論　　説

An Evaluation of Japanese Banks Overseas Business under BIS Regulation

Tohru Inoue[1]　and　Itsuko Shimabukuro[2]

Abstract: This paper analyzes the relationship between Japanese banks' overseas business profitability and regulation of capital adequacy ratio. The result of our estimation shows that the profitability of Japanese banks' overseas business is lower than the required level to keep the capital-asset ratio of BIS regulation.

Keywords: BIS Regulation, Japanese Banks' profitability, Overseas Businsess.

JEL classification code: G21,G28.

1　Introduction

The purpose of this paper is to examine the relationship between Japanese banks' overseas business profitability and the regulation of capital adequacy ratio. Our estimation result shows that the profitability of Japanese banks' overseas business is not high enough to meet the level of capital adequacy regulation.

In the current Japanese banking system, banks that do business abroad must keep higher capital-asset ratio than domestic-limited banks. In the 1980's, Japanese banks expanded internationally. At the same time international rules about capital adequacy ratio were discussed from the point of view of equal-footing of banks in international business. This rule is so-called BIS regulation.

In the 1990s there was a tendency to cut down on the overseas business. Daiwa Bank, for example, withdrew from overseas business in 1998, and Asahi Bank, which was integrated with Daiwa Bank in 2002 also withdrew from overseas business accordingly. According to Maruyama (1999), 34 banks changed from international bank to domestic bank from March 1997 to March 1998. Banks that had been injected with public funds under Financial Function Early Strengthening Law had to present Rehabilitation Plan and were asked tough questions on thoroughness of restructuring. Some banks proceeded with the reduction of the overseas business as a result. For example Fuji bank, which reduced overseas loan drastically in 1999, disclosed its view concerned to its overseas business in Disclosure

[1] Tohru Inoue, 79−4 Tokiwadai Hodogaya−ku Yokohama City 240−8501, Phone 045−339−3755, Fax 045−339−3707, E-mail tedinoue@ynu.ac.jp
[2] ituko@okiu.ac.jp

Report and Rehabilitation Plan.

"This year, loans increased by 1474 billion yen in comparison with the previous year end. We compressed overseas lending, on the other hand, focused on reinforcing domestic lending from the point of view of efficient investment." (Disclosure Report of Fuji Bank, 1999)

"Cut down 450 employees including local hiring and branches substantially (cut down number of branches from 47 to 20). Concentrate a field which needs advanced know-how and competitiveness like project finance, M¥&A finance, securitization, MBO, etc. On the one hand, reduce number of overseas brunches, manage international network efficiently by strengthening relationship with foreign banks." (Rehabilitation Plan of Fuji Bank, 1999)

Figure 1.1 and 1.2 show the total assets and gross business profits. Both figures show how Japanese banks have reduced their overseas business in recent years. Figure 1.3- Figure 1.6 show some general profitability measures of the regional banks and city banks by that changed or not changed from international standard to domestic standard. As compared Figure 1.3 with Figure 1.4, the overseas business lending margin is lower than domestic business, after 1995. In addition, the DD's lending margin is higher than other banks averagely. II(city banks) is the lowest level of ROA and ROE as showned in Figure 1.5 and Figure 1.6.

The critical issue in this paper concerns Japanese banks' overseas business under BIS regulation described above. The profitability of overseas business is relatively lower than that of domestic on average whereas overseas business requires higher capital adequacy ratio. Providing these facts, it is natural to have the following questions.

How BIS regulation affects the asset allocation of banks? Is the profitability of Japanese banks' overseas business enough to sustain 8% of BIS capital ratio? Is the overseas business maintaining the relatively high capital asset ratio desirable for stockholders of banks? And how can we analyze the relation between the profitability of asset, the asset allocation and the capital adequacy ratio under the BIS regulation?

To answer these questions, we constructed the model of banks stock price maximization under the capital adequacy regulation, and calculated the rent of Japanese city banks' overseas business. The advantage of our model is that it can analyze the linkage between the profitability of each business and capital adequacy ratio explicitly.

Both before and after the regulation, numerous studies have been written on the effectiveness of capital requirements on banks' asset choice from the perspective of the predictable credit crunch.

The model posed by Ito and Sasaki (1998) assumes a cost function increasing with the level of capital-asset ratio. They analyze the effects of BIS regulation and their empirical analysis showed that credit crunch occurred.

Milne (2002) classifies BIS regulation as a prudential regulation in two systems, and verifies the effect of risk weight on banks portfolio. Milne outlines two systems, one called the incentive based system and the other is the hard wired system. He concludes that in the incentive based system the regulation works as a compulsory power in advance, and the effects on a bank portfolio varies according to capital adequacy of bank. In the hard wired system, on the other hand, when a capital-asset ratio binds the regulation level, banks reduce high-risk-weight assets.

The model posed by Yasuda (2003) is a version of the incentive based system of Milne (2002). In this model, BIS regulation does not work as a constraint condition in advance due to the non performing loan (NPL) problem. For the banks in his model there is a possibility that capital-asset ratio is lower than the regulation level when it deal with its NPL.

Brrios and Blanco (2003) developed two models. One is the regulatory model in which banks follow BIS regulation. The other is the market model in which banks maximum its stock price. Further, they show that their market model is more appropriate than the regulatory model by empirical analysis using Spanish data. However, they assume the scale of assets is given. Even though they indicate asset composition, they make no mention of decision as to quantity of assets.

Inoue (2004) presents a dynamic optimization model with an adjustment cost of assets and BIS regulation as a constraint condition. Its main conclusion is as follows.

1. The shadow price of a bank asset is equal to the marginal adjustment cost of the asset, and the same level of the rent is generated.
2. The weighted average of rent of bank assets is equal to capital-asset ratio.
3. There is positive correlation between the level of the asset rent and the growth rate of the asset, and the growth rate of the asset rent is equal to acceleration rate of the asset growth.
4. The above three conclusions are valid even if the constraint of the BIS capital-asset ratio is binding.
5. When the constraint of the BIS capital-asset ratio is binding, the growth rate of the asset with high-risk weight and relatively smaller rent decreases, and in some cases, the quantity of the asset decreases. The growth of the quantity of risk-free asset like government bonds is accelerated.
6. When capital-asset ratio of a bank that has many high-risk-weighted assets is binding to the regulatory level, the bank compress high-risk-weighted assets like loans.

