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BIS CAPITAL REQUIREMENTS AS AN INCOMPLETE FORM OF RISK-BASED CAPITAL REGULATIONS

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I Why is the Capital Structure of Banks Relevant?

The capital structure of corporations is not really an important issue when the mechanism of arbitrage in the capital markets works well. In contrast to the generally accepted idea, this is what the standard theory of finance asserts.

For example, suppose that issuing bonds is beneficial to a corporation, because an increase in the debt ratio has the effect of reducing corporate taxes under the tax code in the United States or Japan. As a result, if a significant amount of bonds is issued, the effective rate of return on the bonds has naturally to become higher than those of other types of assets. The bonds could not be smoothly placed without such a relative rise of the effective rate of return on them. This change in the rate of return, however, lowers the benefit of issuing bonds as against other financing methods and imposes limitations on new issues of bonds. In the opposite, the same adjustment mechanism should work in the opposite way so that debt financing and equity financing will be indifferent for individual corporations after such adjustments have been completed.

A view like this was proposed by Miller (1977) and is the most vital revival of the irrelevancy theorem of capital structure since Modigliani and Miller (1958). In the case that there exist some costs associated with issuing debt (e.g. the devaluation of the value of tax shields other than debt, agency costs including bankruptcy related costs and so on), debt financing and equity financing will not be fully indifferent for individual corporations and a level of optimum debt ratio may exist.[1] Even in this case, however, it is obviously unprofitable to raise debt ratios thoughtlessly.

The case of banks is different from the one of corporations in general and it should not be correct to apply the above-mentioned irrelevancy theorem to banks without any modification. This is because banks are 'special' in the sense of being protected by the government. To put it concretely, the following two factors can be pointed out as those mitigating against the direct applicability of the irrelevancy theorem.

First, the possibility of a corporation's default increases as its debt ratio is raised, provided that its assets composition remains unchanged. Therefore, when the debt ratio is raised, in order just to keep the effective rate of return constant, it is indispen-

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1) Kim (1988) gives a discerning summary of the current state of the theory of capital structure.

sable to raise the contractual rate of interest. As far as the purchasers of debt themselves have to bear the risk of default, they will never accept an increase in the debt ratio without a corresponding rise in the contracutal rate of interest. However, the security of debts issued by banks (especially, bank deposits) is officially and tacitly secured by the government[2] so that the purchasers of bank debt are exempted from bearing the risk of default. For this reason, increasing the banks' debt ratios does not necessarily require raising the contractual rate of interest. This means that the higher the debt ratio becomes, the lower the effective cost of debt issued by a bank is.

Secondly, the operation of the payment system is treated as a business which is exclusively assigned to banks by government regulations. As the result, banks seem to be enjoying a kind of monopolistic power, at least in providing payment accounts. On the other hand, banks are not given special treatment when they raise funds in the stock market. In other words, there, they have to compete with other business corporations on an equal playing field. Because of this, it is considered that banks can raise funds by issuing (demand) deposits with relatively lower costs than by issuing equity.

From these two factors, there arises the tendency for it to be profitable for a bank to raise debt ratio (or decrease capital ratio). As a matter of fact, it has been observed both in Japan and the United States that the capital ratios of banks have tended to become lower until the regulatory requirements on the capital of banks were recently strengthened.

In summary, banks are given an incentive to decrease their capital ratios through the provision of public protection so that some direct intervention (i.e. regulation) by the government will be required for keeping the specific (relatively high) capital ratio of banks. In this sense, it is not sufficient to discuss the capital restrictions on banks by itself. The capital restrictions on banks should be put into perspecitve in connection with the system of government regulations on banks.

II Concept of Fair Capital Ratio

The second factor mentioned above should become weaker as competition between banks or between banks and nonbank corporations becomes more intensive with progress in the liberalization of financial activities. Even if the second factor could be completely eliminated, banks would have an incentive to lower their capital ratios, to the extent that the first factor mentioned above still remains. Therefore, in this paper, I discuss the effect of bank capital regulations solely in connection with the first factor, and neglect the existence of the second one.

