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A Contemporary Aspect of Japanese Commercial Banking: Expansion of Fee-Based Business and Its Impact on Management Stability

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A Contemporary Aspect of Japanese Commercial Banking: Expansion of Fee-Based Business and Its Impact on Management Stability*

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Abstract

Recently, Japanese commercial banks have been expanding their fee-based business. The present study conducts a panel-data analysis to investigate the impact of such a diversification of commercial banking on the variability of banks' profitability and the stability of their management. Our findings include the following. As in the literature regarding US commercial banks, a positive correlation was seen between Japanese commercial banks' fee business income and net interest income in the second half of the 1990s. Such a relationship led to an increase in the variability of their ROA but did not affect their management stability over that period. During the period from FY2001 to FY2005, by contrast, such a positive correlation was not clearly observed. Reflecting this change, the fee business expansion did not increase the variability of their ROA in recent years. Moreover, it contributed to an enhancement in their management stability through increasing net profits. These findings suggest that if changes in the Japanese financial environment or other factors restore the positive correlation between the two types of incomes, the variability of Japanese commercial banks' ROA will increase. Whether this will lead to decreasing their management stability depends on to what degree they can enhance ROA due to increases in fee business income, and on how they use the increased income in the context of capital adequacy management. It is of note whether Japanese commercial banks' expanding the fee business contributes to securing the stability of their management without excessively increasing the variability of their profitability.

Keywords: Japanese commercial banks; diversification; fee-based income.

JEL Classification Code: G21

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1. Introduction

Japanese commercial banks have expanded their fee-based business in recent years. On a period-average basis, the amount of net fees and commissions (fees and commissions gained less fees and commissions paid) acquired by all banks nationwide was 1.67 trillion yen, 1.98 trillion yen and 2.14 trillion yen for the periods from FY1991 – FY1995, FY1996 – FY2000, and FY2001 – FY2005, respectively.[1] In particular, the fee business income set a record of 2.68 trillion yen in FY2005. The objective of this paper is to investigate the impact of Japanese commercial banks' expanding their fee-based business on the variability of their profitability and the stability of their management.[2] Specifically, an attempt is made to achieve this objective. It focuses on the correlation in percentage change between profits accruing from such activities and those accruing from traditional lending business, and conducts a panel-data analysis.

In the eyes of companies and households, Japanese commercial banks' expanding their fee-based business has likely been seen as an effort to satisfy a range of client needs. From the banks' viewpoint, the new business may be viewed as a new way of making profits. In particular, when ROA (return on assets), which represents the efficiency of asset utilization, is used as a reference criterion for profitability, an increase in profits accruing from the fee-based business will, by definition, push up their profitability because asset building is rarely required in the business.[3] Such an increase may also have helped Japanese commercial banks dispose of non-performing loans, which were the most important business challenge facing them.

Views on the nature of the fluctuations in banks' fee-based business fall into two camps: one is that the performance of banks' fee-based business is closely related to the change in economic climate, and the other is that the business should be a stable source of

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[1] The inflation rates (general CPI excluding fresh food) during this period were: 1.01%, 0.23% and –0.42% for the periods from FY1991 to FY1995, from FY1996 to FY2000, and from FY2001 to FY2005, respectively (average for the period).

[2] As referred to hereinafter, this paper limits the scope of analysis to the City and Regional Banks, which shall be referred to as "commercial banks" collectively. The definition of the City and Regional Banks is provided at page 6.

[3] As a matter of course, offering fee-based business services also requires bearing the costs involved in providing personnel and maintaining office space. Provided the profit posted from the fee-based business remains positive after such costs are deducted, the fee-based business will improve ROA.

profits and play a role in mitigating profit fluctuations for banks.[4] This view is based on a standpoint in which a bank's income is seen as a composite of a number of business lines with different "risk – return" relationships. Here, it is implicitly assumed that fee business income is more stable than other types of income, and that it is uncorrelated or negatively correlated with them.

However, whether a bank's management stability is improved by the expansion of fee-based business depends on which effect is larger: the effect of improving ROA and thereby potentially leading to an increase in own capital, or the effect of enhancing the variability of ROA. Suppose that there is a positive correlation between fee business income and traditional loan business income; the expansion of fee-based business by a bank will increase the variability of its ROA. If, at the same time, the bank's own capital is pushed up sufficiently thanks to the increased fee business income, the variability increase in profitability will not necessarily lead to a deterioration of its management stability.

In this regard, the literature regarding US commercial banks, such as De Young and Roland (1999) and Stiroh (2004), show that (1) fee business income has a positive correlation with interest income; (2) an expansion of fee-based business increases the variability of banks' profitability; and, (3) the increased variability leads to an increase in banks' default probability. De Young and Roland (1999) use data from US commercial banks for the period from 1988 to 1995, and find that the larger the banks' fee-based business, the greater the variability of their gross and net incomes. Also, Stiroh (2004) finds that based on data from commercial banks in the US for the period from 1978 to 2000, banks' interest and non-interest incomes generally change in a positively correlated manner. Moreover, he finds that: (1) although, among several kinds of fee business incomes, an increase in income from trust business decreases the variability of the growth rate of net profits, an expansion of other fee-based business (i.e., non-interest rate-based business, excluding businesses concerning trusts, trading and management of bank accounts) will increase it, and (2) an expansion of trust business contributes to reducing the probability of bank failure, while that of other fee-based business increases it.[5]

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[4] The present study and related literature mentioned below look into the impact of the expansion of fee-based business on bank management with a focus on the structure of banks' profit-making. Apart from such a viewpoint, it may be possible to focus on the operational or compliance risks associated with fee-based business. Such risks are beyond the scope of this study

[5] Graham and Hewitt (1993) broadly classify earlier studies of US commercial banks into two

To our knowledge, there is no literature that articulates whether the results of such analyses in the US can be applied to commercial banks in Japan. This article provides an empirical analysis of the expansion of the fee-based business by these banks and its impact on their management stability, and clarifies the similarities and differences between Japanese and US commercial banks. In doing so, we have the benefit of panel-data econometrics and control for heterogeneity among banks. Broadly speaking, the above-mentioned articles on US commercial banks rely on aggregate data from a number of banks. By allowing for heterogeneity among banks, we can expect to get more robust results. Furthermore, we investigate what changed the mode of correlation between percentage changes in fee business income and traditional loan business income.

This paper is structured as follows: Section 2 explains the methodology of our empirical analysis and gives a description of the data that we used. Section 3 provides an overview of the expansion of Japanese commercial banks' fee-based business, and reviews the mode of correlation in growth rate between their fee business income and net interest income. Section 4 examines a transition in the correlation in light of economic fluctuations and the financial environment in recent years. Section 5 provides a panel data analysis and examines the impact of Japanese commercial banks' expanding the fee-based business on their management stability. Section 6 summarizes this paper and discusses implications to be drawn from the results of a series of empirical analyses.

We introduce a summary of the results from our empirical analysis and its associated implications:

(1) Japanese commercial banks began to expand their fee-based business from the second half of the 1990s and the pace has accelerated from FY2001.

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categories: (1) studies that analyze the impact of fee-based business already offered; and (2) studies that analyze the potential effects if financial business activities not currently permitted are allowed to be offered by the commercial banks. In addition to De Young and Roland (1999) and Stiroh (2004), Boyd and Graham (1986) report that an analysis of data from the Bank Holding Companies in the US from 1971 to 1983 shows no correlation between the proportion of non-banking assets to their asset portfolios and their probability of failure. Also, Wall (1987) analyzes accounting data from the Financial Holding Companies in the US (1976－1984) and reports that the probability of failure for the Financial Holding Companies as a whole is unchanged or decreases only slightly with increased contribution to consolidated income by the affiliate non-bank financial institutions. Kwan and Laderman (1999) analyze the correlation between the profitability of the banking industry and that of other financial industries, and argue that banks can achieve a more favorable "risk－return" relationship by engaging in additional financial services.

(2) During the second half of the 1990s, there was a positive correlation between Japanese commercial banks' fee business income and net interest income. The prime causative factor is considered to be economic fluctuations. That is, an economic boom will raise both incomes at the same time, while an economic recession will depress them in parallel.

(3) However, the positive correlation weakened in and after FY2001. While profits accruing from fee-based business showed a significant positive rate of growth over most time periods, net interest income showed a modest negative growth rate. The background to such changes is explained below. As for fee business income, sales of investment trusts and insurance policies have grown rapidly, thanks to not only progress in the deregulation of banks' fee-based business, but also to the upturn in financial market conditions in reflection of the recent economic recovery for a couple of years. On the other hand, net interest income was subject to the following influences. Even during the economic recovery phase, interest rates have stabilized at a low level and lending margins decreased under the zero-interest rate and quantitative easing policies. In addition, companies have attempted to decrease their interest-bearing liabilities in order to improve their financial strength, and the amount of loans issued has thereby also declined.

(4) In the second half of the 1990s, the positive correlation in growth rate between fee business income and traditional loan business income increased the variability of banks' ROA. However, because increased fee business income raised the level of ROA, it is not necessarily appropriate to state that the management stability of the banks deteriorated as a result of the expansion of fee-based business.

(5) As the positive correlation mentioned above has weakened since FY2001, the variability of banks' profitability has not increased. Instead, even in circumstances marked by accelerated disposal of non-performing loans, increased income from the rapid expansion of fee-based business may possibly have contributed to maintaining banks' management stability by halting the decline in net profits and supporting the reinforcement of own capital.

(6) Going forward, there is a possibility that fee business income and traditional loan business income will move in a positively correlated way again; this will help to create a situation where the variability of banks' profitability is likely to increase. In other words, bank loans, which have continued to decrease over the past few years, are expected to fluctuate along with the cyclical changes in the economy. In

addition, once the temporary rapid expansion brought about by deregulation ends, it is still possible that banks' fee-based business will be significantly affected by business cycles.

(7) Nevertheless, Japanese commercial banks' expanding their fee-based business may increase the level of their profitability over a certain period and enable them to reinforce their own capital, in the situation where the financial system structurally changes and they make progress in providing different kinds of financial services. From this point forward, we need to continue monitoring increases in the variety of fee-based business services offered by these banks and to assess how the increased variety affects their management stability.

2. Framework and Data for Empirical Analysis

2.1 Framework of the Empirical Analysis

We conduct an empirical analysis in accordance with the three steps described below. The first step is to carry out a preliminary consideration. In this step, a focus is placed on changes in the proportion of fee business income to total gross profits, with an aim of quantitatively illustrating the expansion of Japanese commercial banks' fee-based business. Then, we calculate the correlation coefficient with respect to the real growth rates of fee business income and net interest income in order to examine how the two types of incomes have changed. If a "positive" correlation is found between the two, then the possibility emerges that an increase in fee business income "increases" the variability of banks' profitability as measured by ROA.

The second step is to specify a determinant of the mode of correlation in growth rate between fee business income and traditional loan business income by articulating their changes in relation to the recent economic climate and monetary policies in Japan.

The third step is to empirically examine the impact of Japanese commercial banks' fee business expansion on the variability of their ROA as well as on their management stability, with the help of panel data econometrics. As described in the last section, it is necessary to weigh the effect that boosts the level of banks' ROA against the effect that raises its variability, in order to evaluate the impact fairly.