5. and 6. are the same as the conclusion reached by Milne (2002). Inoue (2004) model could be classified as the hard wired system of Milne's model, in that a capital adequacy regulation works ex ante. The difference is that this is a dynamic model which introduces an adjustment cost, and takes specific consideration of the growth rate of the assets. The model that we will present on the profitability of Japanese banks' domestic and overseas business is a modified version of Inoue's model. We measure the rent of lending by domestic and overseas business using Japanese city bank data, from the point of view of stock price maximization under BIS regulation empirically.

The main results of the empirical analysis of this paper are as follows. We estimated the rents of the domestic loans and the overseas loans from the estimated parameters of the banks' cost function and compared them with the average rent necessary to maintain BIS standard. Throughout the sample period and for all banks in our sample, the rent of overseas loans is smaller than the rent of domestic loans, and the rent of overseas loans is not high enough to maintain BIS capital asset rasio. It means that there was a room for the reconsideration of Japanese banks' overseas business at least during the sample period.

2 The model

In this chapter, we present a modified version of the stock price maximization model of Inoue (2004) so as to consider the profitability of the domestic business and the overseas business under capital adequacy regulation. The advantage of our model is that it can analyze the profitability of each business and capital adequacy ratio explicitly.

The Inoue (2004) model assumes that banks trade M-types of assets including loans, but for simplicity we assume banks trade only two types of assets, the domestic loans and the overseas loans. Moreover, we assume cost is separable by domestic business and overseas business. One reason for these assumptions is separate data by domestic business and overseas business available from calculations. Assumptions of the model are as follows. Banks' stock price equals to net present value of net cash flow, banks maximize the stock price.

Assumption 1 *All the markets are competitive.*

Assumption 2 *The cost is separable to domestic business and overseas business.*

Assumption 3 *Cost function C_{it} is convex with respect to loan L_{it} and new loan l_{it}, and is linear homogeneous.*

Assumption 4 *All the agents have the perfect foresight. Or all the agents are risk neutral.*

Notations in the model are as follows, r_{it} : loan interest rate, d_{it} : funding interest rate, α : regulatory capital-to-asset ratio, b_i : risk weight of asset i. The subscript i refers to firms while subscript t refers to time period.

If banks maximize their discounted present values of net cash flow under the capital requirement regulation as a constraint, we can describe it as the following.

$$\max . V_{(0)} = \int_0^{\infty} e^{-\rho t} \sum_i \left\{ r_{it} L_{it} - d_{it} L_{it} - C_{it}\left(L_{it}, l_{it}\right) \right\} dt \qquad i = 1, 2 \tag{2.1}$$

$$subject \quad to \quad \dot{L}_{it} = l_{it} \tag{2.2}$$

$$\frac{V_t}{\sum_i b_i L_{it}} \geq \alpha \tag{2.3}$$

CASE 1. *Equation (2.3) is not binding.*

Assume multiplier of (2.2) as λ_{it}, F.O.C. becomes the following.

$$r_{it} - d_{it} - C_{t,Li} = -\dot{\lambda}_{it} + \rho \lambda_{it} \tag{2.4}$$

$$\lambda_{it} = C_{t,li} \tag{2.5}$$

As Inoue pointed out, equation (2.4) means that the multiplier is the rent of asset i.

Actually, equation (2.4) can be rewritten as follows.

$$\frac{r_{it}-d_{it}-C_{t,Li}}{\lambda_{it}}+\frac{\dot{\lambda}_{it}}{\lambda_{it}}=\rho \tag{2.4}'$$

Equation (2.4)' means that equivalence of return of asset i evaluated by its rent and the discount rate is F.O.C.. The first term of left hand side of equation (2.4)' is the net income gain, and the second term is the capital gain. This means a loan makes rent. The true return of loan assets consists not only of income gain but the growth rate of rent. Equation (2.5) means asset i generates the rent that equals to marginal adjustment cost of asset i.

Cost function is linear homogeneous, so we have

$$C_{it,L}\,L_{it}+C_{it,l}\,l_{it}=C_{it}\left(L_{it},l_{it}\right) \tag{2.6}$$

We can therefore write

$$\begin{aligned}
&\frac{d}{dt}\sum_i \lambda_{it}\,L_{it}\,e^{-\rho t}\\
=\;&\sum_i\left(\lambda_{it}\,L_{it}+\lambda_{it}\,L_{it}-\rho\lambda_{it}\,L_{it}\right)e^{-\rho t}\\
=\;&\sum_i\left\{\lambda_{it}\,L_{it}+\lambda_{it}\,l_{it}-\rho\lambda_{it}\,L_{it}\right\}e^{-\rho t}\\
=\;&-\left\{\sum_i\left(r_{it}\,L_{it}-d_{it}\,L_{it}-C_{it}\,L_{it}-\lambda_{it}\,l_{it}\right)\right\}e^{-\rho t}\\
=\;&-\left\{\sum_i\left(r_{it}\,L_{it}-d_{it}\,L_{it}-C_{it}\left(L_{it},l_{it}\right)\right)\right\}e^{-\rho t}
\end{aligned} \tag{2.7}$$

Integrating equation (3.7), we have

$$\sum_i \lambda_{i(0)}\,L_{i(0)}=V_{(0)}=\int_0^\infty e^{-\rho t}\left\{\sum_i\left(r_{it}\,L_{it}-d_{it}\,L_{it}\right)-C_{it}\left(\{L_{it}\},\{l_{it}\}\right)\right\}dt \tag{2.8}$$

In other words, the sum of the product of each asset and its rent equals to the net present value of net cash flow (i.e. stock value). This conclusion is valid if the cost function is linear homogeneous.

