How does the stock market value bank diversification? Empirical evidence from Japanese banks

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Abstract

This paper empirically examines the effect of bank's revenue diversification across different activities on the stock-based return and risk measures using data on the Japanese banking sector. In the analyses, we measure non-interest income share as a measure for revenue diversification of banks. These analyses confirm the positive effect of revenue diversification by increasing non-interest income share on the franchise values of banks, while there is no strong evidence that it reduce bank risks. In contrast, when non-interest income is broken down into its constituent parts—fee income, trading income and other non-interest income—we find that a shift toward fee income-generating business decreases all types of risks (systematic risk, idiosyncratic risk, and total risk). Furthermore, we find that the effects of bank's revenue diversification on franchise value and risks are contingent on organizational forms and performance of traditional banking business.

JEL Classification: G11, G21, G28

Keywords: Revenue diversification, Bank stock return, Bank risk, Franchise value

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1. Introduction

Should banks be diversified across various activities such as commercial banking, securities underwriting, insurance, brokerage, and fiduciary services? As a result of worldwide deregulation, technological changes, and developments in product markets, the question of focus versus diversification in the banking industry has gained in importance for bank managers, shareholders, regulators, and financial economists. Although a number of studies have attempted to shed light on the effect of diversification on bank performance, they have provided mixed results. For example, whereas Baele et al. (2007) demonstrate that diversification increases bank franchise values and decreases idiosyncratic risks among European banks, Leaven and Levine (2007) find a diversification discount in financial conglomerates based on cross-country data. Moreover, Stiroh and Rumble (2006) show that although U.S. financial holding companies can benefit from diversification, these benefits are offset by an increase in exposure to highly volatile non-interest income business.

In addition to mixed findings in the previous literature, studies that use stock market data to comprehensively assess the effect of functional diversification on both return and risk are limited. To date, only Stiroh (2006) and Baele et al. (2007), which respectively explore the American and European banking systems, utilize stock market data to this end. These studies use share of non-interest income as a proxy measure for functional or revenue diversification. As stated in Stiroh (2006) and Baele et al. (2007), stock market measures for return and risk have some relative advantages over accounting data. First, in stock market data, equity prices are forward-looking and therefore allow for the prediction of prospective performance and risks associated with different strategic choices. Second, the use of stock market data allows for the decomposition of total risk into systematic and idiosyncratic components. This distinction provides useful information for bank stakeholders because they are often interested in different types of risks faced by the bank. For

instance, investors with sufficiently diversified portfolios are principally interested in systematic risks to bank equity returns. On the other hand, large shareholders, bank managers, and supervisors also pay attention to idiosyncratic and total risks.

This paper comprehensively examines the effect of revenue diversification of Japanese banks on stock-based performance and risk measures (i.e., systematic risk, idiosyncratic risk, and total risk). In the analyses, similar to previous studies, this study employs measures based on non-interest income in bank revenue structure to gauge revenue diversification. Further, to explicitly investigate which activities the market evaluates as beneficial to bank performance and risk, we estimate the respective effects of fee income, trading income, and other non-interest income by decomposing non-interest income share. In addition, we account for the possibility of non-linearity that the effects of revenue diversification on franchise value or risk measures are affected by organizational form of banks and their performances in traditional banking business, because it is considered that banks that perform well in traditional banking business can more effectively implement their revenue diversification than those banks that perform badly. In addition, Yamori et al. (2003) confirm that Japanese banks affiliated with bank holding companies (BHCs) are more profit-efficient than are independent banks. Therefore, it is plausible that BHC organizations may implement revenue diversification more efficiently than do independent banking organizations. To explore these possibilities, this paper explicitly examines whether the effects of banks' revenue diversification on their stock-based return and risk measures are more beneficial to BHC organizations or banks performed better in traditional banking business, compared to independent banking organizations or banks performed badly.