2.2 Data

The data used in the first and third steps are financial indicators of Japanese commercial banks on an unconsolidated basis, and both domestic and foreign branches are covered. These data are obtained from financial statements and preliminary accounts, or *Kessan Tanshin*, published by individual banks. The second step uses, in addition to these financial indicators, macroeconomic data and data obtained from a questionnaire survey conducted by the Financial Systems and Bank Examination Department, the Bank of Japan.

The sample includes 70 commercial banks in total: 6 City Banks that are larger-sized commercial banks operating in major cities across the country, and 64 banks that are smaller-sized commercial banks belonging to the Regional Banks Association of Japan (hereinafter "Regional Banks"). Neither commercial banks belonging to the Second Association of Regional Banks (hereinafter "Regional Banks II") nor trust banks are

included in the sample.[6] The data frequency is either annual or semi-annual; the appropriate frequency is used for the purpose of the analysis.

In addition, the data have been adjusted for mergers by tracing the history of existing banks. That is to say, if two or more banks merge into a single organization, the data of the merged banks prior to the merger are added together in order to ensure data consistency. For example, the Bank of Tokyo Mitsubishi UFJ, which was created in FY2005, is considered as a single bank over the analysis period. Also, in a case where several banks consolidated business to form a number of organizations, the aggregate data for the merged banks are used for the period before consolidation and the figures from the newly formed banks are aggregated for the period after consolidation. To cite one case, in FY 2002, the Dai-Ichi Kangyo Bank, Fuji Bank and the Industrial Bank of Japan consolidated their management and established Mizuho Bank and Mizuho Corporate Bank. Given this consolidation, the figures of these three banks are aggregated for the period before the consolidation and the figures of the two new banks are combined after the consolidation. Also, for considerations based on aggregated values, the Hokkaido Takushoku Bank, which was a City Bank failing in November 1997, is also included in the sample.

[6] The Regional Banks II are not included in the sample. They have little presence in the fee-based business provided by commercial banks. For example, in FY2005, the share of the total net fees and commissions held by the Regional Banks II was only 5.1% in terms of all banks nationwide, excluding trust banks.

3. Preliminary Consideration

3.1 Expansion of Fee-based Business

To capture the expansion of fee-based business by Japanese commercial banks, it is first confirmed that their gross profits can be attributed to three types of incomes from the traditional loan business (net interest income), the fee-based business (net fees and commissions) and market investment activities (profits from market investments). Based on this, their gross profits are decomposed as follows:

Gross profits = net interest income + net fees and commissions
+ profits from market investments

Here;

Net interest income = interest income[7] – cost to raise funds

Net fees and commissions = fees and commissions gained
– fees and commissions paid

Profits from market investments = (trading income – trading expenses)
+ (other operating income – other operating cost)
+ balance of three stocks-related accounts

The above-defined gross profit is equivalent to the "gross operating profit," which is a typical indicator of a bank's income, plus the balance of three stocks-related accounts minus deemed funding costs on money held in trust, or *Kinsen no Shintaku-Unyo Miai Hiyo*.

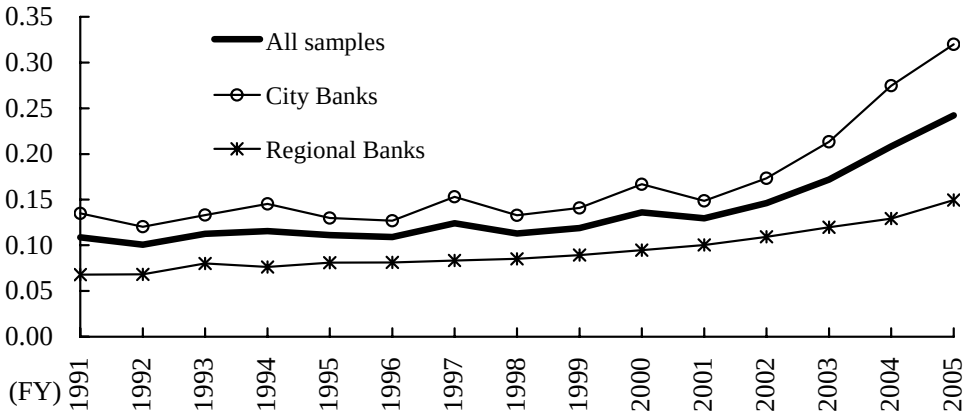
The size of a bank's fee-based business is measured by the proportion of net fees and commissions to gross profits (hereinafter T). In order to control for fluctuations in gross profits caused by volatile profits accruing from market investments, the "T/S ratio" is of note. It is an indicator that T is divided by S, the proportion of net interest income to gross profits.

Chart 1 plots three T/S ratios on an annual basis for all samples, the City Banks, and the Regional Banks, and shows that the T/S ratio for all sample banks remained at a level

[7] Interest income does not include capital gains from investments in securities but includes income gains.

slightly higher than 0.10 in the first half of the 1990s and then turned upwards in the second half of the same period. This trend is seen more clearly from FY2001. By type of bank, the T/S ratio for the City Banks was always higher than the ratio for all samples, also showing steeper growth after FY2001. In contrast, the T/S ratio for the Regional Banks remained lower than the ratio for all samples, showing slower growth from FY2001.

(Chart 1) T/S Ratios



Note: Hokkaido Takushoku Bank is included in FY1991- FY1997.

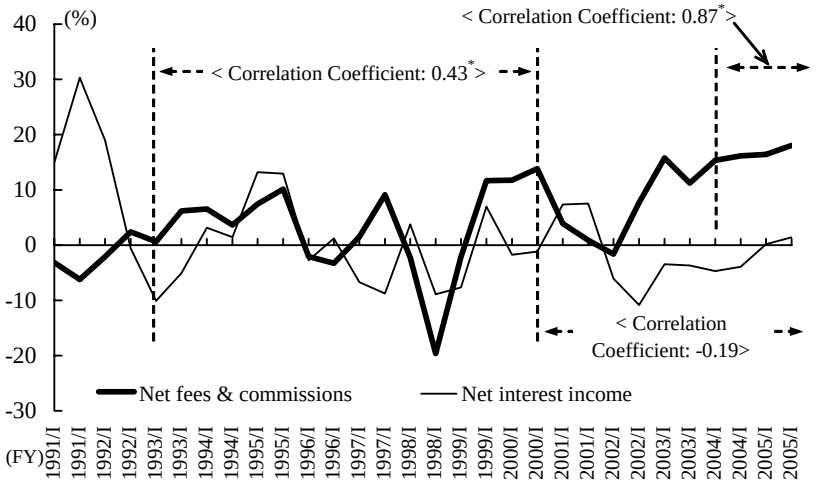
Thus, Japanese commercial banks started to expand their fee-based business from the second half of the 1990s, and the pace of expansion has accelerated since FY2001; this expansion has been driven by the City Banks. It should be mentioned that the encompassing financial liberalization, the so-called "Japanese Big Bang," started in 1998, and Japanese commercial banks were granted the freedom to sell investment trusts and insurance policies on a commission basis in 1998 and 2001, respectively.

3.2 Correlation between Fee Business Income and Net Interest Income

We examine the correlation in growth rate between Japanese commercial banks' fee business income and net interest income. By use of semi-annual time-series data of the aggregated values for all sample banks, Chart 2 plots the year-on-year real growth rates of net fees and commissions and net interest income. It shows that there is a certain positive correlation between these two types of incomes in the 1990s after FY1993 when setting interest rates of time deposits was liberalized. However, we can see the relationship started to weaken from FY2001, in particular during the period to

FY2003.[8]

(Chart 2) Annual Real Growth Rates of Net Fees and Commissions and Net Interest Income



Notes: 1. Both types of incomes are deflated by the General CPI excluding fresh food.
2. * denotes 10 percent significance.
Sources: Individual banks' financial statements; Ministry of Internal Affairs and Communications, "Consumer Price Index."

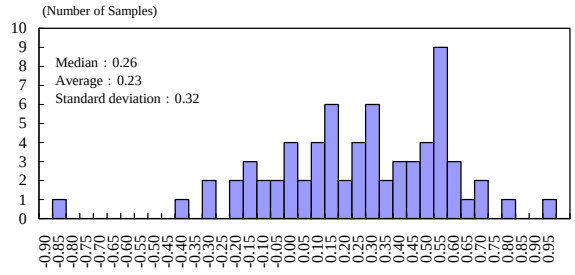
When simply calculating correlation coefficients based on aggregated values, neither the heterogeneity among samples that constantly exists in the sample period (hereinafter the "individual effect") nor shocks given to all samples in common at each time point (hereinafter "time effect") are taken into consideration. Therefore, first, in order to allow for the individual effect, time-series data of the real growth rates are prepared for both net fees and commissions and net interest income, and the correlation coefficients between the two growth rates are calculated for each sample bank. Hereinafter, this is referred to as a time-series correlation coefficient. The growth rate is used, in order to control on the income gaps among the banks attributable to the bank size itself. There are as many correlation coefficients as the number of sample banks, and a histogram can be created as in Chart 3. During the first half of the sample period (i.e., from FY1993 to FY2000), the distribution is biased toward a positive direction, while during the second half of the sample period (i.e., from FY2001 to FY2005), it is non-biased. That

[8] In addition, the correlation in the 1990s becomes insignificant if trust banks are included. This is in part because commissions on trust accounts, which account for a large percentage of the fees and commissions gained by trust banks, are weakly correlated with business cycles and their fluctuations are small over time. This is consistent with Stiroh (2004)'s finding regarding the US banks: the trust business is seen to reduce the variability of the net profit growth rate. Therefore, it is possible that the expansion of the trust business may reduce the variability of profitability in Japan as well.

is to say, although in the 1990s (from FY1993 in particular), more banks had a positive correlation in growth rate between net fees and commissions and net interest income, this tendency was not observed in and after FY2001.

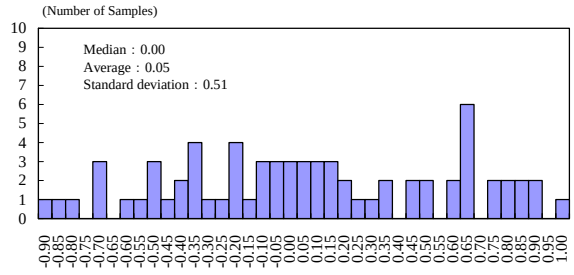
(Chart 3) Histogram of "Time-Series Correlation Coefficients"

<FY1993 – FY2000>



Notes: 1. The data frequency is annual.
2. Deflated by General CPI excluding fresh food.

<FY2001 – FY2005>



Notes: 1. The data frequency is annual.
2. Deflated by General CPI excluding fresh food.

Next, in order to take the time effect into consideration, the annual data from FY1991 to FY2005 are used to calculate the correlation coefficients after pooling the real growth rates of net fees and commissions and net interest income for all sample banks at each time point. Hereinafter, this correlation coefficient is referred to as a cross-sectional correlation coefficient. There are as many cross-sectional correlation coefficients as there are time points. Then, the period average value is calculated for the following three periods: the first and second half of the 1990s and the period from FY2001. Chart 4 tabulates the cross-sectional correlation coefficients and shows that the value increased from almost zero to 0.31 in the second half of the 1990s, and then it returned to almost zero during the period after FY2001.

(Chart 4) Cross-Sectional Correlation Coefficients by Period / Bank Type

（Period Average）

FY	1991-1995	1996-2000	2001-2005
All samples (70 banks)	0.03	0.31**	0.02
City Banks （6 banks）	-0.05	0.39	0.16
Regional Banks（64 banks）	-0.05	0.18	0.10

Notes: 1. The data frequency is annual.
2. Deflated by General CPI excluding fresh food.
3. ** denotes 5 percent significance.