We define

$$L_{(0)}=\sum_i L_{i(0)},\quad w_{i(0)}=\frac{L_{i,(0)}}{L_{(0)}}$$

Thereby we obtain

$$\sum_i w_{i(0)}\,\lambda_{i(0)}=\sum_i w_{i(0)}\,C_{i,l_i(0)}=\frac{V_{(0)}}{L_{(0)}} \tag{2.9}$$

In other words, if capital-to-asset ratio can be defined as the stock value divided by total assets at time 0, capital-to-asset ratio is the average rent weighted by each asset.

If assets are composed of only domestic loans and overseas loans, we have

$$w_1 \lambda_1 + w_2 \lambda_2 = w_1 C_{1,l} + w_2 C_{2,l} = \frac{V}{L} \tag{2.9}'$$

where $w_1 = \frac{L_1}{L_1 + L_2}, w_2 = \frac{L_2}{L_1 + L_2} : w_1$ represents domestic loan share, w_2 represents overseas loan share.

CASE 2. *Equation (3.3) is binding.*

Define the multiplier that corresponds to equation (2.3) as μ_t, F.O.C. is as following.

$$\frac{\partial V}{\partial L_{it}} = e^{-\rho t} \left\{ r_{it} - d_{it} - C_{it,Li} - \mu_t \left(\frac{\frac{\partial V}{\partial L_{it}} - \frac{V}{\sum_i b_i L_{it}} b_i}{\sum_i b_i L_{it}} \right) \right\} \tag{2.10}$$

$$\frac{\partial V}{\partial \dot{L}_{it}} = e^{-\rho t} \lambda_{it} \tag{2.11}$$

$$\frac{\partial V}{\partial l_{it}} = \left(- C_{it,li} + \lambda_{it} \right) e^{-\rho t} = 0 \tag{2.12}$$

However if the constraint (2.3) is binding,

$$\frac{\partial V}{\partial L_{it}} = \alpha b_i \qquad and \qquad \frac{V}{\sum_i b_i L_{it}} = \alpha \tag{2.13}$$

Therefore

$$\frac{\partial V}{\partial L_{it}} - \frac{V}{\sum_i b_i L_{it}} = \alpha b_i - \alpha b_i = 0$$

Equation (2.10) can be rewritten as the following, and it is independent from μ_t.

$$\frac{\partial V}{\partial L_{it}} = e^{-\rho t} \left(r_{it} - d_t - C_{it,Li} \right) \tag{2.10}'$$

In other words, even if BIS capital-asset ratio is binding to minimum regulatory level, $\frac{V}{L}$ is equal to weighted average of each rent. However, as Inoue pointed out, this model has an important implication

for banks portfolio allocation.

If equation (2.3) is binding, the following equations are valid at a time s on the solution path of stock price maximization problem.

$$r_{it} - d_s - C_{s,Li} = \alpha b_i = \rho \lambda_{is} - \dot{\lambda}_{is} \tag{2.14}$$

$$\frac{\dot{\lambda}_{i\alpha}}{\lambda_{is}} = \rho - \frac{\alpha}{\lambda_{is}} b_i \tag{2.14'}$$

Equation (2.14)' means that the growth rate of the rent of asset i equals to the difference between the discount rate ρ and the product of BIS capital-asset ratio α and asset i' risk weight b_i, divided by its rent λ_{is}. From equation (2.6) and convexity of the cost function, the asset generates the larger rent λ_{is}, the higher the growth rate of the asset is. The growth rate of rent is the acceleration of growth rate of the asset. If growth rate of the rent is positive, growth rate of asset increases. In other words, if the constraint (2.3) is binding, the asset of which the growth rate of its rent is positive increases acceleratingly, vis-a-versa. The growth rate of the rent depends upon its risk weight and its size relative to α. The growth rate of the asset of which risk weight is small and that rent is relatively large increases acceleratingly. On the other hand, the growth rate of assets of which risk weight is large and rent is relatively small slows down or decreases. Thus, when a bank's capital ratio meets with the regulatory minimum level, zero risk-weighted assets like government bonds increase acceleratingly, on the other hand growth rate of full risk-weighted asset like loans slows down or the decrease in its quantity can be a case if its rent is smaller than $\frac{\alpha}{\rho}$.

In the following section, we examine whether Japanese banks earn enough rents under the capital requirement regulation from the point of view of stock value maximization, estimating the rents of the domestic loans and overseas loans using equation (2.4), (2.5), and (2.9).

3 Empirical Analysis

3.1 Specification

We estimate the cost functions of domestic business and overseas business, to analyze the relationship of capital ratio and marginal return of domestic and overseas lending. Redefine subscript "D" denotes domestic business instead of "1", "O" denotes overseas business instead of "2".

Since we assume the cost function is linear homogeneous, two cost functions are can be written as follows.

$$\frac{C_D}{L_D} = f\left(\frac{l_D}{L_D}\right),\ \frac{C_O}{L_O} = f\left(\frac{l_O}{L_O}\right)$$

We employ the quadratic functions (3.1) and (3.2) to approximate these two functions.

$$\frac{C_D}{L_D} = \alpha_0 + \alpha_1\left(\frac{l_D}{L_D}\right) + \alpha_2\left(\frac{l_D}{L_D}\right)^2 \tag{3.1}$$

$$\frac{C_O}{L_O} = \beta_0 + \beta_1\left(\frac{l_O}{L_O}\right) + \beta_2\left(\frac{l_O}{L_O}\right)^2 \tag{3.2}$$

We define the capital-to-asset ratio k, the share of the domestic lending and the overseas lending to total asset W_D and W_O, the shadow prices of the domestic lending and the overseas lending M_D and M_O.