In order to get an intuitive understanding, and ignoring how to measure the a-

2) In the case of Japan, the refund of deposits up to ten million yen per depositor is formally secured under the Deposit Insurance Law. In addition, it is widely believed from the government attitude to previous bank failures that the broader range of bank obligations is substantially guaranteed by the government.

mount of risk, let R be the amount of risk incurred by a bank and C be the portion of the risk assumed by the capital of the bank. This expression may lack a certain degree of logical strictness, but it facilitates the understanding of the basic concept. In addition, consider that, for simplicity, the whole of bank liabilities is secured by the government. In that case holders of the bank debt, including depositors, bear no risk and the remaining risk is borne by the government. Accordingly, let us denote the portion of the risk the government assumes by G. By definition,

$$G \equiv R-C \text{ (or } R \equiv C+G).$$

Now, we assume that all of G,R and C are measured in money terms. In that case, the value of G indicates the economic value of the government guarantee on the liabilities of the bank. In other words, G is the value of (benefits which the bank receives from the existence of) deposit insurance. The concept of deposit insurance is broadly defined in this paper to contain any kind of government gurantee on bank liabilities.[3)]

Although banks are secured for thie debt, they are subject to at the same time burdens in exchange for the government guarantee. The most typical example of such burdens is the payment of deposit insurance premiums. Besides this, banks bear other indirect costs such as the assmupiton of periodical reporting duties on their activities and so on. Let us assume that the total opportunity cost of the direct and indirect burdens is P, which we will simply call the deposit insurance premium.

If the total amount of risk imposed on its capital and the deposit insurance premium (i.e. $C+P$) is equal to the amount of risk assumed by the bank (R), it is judged that the bank assumes all of the risk substantially on its own responsibility. On the other hand, if $R>C+P$, a part of the risk assumed by the bank is shifted to the government at no cost. This means that the bank is in effect awarded subsidies. (Conversely, if $R<C+P$, the bank is subject to taxes.) The condition $R=C+P$ is equivalent to $G=P$ (the value of deposit insurance is equal to its premium), since $R \equiv C+G$ as mentioned above.

From this reasoning, it can be asserted that, when R and P are regarded as predetermined, the amount of capital, where C is equal to $R-P$, is the fair amount of capi-

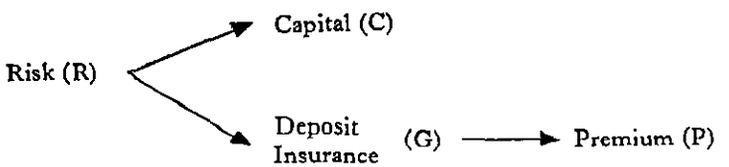

Fig. 1

3) In Japan, in contrast to the situation in the United States, the deposit insurance system strictly defined occupies only an ancillary position in the provisions system of government gurantee against debts of banks. The core of the provisions system seems to be rescue activities administered by the Ministry of Finance and Bank of Japan· For the convenience of terminology, however, the provisions system as a whole is refereed to as "deposit insurance" in this paper.

tal. To put it another way, when the actual amount of capital is equal to the fair amount of capital, the bank is said to take risk on its own responsibility. In this sense, when the capital of a bank is more than the fair amount, the capital of the bank can be said to be adequate. The definition of capital adequacy of banks as stated below is based on just this point of view.

> Capital is *adequate* either when it reduces the chances of future insolvency of an institution to a predetermined minimum level or, alternatively, when the premium paid by the bank to an insurer is "fair"; that is, when it fully covers the risks borne by the insurer. (Maisel (1981))

It can be also inferred from what we have already discussed that, if there is no restriction, banks can obtain profits (in the form of substantial subsidies) by lowering capital ratios. The capital regulations are laid down in order to prevent banks from doing this. However, the current capital regulations function only in the form of setting the minimum standards of capital ratios which banks must satisfy. This may induce another form of undesirable behavior of banks under the current system of deposit insurance premiums.

In other words, because deposit insurrance premiums are proportional to the amount of liabilities under the current insurance premium system (a fixed premium rate system), such a uniform setting of the minimum standards (causes actual capital rations to stick to the minimum levles and) makes C and P per unit of assets constant. Accordingly, the increase of R per unit of assets easily results in $R>C+P$ and banks can thereby obtain substantial subsidies. Capital regulations in this form may therefore induce banks to take excessive risk.

Generally, this is nothing other than what is known as the moral hazard effect caused by the provision of deposit insurance at fixed premiums. As a means of removing such undesirable effects, it has even been proposed to introduce a risk-based system of deposit insurance premiums under which P is adjusted with changes of R in order to always maintain the relation of $R=C+P$.

