover (1995).

(1) into first differences with GLS transformation applied to remove moving average serial correlations.[35]

The estimates are presented in Table A3. Two regression results are reported. Model A refers to the model stated in (1). Model B extends Model A by incorporating two more variables to study the interaction between REG and the closeness of CAR to REG (that is, the variable CLOSE) and the interaction between the size of the bank (that is, the variable BIG) and economic growth.[36] All variables are included in the initial estimation. The final results reported in the table are arrived at through the backward elimination procedure. The application of orthogonal deviation transformation requires that the error term is not second-order serially correlated. As shown by the test statistics, m_2, this condition is met.

Table A3: Determinants of banks' capital level: GMM estimates

Variable	Model A		Model B	
	Coeff.	*t*-statistic	Coeff.	*t*-statistic
REG	.1205***	2.7363	.1149***	2.6122
SIZE	-.0350***	-3.3550	-.0529***	-4.7470
GROWTH	-.0180**	-2.3527	-.0231***	-2.8686
ROE	-.0866**	-2.4490	-.1151***	-3.2297
PEER	.0586*	1.8692	.0575*	1.8511
WF	.1892**	2.1809	.1781**	1.9968
CAR$_{t-1}$	.8643***	39.8726	.8838***	30.2558
RISK	(*removed*)	–	(*removed*)	–
AFC	(*removed*)	–	(*removed*)	–
Interactions				
REG x CLOSE	–	–	.0160**	2.1200
GROWTH x BIG	–	–	.0233***	3.2606
m_2	1.5633		1.6485	
No. of banks	28		28	
No. of observations	1,221		1,221	

Notes:
1. RISK, ROE, WF and CAR$_{t-1}$ are instrumented by their one-period lags.
2. *t*-statistics are based on robust standard errors.
3. ***, ** and *denote significance at the 1%, 5% and 10% levels respectively.
4. All variables are considered initially. Those with insignificant coefficients are removed during the model selection procedure.
5. m_2 is the test statistic for second-order serial correlation based on residuals from the first-difference equation with orthogonal deviation transformation. Asymptotically, it follows the standard normal distribution. The critical values for the 1, 5 and 10 per cent levels of significance are 1.65, 1.96 and 2.57 respectively.

[35] See Maeshiro and Vali (1998) for details about how orthogonal deviations offer efficiency gains over first differences.

[36] CLOSE is a dummy variable that equals one (zero) if the bank's CAR is higher (lower) than REG by less than one standard deviation of its CAR. BIG is another dummy variable. It equals one (zero) if the bank's real value of total assets is above the upper quartile of the data on SIZE.

Table A4 summarises the estimated effects on CAR of changes in the exogenous variables. There are short-run changes and long-run changes because the full response of CAR to an exogenous change is found to be not instantaneous. The short-term change reflects the response of CAR in the contemporaneous quarter, whereas the long-term change measures the response that will be reached ultimately when no more exogenous change occurs.

Table A4: A summary of the estimated effects of exogenous changes

Explanatory variable increases by 10%	Model A % Change		Model B % Change	
	Short-term	Long-term	Short-term	Long-term
REG	+1.2	+8.9	+1.1	+8.4
SIZE	-0.4	-2.6	-0.5	-3.9
GROWTH	-0.2	-1.3	-0.2	-1.7
ROE	-0.9	-6.4	-1.2	-8.5
PEER	+0.6	+4.4	+0.6	+4.3
WF	+1.9	+13.9	+1.8	+13.1

ANNEX B

Details of the survey results

Background

The "Survey on Capital Holding Decisions" was sent to all locally incorporated licensed banks on 20 December 2004. Table B1 gives the response rate.

Table B1: Response rate of the survey

Population	24
No. of surveys completed	24
Rate of response	100%

Survey questions and banks' answers are presented in the rest of this Annex. In the survey, regulatory capital requirement refers to the minimum capital adequacy ratio set by the HKMA on individual banks (that is, it may be higher than the Basel 8% minimum) and desired capital means a range within which the bank wishes its actual capital to stay.

Questions and replies

This section states the survey questions and presents the statistics of banks' responses. The questionnaire, with slight modifications, is adapted from that of Alfon et al. (2004).