In the end, on an aggregated value basis, there was a positive correlation in growth rate

between Japanese commercial banks' net fees and commissions and net interest income in the second half of the 1990s. But this positive correlation has weakened since FY2001. However, when the individual effects are allowed for, the correlation between the two types of incomes varies across individual banks, and it is not necessarily true to say that the two are uncorrelated for all of the banks. Paying attention to the distinction between the City and Regional Banks, a positive correlation formed in growth rate between the two types of incomes, mainly in the City Banks, during the second half of the 1990s.

3.3 Summing Up

Japanese commercial banks' fee-based business burgeoned from the second half of the 1990s, especially in the City Banks. Also, over the same period, a positive correlation formed in growth rate between their fee business income and traditional loan business income; this correlation was led by the City Banks. However, the positive correlation weakened in and after FY2001. Based on these results, the following two points should be addressed:

The first is whether or not the recent expansion of fee-based business by Japanese commercial banks has increased the variability of their profitability. During the second half of the 1990s in particular, when an obvious positive correlation in growth rate was observed between fee business income and traditional loan business income, the expansion of fee-based business might have increased the variability. Section 5 addresses this point with the help of panel-data econometrics.

The second is what caused the positive correlation to weaken. In this regard, Section 4 examines the change in the correlation between the two types of incomes, connecting it with changes in the Japanese economic environment, such as a prolonged highly accommodative financial environment and economic fluctuations.

4. Examination of the Recent Weakening of Positive Correlation between Incomes in the Fee and Loan Businesses

4.1 Approach

As shown in Chart 2, net fees and commissions and net interest income had a positive correlation in terms of their real growth rates in the 1990s on the basis of aggregated data, but the relationship weakened after FY2001. This section focuses on this change and attempts to elucidate its cause. To be more concrete, the transition in correlation is examined in relation to changes in economic conditions and the interest rate environment: first for net fees and commissions, and then for net interest income. This section relies on the aggregated values of all 70 sample banks.

4.2 Trends in Net Fees and Commissions

Chart 5 tabulates the real growth rate of net fees and commissions from FY2001 to FY2005. It shows that fee business income started to increase rapidly from FY2003. In addition, by classifying this income into two categories, "net fees and commissions on exchanges" and "net fees and commissions from other services," it can be seen that the latter's rapid growth accounted for most of the overall growth.

(Chart 5) Annual Real Growth Rates of Net Fees and Commissions

(%)

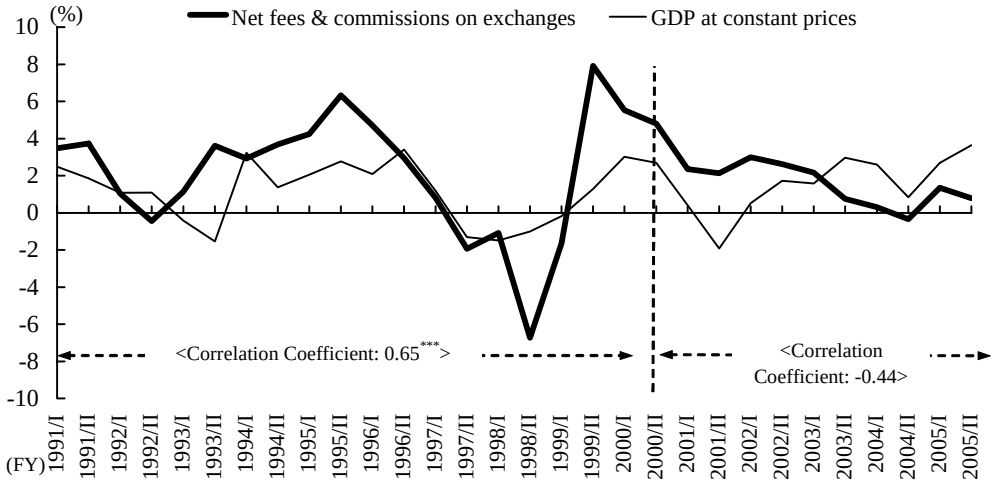
FY	2001	2002	2003	2004	2005
Net fees and commissions	2.2	3.3	13.3	16.0	17.2
Net fees and commissions on exchanges	2.1	3.0	1.4	0.2	1.0
Net fees and commissions from other service	2.3	3.6	24.8	28.4	27.2

Note: Deflated by General CPI excluding fresh food.
Source: Individual banks' financial statements.

Chart 6 plots the real growth rates of "net fees and commissions on exchanges" and GDP. Looking at it, the two rates had a tendency to move in the same direction until FY2000. In fact, the correlation coefficient between the two is calculated to be 0.65, which is not zero at a significance level of 1%. As described in detail later, given that the favorable economic situation enhanced the activity of fund settlements, such a positive correlation seems natural. In contrast, during the period from FY2001 to FY2005, the correlation coefficient is -0.44. This negative value is a level which is not different from zero even at a significance level of 10%. Accordingly, although "net

fees and commissions on exchanges" moved in the same direction as the economic conditions from FY1991 to FY2000, they lost an obvious correlation after FY2001.

(Chart 6) Annual Real Growth Rates of Net Fees and Commissions on Exchanges and GDP



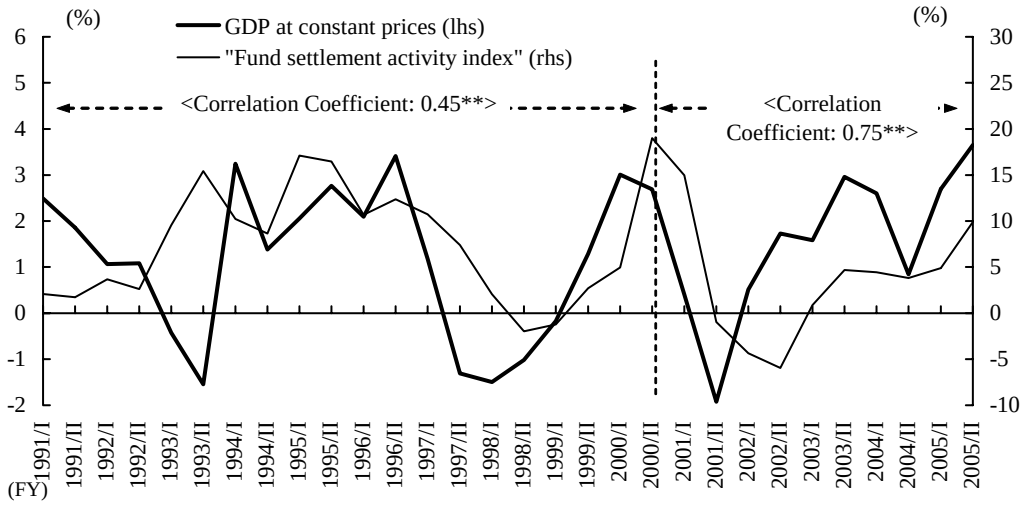
Notes: 1.Net fees & commissions on exchanges are deflated by the General CPI excluding fresh food.
2. GDP in FY1991 - FY1994 is fixed-based 93SNA, and GDP in FY1994 - FY2005 is chained-based 93SNA.
3. *** denotes 1 percent significance.
Sources: Individual banks' financial statements; Cabinet Office, "National Accounts;" Ministry of Internal Affairs and Communications, "Consumer Price Index."

To delve into this change, Chart 7 plots year-on-year percentage changes in both a proxy variable for the degree of the activity of fund settlements and GDP at constant prices. The proxy variable is calculated as follows. The first is to sum up six pieces of monthly data to make semi-annual time-series data with respect to the following two factors: (1) the monthly amount for fund transactions executed in the Japanese domestic exchange settlement system, the so-called *Zengin Shisutemu:* and (2) the monthly number of fund settlements in the system. It should be mentioned that the above (1) is deflated with the general CPI excluding fresh food. The second step is to index time-series data of the two as one in the first half of FY1990. The third step is to multiply one index with another to make a single indicator. This indicator is called the "fund settlement activity index" hereinafter.[9] The last step is to calculate annual rates of change in the fund settlement activity index. Looking at Chart 7, the timing

[9] If the total number of settlement transactions increases as a result of increases in small amount settlement transactions, the total amount settled may not always increase. Also, even if the total amount settled increases because the number of large amount settlement transactions increases, the number of settlement transactions may not always increase. The fund settlement activity index takes both factors, namely, the number of transactions and the amount, into consideration.

correlation coefficient, which is positive and significantly different from zero, suggests that the percentage change in the real GDP at a certain point of time moved in the same direction as the percentage change in the fund settlement activity index at the following point of time between FY1991 and FY2005.[10]

(Chart 7) Economic Climate and Fund Settlement Activities

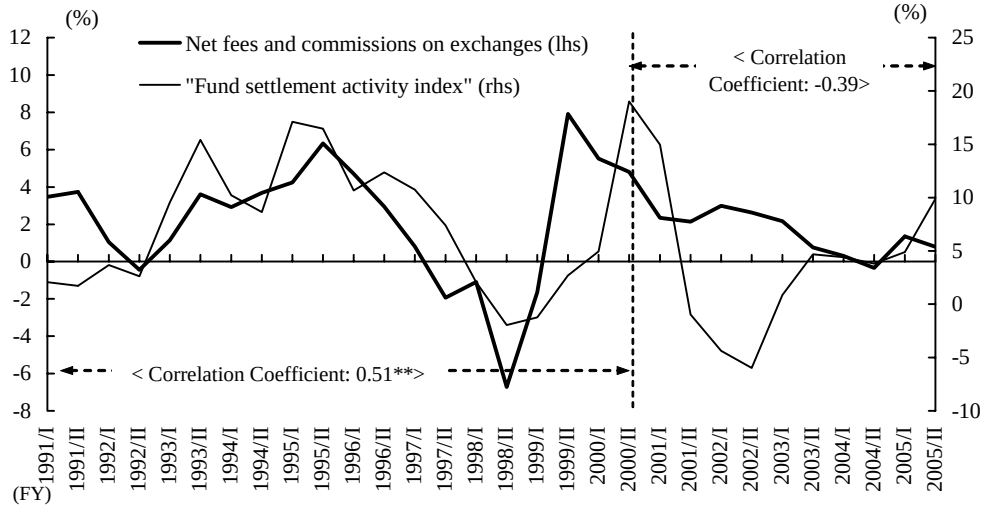


Notes: 1. See the text for the definition of "fund settlement activity index."
2. GDP in FY1991 - FY1994 is fixed-based 93SNA, and GDP in FY1994 - FY2005 is chained-based 93SNA.
3. Correlation coefficient is calculated by use of GDP at constant prices at a point of time and "fund settlement activity index" at a next point of time.
4. ** denotes 5 percent significance.
Sources: Cabinet Office, "National Accounts;" Ministry of Internal Affairs and Communications,

In Chart 8, the percentage change in the fund settlement activity index and that in “net commission income for exchange business” are plotted. Looking at it, we can find a positive correlation for the two from FY1991 to FY2000 but no correlation during the period FY2001 to FY2005. By examining the latter period more closely, we can see that although fund settlements became more active, “net commission income for exchange business” was sluggish in the period from FY2003 to FY2005 in particular.