Strictly speaking, however, the effect of inducing banks to take excessive risk is not caused only by the fixed premium rate system alone. This effect only occurs in conjunct with the capital regulations that require establishing fixed standards of capital ratio. Therefore, the effect can be removed by varying C along with changes of R in order to always preserve the relation of $R=C+P$, even under the condition of keeping P constant. In other words, the moral hazard effect can also be removed by introducing a risk-based system of capital ratio standards. Such a risk-based system of capital ratio standards can be said to be a dual one to the above-mentioned risk-based system of deposit insurance premiums.[4]

4) Because the essential thing is to maintain the relation of $R=C+P$, the pure forms of the risk-based system of deposit insurance premiums or the risk-based system of capital ratio standards are not necessarily required. Any suitable hybrid of these two systems can do the same job.

III BIS Capital Requirements

Governors of central banks of the Group of Ten Countries (G10) gathered at the Bank for International Settlements (BIS) in Basel in July 1988. They unanimously approved the report on "International Convergence of Capital Measurment and Capital Standards" proposed by the "Cook Committee on Banking Regulations and Supervisory Practices" and decided to introduce new capital requirements based upon the contents of this report. The new capital requirements established by this Basel Accord (hereinafter referred to as the "BIS capital requiremnets") have adopted the concept of the above-mentioned risk-based system of capital ratio standards. The BIS capital requirements are fundamentally different from existing capital regulations in this regard. This point is concretely shown by the fact that the BIS capital requirements use a risk weight method.

In the Cook committee's report, five grade risk weights of 0, 10, 20, 50 and 100% were determined and it was decided which risk weight should be applied to each classification of assets, although some details were delegated to the discretion of each national authority. For example, respective risk weights such as 0% for short-term bonds issued by central governments, 50% for residential mortgages and 100% for commercial loans were prescribed.

Furthermore, off-balance sheet activities are taken into account based on two points. One is the category of the off-balance sheet activities. Conversion ratios are prescribed for several categories of off-balance sheet activities. The other factor is who is the transaction partner of the activities. Which of the risk weights that should be applied is decided according to the transaction partner. To sum up, the transaction volumes of each off-balance sheet activities are transformed into the equivalent amounts of risk assets by multiplying the transaction volumes of off-balance sheet activities both by an applicable conversion ratio and a risk weight.

Suppose that a bank owns n kinds of assets and denote the amount of each asset by A_i while the value of the risk weight to be applied to the asset is w_i $(i=1,2,\ldots,n)$. Further, suppose that the bank is engaged in m kinds of off-balance sheet activities and denote the transaction volume of each activity by O_j and the value of the risk weight multiplied by the applicable conversion ratio by z_j (j=1,2,...,m). Then, the total amount of assets on the balance sheet of this bank is $\sum A_i$, while the total amount of risk assets to be used as the denonimator when the capital ratio of the bank is measured in the BIS capital requirements is $\sum w_i A_i + \sum z_j O_j$. Therefore, we define

$$(1) \qquad \omega = \frac{\sum w_i A_i + \sum z_j P_j}{\sum A_i}$$

and refer to ω as the average risk weight.

On the other hand, the concept of capital consists of two categories; that is, core capital and supplementary capital. The former means equities and capital reserves while the latter includes (at most 45% of) unrealized capital gain on securities (or

hidden reserve), allowance being made for bad performance debt and subordinate debts. However, the excess of the amount of supplementary capital above the amount of core capital is not counted as required capital. In short, let the core capital be T_1 and the supplementary capital be T_2, then $T=\min(2T_1, T_1+T_2)$ will be the amount of the required capital used as the numerator when the capital ratio is measured according to the BIS requirements.