If assets consist of loans alone, we can define $k = W_D M_D + W_O M_O$ from our theoretical model. This can be rewritten as follows.

$$k = W_D\left(\alpha_1 + 2\alpha_2 \frac{l_D}{L_D}\right) + W_O\left(\beta_1 + 2\frac{l_D}{L_O}\right) \tag{3.3}$$

Actually, we need to consider the rents of other assets, so equation (3.3) can be rewritten as follows.

$$k = W_D\left(\alpha_1 + 2\alpha_2 \frac{l_D}{L_D}\right) + W_O\left(\beta_1 + 2\beta_2 \frac{l_O}{L_O}\right) + \gamma(1 - W_D - W_O) \tag{3.3'}$$

In the empirical analysis, we estimate (3.1), (3.2), (3.3)' by three stage Least Squares (3SLS) simultaneously.

3.2 Data

The data sources we used in our empirical analysis were the banks' fiscal-year-end Financial Reports. Sample period is from 1994 to 1999. Banks[3] included in the sample are Mitsubishi Bank, Bank of Tokyo Mitsubishi (BTM), Sakura Bank, Sumitomo Bank, Fuji Bank, Daiichi Kangyo Bank (DKB), Tokai Bank, Sanwa Bank, Asahi Bank. Because of the availability of data, Bank of Tokyo and Daiwa Bank are excluded. Separable data by domestic and overseas business is available after 1993. We need a lagged variable as instrument variables, so estimation period is after 1994.

The data used in estimation are as follows, C : operating cost, l : the difference of loan between that of the current year and the previous year, L : year-end loan, k : Tier1 divided by total asset. We calculated operating costs that are separated by the domestic business and the overseas business according to Yamori (1999).

3.3 Result

Table 3.1 shows the results of the estimation. Constant variable and coefficients of first term and quadratic term are positive in both domestic and overseas cost function. They are consistent with predicted signs. For the domestic business, all coefficients are significant, but the quadratic term of overseas cost function is not significant.

The assumption of the separability of cost function is a debatable point[4]. Strictly speaking, it is better to

---

[3] Many of these banks' names have changed of M&A or reorganization, as follows : Mitsubishi Bank and Bank of Tokyo are Bank of Tokyo Mitsubishi. Sakura Bank and Sumitomo Bank are Mitsui Sumitomo Bank. Sanwa Bank and Tokai Bank are UFJ Bank. Daiichi Kangyo Bank and Fuji Bank are Mizuho Bank and Mizuho corporate Bank. Daiwa Bank and Asahi Bank are Resona Bank and Saitama Resona Bank.

[4] This assumption seems rather strong. However there are the reasons to separate the cost to domestic and overseas. We estimated both the separated cost function and the combined cost function in trans-log form to access the plausible form of cost function and to check the the assumption that the costs of domestic business and overseas business are separable. Table.A1 shows the results of 2SLS estimation of the cost function combining domestic and overseas, and Table.B1 shows those of the separated cost functions.

specify the cost function that can deal with the substitution or complementarity of the domestic and the overseas cost each other like trans-log cost function. However, some accounting information separated by the domestic and the overseas business are not available before 1993, so specifying a cost function with many independent variables like trans-log function is difficult because of lack of degree of freedom.

Table 3.2 shows

- The rent of domestic and overseas loans calculated from estimated parameter of cost function.
- Requirement level of rents to achieve 8% capital-to-asset ratio.
- Requirement level of rents to achieve 4% capital-to-asset ratio.

Not only is the rent of overseas business lending smaller than the domestic it doesn't achieve the level necessary for 8% regulation capital ratio at any year of the estimation period.

Core capital ratio $\left(\frac{Tier1}{Risk\ Asset}\right)$ is required over 4%. The rent to achieve the level is larger than that of 8% calculated by given Tier 2. This means that almost all banks depend on Tier 2 to satisfy the regulatory capital ratio. It results that some banks did not earn sufficient rents on domestic lending to reach the regulatory level of core capital ratio in several years. Needless to say, rent of overseas lending is insufficient to achieve the level of 8% regulatory capital ratio in all cases.

These findings do leave a room for argument since our specification of cost function and our estimation method are rather specific. In particular, the estimated rents are sensitive to estimated parameters, so it should be treated carefully. However, the relative relationship between the rents on domestic business and overseas business are robust despite the different sample periods and the variables. Thus, we can safely conclude that Japanese banks profitability on overseas business is lower than that of domestic business. Under the regulation of capital adequacy ratio, international banks must satisfy higher regulatory capital ratio than domestic banks, which means that international banks need to hold assets that generate higher rents. Thus, the circumstances mentioned above have to be improved from the point of view of shareholder's profit. The trend towards Japanese banks reducing overseas lending mentioned in Chapter 1 is consistent with the findings of our study and our theoretical implication supposing that the relative relationship between the domestic and overseas rents in our estimation is correct.

4 Conclusion

The banks that have been injected with public funds face on urgent need for drastic restructuring. We have in fact witnessed such movements in Japanese banks, which have included branch-rearrangement, regrouping large-scale staff reduction.

The data sources used in these estimations are the same explained in chapter 3.2. The labor price (P_L) and the capital price(P_K) used in these trans-log cost functions are calculated as follows.

$$P_L = \frac{\text{Personal Expenses}}{\text{Number of Staffs}}, \quad P_K = \frac{\text{Number of Staffs}}{\text{Equipment and Real Estate}}.$$

We found that the marginal costs calculated from the estimated results of separated cost function are positive throughout the sample period whereas the marginal costs from the combined cost function are often negative (see Table.A2 and Table.B2). This fact may permit us to estimate the cost function separately, because a necessary condition of cost function that the sign of marginal costs are positive is not satisfied in the combined cost function.

However, there is a limit to cost retrenchment alone as a means of becoming a going concern, so improvement of low-profitability is unavoidable.

We examined asset selection of banks that maximize their stock price under BIS capital adequacy regulation from point of view of the asset rents by separating cost to domestic business and overseas business. This treatment is the reason that BIS regulatory level of capital-asset ratio of international banks is higher than that of domestic banks in Japan.

Generally speaking, banks that pursue their profit have to invest to high-profitable assets rather than low-profitable ones. In addition, under the capital adequacy regulation they need take into account difference in risk weight of asset and the regulation level by business.