[10] Similarly, the timing correlation coefficient between the real percentage changes in net exchange income and GDP at constant prices is calculated as 0.42 (not zero at the 10% significance level) for the period from FY1991 to FY2000 and as -0.84 (not zero at the 1% significance level) for the period from FY2001 to FY2005. For this reason, as is the case with fund settlement activities, although net exchange income moved in the same direction as the business cycles during the first half of the sample period, we can see that the positive correlation was lost in the second half of the sample period.

(Chart 8) Annual Percentage Changes in Net Fees and Commissions on Exchanges and Fund Settlement Activities



Notes: 1. See the text for the definition of "fund settlement activity index."
2. ** denotes 5 percent significance.
Sources: Individual banks' financial statements; Ministry of Internal Affairs and Communications, "Consumer Price Index;" Bank of Japan, "Kessai Dôko."

For these reasons, we can see that during the period from FY2001 to FY2005, although fund settlement activity increased or decreased in line with the changing economic climate as it had done historically, net fees and commissions on exchanges grew at a sluggish pace in the business recovery / economic expansion phase from FY2002. This situation cannot occur without a decrease in the average commission rate charged on the number or amount of fund settlement transactions. In fact, over the past few years, a number of banks have offered their depositors a discount on their remittance charges that is dependent on the size of deposit balances or depositors' membership status.[11]

However, it is possible to speculate that once such remittance-charge-cutting competition terminates and the average commission rate stops falling, the growth rate of "net fees and commissions on exchanges" will also move in the same direction as changes in economic conditions.

[11] In addition to the traditional motivation to obtain more deposits as seed money to expand the loan business, Japanese commercial banks in recent years are more motivated to retain depositors as purchasers of fee-based business services (sales of investment trusts and insurance policies, as described later), and to reduce the liquidity risk by borrowing less-incoming-and-outgoing money from depositors. Which factor is the most important is beyond the scope of this study.

On the other hand, as has already been pointed out, "net fees and commissions from other services" have increased rapidly since FY2003, independent of small fluctuations in real GDP growth. In relation to this, the proportions of sales commissions for investment trusts and insurance policies to total fees and commissions gained are tabulated in Chart 9. Their shares in FY2005 were 13.7% and 8.8%, respectively. The chart also shows that from FY2001 to FY2005, sales commissions for investment trusts and insurance policies expanded by 10.6% and 8.3%, respectively. Moreover, in terms of the growth rate, we can see a rapid increase in the sales commissions for investment trusts and insurance policies (Chart 10). Lastly, these two account for 33.4% of "net fees and commissions from other services" in FY2005.[12]

(Chart 9) The Proportions of Sales Commissions for Investment Trusts and Insurance Policies to Total Fees and Commissions Gained

(%, %pt)

FY	2001	2002	2003	2004	2005	2001→2005
Investment Trusts	3.1	5.0	7.4	9.5	13.7	+10.6
Insurance Policies	0.5	2.2	5.8	8.7	8.8	+8.3

Note: The City and Regional Banks are included.
Source: Bank of Japan.

(Chart 10) Amount and Growth Rate of Sales Commissions for Investment Trusts and Insurance Policies

(million yen)

FY	Investment Trusts		Insurance Policies	
2001	33,872	NA	5,195	NA
2002	56,270	(66.1%)	25,047	(382.1%)
2003	94,547	(68.0%)	74,131	(196.0%)
2004	140,188	(48.3%)	128,561	(73.4%)
2005	237,139	(69.2%)	152,630	(18.7%)

Notes: 1. The City and Regional Banks are included.
2. Year-on-year percentage changes are in parentheses.
Source: Bank of Japan.

Sales commissions for investment trusts and insurance policies account for

[12] It is not possible to obtain the expenses incurred for sales of investment trusts and insurance policies. For this reason, the "net" sales commission income for investment trusts and insurance policies cannot be calculated. Therefore, the cited percentage of 35.4% is slightly higher than it would be in reality.

approximately one third of "net fees and commissions from other services," and showed quite high percentage increases. Therefore, the two must have served as a prime factor contributing to the rapid growth of "net fees and commissions from other services." The nature of these two financial products enables us to state that not only the effect of mitigated regulations, but also the underlying strength of future personal income (which started to develop during the economic recovery phase that occurred after the prolonged economic slump) and rising stock prices over the past several years contributed to increases in sales of these financial products.[13]

Thus, since the economic recovery starting in FY2002, commission income associated with exchange business saw sluggish growth but commission income not relating to exchange business increased significantly and the performance of net fees and commissions as a whole had a positive correlation with business cycles. In fact, the correlation coefficient in the real growth rate between the overall fee income and GDP calculated using semi-annual data is 0.74 for the period from FY2001 to FY2005, and this value is not zero at the 5% significance level.

4.3 Trends in Net Interest Income

As already pointed out, the positive correlation in real growth rate between net fees and commissions and net interest income weakened in and after FY2001. On the other hand, the real growth rate of net fees and commissions continued to have a positive correlation with that of GDP, even after FY2001. Therefore, a potential background factor contributing to the weakening of the positive correlation between the two types of incomes can be attributed to the weakening of the positive correlation in real growth rate between net interest income and GDP. In fact, this is supported by Chart 11 that plots their growth rates. That is to say, the correlation coefficient between the real growth rate of net interest income and that of GDP was 0.53 and -0.41 in the period from FY1993 to FY2000 and in the period from FY2001 to FY2005, respectively.[14]

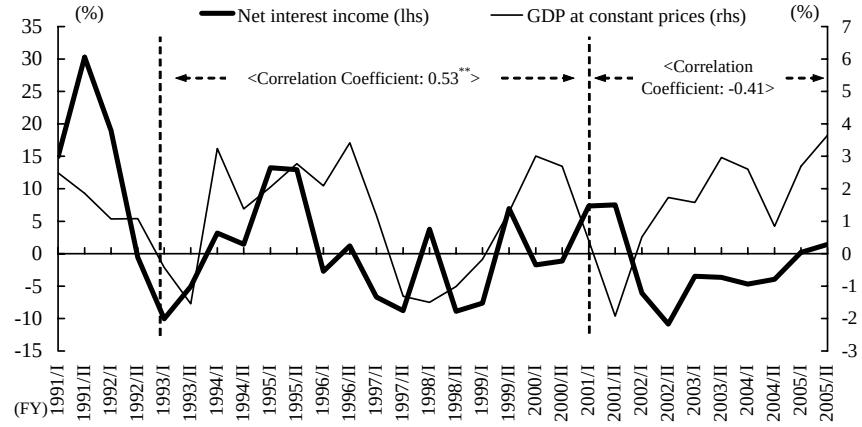
One factor responsible for such a weakening of the positive correlation would be changes in the financial environment. Even in the economic recovery phase that has occurred over the past few years, interest rates have stabilized at a lower level due to the

[13] Most of the insurance policies sold over the counter by the banks are savings-based and the amount payable for such insurance policies is influenced by financial asset prices in the market.

[14] Based on the data period used to calculate correlation coefficients, 0.53 is not statistically zero at the 5% significance level, while -0.41 does not differ from zero even at 10%.

zero interest rate and quantitative easing policies, and lending margins have decreased. In addition, as a result of efforts by companies to reduce their interest-bearing liabilities and to improve their financial strength, the balance of bank loans has continued its long-term decline, even when the economy started to recover after hitting the bottom at the outset of 2002.

(Chart 11) Annual Real Growth Rates of Net Interest Income and GDP



Notes: 1. Net interest income is deflated by the General CPI excluding fresh food.
2. GDP in FY1991 - FY1994 is fixed-based 93SNA, and GDP in FY1994 - FY2005 is chained-based 93SNA.
3. ** denotes 5 percent significance.
Sources: Individual banks' financial statements; Cabinet Office, "National Accounts;" Ministry of Internal Affairs and Communications, "Consumer Price Index."

In this regard, the likeliness that the balance of bank loans will fluctuate in line with business cycles seems to be increasing, insomuch as disposal of a large amount of non-performing loans or excessive indebtedness, which was the biggest issue for Japanese banks and firms until recently, have almost been accomplished. In the same vein, it also seems likely that the positive correlation in real growth rate between net interest income and GDP will start to emerge again.[15]

4.4 Summing Up

In the 1990s, from FY1993 onwards, when interest rates of time deposits were

[15] In fact, Figure 11 shows that the growth rate of net interest income and that of the GDP moved in the same direction from FY2005. However, it is too soon to state that this restored positive correlation will remain stable going forward for the following reasons. First, it is difficult to predict with certainty the future of competition among the banks, which would have a significant impact on the determination of lending margins. Also, in the banking business in Japan, it is becoming more common to sell and purchase loans in the secondary market, in addition to running the traditional loan business in which banks loans are extended and kept in loan portfolios. Thus, it is still unclear how such changes will influence banks' income per item or their ROA in the midst of economic fluctuations.

liberalized, a positive correlation in growth rate was observed between net fees and commissions and net interest income. During this period, since both growth rates had a positive correlation with real GDP growth, the upturn (downturn) of the economy should have increased (decreased) both net fees and commissions and net interest income.

However, from FY2001, whereas net fees and commissions, and commission income for non-exchange business in particular, increased under the auspices of the economic recovery and deregulation, net interest income lost its association with economic fluctuations due to the continued highly accommodative financial environment and companies' efforts to decrease their interest-bearing liabilities. As a result, from FY2001, the positive correlation in growth rate between net fees and commissions and net interest income has weakened.

5. Panel Data Analysis

5.1 Preliminary

In this section, a regression analysis using panel data is performed to answer the following two questions:

(1) Has the expansion of Japanese commercial banks' fee-based business increased the variability of their profitability?

(2) Has the expansion had an influence on their management stability?

Panel data used are on an annual basis and cover 70 Japanese commercial banks between FY1996 and FY2005. The data period reflects the validation result in Section 3, which indicated that Japanese commercial banks started to expand their fee-based business from the second half of the 1990s. It is divided into two further periods: the period "from FY1996 to FY2000" and that "from FY2001 to FY2005." As discussed in detail in the previous section, a positive correlation in growth rate between fee business income and traditional loan business income is observed on an aggregated value basis in the second half of the 1990s, but the correlation weakened after FY2001. The division of the sample period reflects this.

To conduct a regression analysis using panel data, there are two issues to be noted in the selection of the estimation model. The first issue is whether to add the individual effect and time effect dummies as explanatory variables. Here, the individual effect dummy is used to control for heterogeneity among sample banks. For example, if differences in the location of principal offices affect explanatory variables throughout the data period, such an effect should be controlled for by the individual effect dummy. A time dummy, on the other hand, controls on several shocks that impacted on all sample banks in common in a certain fiscal year. Such shocks potentially include macroeconomic and policy shocks. We need to select the most appropriate model from the following: a model that does not use any of these dummies as explanatory variables (hereinafter the "pooling model"), a model that adds the individual effect dummy only as an explanatory variable (hereinafter the "one-way model"), and a model that adds both dummies as explanatory variables (hereinafter the "two-way model").

Another issue is whether or not we admit a correlation between the individual effect dummy and other explanatory variables. We need to choose from a model that admits such a correlation (the fixed effect model) or one that does not admit it (the random

effect model).

Based on the two issues described above, five models can be considered. These include the pooling model, the one-way fixed effect model, the one-way random effect model, the two-way fixed effect model, and the two-way random effect model. We need to choose the most appropriate model from these options.