In the Basel Accord, it was agreed among bank supervisory authorities of the G–10 countries that the condition

$$\frac{T}{\sum w_i A_i+\sum z_j O_j} \geq 0.08 \tag{2}$$

should be satisfied by the end of fiscal 1992 at latest. The value of the left side of equation (2) is refereed to as the risk assets ratio. By equation (1), however, equation (2) is equivalent to the followng equation:

$$\frac{T}{\sum A_i} \geq 0.08\,\omega. \tag{3}$$

The value of the left side of equation (3) corresponds to what is called a gearing ratio in the conventional capital regulations. Therefore, the average risk weight ω can be interpreted as the measure of bank risks implicitly employed by the BIS capital requirements. That is, as can be seen from equation (3), any bank with a high average risk weight must raise its capital ratio as measured by the gearing ratio under the BIS requirements. This is nothing other than the judgement that the higher the value of ω is, the larger the risk (per unit of assets on the balance sheet) of a bank is. Although w_i is always less than or equal to one, the value of ω is not necessarily smaller than or equal to one. As seen from equation (1), banks which are actively engaged in off-balance sheet activities, e.g. US money center banks, may attain a value of ω greater than 1.

In summary, while the minimum standards of capital ratios are constant irrespective of the value of ω under the conventional regulations, under the BIS requirements the standards are adjusted in proportion to the value of ω. Therefore, if the value of the average risk weight ω appropriately reflects the true risk (per unit of assets) of banks, the BIS requirements can be regarded as constituting a risk-based system of capital ratio standards which suppresses the moral hazard effect. In other words, how desirable the BIS capital requirements are depends upon how appropriate ω is as a measure of bank risk.

However, a few questions must be raised concerning the appropriateness of ω as a measure of the risk of banks. The first question arises, because risk weights adopted in the BIS requirements are measured only roughly in five grades, so that there may be a considerable difference in the risks among assets to which the same risk weight is applied. For example, all commercial loans are subject to the weight of 100%, but there is no banker who thinks that the risks of all commercial loans are the same.

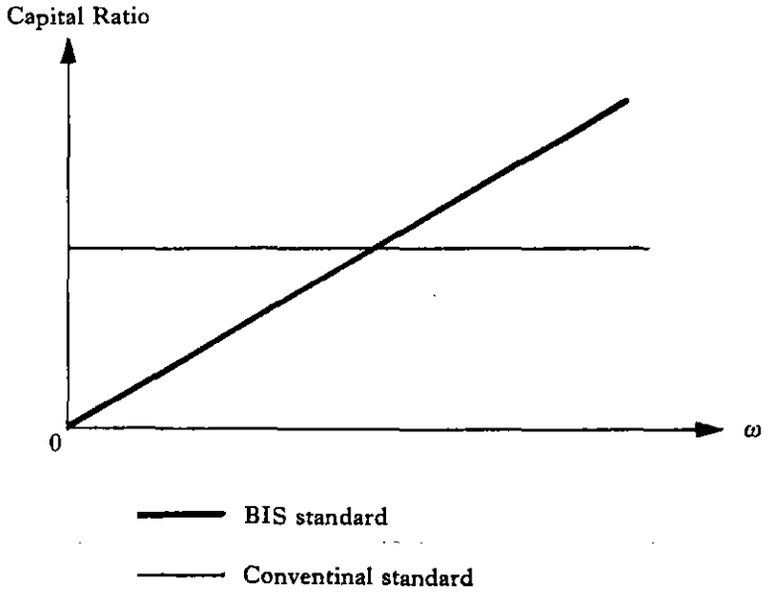

Fig. 2

Secondly, the method of calculating the amount of risk assets is based on the assumption that risks are additive. It is well known, however, that there is a merit of diversified investments and that such risks are sub-additive. That is, as for regarding the standard deviation of the rates of return on assets as an indicator of risk, the risk of portfolio investments is less than the simple sum of the risks of the constituent assets. The only exception is the case where the correlation coefficient between the rates of return on all the constituent assets is unity. We are, therefore, inclined to wonder whether the method of calculation adopted in the BIS requirements disregards an elementary principle of portfolio selection theory.[5)]

In the light of these questions, there is a high probability that ω, the average risk weight, is not an appropriate measure of risk for banks. Nevertheless, the question of how appropriate ω is as a measure must finally be judged by experience. Even though there are deficiencies in the theoretical foundations of the BIS requirements, that does not automatically remove the possibility of ω being useful in practice within the limits of approximation. I will try to address this empirical problem by measuring risk for banks using an alternative method and then compare the results with those obtained by using the method in the BIS requirements.