In our study, we found that during the sample period not only all banks earn lower rent in overseas business than domestic business but also that not enough to satisfy the BIS capital regulatory level. Needless to say, these findings do not mean that Japanese banks should withdraw from overseas business but mean that they should improve or reconsider their overseas business.

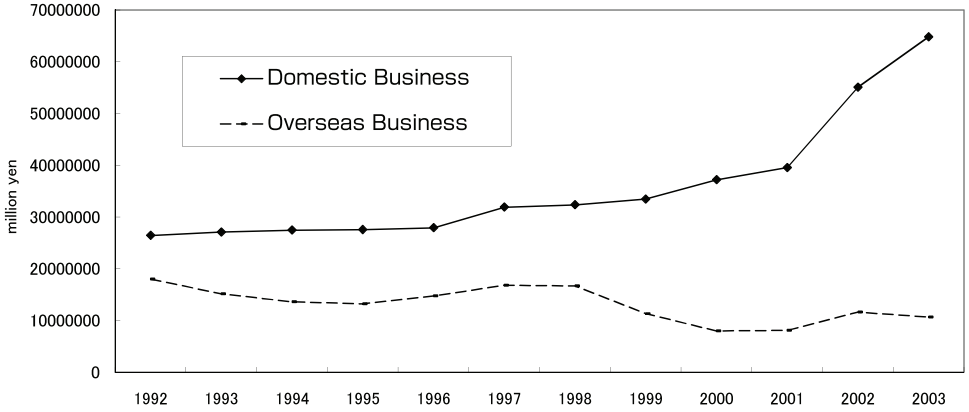
Further consideration needs to be given to the rents that fall outside of our argument (e.g. good reputation that banks can get by doing business overseas as an international bank) or the sunk cost of withdrawing overseas business. However, as we have demonstrated in the theoretical analysis above, under BIS capital regulation international banks must earn more rent than domestic banks. Our result suggests that the overseas lending of all Japanese banks need reconsideration, improvement and, in some cases, reduction or withdrawal. This is consistent with Japanese banks behavior in recent years. While the four Japanese mega financial groups are ranked high in scale in the world, their profitability is lagging. For Japanese banks, the recovery of profitability is a pressing problem.

References

[1] Brrios,V. and Blanco, J., 2003,“The effectiveness of bank capital adequacy regulation:A theoretical and empirical approach,”*Journal of Banking & Finance*, Vol.27, pp.1935−1958.
[2] Hughes, J., Mester, L., and Moon, C., 2001,“Are economies in banking elusive or illusive? Evidence obtained by Incorporating capital structure and risk-taking into models of bank production,”*Journal of Banking & Finance*, Vol.25, pp.2169−2208.
[3] Inoue, T., 2004,“Ginkoshisan no rent to jikoshihonhiritsu,”*Yokohama Keiei Kenkyu*,Vol.24(4).
[4] Ito T. and Sasaki Y., 1998,“Impacts of the Basle capital standard on Japanese banks behavior,”*NBER Working Paper*6730.
[5] Maruyama, S., 1999,“Jikosihon ga kin'yukikankeiei ni ataeru eikyo ni tsuite,”*Yuseikenkyujo Geppo*, No129.
[6] Milne, A., 2002,“Bank capital regulation as an incentive mechanism: Implications for portfolio choice,”*Journal of Banking & Finance*, Vol.26, pp.1−23.
[7] Yamori, Y., 1999, *Nihon no Kin'yukikan to kin'yushijo no kokusaika*, Chikura Shobo.
[8] Yasuda, Y., 2003,“Furyosaikenmondai no moto de jikosihonhiritukisei ga ginkoukoudou ni ataeru eikyo,”Kin'yuchosakai(Eds), *Kin'yukikan no soshikikeitai to kisei・kantoku*, pp163−184.
[9] Zenginkyo chosa−bu(Eds), 2003, *Zusetsu wagakuni no ginko*.

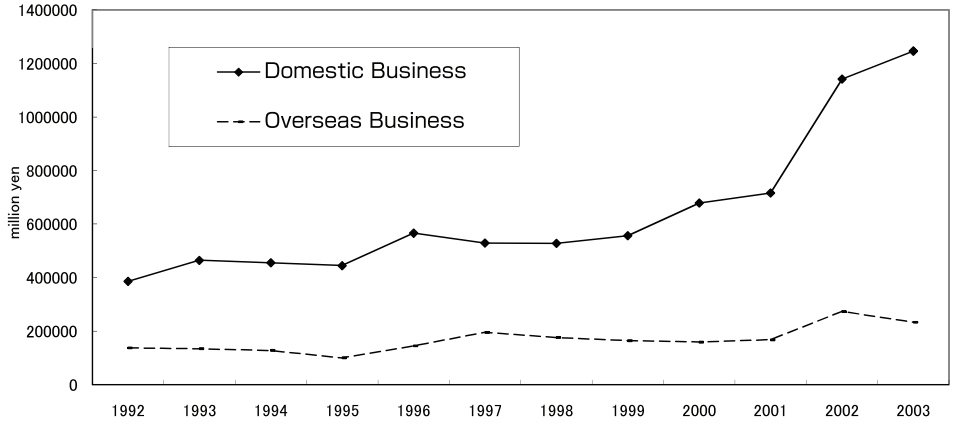
〔Tohru Inoue, Professor, Faculty of Business Administration, Yokohama National University〕
〔Itsuko Shimabukuro, Associate Professor, College of Economics, Okinawa International University〕
〔2008年8月7日受理〕

Figure 1.1 Total Assets



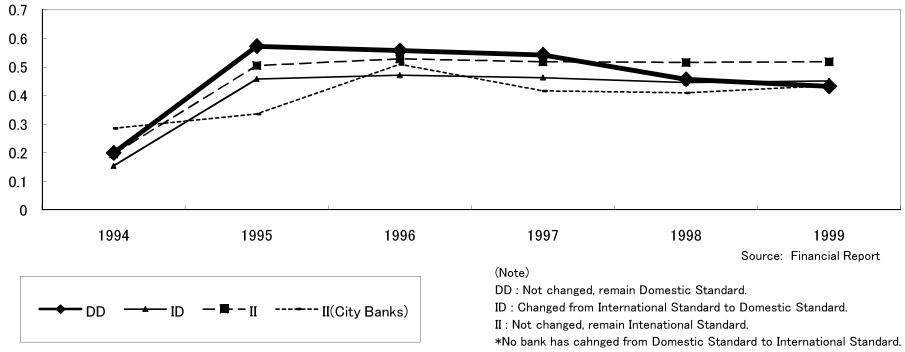
Source: Financial Report, except for Daiwa bank and Ssahi Bank