The model should be selected through the following process. First, we need to examine whether the one-way fixed effect model is more appropriate than the pooling model (Test I). We perform the F Test with the null hypothesis: a pooling model and the alternative hypothesis: one-way fixed effect model. If the *F*-statistic is large enough, the null hypothesis is rejected and thus the one-way fixed effect model is chosen.

Next, we examine whether the one-way fixed effect model is more appropriate than the two-way fixed effect model (Test II). We perform the F test with the null hypothesis: one-way fixed effect model and the alternative hypothesis: two-way fixed effect model. If the F-statistic is large enough, the null hypothesis is rejected, and thus the two-way fixed effect model is chosen.

Finally, if the one-way (or two-way) fixed effect model is chosen, we need to examine whether such a model is more suitable than the one-way (or two-way) random effect model (Test III). In order to meet this need, we perform the Hausman test with the null hypothesis: one-way (or two-way) random effect model and the alternative hypothesis: one-way (or two-way) fixed effect model. If the test statistic is small enough, the null hypothesis is not rejected, and so the one-way (or two-way) random effect model is chosen.

5.2 Expansion of Fee-based Business and Variability of Banks' Profitability

5.2.1 Analytic Procedure

First, an empirical analysis is performed following the two procedures described below in an attempt to answer the first question, "has the expansion of Japanese commercial banks' fee-based business increased the variability of their profitability?" First, we examine the extent to which the positive correlation in real growth rate between net fees and commissions and net interest income can explain the variability of gross profits. Second, we examine the relationship between the variability of "gross" profits and that

of profitability in relation to “net” profits using panel data analysis.

5.2.2 Approximation of “Covariant Effect”

Gross profits are the total of net fees and commissions, net interest income and profit from market investments. By definition, the variance of the percentage changes in gross profits is determined by (1) the proportions of the three types of profits to gross profits, (2) the variances of these profits’ growth rates, and (3) the scale of correlation coefficients among the three. Therefore, the values in each fiscal year for (1), and the variances and correlation coefficients calculated for two data periods for (2) and (3) can be used for calculating the variances of the percentage changes in gross profits in the two data periods (See Formula (1) hereinafter).

$$
\begin{aligned}
VAR\_GARARI_{i,\tau} = {} & (T_{i,t})^2 \times (VAR\_GEKIMU_{i,\tau}) \\
& + (S_{i,t})^2 \times (VAR\_GSHIKIN_{i,\tau}) \\
& + (M_{i,t})^2 \times (VAR\_GMARKET_{i,\tau}) \\
& + 2T_{i,t}S_{i,t} \times \sqrt{VAR\_GEKIMU_{i,\tau}} \times \sqrt{VAR\_GSHIKIN_{i,\tau}} \times \rho[GEKIMU, GSHIKIN]_{i,\tau} \\
& + 2S_{i,t}M_{i,t} \times \sqrt{VAR\_GSHIKIN_{i,\tau}} \times \sqrt{VAR\_GMARKET_{i,\tau}} \times \rho[GSHIKIN, GMARKET]_{i,\tau} \\
& + 2M_{i,t}T_{i,t} \times \sqrt{VAR\_GMARKET_{i,\tau}} \times \sqrt{VAR\_GEKIMU_{i,\tau}} \times \rho[GMARKET, GEKIMU]_{i,\tau}
\end{aligned}
$$

$$\cdots \quad (1)$$

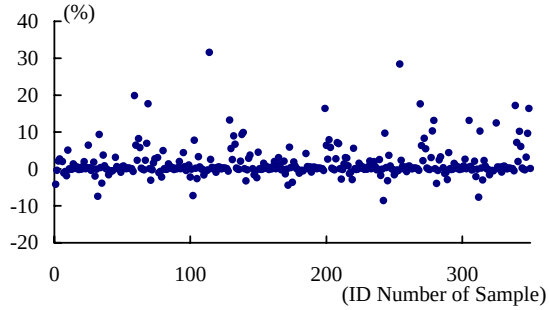
Here, VAR_X (X=*GARARI*,…,*GMARKET*) represents the variance of a variable X. And, $\rho[\cdot]$ is the correlation coefficient of the two variables in brackets. The suffix i represents the individual bank. The suffix τ is used to distinguish the first and second periods of data, and the suffix t represents each fiscal year during the data period. *GARARI*, *GEKIMU*, *GSHIKIN*, and *GMARKET* represent the year-on-year percentage changes in gross profits, net fees and commissions, net interest income and profit from market investments, respectively. All of these are deflated with the general CPI (excluding fresh food). *T*, *S* and *M* represent the proportions of net fees and commissions, net interest income and profit from market investments to gross profits, respectively.

By dividing the fourth term of the right hand side of the formula (1) above by the left hand side, we can see the extent to which the positive correlation in growth between net fees and commissions and net interest income can explain the variability of gross profits *in toto*. Chart 12 plots the figures for this proportion (hereinafter, the covariant effect

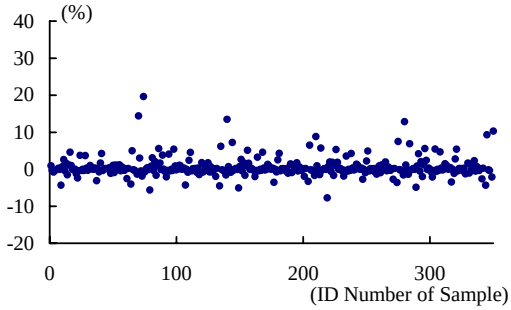
of “fee & loan businesses”) per fiscal year for each sample bank separately for the first and second half of the data period.

(Chart 12) Covariant Effects of “Fee & Lending Businesses”

<First Half of Data Period: FY1996-FY2000>



<Second Half of Data Period: FY2001-FY2005>



From Chart 12, we can confirm that the covariant effect of “fee & loan businesses” can be positive, reflecting the positive correlation between net fees and commissions and net interest income. Also, there are more samples where the correlation is in negative territory in the second half of the data period compared to the first half (of 350 samples, 125 and 176 for the first and the second half, respectively, are in negative territory). This is consistent with the result from Section 3, in which a preliminary consideration was carried out using an aggregated value and revealed a weakening of the correlation between the two kinds of incomes. Moreover, in both periods, sample banks varied considerably in terms of the covariant effect of “fee & loan businesses.” For this reason, it seems reasonable to perform a quantitative analysis taking the heterogeneity of each sample into consideration.

Thus, when there is a stronger positive correlation in growth rate between net fees and commissions and net interest income, the variability of gross profits should be larger. With the help of panel-data econometrics, the next subsection examines whether higher variability of “gross” profits increases the variability of profitability in relation to “net” profits.

5.2.3 ROA Variation Model: Description of Model

Gross profit minus expenses equals net profit. The return on assets (ROA), which can be obtained by dividing net profits by total assets, is a common indicator of profitability in terms of the efficiency of asset utilization. By definition, the variability of ROA is

influenced by the variability of gross profits, expenses, and total assets. The impact of Japanese commercial banks' expanding their fee business on the variability of their gross profits has already been verified in the previous subsection. Therefore, by examining the relationship between the variability of gross profits and that of ROA, we can understand the impact of their fee business expansion on the variability of ROA. Thus, the following regression equation (2) is estimated:

$$\begin{aligned} VOLA\_ROA_{i,t} = {} & c + \eta_i + D_t + \beta_{GARARI\,t} VOLA\_GARARI_{i,t} \\ & + \beta_{GCC\,t} VOLA\_GCC_{i,t} \\ & + \beta_{KEIHI\,t} VOLA\_GKEIHI_{i,t} \qquad \cdots \quad (2) \\ & + \beta_{GA_t} VOLA\_GASSET_{i,t} \\ & + u_{i,t} \end{aligned}$$

The suffix i (=1, 2, 3 … 70) represents the sample bank and the suffix t (=1996, … , 2000 or 2001,… , 2005) represents the fiscal year. C is the constant term, η_i is the individual effect, and D_t is the time dummy. β_k is the regression coefficient for the relevant explanatory variable ($k = GARARI_t, \ldots, GASSET_t$). $u_{i,t}$ is the error term based on a standard assumption. In addition, as described above, whether η_i or D_t is employed as an explanatory variable depends on the results of the model selection test. *VOLA* is the standard deviation of the variable following it. The standard deviation is calculated from five pieces of data from the relevant fiscal year and the four years preceding it.

To explain the individual variables and their functions, first, *ROA* is the return on total assets, which is equal to the current net profit before tax divided by the average balance of total assets.[16] *GARARI* is the real percentage change in gross profits from the previous year.[17] *GCC* is the real percentage change in credit-related expenses from the previous year. *GKEIHI* is the real percentage change in general and administrative expenses from the previous year. These three variables collectively control for net profit, which is the numerator of the formula used for calculating ROA. On the other hand, *GASSET* is the real percentage change in the average balance of total assets from the previous year and controls for the denominator of the formula used for calculating

[16] The definition and symbols of indices referred to in this section are listed in Appendix I, which also summarizes their key statistics.

[17] The term "real" means that the value has been deflated by the General CPI (excluding fresh food).

ROA. By estimating the value of β_{GARARI}, which is the regression coefficient of *GARARI*, we can see the extent to which a 1% increase in the variability of gross profits increases the variability of ROA.

Chart 13 summarizes the results of the model selection relating to η_i and D_t, and shows that the two-way random effect model and the one-way random effect model are chosen for the first and the second half of the data period, respectively.

(Chart 13) Results of Model Selection Test I

<Data period: FY1996 – FY2000>

	Null hypothesis	Alternative hypothesis	Test Statistics	p-value
Test I	Pooling model	One-way fixed effect model	F(4, 279): 126.06	***
Test II	One-way fixed effect model	Two-way fixed effect model	F(4, 275): 35.46	***
Test III	Two-way random effect model	Two-way fixed effect model	Hausman: 1.37	

<Data period: FY2001 – FY2005>

	Null hypothesis	Alternative hypothesis	Test Statistics	p-value
Test I	Pooling model	One-way fixed effect model	F(4, 279): 196.08	***
Test II	One-way fixed effect model	Two-way fixed effect model	F(4, 275): 0.95	
Test III	One-way random effect model	One-way fixed effect model	Hausman: 2.87	

Note: ***, **, and * denote 1, 5, and 10 percent significance, respectively.

5.2.4 Estimation Results: ROA Variation Model

Chart 14 summarizes the estimation results. The regression coefficient of the variability of the growth rate of gross profits (*VOLA_GARARI*) is a positive value that is significantly different from zero in the first half of the data period, whilst it is not significantly different from zero in the second half of the period.

(Chart 14) Estimation Result I

Explained variable: *VOLA_ROA*						
	Data period: FY1996 – FY2000 Two-way random effect model (N: 70, T: 5) $\overline{R}^2$: 0.103			Data period: FY2001 – FY2005 One-way random effect model (N: 70, T: 5) $\overline{R}^2$: 0.346		
	Coefficient	t-ratio	p-value	Coefficient	t-ratio	p-value
VOLA_GARARI	0.009	9.404	***	0.000	0.804	
VOLA_GCC	0.000	1.803	*	0.003	15.786	***
VOLA_GKEIHI	-0.018	-1.927	*	0.006	-0.558	
VOLA_GASSET	0.014	1.411		-0.007	-0.654	
Significant time dummies						
D_{1996}	-0.003	-10.391	***			
D_{1997}	-0.002	-8.198	***			
D_{1998}	-0.001	-3.061	***			
D_{1999}	-0.001	-3.056	***			
D_{2000}	0.019	8.884	***			

Note: ***, **, and * denote 1, 5, and 10 percent significance, respectively.