		%
1.	**How is desired capital specified?**	
A.	A ratio (of capital base to risk-weighted assets).	87.50
B.	A level of capital base (i.e. in terms of amount).	12.50

		%
2.	**If your AI's actual capital is above desired capital due to non-transitory factors, you will reduce the actual capital as quickly as possible.**	
A.	Very likely.	8.33
B.	Likely.	20.83
C.	Unlikely.	54.17
D.	Very unlikely.	16.67

		%
3.	**If your AI's actual capital is below desired capital due to non-transitory factors, you will increase the actual capital as quickly as possible.**	
A.	Very likely.	58.33
B.	Likely.	33.33
C.	Unlikely.	8.33
D.	Very unlikely.	0

4.	Suppose your AI's actual capital deviates from desired capital due to non-transitory reasons.	%
A.	Actual capital will be adjusted to meet desired capital more quickly if actual capital exceeds desired capital than if the opposite is the case.	0
B.	Actual capital will be adjusted to meet desired capital more quickly if desired capital exceeds actual capital than if the opposite is the case.	79.17
C.	The pace of adjustments in both cases will be the same.	20.83

5.	How does regulatory capital requirement enter into your decision in setting desired capital?	%
A.	Given the regulatory capital requirement, we assess how much additional capital we should hold.	29.17
B.	We assess how much capital is needed to run the business and then verify whether it meets the regulatory requirement.	58.33
C.	Others (please specify).	12.50[37]

6. What are the determinants of your AI's desired capital?

6.1.	To avoid the consequences of breaching regulatory capital requirement.	%
A.	Very important.	93.94
B.	Important.	6.06
C.	Not important.	0
D.	Not relevant.	0

6.2.	To maintain/improve your AI's credit rating by external credit rating agencies.	%
A.	Very important.	16.67
B.	Important.	58.33
C.	Not important.	0
D.	Not relevant.	0
E.	Not applicable, because my AI is not rated.	25.00

6.3.	Capital held by your AI's peers.	%
A.	Very important.	0
B.	Important.	62.5
C.	Not important.	29.17
D.	Not relevant.	8.33

6.4.	Your AI's risks as perceived by the markets (which may differ from your own assessment).	%
A.	Very important.	25.00
B.	Important.	75.00
C.	Not important.	0
D.	Not relevant.	0

[37] A combination of A and B.

6.5. Financing your AI's long-term business strategy.

		%
A.	Very important.	58.33
B.	Important.	41.67
C.	Not important.	0
D.	Not relevant.	0

6.6. Securing access to inter-bank money markets.

		%
A.	Very important.	29.17
B.	Important.	50.00
C.	Not important.	16.67
D.	Not relevant.	4.17

6.7. Securing wholesale deposits.

		%
A.	Very important.	12.50
B.	Important.	62.50
C.	Not important.	16.67
D.	Not relevant.	8.33

6.8. Securing retail deposits.

		%
A.	Very important.	37.50
B.	Important.	41.67
C.	Not important.	20.83
D.	Not relevant.	0

6.9. Complement to risk management and internal systems and controls.

		%
A.	Very important.	29.17
B.	Important.	66.67
C.	Not important.	4.17
D.	Not relevant.	0

6.10. Cushion against the effect of economic downturn.

		%
A.	Very important.	33.33
B.	Important.	66.67
C.	Not important.	0
D.	Not relevant.	0

6.11. Cushion against unexpected losses arising from material risks faced by your AI.

		%
A.	Very important.	41.67
B.	Important.	58.33
C.	Not important.	0
D.	Not relevant.	0

6.12. Regulatory capital underestimates the risks that it captures.

		%
A.	Very important.	4.17
B.	Important.	70.83
C.	Not important.	16.67
D.	Not relevant.	8.33

6.13. Activities attracting no capital requirements yet requiring capital.

		%
A.	Very important.	4.17
B.	Important.	75.00
C.	Not important.	8.33
D.	Not relevant.	12.50

6.14. Other considerations.

Note: One bank said that the large exposure limit and other regulatory limits were relevant.

6.15. Please select the top five determinants of desired capital from factors 6.1 to 6.14 and rank them according to their degree of importance in determining your AI's desired capital by 1, 2, 3, 4 and 5, with 1 being assigned to the most important factor, 2 to the second most important factor, ….