Figure 1.2 Gross Business Profit



Source: Financial Report, except for Daiwa Bank and Asahi Bank

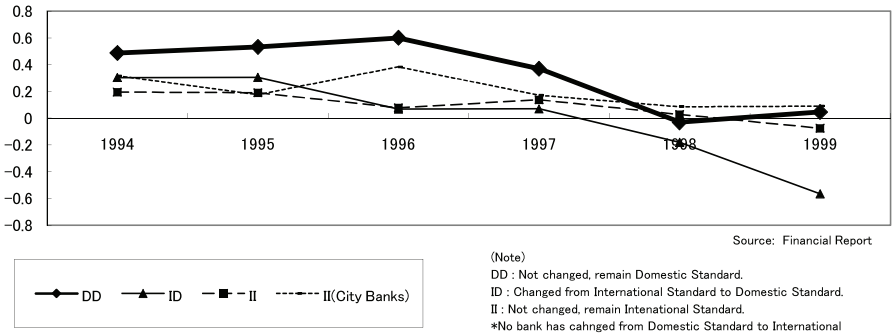
Figure 1.3 The Margin of Lending of Domestic Sector (%)
-Regional Banks and City Banks-



Source: Financial Report

(Note)
DD : Not changed, remain Domestic Standard.
ID : Changed from International Standard to Domestic Standard.
II : Not changed, remain Intenational Standard.
*No bank has cahnged from Domestic Standard to International Standard.

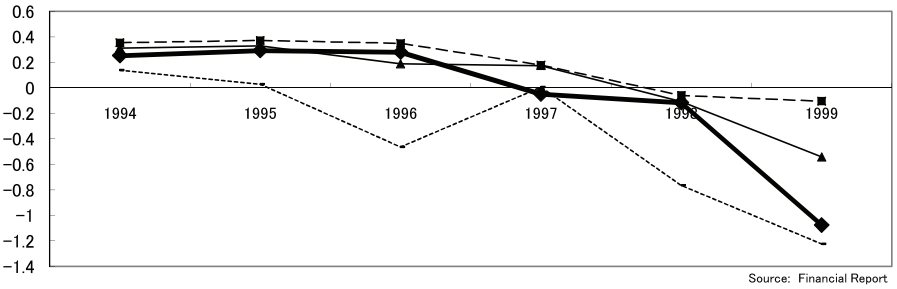
Figure 1.4 The Margin of Lending of Overseas Sector (%)
-Regional Banks and City Banks-



Source: Financial Report

(Note)
DD : Not changed, remain Domestic Standard.
ID : Changed from International Standard to Domestic Standard.
II : Not changed, remain Intenational Standard.
*No bank has cahnged from Domestic Standard to International

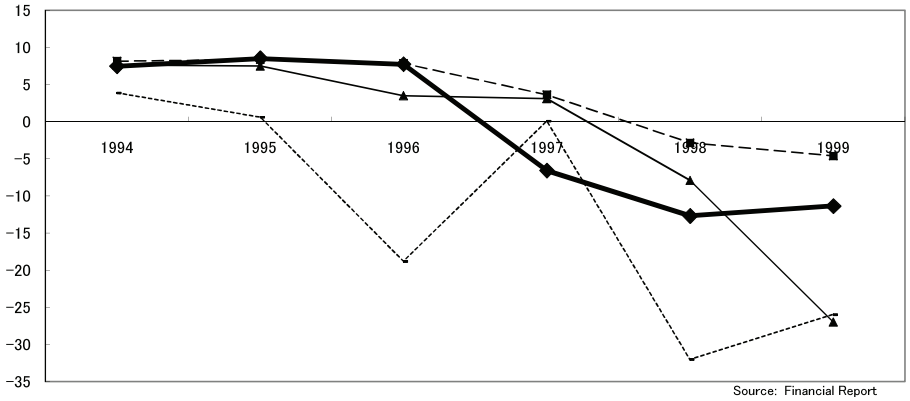
Figure 1.5 ROA(%)-Regional Banks and City Banks-



Source: Financial Report

(Note)
DD : Not changed, remain Domestic Standard.
ID : Changed from International Standard to Domestic Standard.
II : Not changed, remain Intenational Standard.
*No bank has cahnged from Domestic Standard to International

Figure 1.6 ROE(%) -Regional Banks and City Banks-



Source: Financial Report

(Note)
DD : Not changed, remain Domestic Standard.
ID : Changed from International Standard to Domestic Standard.
II : Not changed, remain Intenational Standard.
*No bank has cahnged from Domestic Standard to International Standard.

Table.2.1 Outline of Capital Adequacy Regulation in Japan.

■International Convergent Standard

$$Cpital - to - Asset \quad ratio = \frac{Tier1 + Tier2}{Risk \quad Asset} \geq 8\%$$

Tier1	Shareholder's equity.
Tier2	Subordinated loan, latent revaluation reserves related to holding securities, etc.

■Domestic Standard

$$Cpital - to - Asset \quad ratio = \frac{Tier1 + Tier2}{Risk \quad Asset} \geq 4\%$$

Tier1	Shareholder's equity.
Tier2	Subordinated loan, etc. Latent revaluation reserves related to holding securities are not included.

Risk Weights of Risk Assets

0%	Government Bond.
20%	Claims on Credit Institutions.
50%	Mortgage Loan.
100%	Claims on Commercial companies.

source: http://www.fsa.go.jp

Table.3.1 Cost Function Estimation.