Our analyses reveal that the non-interest income share increases the franchise values of banks, while there is no strong evidence that it reduces stock-based risk measures for bank risk (systematic risk, idiosyncratic risk, and total risk). When non-interest income is decomposed into its three

component sources (fee income, trading income, and other non-interest income), we find that banks are able to decrease all types of risk measures by raising fee income share. Finally, we confirm that (a) the positive effect of revenue diversification on franchise value of banks is more pronounced for BHC organizations than for independent banking organizations and (b) the negative effects of revenue diversification on stock-based risk measures are more pronounced for banks performed better in traditional banking business than banks performed badly.

This paper contributes to the existing literature in the three ways. First, while previous studies have focused on only whether revenue diversification or functional diversification improves firm value and the riskiness of banks, this paper includes additional analyses related to the possibility that the effect of revenue diversification on firm value and the riskiness of banks may be dependent on particular bank characteristics such as its organizational form and performance in traditional banking business. Second, this paper redresses the deficiencies in the literature that have resulted from the exclusive use of American and European banks as data[1]. Specifically, studies that have comprehensively assessed the effect of revenue diversification on both return and risk using stock market data are limited to Stiroh (2006), which use U.S. banking system data, and Baele et al. (2007), which use European banking system data. In this paper, we focus on the Japanese banking system and conduct comprehensive analyses on the effect of bank's revenue diversification on stock-based return and risk measures. We utilize the Japanese banking system because it is well known as bank-centered financial system, which can affect potential benefits of bank diversification. For instance, because Japanese households have preferred to hold more deposits than other financial assets compared to households in other developed countries, Japanese banks have built a strong customer base through their depository services (see Hoshi and Kashyap 1999). Therefore, Japanese

[1] Work by Berger et al. (2010) is an exception, but it is based on accounting data rather than stock market data.

banks are more likely to succeed in selling a wide array of financial products to a variety of customers. Furthermore, Japanese banks have close ties with their client firms, which can facilitate their entry into the investment banking business. On the other hand, the Japanese banking system has undergone rapid deregulation since the 1990s. As a consequence, many banks have implemented functional diversification in the last decade, shifting toward securities underwriting, insurance, brokerage, and fiduciary services. As a result, in this paper, we test the potential benefits of revenue diversification in a bank-centered financial system by using recent data from the Japanese banking system.

Third, relative to previous studies that have used stock market data to assess the effect of revenue diversification on both return and risk (see Stiroh 2006 and Baele et al. 2007), we spend considerably greater effort on investigating a potential endogeneity problem. Specifically, we consider the possibility of endogeneity between diversification measures and return or risk measures by estimating a regression model with fixed effects and instrumental variables (IV).

The remainder of this paper is organized as follows. Section 2 presents a review of the related literature and discusses the expected effect of bank diversification. Section 3 describes the institutional background of the Japanese banking system in terms of bank diversification. Section 4 discusses the data and samples used in this study. Section 5 describes the empirical methodology. Section 6 presents the main empirical results. Section 7 presents the results of robustness checks. Section 8 summarizes and concludes the study.

2. Related literature and expected effect of bank diversification

In this section, we review past research that has explored the impact of activity diversification on firm value and the risks that banks face. Functionally diversified banks, which engage in commercial banking, securities underwriting, insurance, brokerage, fiduciary activities, and other

financial services, may enjoy economies of scale. That is, bank profitability can improve if the sharing of human capital, information, and technologies generates synergies through integration. Further, banks could allocate their resources more efficiently through internal capital markets generated by conglomerates (Stein 1997). Conversely, functional diversification could aggravate agency problems between corporate insiders and outsiders, between the head office and divisional managers, and between the various divisions of conglomerates (Jensen and Meckling 1976; Rajan et al. 2000; Stein 2002; etc.). For instance, managers may expand the range of activities in which a bank engages to extract private benefits (Jensen and Meckling 1976). The agency costs generated by conglomeration weaken the performance of functionally diversified banks or financial conglomerates. As a result, the effect of functional diversification on bank performance is inconclusive.