IV Application of an Option Pricing Model

The alternative method adopted here is that applying an option pricing model and

5) Among indexes of risk, betas as used by CAPM satisfiy additivity. In other words, it is a sufficient condition for making risk assets an accurate measure of portfolio risk that risk weights are set in proportion to the betas.

calculating the amount of risk for banking activities on the basis of the stock prices of banks. The basic assumption for this method to be effective is that the stock prices of banks are formed in a manner such that actual conditions of the banks' activities are correctly evaluated, or the stock market for banks is informationally efficient. At the same time, various possibilities of distortion must be pointed out concerning the stock price formation of banks in Japan. Unfortunately, no close and precise examination of the efficiency of stock price formation of banks in Japan has ever been made up to now. The present paper will simply avoid dealing with this matter and assume efficiency of the stock price formation of banks.

Denote the corporate value of a bank by V and assume that the movement of V will be subject to the following stochastic process (geometric Brownian process):

$$dV = \mu_V V dt + \sigma_V V dz \tag{4}$$

where t denotes time (in units of years) and z is the standard Wiener process. In this expression, σ_V shows the (instantaneous) standard deviation of rate of changes in the corporate value and is used as a measure of risk for banking activities.

In addition, assume that the deposit insurance policy of the government is as follows: The government inspects banks on site once a year. At the time of inspection, if it is found that the corporate value of a bank is less than the amount of outstanding liabilities (B), i.e. its net wealth is negative, the government immediately orders the bank to close and refunds the full amount of the bank's outstanding obligations to all its creditors. If it is not negative, a bank is entitled to continue its business.

Under such a deposit insurance policy, the value of the deposit insurance (G) received by an unclosed bank just after the last inspection can be derived from the Black and Scholes's option pricing formula[6] as follows:

$$G = BN(-x+\sigma_V) - VN(-x), \tag{5}$$

$$x = \frac{\ln(V/B)}{\sigma_V} + \frac{\sigma_V}{2}, \tag{6}$$

where $N(\ )$ is a cumulative standard normal distrubution function.

While σ_V and V are not directly observable[7], thier values can be indirectly derived from stock data. Stocks can be regarded as call options on corporate value. Let the aggregate value of stocks be S and the (instantaneous) standard deviation of changing rate of the value be σ_S. Then, on the assumption of efficient price formation, the following relations can be expected to hold.

$$S = VN(x) - BN(x-\sigma_V), \tag{7}$$

6) Although deposit insurance and put options are certainly deferent in their appearance, they share the same logical structure. This fact was first pointed out by Merton (1977). For the details of reasoning in the main text, refer to Chapter Five of Ikeo (1990).

7) The sum of the values of stocks (S) and liabilities (B) is not euqal to the corporate value (V) given the existence of deposit insurance, but to V plus G.

$$(8) \qquad \sigma_S = \frac{\sigma_V V N(x)}{S}.$$

Consequently, the value of V and σ_V can be obtained from the data B, S and σ_S by solving equations (7) and (8) as simultaneous equations. Then, the value of deposit insurance for a bank can be calculated by substituting the value of V and σ_V into equation (5). Further, we can obtain the fair rate of deposit insurance for the bank by dividing this value by the deposit balance (D). If this fair rate of deposit insurance differs from the actual rate of deposit insurance (at present 0.012% in Japan), the bank is either in a state of under-capitalization (in the case that the fair rate is more than the actual rate) or over-capitalization (in the opposite case).

As a second step, we can calculate how much capital should be poured in or remvoed in order to let the fair rate of deposit insurance and the actual rate of the insurance coincide under a constant balance of obligation, assuming that capital changes in the form of a homologous enlargement or curtailment of existing portfolio (i.e. without changing σ_V). The value of capital ratio when such an amount of capital is actually changed is the fair capital ratio. The calculation procedure of estimation made in this paper is just like the one above.[8)]

We chose as estimation points the end of March 1989 and the end of March 1990,[9)] because these were the latest points for which data could be obtained when the research was done. Of the data required, balances of liabilities and deposits were collected from "Analysis of Financial Statements of Banks in Japan" compiled by the Federation of Bankers' Associations of Japan while the stock prices and total numbers of outstanding stocks were taken from the "Data Book on Stock Prices", an extra number of *Toyo Keizai*. Data on monthly rates of earnings on stocks were collected from "Rates of Earning in Stock Investment" by the Japan Securities Research Institute. Finally, the annual rates of standard deviation of rates of earnings on stocks were estimated by using data for the 36 months from January 1986 to December 1988 as well as for the 36 months from January 1987 to December 1989. Each estimated value was used as the value of σ_S as of March 1989 and 1990 respectively.