In regard to the regression coefficients of the other explanatory variables, for the first half of the data period, the regression coefficients for the variability of changes in general and administrative expenses (*VOLA_GKEIHI*) as well as for the time dummies are statistically significant for all fiscal years. For the second half of the data period, the regression coefficient for the change in the variability of credit-related expenses (*VOLA_GCC*) is positive and statistically significant.

Based on the estimation results described above, the effect of Japanese commercial banks' expanding their fee-based business on the variability of their profitability is demonstrated to be different between the second half of the 1990s and the period after FY 2001. In the second half of the 1990s, there is a positive correlation in growth rate between net fees and commissions and net interest income in most cases, which resulted in increases in the variability of changes in gross profits. And, on average for the sample banks as a whole, this effect caused increases in the variability of ROA. Seen in this light, in the second half of the 1990s, the expansion of Japanese commercial banks' fee-based business increased the variability of their profitability. However, since FY2001, the positive correlation between the two types of incomes has weakened to almost zero and it is not appropriate to say that the fee business expansion increased the variability of their profitability during this time period. Instead, it was credit-related expenses that increased rapidly due to the accelerated disposal of non-performing loans, and it was this which boosted the variability of their profitability.

5.3 Expansion of Fee-based Business and Stability of Bank Management

5.3.1 Model

Next, we answer the other question: “Has the expansion of Japanese commercial banks’ fee-based business had an influence on their management stability?” So far, the analysis has shown that although increases in Japanese commercial banks’ net fees and commissions resulted in increasing the variability of ROA in the first half of the data period, this relationship was not established in the second half of the period. In addition, since the fee-based business rarely involves asset building, increases in net fees and commissions boost ROA. Based on these facts, in order to understand how the expansion of Japanese commercial banks’ fee-based business influenced their management stability, we need to perform estimations using the following regression equation:

$$\begin{aligned} Z_{i,t} &= c + \eta_i + D_t + \beta_{GARARI\,t} VOLA\_GARARI_{i,t} + \beta_{GCC\,t} VOLA\_GCC_{i,t} \\ &\quad + \beta_{KEIHI\,t} VOLA\_GKEIHI_{i,t} + \beta_{GA\,t} VOLA\_GASSET_{i,t} \\ &\quad + \beta_{AROA\,t} AROA_{i,t} + \beta_{ACOA\,t} ACOA_{i,t} + u_{i,t} \end{aligned} \quad \cdots(3)$$

The suffix i represents the sample bank and the suffix t (=1996, … , 2000; or 2001,… , 2005) represents the fiscal year. c is the constant term, η_i is the individual effect of the individual sample bank and D_t is a time dummy. β_k is the regression coefficient of the relevant explanatory variable ($k = GARARI,\ldots,ACOA$). $u_{i,t}$ is the error term based on a standard assumption. Whether η_i or D_t is inserted or not depends on the results of model selection.

Z is the Z score which is a proxy variable for the stability of management, which is an indicator calculated from the formula below.

$$\frac{AROA + ACOA}{VOLA\_ROA}$$

$AROA$ and $ACOA$ are the average values of ROA and COA (capital adequacy ratio) for the period calculated using data from the current fiscal year and the four years preceding it, respectively. $VOLA\_ROA$ is the standard deviation of ROA calculated using data from the current fiscal year and the four years preceding it. The Z score measures, on the basis of the standard deviation of profitability, the size of losses that deplete

expected income and equity capital and lead to a company failing; the larger the value of the Z score, the higher the management stability (Lown, Osler, Strahan, and Sufi 2000). Some of the earlier studies that examined the subject of this paper also used this indicator (Stiroh 2004, etc).

The Z score is composed of *AROA*, *ACOA*, and *VOLA_ROA*. This means that when evaluating the impact of Japanese commercial banks' expanding their fee-based business on their management stability, it is necessary to take into consideration not only its impact on the variability of their profitability but also the level of their profitability and the adequacy of own capital.

Based on the definition of Z score, *Z* can be regressed to three variables, which are *AROA*, *ACOA* and *VOLA_ROA*. In addition, based on the concept of the regression equation (2) above, instead of *VOLA_ROA*, *VOLA_GARARI*, *VOLA_GCC*, *VOLA_GKEIHI* or *VOLA_GASSET* can be used as explanatory variables.

The sign and statistical significance of the regression coefficient of *VOLA_GARARI* are of paramount importance in this analysis. If it is a negative value that is significantly different from zero, it can be said that increased variability of gross profits tended to decrease the stability of bank management. Then, as has already been mentioned, since the variability of gross profits is affected by the covariant effect of fee business income and loan business incomes, if the regression coefficient of *VOLA_GARARI* is statistically significantly negative, it is possible that the covariant effect had a negative impact on the stability of bank management through the increased variability of gross profits.

In addition, because increases in net fees and commissions have the effect of improving banks' ROA, if the regression coefficient of *AROA* is a positive value significantly different from zero, it is possible to say that Japanese commercial banks' expanding their fee-based business contributed to improving their management stability. Lastly, the larger the positive value of the regression coefficient of *ACOA*, the more important the improvement in the capital adequacy ratio is for improving their management stability.

5.3.2 Estimation Results

First, when performing this estimation, the existence or nonexistence of multicollinearity among explanatory variables needs to be examined. This is because

VOLA_GARARI, *VOLA_GCC,* *VOLA_GKEIHI* and *VOLA_GASSET*, the four explanatory variables that act as a proxy for *VOLA_ROA,* might have strong correlations with *AROA* or *ACOA.* If there are such correlations, multicollinearity emerges among the explanatory variables, and the reliability of estimated regression coefficients decreases. Therefore, in accordance with Snee and Marquardt (1984), the variance inflation factors (hereinafter "VIFs") [18] are calculated to check for possible multicollinearity with respect to the four variables, *AROA*, and *ACOA*. Appendix II summarizes eight kinds of VIFs for each sample bank, and shows that 27 banks have a VIF or some VIFs that exceed(s) the standard criterion of 10 in the first half of the data period whereas 31 banks do so in the second half of the data period. It is quite likely that multicollinearity will occur with regard to these banks' explanatory variables, and therefore they are excluded from the analysis. Due to this data-cleaning, the number of sample banks in this analysis is 43 and 39 for the first and the second half of the data period, respectively.

Chart 15 shows the results of model selection. The two-way fixed effect model is chosen for both the first and second half of the data period.

(Chart 15) Results of Model Selection Test II

<Data period: FY1996 – FY2000>

	Null hypothesis	Alternative hypothesis	Test Statistics	p-value
Test I	Pooling model	One-way fixed effect model	F(4, 171): 5.75	***
Test II	One-way fixed effect model	Two-way fixed effect model	F(4, 167): 4.68	***
Test III	Two-way random effect model	Two-way fixed effect model	Hausman: 11.84	**

<Data period: FY2001 – FY2005>

	Null hypothesis	Alternative hypothesis	Test Statistics	p-value
Test I	Pooling model	One-way fixed effect model	F(4, 155): 6.34	***
Test II	One-way fixed effect model	Two-way fixed effect model	F(4, 151): 2.72	**
Test III	Two-way random effect model	Two-way fixed effect model	Hausman: 11.15	***

Note: ***, **, and * denote 1, 5, and 10 percent significance, respectively.

Chart 16 summarizes the estimation results and shows that the regression coefficient for *VOLA_GARARI* is not significantly different from zero for both periods. Accordingly, on average for Japanese commercial banks from FY1996 to date, the increased

[18] $VIF_{x,y}$ of the variables x and y can be obtained by $1/\{1-(\rho_{xy})^2\}$. Here, ρ_{xy} is the correlation coefficient of x and y.

variability of gross profits was not an important factor in destabilizing their management. Therefore, it is not appropriate to say that Japanese commercial banks' expanding their fee-based business resulted in reducing the stability of their management.

(Chart 16) Estimation Result II

Explained variable: *Z*						
	Data period: FY1996 – FY2000 Two-way fixed effect model (N: 43, T: 5) $\overline{R^2}$: 0.353, DW: 1.856			Data period: FY2001 – FY2005 Two-way fixed effect model (N: 39, T: 5) $\overline{R^2}$: 0.131, DW: 1.876		
	Coefficient	t-ratio	p-value	Coefficient	t-ratio	p-value
VOLA_GARARI	-11.813	-1.315		-9.204	-1.575	
VOLA_GCC	-0.028	-0.379		2.499	1.325	
VOLA_GKEIHI	179.102	1.575		202.540	1.895	*
VOLA_GASSET	-177.133	-1.555		-106.500	-1.536	
AROA	2669.450	1.381		4189.440	4.208	***
ACOA	-1099.870	-0.852		343.670	0.987	
Significant time dummies						
D_{1996}/D_{2001}	29.017	1.785	*	18.715	1.961	*
D_{1997}/D_{2002}	-9.200	-2.314	***	10.537	1.965	*
D_{1998}	-5.790	-2.425	***			

Notes: 1. The PW transformation is conducted for both time periods, according to Baltagi and Li (1991).
2. ***, **, and * denote 1, 5, and 10 percent significance, respectively.

The regression coefficient of *AROA* is a positive value for both periods and, in particular, is significantly different from zero in the second half of the period. This result implies that an improvement in Japanese commercial banks' profitability had a more stabilizing effect on their management in the second half of the data period than in the first. In addition, the regression coefficient for *ACOA* is not significantly different from zero for both periods.

Lastly, the time dummies for FY1997 and FY 1998 would have the effect of decreasing management stability. This seems reasonable given that a financial crisis occurred during this period.

5.4 Summing Up

If banks' net fees and commissions and net interest income move in the same direction, the variability of their "gross" profits will increase. Based on this, banks' expanding their fee-based business may have the effect of increasing the variability of their profitability in relation to "net" profits, or ROA. According to the literature, this

actually happened to US banks and we find that it also happened to Japanese commercial banks in the second half of the 1990s. However, the increased variability of profitability did not influence the stability of Japanese commercial banks' management, and this is different from the findings of earlier studies on US banks. In addition, since FY2001, increases in the variability of profitability through the above-mentioned pathway have not been clearly observed in Japan. This is mainly because the positive correlation between percentage changes in net fees and commissions and net interest income has been weakened as net interest income and economic fluctuations have begun to change in a less correlated fashion.

How the expansion of banks' fee-based business affects their management stability is determined by the degree to which it enhances banks' profitability, the degree to which it enhances the variability of banks' profitability, and how the increased income is used by banks in the context of managing capital adequacy. In Japan, an increase in commercial banks' profitability, or ROA, should have contributed to enhancing the stability of their management, especially after FY2001. Although such an increase in profitability can lead to an increase in capital adequacy in general, there is a lack of strong evidence that an increase in Japanese commercial banks' capital adequacy ratio led to an enhancement of their management stability after FY2001. However, Japanese commercial banks disposed of huge amounts of non-performing loans by paying credit costs over the same period. In such a situation, increased income brought about by the expansion of fee-based business may have contributed to preventing net profits from dropping. In this sense, it may be said that the expansion of the fee business played an important role in supporting bank's management stability.