Similar to the inconclusiveness in the theoretical literature, there has been no consensus in the empirical literature, which has primarily used data from the revenue structures of banks as an indicator for functional diversification. Leaven and Levine (2007), Schmid and Walter (2009), and Berger et al. (2010) respectively use cross-country data, data from American banks, and data from Chinese banks to reveal diversification discounts in financial conglomerates or diversified banks. However, some studies have provided evidence for diversification premiums based on data from the European financial system (Vander and Vennet 2002; Baele et al. 2007) and large banks from nine developed countries (Elsas et al. 2010).

According to standard portfolio theory, the effect of functional diversification on bank risk is less clear. For instance, if the magnitude of volatility of cash flow generated by non-traditional banking activities is higher (lower) than that of cash flow generated by traditional banking activities, the shift toward non-banking activities has the effect of increasing (decreasing) the total risk of banks. On the other hand, if the correlation between cash flow generated by non-banking activities

and that generated by traditional banking activities is low enough, the shift toward non-banking activities has the effect of lowering the total risk of banks. Hence, the total effect of the shift toward non-banking activities on the total risk of banks is dependent on the magnitudes of these two effects. In addition, when total risk is decomposed into systematic risk and idiosyncratic risk, the effect of functional diversification on both systematic risk and idiosyncratic risk is also unclear ex ante. For instance, if the cash flow generated by non-banking activities is completely correlated (uncorrelated) with the return on market portfolio, the shift toward non-banking activities is expected to increase (decrease) the systematic risk of banks.

Empirically, Stiroh (2006) uses stock market data for American bank holding companies to confirm that while banks that are more dependent on non-interest income do not enjoy higher equity returns, the volatility of their equity returns (in terms of total risk and idiosyncratic risk) and market beta (systematic risk) is greater than that of banks that are less dependent on non-interest income. Using stock market data for European banks, Baele et al. (2007) find that functional diversification increases market value. Furthermore, they show that it increases systematic risk but decreases idiosyncratic risk[2].

3. Bank diversification and institutional background in Japan

Japanese banks were principally prohibited from entering other financial sectors for a long

[2] There are some studies related to functional or revenue diversification in Japanese banks. Sawada and Yasuda (2010), for example, examine the effect of a bank's entry into the securities business, using the events of bank acquisitions of stakes in security firms. They find that while abnormal returns in banks do not significantly differ from zero, returns in security firms are statistically positive. Tachibana and Hatakeda (2009) use data from Japanese banks to investigate the effect of revenue and loan diversification on bank performance. However, our paper differs from Tachibana and Hatakeda (2009) in several ways. First, the measures for bank performance used in their study are based on accounting data (i.e., ROA and the standard deviation of ROA). Second, they focus only on regional banks. Third, their analyses are based on banks' single-entity financial statements rather than consolidated financial statements. Fourth, they do not explicitly consider the possibility of endogeneity between diversification measures and return or risk measures.

time, beginning in the post-war period. Since the 1990s, however, deregulation of the financial sector progressed rapidly. In 1993, the Financial System Reform Law allowed banks, trust banks, and securities companies to partially enter each other's sectors through subsidiaries. Thus, this law allowed commercial banks to engage in the securities business (with the exception of equities-related business) through their securities subsidiaries. Because of these changes, commercial banks have rapidly increased their respective market shares, particularly in the field of domestic bond underwriting (Konishi 2002).

In 1997, efforts to liberalize the financial market and financial sector led to the commencement of the "big bang" financial reform in Japan. As a result of this reform, financial holdings (i.e., banks, securities companies, insurance companies, and trust companies) have been permitted in Japan since 1998. Additionally, restrictions levied on banks' securities subsidiaries were completely abolished in 1999. Deregulation further led large city banks to establish holding company-based financial groups (bank holding companies) after the early 2000s[3]. By operating commercial banks, trust banks, securities companies, consumer finance companies, and other financial service companies as subsidiaries, these bank holding companies have provided comprehensive financial services to their customers. By the mid-2000s, regional banks had begun to actively enter into the securities business by establishing securities subsidiaries or acquiring regional securities companies. Furthermore, over-the-counter sales of investment trusts and insurance products by banks were allowed[4] and have generated an increasing amount of fee income for banks since 2001 (Inaba and Hattori 2006).[5]

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[3] In the case when banks entered insurance business, bank holding companies had been permitted to have only failed insurance companies as subsidiaries until September 2000.