The last step implicitly depends on the assumption that the expectation of volatility of stock prices is formed in a static manner. This assumption is not a desirable one. If we select the estimation point at an earlier time, data after the point are available and it becomes possible to adopt the assumption, in the spirit of the rational expectation hypothesis, that expectation is equal to actual result. However, since this paper aims principally at comparison with the BIS requirements, it is not suitable for its purpose to select the estimation point too early. For this reason, it was received to adopt the above assumption. Further, given the limitations on the data, it was also assumed that the book values of liabilities and deposits were equal to their market values.

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8) This procedure is basically due to Ronn and Verma (1989).

9) March is the last month of the fiscal year in Japan.

V Results of Estimation

Table 1 and 2 arrange the results of estimates on thirteen city banks (Mitsui Bank and Taiyo-Kobe Bank are handled separately[10]). Columns [2] and [3] of the respective tables show the values of V and σ_V obtained by solving the simultaneous equations (7) and (8). The value of G was calculated by substituting these vlaues into equation (5) and the fair rates of deposit insurance shown in column [4] were obtained by dividing G by the balance of deposits. Column [5] is the resulting increase (or decrease, if the sign is negative) in capital amount necessary to eliminate the gap between the fair rate of deposit insurance and the actual rate of the insurance.

The data in column [5] show that eight city banks among the thirteen have negative signs at the end of March 1989 and that the total of the data is also negative. The data for the end of March 1990 show that eleven banks among the thirteen have negative signs and that the total is again negative. These results show that, as far as the deposit insurance policy of the government is as assumed in the previous section, the city banks as a whole have enough capital.

Now, let us compare these results with those for the case in which the BIS capital requirements are applied. Tables 3 and 4 present data concerning the BIS capital requirements at the end of March for 1989 and 1990 respectively. The amounts of risk assets ($\sum w_i A_i + \sum z_j O_j$ in the symbols used in this paper) in column [2] and the risk assets ratios in column [5] were collected from annual securities reports. The data

Table 1 March 1989

[1] Name of bank	[2] Corporate value (billion yen)	[3] σ_V (%)	[4] Fair rate of deposit insurance (%)	[5] Necessary capital increase (billion yen)
Daiichi-Kangyo	62169.5	5.85	0.0078	−412.7
Sumitomo	61473.7	6.53	0.0122	20.7
Fuji	59059.6	6.08	0.0075	−435.7
Mitsubishi	56601.1	5.48	0.0049	−716.9
Sanwa	53703.2	5.88	0.0387	1052.3
Tokai	35041.2	3.90	0.0005	−1111.4
Mitsui	32484.4	5.07	0.0079	−185.3
Tokyo	28747.6	4.45	0.0108	−36.9
Taiyo-Kobe	25942.9	4.38	0.0301	315.9
Daiwa	17232.7	5.86	0.0239	194.1
Kyowa	15750.8	4.09	0.0148	39.7
Saitama	14792.2	3.57	0.0020	−261.0
Hokkaido-Takushoku	11322.1	3.23	0.0038	−119.8

10) These two banks merged in April, 1990.

Table 2 March 1990

[1] Name of bank	[2] Corporate value (billion yen)	[3] σ_V (%)	[4] Fair rate of deposit insurance (%)	[5] Necessary capital increase (billion yen)
Daiichi-Kangyo	72233.7	3.87	0.0045	−777.0
Sumitomo	69063.9	4.25	0.0026	−1197.3
Fuji	68643.6	4.87	0.0078	−397.9
Mitsubishi	66255.9	3.94	0.0031	−958.5
Sanwa	64480.8	5.21	0.0325	971.1
Tokai	40998.4	2.61	0.0003	−1038.1
Mitsui	37867.4	3.91	0.0033	−523.1
Tokyo	33733.3	2.97	0.0047	−269.6
Taiyo-Kobe	30727.3	4.24	0.0335	409.9
Daiwa	20344.8	3.88	0.0044	−222.9
Kyowa	17591.6	3.62	0.0070	−100.5
Saitama	17629.3	2.47	0.0007	−351.7
Hokkaido-Takushoku	12566.8	3.30	0.0029	−165.3

on total assets ($\sum A_i$) in column [3] was obtained from the "Analysis of Financial Statements of Banks in Japan" by the Federation of Bankers' Associations of Japan as in the case of outstanding liabilities. Average risk weights in column [4] were obtained by dividing the values of column [2] by the values of column [3] according to equation (1).