6. Conclusion

Japanese commercial banks, especially the City Banks, began to expand the provision of fee-based business services in the second half of the 1990s. Over the same time period, the growth rate of profit from fee-based business became positively correlated with the growth rate of net interest income. However, such a positive correlation weakened in and after FY2001.

As a factor behind this change, the combination of the economic recovery, decreases in the amount of loans following companies' efforts to reduce interest-bearing liabilities, and an accommodative financial environment can be noted. When we compared the growth rates of net fees and commissions and net interest income with business cycles, we found that in the 1990s, when a positive correlation was observed between the two types of incomes, both moved in the same direction as GDP. This shows that an upturn (downturn) of the economy is likely to increase (decrease) both net fees and commissions and net interest income. However, since FY2001, while net fees and commissions (in particular, from sales commissions from investment trusts and insurance policies or other commissions not associated with the traditional exchange business) increased rapidly as a reflection of both the easing of regulations and the economic recovery in recent years, the association between net interest income and economic fluctuations decreased as a highly accommodative financial environment continued, and partly because of enterprises' endeavors to reduce their interest-bearing liabilities.

If there is a positive correlation in growth rate between fee business income and traditional loan business income, the variability of the aggregated value of these incomes should be larger than the sum of each income's variability. We investigated this hypothesis for Japanese commercial banks with the help of panel-data econometrics, and found that the expansion of fee-based business increased the variability of their "gross" profits in the second half of the 1990s. However, we also confirmed that while the increased variability of the gross profits increased the variability of their profitability in relation to "net" profits, or ROA, it was not strong enough to decrease the stability of their management over that period of time.

On the other hand, it is suggested that the expansion of fee-based business should have enhanced Japanese commercial banks' ROA and contributed to stabilizing their management from FY2001. In a situation where losses from the disposal of non-performing loans amplified, increases in net fees and commissions may have

underpinned the level of net profits and have contributed to narrowing a pathway that those losses led to a reduction of equity capital. These should have resulted in preventing Japanese commercial banks' management from being significantly destabilized.

The way in which the expansion of fee-based business affects the variability of banks' profitability depends on the mode of correlation in growth rate between fee business income and traditional loan business income. The present study, in specific terms, makes it clear that for Japanese commercial banks the correlation between the two incomes will be determined by (1) the relationship between exchange-related fees and commissions and business cycles, (2) the relationship between non-exchange related fees and commissions and business cycles once the effect of deregulation has worn off, and (3) the relationship between net interest income and business cycles.

For (1) above, we first need to recall that there was a stable positive correlation between fund settlement activities and business cycles in the 1990s. Based on this fact, once price competition for remittance or other charges subsides, a positive correlation between net fees and commissions on exchanges and business cycles may return. For (2) above, deregulation enabled Japanese commercial banks to start fee-based business unrelated to exchange, and to expand it in a rapid fashion. When such a deregulation effect wears off, non-exchange related commission income may also have a positive correlation with economic fluctuations and financial asset prices. In addition, for (3) above, once adjustment for the excessive indebtedness of companies was almost over and once the highly accommodative financial policy ended (or once there was an increased possibility of its ending), interest rates increased in line with the business climate, and net interest income began to increase in the second half of FY2005. Meanwhile, net fees and commissions also continued to increase at this time. That is to say, a positive correlation between these two variables returned and this means that it may result in increasing the variability of Japanese commercial banks' profitability.

However, the considerable positive effect that an expansion of fee-based business has on improving ROA is expected to continue. It has not been long since Japanese commercial banks have been allowed to offer fee-based business services, and as a result it does not seem that the competition for fee business income has reached its peak among the banks. This means that the banks are in a favorable position to use fee business income earned for reinforcing their own capital, which has a strong impact on the stability of their management. This reasoning suggests that the stability of Japanese banks' management would not necessarily decrease even if they were to see a

restoration of a positive correlation in percentage change between fee-based business income and traditional loan business income and an increase in the variability of their profitability.

In addition, it is also possible that the expansion of fee-based business may (along with structural changes to the financial system and diversification of banking services) improve the profitability of Japanese commercial banks over the long term and contribute to securing the stability of their management. US banks, ranging from major to medium and small banks, offer a fee-based service based on the characteristics of their business platform, such as credit card, deposit-related and corporate asset management services. It may also be possible for Japanese commercial banks to expand their fee-based business to areas other than selling investment trusts and insurance policies on a commission basis. As a matter of course, if the competition among the banks over fee-based business intensifies as time goes by, the positive effect of an expansion of fee-based business improving their ROA may decline. Thus, it is an important point whether Japanese commercial banks' expanding their fee business contributes to securing the stability of their management without excessively increasing the variability of their profitability, by enhancing their profitability and thereby making it easier for them to reinforce their equity capital.[19]

Finally, we propose a direction for studies to take in the future. A positive correlation in the percentage change tends to exist between banks' fee business income and net interest income, and such a relationship increases the variability of their profitability, as evidenced by the literature for US banks and by this paper for Japanese commercial banks. In future, a more detailed analysis of the causes of such a positive correlation would represent an important contribution. This paper has emphasized the possibility that changes in real GDP or, from a slightly wider view, economic fluctuations, may drive fee business income and net interest income in the same direction. In addition, as for a positive correlation in percentage change between fee business income and real GDP, it seems that the "demand" for fund settlement services and financial products is likely to increase (decrease) during a period of economic boom (recession). Although this is considered a reasonable view, more detailed studies of the "supply" side are still required; for example, the intensity of competition among the banks and the nature of

[19] If the positive correlation between net interest income and net fees and commissions, which has recently returned, remains, and the expansion of fee-based business destabilizes banks' management with increases in the variability of their ROA, the capital adequacy ratio must be increased so as to restore management stability. This demonstrates that for a bank, an accurate understanding of the bank's profit structure is important in the context of capital adequacy management.

regulations that will affect it should be considered more closely. Also, if in future the variety of financial services provided as part of banks' fee-based business increases in Japan, it may be necessary to re-examine the correlation in percentage change between fee business income and traditional loan business income. These issues would be suitable subjects for future studies examining bank profit structure.

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(Appendix I)

▼ Definition of Indices

Description	Definitional Equation	Symbol
Profitability	Current net profit before tax / average balance of total assets	ROA
Variability of profitability	Standard deviation of ROA	*VOLA_ROA*
Average profitability	Period average of ROA	*AROA*
Growth of gross profits	Percentage changes of gross profits from the previous fiscal year	*GARARI*
Growth of fee business income	Percentage changes in net fees and commissions from the previous fiscal year	*GEKIMU*
Growth of net interest income	Percentage changes in net interest income from the previous fiscal year	*GSHIKIN*
Growth of profit from market investments	Percentage changes in profit from market investments from the previous fiscal year	*GMARKET*
Growth of expenses	Percentage changes in general and administrative expenses from the previous fiscal year	*GKEIHI*
Growth of credit costs	Percentage changes in credit-related expenses from the previous fiscal year	*GCC*
Capital adequacy ratio	Fiscal-year-end balance of capital / fiscal-year-end balance of total assets	*COA*
Average capital adequacy ratio	Period average of COA	*ACOA*
Z Score	(*AROA+ACOA*)/*VOLA_ROA*	*Z*
Growth of assets	Percentage changes in the average balance of total assets from the previous fiscal year	*GASSET*

Note: All percentage changes are deflated by General CPI excluding fresh food.

▼ Basic Statistics of Variables Used for Our Regression Analysis

Variable	Average	Standard Deviation	Median	Max	Min
VOLA_ROA	0.50%	0.58%	0.35%	6.84%	0.02%
VOLA_GARARI	616.65%	7441.70%	14.10%	93640.62%	1.23%
VOLA_GCC	178.20%	408.19%	110.45%	7721.95%	7.57%
VOLA_GKEIHI	3.94%	6.24%	3.00%	71.80%	0.52%
VOLA_GASSET	3.13%	6.27%	1.83%	66.19%	0.49%
Z	25.48	28.07	13.65	226.24	-1.20
AROA	0.01%	0.45%	0.14%	1.03%	-3.25%
ACOA	4.30%	1.22%	4.25%	10.60%	-6.27%

Note: For each variable, its basic statistics are calculated by use of 70 sample banks' data for ten years.