[4] Over-the-counter sales of investment trusts by banks have been allowed since December 1998. Over-the-counter sales of insurance products have been partially allowed since April 2001 and completely allowed since December 2007.

[5] Inaba and Hottori (2006) investigate the movement of fee income-generating business in Japanese banks, based on unconsolidated financial statements. They find that although there exists a positive

4. Data and samples

This paper uses data on publicly traded banks (independent banks) and bank holding companies (financial groups with subsidiary banks) from 1999 to 2011. With respect to bank holding companies (BHCs), since we select only those companies which are classified as banking industry, their consolidated financial statement are based on common bank accounting system. Therefore, it is possible to compare independent banks and bank holding companies directly. Sample independent banks are composed by commercial and trust banks, and sample BHCs have at least a commercial or a trust bank as their subsidiaries. We chose this sample period because of the availability of consolidated financial statements, which are needed to capture the effect of the functional diversification of banks. Although the Japanese corporate accounting system was reformed in the late 1990s and has been based on consolidated accounting rather than single accounting since March 2000, the consolidated accounting system was introduced into the Japanese banking industry in March 1999. The sample period also includes different business cycles and stock market conditions. The data on consolidated financial statements and the stock market are taken from the Nikkei NEEDS–Financial Quest.

To obtain data from the stock market, we use daily stock returns, we exclude banks for which more than 20% of trading days within a year have missing data[6]. For banks that have merged with other banks, we remove the data for the point in time immediately following the merger to resolve any issues arising from data discontinuity. For BHCs, we use only the top-tiered entity to avoid double-counting the same activity. That is, publicly traded banks that are subsidiaries of BHCs are excluded from the sample. The final sample consists of 113 banks and BHCs that yielded 991 bank-year observations.

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relationship between interest income and fee income in the 1990s, it does not hold after 2001.

[6] The empirical results are rarely changed if we make the criterion more stringent, although the number of observation decreases.

5. Methodology

5.1 Performance and risk measure

The primary aim of this paper is to investigate the effect of bank's revenue diversification on performance and riskiness using stock market data. To do this, we use Tobin's *Q* as a stock-based measure of performance. Tobin's *Q* is defined as the ratio of the present value of a bank's future cash flows to the replacement cost of its assets. It has thus been used in previous research as a proxy for a firm's franchise value or long-term performance (e.g., Keeley 1990; Lang and Stulz 1994). In the following analyses, we use the sum of market value of equity and the book value of liabilities divided by the book value of assets (market-to-book ratio) as the *Q* ratio.

To gauge bank risk, we utilize three types of market-based risk measures: total risk, systematic risk, and idiosyncratic risk. To obtain these measures, we estimate the following market model with two indexes.

$$R_{it} = \alpha_i + \beta_{it} R_{mt} + \gamma_1 I_t + u_{it,} \qquad (1)$$

where R_{it} indicates the daily stock return of bank i at time t and R_{mt} is the return on the stock market index at time t. We use the Tokyo Stock Exchange Price Index (TOPIX) as the proxy for the market index. I_t represents the change of a default-free debt index on t. The Nikkei JGB Index, which indicates the weighted-average yield of 10-year Japanese government bonds, is used as the proxy for the default-free debt index. We estimate equation (1) for each year and bank. Here, β_{it} is a measure of the bank's systematic risk. Further, we use the standard deviation of (a) the bank stock returns and (b) the residuals estimate in equation (1) as measures for total risk and idiosyncratic risk, respectively.