Table 3 March 1989

[1] Name of bank	[2] Risk assets (billion yen)	[3] Assets (billion yen)	[4] ω	[5] BIS standard (%)
Daiichi-Kangyo	35181.5	54280.6	0.65	8.23
Sumitomo	34173.1	52962.2	0.65	8.30
Fuji	34220.4	51229.0	0.67	8.32
Mitsubishi	32157.9	49619.7	0.65	8.36
Sanwa	31674.1	48210.8	0.66	7.79
Tokai	21038.0	31424.2	0.67	7.67
Mitsui	20757.7	29040.1	0.71	7.33
Tokyo	18353.9	26106.4	0.70	6.96
Taiyo-Kobe	16784.8	24134.1	0.70	7.57
Daiwa	10643.4	15382.4	0.69	8.70
Kyowa	9929.9	14627.0	0.68	7.91
Saitama	8883.1	13633.9	0.65	8.45
Hokkaido-Takushoku	7129.4	10579.8	0.67	7.27

Table 4 March 1990

[1] Name of bank	[2] Risk assets (billion yen)	[3] Assets (billion yen)	[4] ω	[5] BIS standard (%)
Daiichi-Kangyo	43789.2	66590.8	0.66	8.28
Sumitomo	42679.2	62773.4	0.68	8.44
Fuji	41780.7	61895.0	0.68	8.24
Mitsubishi	38904.0	60673.3	0.64	8.46
Sanwa	39109.8	58982.6	0.66	8.46
Tokai	26399.4	38480.7	0.69	7.72
Mitsui	24912.0	34634.3	0.72	6.91
Tokyo	22247.2	31816.3	0.70	8.02
Taiyo-Kobe	19528.6	28712.4	0.68	7.23
Daiwa	13273.2	18770.8	0.71	8.42
Kyowa	11322.4	16471.9	0.69	8.83
Saitama	11006.6	16735.5	0.66	8.27
Hokkaido-Takushoku	8333.7	11752.3	0.71	8.50

As seen from column [5] in Tables 3 and 4, there were only six banks among the thirteen city banks that met 8 percent final BIS standard requirement as of the end of March 1989 while nine banks met it as of the end of March 1990. Comparing these results with column [5] of Tables 1 and 2, a difference in evaluation is found for six banks at the end of March, 1989, and for three banks at the end of March, 1990. In other words, while the results of the estimation obtained in this paper show that these banks have enough capital (or not enough capital), they are judged to be insufficient in capital (or to have enough capital) from the standpoint of the BIS requirements. Considering that sample includes only 13 banks, we must say that this is not a negligible discrepancy.

The discrepancy is partially due to the fact that different definitions of capital are used, but main cause of it is the difference in the evaluation of risk for banks. The correlation coefficients between ω, which is a measure of risk in the BIS requirements, and σ_V, which is the measure used in this paper, is -0.266 as of the end of March 1989 and -0.174 as of the end of March 1990. At least, these results show that these two measures can not both be appropriate at the same time.

Of course, the esitmation in this paper is obtained on the basis of many restrictive assumptions. Most imporantly, it is based on the assumption that the stock price formation of banks reflects the fundamentals of banking activities. There is a possibility that this assumption is contrary to reality and that the estimated values in this paper are therefore not appropriate. In that sense, it is proper to say that the above-mentioned results show the difficulty in objectively measuring the risk for banks.

However, considering with the above-mentioned problems about the theoretical

basis of the risk measruing method in the BIS requirements, it can also be said that the above results increase the doubts about appropriateness of the current BIS method.

To reiterate, the BIS requirements pay more attention to the incentive effect for banking activities as compared to conventional regulations. This is shown by the fact that they adopt the notion of the risk-based system of capital ratio standard. However, in order that such consideration may actually produce a better result, the risk of banking activities as a whole must be measured appropriately. It is the conclusion of this paper that the current efforts of banking regulators leave wide room for improvement in this regard.

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