Table B2: Banks' Replies to Question 6.15

	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	6.10	6.11	6.12	6.13
1	91.7	0	0	0	8.3	0	0	0	0	0	0	0	0
2	4.2	16.7	0	12.5	33.3	0	0	8.3	4.2	4.2	12.5	0	0
3	4.2	4.2	4.2	12.5	16.7	4.2	0	8.3	16.7	8.3	16.7	4.2	0
4	0	8.3	8.3	16.7	12.5	8.3	12.5	4.2	8.3	8.3	8.3	0	0
5	0	4.2	4.2	8.3	16.7	16.7	4.2	8.3	8.3	8.3	12.5	0	8.3
S2	**95.8**	**16.7**	0	**12.0**	**41.7**	0	0	8.3	4.2	4.2	**12.5**	0	0
S3	**100.0**	**20.8**	4.2	**25.0**	**58.3**	4.2	0	16.7	20.8	12.5	**29.2**	4.2	0
S4	**100.0**	**29.2**	12.5	**41.7**	**70.8**	12.5	12.5	20.8	29.2	20.8	**37.5**	4.2	0
S5	**100.0**	**33.3**	16.7	**50.0**	**87.5**	29.2	16.7	29.2	37.5	29.2	**50.0**	4.2	8.3

Note: For example, 91.7% of respondents ranked 6.1 as the most important factor, and 8.3% of respondents ranked 6.5 as the most important factor, and so forth.[38] S2 to S5 are cumulative figures. For example, given a particular factor, the numbers on row S3 show the percentage of respondents who assigned the ranking of 1, 2, or 3 to that factor. By comparing these cumulative figures, the following suggestive ordering is obtained (the degree of importance diminishes from left to right).

$$1 \succ 5 \succ 4 \ (\succ) \ 11 \ (\succ) \ 2$$

where $(\succ)$ is less conclusive than $\succ$.

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[38] Table B2 does not incorporate 6.14 because only one reply to question 6.14 was received.

7. How does desired capital differ from actual capital?	%
A. Actual capital usually exceeds desired capital.	70.83
B. Desired capital usually exceeds actual capital.	12.50
C. Desired capital is usually very close to actual capital.	4.17
D. Actual capital may exceed or fall below desired capital.	12.50

8. Why is actual capital persistently higher or persistently lower than desired capital?

8.1. This is your AI's conventional practice.	%
A. Very important.	4.17
B. Important.	62.50
C. Not important.	12.50
D. Not relevant.	4.17
E. Not applicable, because my answer to 7 is C/D.	16.67

8.2. Other reasons (please specify).

Note: Some banks said that this was a market practice.

9. Why would actual capital be lower than desired capital?

9.1. Unexpected developments within the AI.	%
A. Very important.	16.67
B. Important.	41.67
C. Not important.	8.33
D. Not relevant.	33.33

9.2. Unexpected events in the economy affecting adversely the banking sector.	%
A. Very important.	29.17
B. Important.	54.17
C. Not important.	0
D. Not relevant.	16.67

9.3. Cost of raising extra capital.	%
A. Very important.	20.83
B. Important.	29.17
C. Not important.	16.67
D. Not relevant.	33.33

9.4. Other factors (please specify).

10.   What would be the markets' reaction to an unexpected reduction in your AI's actual capital arising from, say, a significant reduction in profits?

10.1. Shares would be traded at a lower multiple of earnings.

		%
A.	Very likely.	25.00
B.	Likely.	25.00
C.	Unlikely.	4.17
D.	Not relevant.	4.17
E.	Not applicable, because my AI is not listed.	41.67

10.2. Credit rating would be reviewed.

		%
A.	Very likely.	33.33
B.	Likely.	45.83
C.	Unlikely.	0
D.	Not relevant.	0
E.	Not applicable, because my AI is not rated.	20.83

10.3. The inter-bank market would tighten the terms of loans to your AI.

		%
A.	Very likely.	16.67
B.	Likely.	62.50
C.	Unlikely.	12.50
D.	Not relevant.	8.33

10.4. Wholesale depositors would withdraw funds.

		%
A.	Very likely.	4.17
B.	Likely.	50.00
C.	Unlikely.	37.50
D.	Not relevant.	8.33

10.5. Retail depositors would withdraw funds.

		%
A.	Very likely.	0
B.	Likely.	45.83
C.	Unlikely.	54.17
D.	Not relevant.	0

10.6. Other reactions (please specify).

11. **Suppose your AI had experienced a downgrade in its credit rating as a result of an event such as a significant deterioration in credit quality, how would you react to the downgrade?**