5.2 Diversification measures

To measure functional diversification, this paper focuses on a bank's revenue structure. We

primarily utilize the ratio of non-interest income to total operating income (non-interest income share) on the gross basis[7]. We use "ordinary income" in Japanese bank accounting as total operating income, according to the definition of the Japanese Bankers Association[8]. The non-interest income share is expected to capture non-traditional banking business. Considering the possibility that the effect of non-interest income share is not monotonous, we add its quadratic term in explanatory variables. Furthermore, we decompose non-interest income share into its constituent parts: fee income, trading income, and other non-interest income shares. The details of this decomposition and revenue categories are shown in Appendix 1 (A.1.). We also use these shares in the regression analysis to investigate how each factor among non-interest income share affects franchise value and risk measures. We also employ a complementary measure of bank diversification that has been characterized as revenue diversity in previous studies (Baele et al. 2007; Laeven and Levine 2007; Elsas et al. 2010). This measure is defined as

$$\text{Revenue diversity} = 1 - \left| \frac{\text{Interest income} - \text{Non - interest income}}{\text{Total Operating income}} \right| \qquad (2)$$

In this equation, revenue diversity takes on its maximum value (1) when non-interest income share is 0.5 and its minimum value (0) when non-interest income share is zero or one. This measure is similar to the HHI-type measures used in Stiroh and Rumble (2006).

Figure 1 presents the annual mean of the non-interest share and revenue diversity for the sample banks. Non-interest share and revenue diversity demonstrated similar trends, culminating with matching peaks in 2006. In Figure 2, non-interest income share is broken down into fee income,

[7] In this paper, we focus not on the net income structures of banks, but on the gross income structures, to ensure that the diversification measure will not be unduly distorted by their cost structures.

[8] We follow the definition of the Japanese Bankers Association at "http://www.zenginkyo.or.jp/en/banks/financial_statement/"

trading income, and other non-interest income shares. Fee income share gradually increases until 2007, which may reflect banks' tendencies to enter into new businesses (e.g., insurance sales and investment trust products).

5.3 Specification

To explore the effect of bank diversification on risk and franchise value, we estimate the following equation:

$$\mathrm{Y}_{\mathrm{it}} = \alpha_1 + \alpha_2 \cdot DIV_{it} + \gamma' \cdot X_{it} + \varphi' \cdot YEAR + \eta_i + \varepsilon_{it}, \quad (3)$$

where Y_{it} is bank franchise value (Tobin's *Q*) or market-based risk measures (market beta, idiosyncratic risk, and total risk). *DIV* denotes the revenue diversification measures defined above. X denotes the vector of other control variables. These include the equity-to-asset ratio, cost-to-income ratio, non-performing loan ratio (bad loan ratio), loan growth rate, log of total assets (bank size), and returns on asset (ROA). The equity-to-asset ratio measures bank capital structure, which could affect bank franchise value and risks in several ways, for example, agency cost, financial leverage, or a buffer to negative shocks. Hence, the effects of bank capital structure on franchise value and risks are less clear in advance.

The cost-to-income ratio measures cost inefficiency, which is expected to affect the franchise value of banks negatively. The non-performing loan ratio represents the quality of loans that banks offer. Non-performing loans are referred to as *risk management loans,* which include loans to debtors in legal bankruptcy, past-due loans, loans in arrears by three months or more, and restructured loans. The non-performing loan ratio is expected to be negatively correlated with the franchise value of banks and positively correlated with risk measures. Loan growth rate is expected to have a positive (negative) relationship with franchise value (risk measures) if the stock market evaluates it as performance of a traditional banking business. In contrast, it is possible that loan

growth rate may have positive effect on risk measures if the stock market evaluates it as an increase in their assets' credit risk. The measure for returns on assets (ROA) captures current profitability of banks. While bank profitability is expected to be positively related with franchise value, its effect on bank risk is less clear in advance.