▼ VIF Checking for Regression Equation (3): First Half of Data Period

	$VIF_{ACOA,\ VOLA\_GARARI}$	$VIF_{ACOA,\ VOLA\_GCC}$	$VIF_{ACOA,\ VOLA\_GKEIHI}$	$VIF_{ACOA,\ VOLA\_GASSETI}$	$VIF_{AROA,\ VOLA\_GARARI}$	$VIF_{AROA,\ AVOLA\_GCC}$	$VIF_{AROA,\ VOLA\_GKEIHI}$	$VIF_{AROA,\ VOLA\_GASSETI}$
Mizuho & Mizuho Corporate	2.4	1.1	6.33	4.8	1.0	1.1	1.5	1.0
Bank of Tokyo-Mitsubishi UFJ	3.0	1.2	1.8	7.0	1.1	1.0	5.5	1.0
Sumitomo Mitsui	2.2	1.0	2.0	13.5	1.3	2.1	1.3	1.0
Resona & Saitama Resona	2.3	2.3	2.5	2.3	2.0	5.1	2.5	2.1
Shinsei	1.8	1.2	1.5	1.7	2.1	1.5	1.8	2.3
Aozora	1.1	1.7	1.0	1.2	1.5	5.6	1.1	1.7
Hokkaido	1.5	5.3	9.3	5.6	1.9	3.0	67.6	4.7
Aomori	1.0	9.1	15.0	1.4	1.1	5.2	3.0	1.0
Michinoku	1.1	2.3	2.7	1.0	1.5	1.1	4.7	2.7
Akita	6.3	2.9	3.9	1.3	11.7	1.5	3.5	1.0
Hokuto	1.9	1.0	2.5	2.6	2.1	1.0	2.3	2.5
Shonai	1.8	1.3	1.1	1.2	1.0	1.0	1.0	1.3
Yamagata	2.5	10.3	1.2	7.8	2.6	1.1	1.0	1.6
Iwate	2.9	3.6	1.1	2.7	1.0	1.0	3.9	1.6
Tohoku	2.1	2.5	2.0	6.6	2.0	3.2	1.8	10.4
77	5.1	3.5	1.5	1.9	3.5	2.4	1.3	1.6
Toho	1.1	2.0	3.9	1.5	1.6	2.1	1.7	2.8
Gunma	3.7	5.3	1.4	1.3	1.3	13.7	1.0	1.0
Ashikaga	1.9	1.8	1.9	2.1	3.0	1.4	2.5	2.3
Joyo	1.4	1.0	3.0	5.1	1.1	1.4	7.9	5.5
Kanto Tsukuba	2.7	5.4	9.8	4.6	1.2	1.9	9.2	2.0
Musashino	1.0	3.3	1.4	2.0	1.9	1.9	2.6	1.7
Chiba	1.1	3.6	1.6	2.0	1.2	6.0	1.7	2.1
Chiba kogyo	1.6	1.4	4.4	3.2	1.5	1.6	4.4	3.7
Tokyo Tomin	2.2	1.4	1.3	1.0	1.3	1.8	1.2	1.2
Yokohama	1.7	1.6	2.0	1.0	2.4	1.1	2.0	2.0
Daishi	1.2	1.8	1.2	15.4	1.6	3.3	1.1	80.9
Hokuetsu	1.5	2.2	2.9	2.5	1.8	16.9	5.9	1.2
Yamanashi Chuo	1.3	10.3	1.0	1.0	6.2	2.3	1.7	1.5
Hachijuni	4.1	1.3	2.4	2.3	42.1	2.1	11.0	5.9
Hokuriku	2.2	2.2	1.4	1.5	2.8	3.5	21.2	8.4
Toyama	5.9	1.8	1.9	1.6	8.8	1.6	1.6	2.2
Hokkoku	5.5	4.2	1.3	3.8	3.9	6.7	1.3	1.9
Fukui	3.3	1.2	1.0	1.8	1.0	29.4	2.3	1.0
Shizuoka	3.1	2.3	1.5	4.5	3.9	2.4	1.5	3.3
Suruga	4.1	1.2	14.1	1.8	1.6	2.1	1.7	1.0
Shimizu	3.1	2.2	3.8	1.5	3.2	2.0	4.1	1.6
Ogaki Kyoritsu	1.4	1.1	1.1	1.4	1.6	1.9	6.1	2.4
Juroku	1.6	9.1	1.1	15.4	2.3	9.2	1.1	5.0
Mie	2.9	3.9	5.0	6.5	2.5	4.6	3.0	7.1
Hyakugo	2.5	2.8	6.0	1.6	1.4	1.9	70.8	3.3
Shiga	14.0	8.6	6.3	2.5	9.6	3.6	5.0	3.9
Kyoto	11.1	2.3	1.6	1.2	1.3	23.8	1.5	1.0
Kinki Osaka	2.8	5.1	1.5	1.4	2.4	7.6	1.4	1.3
Senshu	8.6	9.7	1.2	1.4	14.7	3.0	1.8	1.2
Ikeda	1.1	1.3	1.5	4.9	1.1	9.8	1.6	1.6
Nanto	2.0	1.1	1.0	1.1	2.0	31.3	1.1	4.0
Kiyo	2.3	3.3	1.4	16.8	4.9	3.0	2.1	4.7
Tajima	5.8	1.1	1.0	1.6	36.3	1.0	1.2	1.9
Tottori	2.6	1.2	44.1	1.0	1.1	1.0	2.1	2.0
San-in Godo	1.0	1.3	4.1	1.7	1.0	1.0	3.9	1.2
Chugoku	7.1	2.7	2.4	7.4	5.0	2.6	2.1	5.4
Hiroshima	1.1	3.5	1.1	1.0	1.4	1.7	1.4	1.0
Yamaguchi	5.0	5.4	1.1	3.8	2.1	2.4	1.3	6.3
Awa	1.1	2.2	1.1	1.1	1.6	1.3	1.0	1.7
Hyakujushi	2.4	3.3	3.5	7.4	4.6	1.7	1.8	2.8
Iyo	1.1	2.4	1.4	1.3	1.0	1.4	1.1	1.2
Shikoku	7.5	10.1	2.0	1.7	5.6	12.7	2.8	1.6
Fukuoka	1.7	3.8	1.1	1.2	1.3	48.9	1.0	1.1
Chikuho	1.2	1.6	2.1	6.8	1.1	2.6	3.7	11.2
Saga	3.1	4.2	3.4	1.6	3.8	4.9	3.5	1.5
The Eighteenth	1.3	3.9	2.5	20.2	1.6	2.3	2.7	13.2
Shinwa	1.0	1.0	1.0	2.6	1.0	2.0	1.2	3.5
Higo	5.1	4.4	1.7	1.1	3.8	2.2	1.3	1.2
Oita	1.9	5.4	1.1	1.5	2.7	3.3	1.1	1.4
Miyazaki	1.5	1.7	1.1	1.5	1.2	1.4	1.1	1.2
Kagoshima	1.8	5.4	5.7	1.5	2.1	1.8	15.7	1.8
Ryukyu	1.0	2.4	5.6	1.2	1.1	4.0	9.6	2.1
Okinawa	1.0	3.3	2.2	2.5	1.4	30.3	66.7	2.1
Nishi-Nippon City	1.2	1.7	1.0	2.0	1.7	1.1	1.8	1.1

▼ VIF Checking for Regression Equation (3): Second Half of Data Period

	$VIF_{ACOA,\ VOLA\_GARARI}$	$VIF_{ACOA,\ VOLA\_GCC}$	$VIF_{ACOA,\ VOLA\_GKEIHI}$	$VIF_{ACOA,\ VOLA\_GASSETI}$	$VIF_{AROA,\ VOLA\_GARARI}$	$VIF_{AROA,\ AVOLA\_GCC}$	$VIF_{AROA,\ VOLA\_GKEIHI}$	$VIF_{AROA,\ VOLA\_GASSETI}$
Mizuho & Mizuho Corporate	1.5	2.5	3.4	1.1	3.5	2.9	3.0	1.0
Bank of Tokyo-Mitsubishi UFJ	1.3	1.0	1.4	1.9	2.0	1.0	6.3	2.4
Sumitomo Mitsui	116.0	1.2	18.6	10.2	1.0	1.3	6.4	2.5
Resona and Saitama Resona	2.1	35.5	6.9	2.9	1.9	1.5	1.1	2.5
Shinsei	8.2	1.8	6.1	2.3	1.9	2.3	2.6	1.4
Aozora	6.4	3.4	1.8	1.0	1.3	8.1	1.5	1.0
Hokkaido	1.6	3.4	1.3	1.1	46.9	1.7	2.1	1.2
Aomori	1.1	1.6	1.2	1.5	1.6	3.2	1.1	6.2
Michinoku	2.0	1.1	1.1	3.1	3.9	1.1	1.2	4.0
Akita	5.3	4.0	4.8	3.2	21.8	1.8	1.8	1.5
Hokuto	1.5	6.7	2.8	2.0	2.4	6.1	6.1	2.0
Shonai	1.6	5.4	6.5	3.1	27.4	15.7	1.9	2.9
Yamagata	1.2	4.1	1.1	1.6	1.0	1.1	1.2	1.2
Iwate	3.2	3.9	6.2	10.1	1.5	1.4	1.3	1.1
Tohoku	1.2	1.1	2.3	1.0	1.1	90.0	1.4	1.3
77	5.0	1.1	1.2	5.7	1.0	1.0	1.5	1.9
Toho	1.7	5.5	1.3	1.1	1.0	5.6	1.1	1.0
Gunma	1.7	2.3	1.0	3.0	2.2	1.3	1.2	1.5
Ashikaga	3.3	1.8	1.9	6.0	1.5	3.3	3.0	1.0
Joyo	1.2	1.9	2.2	3.7	13.4	2.0	2.7	3.9
Kanto Tsukuba	2.7	1.0	1.0	1.0	2.1	1.9	6.3	5.2
Musashino	5.2	3.4	2.9	1.6	1.6	4.8	2.9	2.0
Chiba	1.9	1.6	2.5	1.9	3.7	2.7	7.5	2.0
Chiba kogyo	1.4	2.1	1.1	1.1	5.0	2.0	1.1	1.1
Tokyo Tomin	8.0	4.0	1.1	2.1	1.2	15.2	1.3	1.5
Yokohama	2.3	9.5	1.2	2.3	6.6	5.8	1.0	2.4
Daishi	1.3	2.0	1.0	10.8	3.3	2.4	1.1	93.2
Hokuetsu	1.3	1.6	7.6	3.9	2.8	78.8	2.7	1.8
Yamanashi Chuo	2.7	1.4	2.1	13.2	3.0	1.0	113.2	1.5
Hachijuni	18.3	2.0	4.6	6.7	1.8	1.9	3.5	7.4
Hokuriku	1.0	1.2	1.1	1.8	2.3	2.0	8.7	1.9
Toyama	3.4	14.7	4.4	1.1	1.0	1.0	1.0	2.4
Hokkoku	1.9	1.6	1.7	2.4	1.2	2.8	2.5	7.9
Fukui	2.9	1.4	1.5	57.2	1.0	28.0	18.1	1.3
Shizuoka	2.7	1.0	1.2	63.3	1.0	1.7	1.1	3.3
Suruga	3.4	3.1	3.2	3.5	2.8	2.4	1.2	1.9
Shimizu	1.8	1.0	1.1	2.9	1.0	8.6	1.2	1.0
Ogaki Kyoritsu	1.0	4.0	1.1	3.2	1.1	1.4	1.0	1.1
Juroku	1.8	1.9	2.2	3.3	1.1	1.6	1.7	1.1
Mie	5.1	2.7	2.2	5.4	1.1	1.2	1.3	5.2
Hyakugo	1.2	1.0	1.2	2.1	1.0	1.3	1.0	5.8
Shiga	3.0	1.0	13.2	3.3	1.0	1.3	1.8	36.9
Kyoto	1.1	1.0	16.3	4.6	2.1	1.1	5.4	5.1
Kinki Osaka	11.4	1.6	3.2	4.0	1.0	1.1	1.2	1.1
Senshu	14.5	5.0	4.1	10.2	10.2	3.3	2.0	30.9
Ikeda	1.4	1.8	1.0	1.3	1.5	2.9	1.0	15.0
Nanto	2.3	2.2	3.5	1.1	1.2	17.7	5.5	1.1
Kiyo	1.0	5.2	5.9	1.5	4.1	1.8	2.9	13.7
Tajima	3.3	3.5	3.1	7.5	1.3	1.4	1.0	1.3
Tottori	16.5	1.2	1.1	1.4	2.2	1.3	2.0	1.7
San-in Godo	1.2	3.4	1.7	2.7	1.3	1.5	1.1	1.7
Chugoku	5.7	2.0	1.0	3.5	1.8	1.4	1.0	2.3
Hiroshima	3.2	13.1	2.9	4.0	1.2	31.5	2.1	3.1
Yamaguchi	1.6	4.6	1.6	1.0	1.7	1.5	1.4	1.1
Awa	1.1	1.5	1.1	1.1	2.5	1.0	3.8	1.6
Hyakujushi	33.7	1.6	1.4	1.3	1.2	1.0	1.1	1.0
Iyo	1.4	1.9	1.1	1.3	1.0	3.5	1.0	1.0
Shikoku	1.4	1.0	1.3	1.5	1.7	1.0	1.0	1.2
Fukuoka	2.6	2.4	1.9	1.0	1.2	9.1	3.2	1.4
Chikuho	1.0	5.6	16.5	9.3	1.1	1.4	3.2	3.2
Saga	4.2	5.2	3.3	1.7	1.0	1.0	1.8	1.6
The Eighteenth	1.3	4.9	1.1	5.1	2.1	1.0	1.2	1.0
Shinwa	1.0	1.4	1.1	1.0	1.1	1.5	1.1	1.1
Higo	2.7	1.1	6.0	1.0	2.9	1.1	1.0	1.0
Oita	1.5	3.2	10.1	1.4	3.6	1.0	1.0	1.7
Miyazaki	17.9	12.1	1.3	1.7	1.2	1.0	5.7	1.6
Kagoshima	1.6	2.3	14.3	3.0	3.5	1.9	2.2	10.5
Ryukyu	1.3	2.3	2.0	3.7	2.9	2.2	1.9	3.1
Okinawa	1.3	1.4	1.1	3.0	4.8	2.5	1.0	1.5
Nishi-Nippon City	4.7	1.0	2.2	1.9	5.8	3.5	12.7	7.7