11.1. To change the desired capital (as defined by your answer to question 1).

		%
A.	The desired capital would not be changed in the short or medium term.	37.50
B.	The desired capital would be increased in the short and medium term.	16.67
C.	The desired capital would be increased in the medium term only.	8.33
D.	The desired capital would be increased in the short term only.	4.17
E.	The desired capital would be reduced in the short or medium term.	0
F.	Not applicable, because my AI is not rated.	33.33

11.2. To change the actual capital base.

		%
A.	The actual capital would not be changed in the short or medium term.	25.00
B.	The actual capital would be increased in the short and medium term.	29.17
C.	The actual capital would be increased in the medium term only.	12.50
D.	The actual capital would be increased in the short term only.	0
E.	The actual capital would be reduced in the short or medium term.	0
F.	Not applicable, because my AI is not rated.	33.33

11.3. To change the actual risk weighted assets (RWA).

		%
A.	The actual RWA would not be changed in the short or medium term.	12.50
B.	The actual RWA would be reduced in the short and medium term.	41.67
C.	The actual RWA would be reduced in the medium term only.	8.33
D.	The actual RWA would be reduced in the short term only.	4.17
E.	The actual RWA would be increased in the short or medium term.	0
F.	Not applicable, because my AI is not rated.	33.33

11.4. To change the risk level by changing the composition of the actual RWA (i.e. the size of the actual RWA may or may not be changed as a result).

		%
A.	The composition will not be changed in the short or medium term.	8.33
B.	The composition will be changed to reduce the risk level in the short and medium term.	45.83
C.	The composition will be changed to reduce the risk level in the medium term only.	8.33
D.	The composition will be changed to reduce the risk level in the short term only.	4.17
E.	The composition will be changed to increase the risk level in the short or medium term.	0
F.	Not applicable, because my AI is not rated.	33.33

11.5. Other reactions (please specify).

12. If your AI's regulatory capital requirement is increased but its current capital adequacy ratio is still above the new requirement, how would you react to it?

12.1. To change the desired capital (as defined by your answer to question 1).

		%
A.	The desired capital would not be changed in the short or medium term.	45.83
B.	The desired capital would be increased in the short and medium term.	20.83
C.	The desired capital would be increased in the medium term only.	33.33
D.	The desired capital would be increased in the short term only.	0
E.	The desired capital would be reduced in the short or medium term.	0

12.2. To change the actual capital base.

		%
A.	The actual capital would not be changed in the short or medium term.	58.33
B.	The actual capital would be increased in the short and medium term.	16.67
C.	The actual capital would be increased in the medium term only.	25.00
D.	The actual capital would be increased in the short term only.	0
E.	The actual capital would be reduced in the short or medium term.	0

12.3. To change the actual RWA.

		%
A.	The actual RWA would not be changed in the short or medium term.	83.33
B.	The actual RWA would be reduced in the short and medium term.	8.33
C.	The actual RWA would be reduced in the medium term only.	8.33
D.	The actual RWA would be reduced in the short term only.	0
E.	The actual RWA would be increased in the short or medium term.	0

12.4. To change the risk level by changing the composition of the actual RWA (i.e. the size of the actual RWA may or may not be changed as a result).

		%
A.	The composition will not be changed in the short or medium term.	45.83
B.	The composition will be changed to reduce the risk level in the short and medium term.	20.83
C.	The composition will be changed to reduce the risk level in the medium term only.	33.33
D.	The composition will be changed to reduce the risk level in the short term only.	0
E.	The composition will be changed to increase the risk level in the short or medium term.	0

12.5. Other reactions (please specify).

13. Do you make use of any financial or economic capital model for determining desired capital?

		%
A.	Yes.	25.00
B.	No.	41.67
C.	No, but there is a plan to develop such model in the near future.	33.33
D.	Others (please specify).	0

14. Do stress tests play a role in setting desired capital?	%
A. Yes.	45.83
B. No.	20.83
C. No, but there is a plan to make more use of stress-testing for assessing capital level in the near future.	33.33
D. Others (please specify).	0

15. To what extent are your decisions on desired capital influenced or determined by group capital allocation policies?	%
A. To a great extent.	33.33
B. To a limited extent.	16.67
C. Not at all.	4.17
D. Others (please specify).	8.33[39]
E. Not applicable, because my AI is not a subsidiary of a foreign banking group.	37.5

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[39] One bank said that both group and own policies were important. Another bank said that it has no such group policy.

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