In addition to the financial variables outlined above, we also include the year dummy variables, *Year* to control for macro-level shocks and unobserved time heterogeneity. η_i indicates individual fixed effects. It is important to control individual effects because of the possibility of endogeneity between diversification measures and return or risk measures. For example, firm-specific characteristics like management ability or geographic location may affect bank performance or risk, and the decision to diversify (Campa and Kedia 2002; Stiroh and Rumble 2006). To control these individual effects, we estimate equation (3) with the within-effect model.[9] The explanatory variables are principally lagged one year to mitigate potential simultaneity. However, with respect to loan growth rate, we use its value in the same time with the dependent variables, because to calculate the one year lagged value of loan growth rate, we need the information on both one- and two- year lagged values of the outstanding amount of loans.[10] However, the estimate results do not change, even if we exclude it from the explanatory variables. The robust-standard errors clustered at the bank level are used.

So far it has been implicitly assumed that the effects of bank's revenue diversification on franchise value or risks are same across all banks. However, it is possible that some banks are more adept at managing revenue diversification across different activities than other banks. Therefore, we explore the possibility that the effects of revenue diversification may be affected by particular bank

[9] The sole consideration of individual effects may be insufficient for controlling endogeneity between diversification measures and return or risk measures. To account for this, we also estimate the equation with instrument variables in the section 7.

[10] If the loan growth rate for explanatory variables is lagged by one year, the sample size decreases because information related to the values of loans' outstanding amounts in the consolidated financial statement is not available before year 1998.

characteristics. Firstly, we focus on organizational forms of banks as these characteristics, because using data from Japanese regional banks, Yamori et al. (2003) confirm that banks affiliated with BHC are more profit-efficient than independent banks. Yamori et al.(2003) has suggested that that Japanese banks affiliated with bank holding companies (BHCs) are more profit-efficient than are independent banks. Therefore, it is possible that BHCs will implement revenue diversification derived from their activities in securities, insurance, and fiduciary business more efficiently than independent banking companies will. To investigate whether banks' organizational forms influence the effects of revenue diversification on firm value or risk measures, we perform additional estimations by including an interaction term of non-interest income share with a dummy variable that indicates whether a firm is in the form of a BHC (one) or as an independent banking company (zero). The sole effect of the BHC dummy variable is absorbed by the individual effect outlined in equation (3).

Secondary, we consider performance in traditional banking business such as bank characteristics which could affect the effect of revenue diversification, because it is considered that banks performed well in traditional banking business such lending business can more effectively implement their revenue diversification than those banks performed badly. To test this possibility, we also include interaction terms of non-interest income share with the variables for performance in traditional banking business (i.e., loan growth rate and bad loan ratio) in explanatory variables. Tables 1 and 2 respectively display the basic statistics and correlation matrix associated with the main variables of this study.

6. Empirical results

Table 3 presents the results estimated from equation (3) using the franchise value (Tobin's *Q*) as the dependent variable. Column 1 shows that the coefficient of non-interest income share is

positive and statistically significant, which indicates that banks which raise their share of non-interest income likewise increase their franchise values. In Column 2, we add ROA, which serves as an accounting measure for current profitability of banks, in explanatory variables. The analysis confirms that the coefficient of non-interest income share is positive and statistically significant, even when controlling for ROA. As demonstrated in Column 3, the coefficient of the quadratic term for non-interest income share is not statistically significant. Therefore, we cannot conclude that the relationship between non-interest income share and franchise value is non-linear. In Column 4, non-interest income share is decomposed into fee income, trading income, and other non-interest income shares. We find that both fee income and trading income shares positively influence bank franchise value. Column 5 shows that the coefficient of revenue diversity is also positive and statistically significant. To summarize, the stock market positively evaluates banks' revenue diversification or increased dependence on non-interest income.

These results are consistent with Baele et al. (2007), who investigate the case of European banks.[11] Baele et al. (2007) point out that since European banks have longer experience diversifying their activities and have devoted adequate management resources to non-banking activities, the stock market highly evaluates their diversification of activities. Japanese banks, by comparison, do not have extensive experience with functional diversification. However, they have established a stronger customer base in the bank-centered financial system than non-banking financial institutions.[12] Therefore, stock market investors may expect that functional diversification would be more beneficial to Japanese banks than their counterparts in other financial systems.