Parameter	Estimate	Standard Error	t-statistic	P-value
a0	0.012**	0.000	47.792	0.000
a1	0.034**	0.007	4.587	0.000
a2	0.381**	0.121	3.148	0.002
$\beta 0$	0.008**	0.001	7.225	0.000
$\beta 1$	0.01*	0.005	1.953	0.051
$\beta 2$	0.008	0.061	0.139	0.889
γ	-0.005**	0.002	-2.087	0.037

Notes

・**5% significant level,*10% significant level.

・Equations are as the following.

$$\frac{C_D}{L_D} = \alpha_0 + \alpha_1 \frac{l_D}{L_D} + \alpha_2 \left(\frac{l_D}{L_D}\right)^2$$

$$\frac{C_O}{L_O} = \beta_0 + \beta_1 \frac{l_O}{L_O} + \beta_2 \left(\frac{l_O}{L_O}\right)^2$$

$$k = W_D \left(\alpha_1 + 2\alpha_2 \frac{l_D}{L_D}\right) + W_O \left(\beta_1 + 2\beta_2 \frac{l_O}{L_O}\right) + \gamma (1 - W_D - W_O) + Dummy$$

・Sample period is from 1994 to 1999.

・Number of Observations ; 46

・γ is the average rent of the other assets of the bank and the sign of γ is ambiguous. Because the other assets include the reserve, and the rent of the reserve is likely to be negative.

Table.3.2 Calculated Value of Rents (unit: %).

Year	Bank	Domestic	Overseas	8%	4%
1994	Mitsubishi	4.870	0.906	2.478	3.020
1995	Mitsubishi	3.560	0.935	2.995	3.054
1996	Mitsubishi	2.983	1.169	2.596	3.060
1999	BTM	4.158	0.840	2.011	2.909
1994	Sakura	3.317	0.940	2.416	2.975
1995	Sakura	2.948	1.045	3.093	3.044
1996	Sakura	3.099	1.243	2.926	3.068
1997	Sakura	2.590	1.178	2.731	3.090
1998	Sakura	2.771	1.097	2.495	2.904
1999	Sakura	3.538	0.765	2.008	2.830
1994	Sumitomo	4.270	0.965	2.797	3.081
1995	Sumitomo	3.614	0.970	3.390	3.098
1996	Sumitomo	3.447	1.159	2.701	3.145
1997	Sumitomo	3.740	1.149	2.893	3.085
1998	Sumitomo	5.102	1.034	2.485	2.819
1999	Sumitomo	5.128	0.799	1.988	3.034
1994	Fuji	3.742	1.012	2.579	2.972
1995	Fuji	2.433	1.011	3.350	2.999
1996	Fuji	2.061	1.239	2.937	3.079
1997	Fuji	2.604	1.189	2.778	3.124
1998	Fuji	4.384	1.055	2.498	2.956
1999	Fuji	6.894	0.713	2.220	3.549
1994	DKB	3.265	0.952	2.696	3.038
1995	DKB	3.352	1.003	3.308	3.076
1996	DKB	2.606	1.267	2.709	3.164
1997	DKB	3.481	1.198	2.927	3.233
1998	DKB	3.214	1.043	2.721	3.065
1999	DKB	4.324	0.809	1.614	2.697
1994	Tokai	4.241	0.863	2.448	3.011
1995	Tokai	3.268	0.886	2.815	2.995
1996	Tokai	2.890	1.275	2.802	2.977
1997	Tokai	3.369	1.179	2.513	2.909
1998	Tokai	3.648	1.061	2.153	2.728
1999	Tokai	4.192	0.836	2.135	2.718
1994	Sanwa	4.082	0.989	2.474	3.049
1995	Sanwa	3.232	0.984	3.021	2.995
1996	Sanwa	3.248	1.308	2.665	3.101
1997	Sanwa	2.909	1.169	2.678	3.108
1998	Sanwa	2.599	1.058	2.303	2.881
1999	Sanwa	4.882	0.715	2.213	2.969
1994	Asahi	4.953	0.924	2.548	3.030
1995	Asahi	3.361	0.948	3.193	3.004
1996	Asahi	2.912	1.181	2.534	2.920
1997	Asahi	3.868	1.141	2.759	2.953
1998	Asahi	4.516	0.994	2.301	2.784
1999	Asahi	5.052	0.840	1.650	2.755

Notes

・"Domestic" line shows the rent of domestic lending.

・"Overseas"line shows the rent of overseas lending.

・"4%" line shows minimum requirement level of rent to adequate BIS standard 4% (components onlyTier1) level is calculated by the formula:

$$4\times\frac{Risk\ asset}{Total\ asset}.$$

・"8%" line shows minimum requirement level of rent to adequate BIS standard 8% level is calculated by the formula:

$$\left(8-\frac{Tier2+deduction}{Risk\ asset}\times 100\right)\times\frac{Risk\ asset}{Total\ asset}.$$

under the assumption that Tier2 is given.

・"Risk asset" is difined by BIS standard in table 3.1.

Table.A1 Trans-log Cost Function Estimation - Combined Version -.

Parameter	Estimate	Standard Error	t-statistic	P-value
a0	-9109.09	63386.2	-0.144	0.886
a1	1319.42	8944.77	0.148	0.883
a2	-366.238	2444.06	-0.15	0.881
$\beta 11$	-30.889	215.508	-0.143	0.886
$\beta 22$	20.558	132.853	0.155	0.887
$\beta 12$	-16.658	108.427	-0.154	0.878
δ	0.070	6.906	0.01	0.992

Notes
・**5% significant level,*10% significant level.
・Equation is as the following.

$$InC = \alpha_1 InL_D + \alpha_2 InL_O + \frac{1}{2}\beta_{11}(InL_D)^2 + \frac{1}{2}\beta_{22}(InL_O)^2 \beta_{12} InL_D InL_O + \delta InP_L + (1-\delta) InP_K + Dummy$$

L_D: *Domestic Loan* L_O: *Overseas Loan*

P_L: *Labar Price* P_K: *Capital Price*

・Estimation method is 2SLS.
・Sample period is from 1993 to 1999.
・Number of Observations ; 46

Table.B1 Trans-log Cost Function Estimation - Separated Version -.

■Domestic

Parameter	Estimate	Standard Error	t-statistic	P-value
a0	65.79	152.014	0.433	0.665
a1	9.812	12.671	0.774	0.439
a11	-0.543	0.749	-0.724	0.469
a2	0.95**	0.031	30.192	0.000

Notes
・**5% significant level,*10% significant level.
・Equation is as the following.

$$InC_D = \alpha_0 + \alpha_1 InL_D + \frac{1}{2}\alpha_{11}(InL_D)^2 + \alpha_2 InP_L(1-\alpha_2) InP_K + Dummy$$

L_D: *Domestic Loan* P_L: *Labar Price* P_K: *Capital Price*

・Estimation method is 2SLS.
・Sample period is from 1993 to 1999.
・Number of Observations ; 46

■Overseas

Parameter	Estimate	Standard Error	t-statistic	P-value
$\beta 0$	569.154**	259.681	2.192	0.028
$\beta 1$	0.535**	0.102	5.268	0.000
$\beta 11$	0.04**	0.013	3.176	0.001
$\beta 2$	0.978**	0.084	11.611	0.000

Notes
・**5% significant level,*10% significant level.
・Equation is as the following.

$$InC_O = \beta_0 + \beta_1 InL_O + \frac{1}{2}\beta_{11}(InL_O)^2 + \beta_2 InP_L(1-\beta_2) InP_K + Dummy$$

L_O: *Overseas Loan* P_L: *Labar Price* P_K: *Capital Price*

・Estimation method is 2SLS.
・Sample period is from 1993 to 1999.
・Number of Observations ; 46

Table.A2 Marginal Cost - Combined Version -.

Year	Bank	Domestic	Overseas
1994	Mitsubishi	0.095	-0.082
1995	Mitsubishi	0.116	-0.35
1996	Mitsubishi	0.133	0.014
1999	BTM	-0.248	0.649
1994	Sakura	-0.031	-2.4
1995	Sakura	-0.027	-2.211
1996	Sakura	-0.076	-1.003
1997	Sakura	-0.102	-0.39
1998	Sakura	-0.108	-0.136
1999	Sakura	-0.018	-1.503
1994	Sumitomo	0.001	0.136
1995	Sumitomo	0.011	0.012
1996	Sumitomo	-0.025	0.264
1997	Sumitomo	-0.067	0.442
1998	Sumitomo	-0.106	0.435
1999	Sumitomo	-0.066	-0.113
1994	Fuji	0.094	0.183
1995	Fuji	0.129	0.176
1996	Fuji	0.105	0.511
1997	Fuji	0.081	0.691
1998	Fuji	0.042	0.709
1999	Fuji	0.07	0.079
1994	DKB	0.013	-0.351
1995	DKB	0.02	-0.436
1996	DKB	-0.024	0.181
1997	DKB	-0.078	0.485
1998	DKB	-0.077	0.499
1999	DKB	-0.024	-0.028
1994	Tokai	0.601	-2.299
1995	Tokai	0.646	-3.435
1996	Tokai	0.621	-1.928
1997	Tokai	0.612	-1.271
1998	Tokai	0.58	-1.103
1999	Tokai	0.59	-2.209
1994	Sanwa	0.033	0.28
1995	Sanwa	0.049	0.221
1996	Sanwa	-0.016	0.534
1997	Sanwa	-0.044	0.651
1998	Sanwa	-0.036	0.69
1999	Sanwa	0.041	0.258
1994	Asahi	0.69	-2.174
1995	Asahi	0.698	-2.688
1996	Asahi	0.642	-1.647
1997	Asahi	0.597	-1.139
1998	Asahi	0.555	-1.31
1999	Asahi	0.552	-2.615

Note:
Bank of Tokyo and Daiwa bank are excepted for availability of data.

Table.B2 Marginal Cost - Separated Version -.

Year	Bank	Domestic	Overseas
1994	Mitsubishi	0.007	0.009
1995	Mitsubishi	0.007	0.010
1996	Mitsubishi	0.007	0.009
1999	BTM	0.005	0.015
1994	Sakura	0.006	0.015
1995	Sakura	0.006	0.014
1996	Sakura	0.006	0.012
1997	Sakura	0.006	0.011
1998	Sakura	0.006	0.010
1999	Sakura	0.006	0.014
1994	Sumitomo	0.006	0.008
1995	Sumitomo	0.006	0.009
1996	Sumitomo	0.006	0.008
1997	Sumitomo	0.006	0.009
1998	Sumitomo	0.006	0.008
1999	Sumitomo	0.005	0.012
1994	Fuji	0.008	0.007
1995	Fuji	0.008	0.008
1996	Fuji	0.009	0.007
1997	Fuji	0.009	0.007
1998	Fuji	0.009	0.007
1999	Fuji	0.007	0.010
1994	DKB	0.006	0.009
1995	DKB	0.006	0.009
1996	DKB	0.007	0.008
1997	DKB	0.007	0.007
1998	DKB	0.007	0.007
1999	DKB	0.006	0.009
1994	Tokai	0.009	0.012
1995	Tokai	0.009	0.014
1996	Tokai	0.010	0.011
1997	Tokai	0.010	0.012
1998	Tokai	0.010	0.011
1999	Tokai	0.009	0.013
1994	Sanwa	0.006	0.007
1995	Sanwa	0.007	0.007
1996	Sanwa	0.007	0.006
1997	Sanwa	0.007	0.006
1998	Sanwa	0.007	0.006
1999	Sanwa	0.007	0.008
1994	Asahi	0.012	0.007
1995	Asahi	0.011	0.007
1996	Asahi	0.011	0.006
1997	Asahi	0.011	0.007
1998	Asahi	0.010	0.007
1999	Asahi	0.009	0.008

Note:
Bank of Tokyo and Daiwa bank are excepted for availability of data.