In Columns 6-8, we add interaction terms of non-interest income share with the variables that

[11] On the other hand, these results are contrast with Laeven and Levine (2007) who found a diversification discount for banks in 43 counties.

[12] Japanese banks have long maintained close ties with their client firms, called the main bank system. In addition, because Japanese households prefer to hold more deposits than other financial assets, they have obtained ample funds (Aoki, Patrick, and Sheard 1994; Hoshi and Kashyap 1999).

indicate organizational forms and performance in traditional banking business (i.e., the BHC dummy variable, bad loan ratio and loan growth ratio). Column 6 indicates that the coefficient of the interaction terms of non-interest income share with the BHC dummy is positive and statistically significant ($p < .05$). This signals that the positive effect of revenue diversification on bank franchise value is more pronounced for BHC organizations than independent banking organizations. This result demonstrates that a bank's organizational form affects the impact of a bank's revenue diversification on franchise value.[13] Columns 7 and 8 demonstrate that the coefficients of the interaction terms of non-interest income share with measures for accounting performance in traditional banking activities (loan growth rate and bad loan ratio) were not statistically significant. As a result, there is no evidence to suggest the impact of revenue diversification on bank's franchise value is increasing on its performance in traditional banking business.

Other control variables are considered as well. It is generally found that bank size, capital structure, cost efficiency, and loan quality do not significantly affect bank franchise value. The coefficient for loan growth rate is positive and statistically significant in most cases. This result indicates that the stock market positively evaluates banks that perform better in terms of their traditional banking business. ROA's coefficient is similarly positive and statistically significant in all cases. This indicates that current profitability positive influences bank franchise values.

Table 4 summarizes the results estimated with total risk as the dependent variable. Column 1 shows that the coefficient of non-interest income share is marginally negative ($p < .10$), suggesting that banks which increase their non-interest income share decrease their total risk. Column 3 illustrates that the coefficients of fee income and trading income are both significantly negative. The

[13] To explore whether bank size affects the effect of revenue diversification on franchise value, we perform another regression that included an interaction term between non-interest income share and bank size; this interaction term was not statistically significant. Therefore, organizational form is considered to be an important factor rather than bank size.

more pronounced effect of fee income on total risk is likely due to the expectation that fee income became a stable source of bank revenue as a result of the deregulations in the late 1990s and early 2000s. Column 2 confirms the inverse U-shaped relationship between non-interest income share and total risk. Our calculations reveal that total risk is maximized at a non-interest income share of 25.7%, which approximately corresponds to the 30th percentile.

To explore the reasons for the inverse U-shaped relationship described above, although not reported in the table, we compare the average fee-income share for banks with a high share of non-interest income (i.e., more than 30th percentile) with those with low share of non-interest income (i.e., less than 30th percentile). We find that whereas the mean (median) of the fee-income share for banks with a high share of non-interest income was 12.3% (12.0%), that of banks with low share of non-interest income is 11.0% (10.9%). The difference between the two samples was statistically significant ($p < .01$). This result demonstrates that banks with a high share of non-interest income can reap greater reward from it by raising the share of fee income. In turn, this may generate the observed inverse U-shaped relationship between non-interest income share and total risk. Column 4 illustrates that revenue diversity does not have a significant effect on total risk.

In Columns 5-7, we add the interaction terms of non-interest income share with the variables for organizational form and performance in traditional banking. In Column 5, the coefficient of the interaction term of non-interest income share with the BHC dummy is negative, but not statistically significant. Therefore, there is no evidence to suggest that organizational forms of banks affect the effect of revenue diversification on their total risks. Column 6 includes interaction term of non-interest income share with loan growth rate, and its coefficient is not statistically significant. In contrast, Column 7 which contains the coefficient of the interaction term of non-interest income share with bad loan ratio is positive and statistically significant ($p < .01$). This result suggests that the risk-reducing effect of non-interest income share on total risk is greater for banks with a lower

credit risk on their loans. While not shown here, our calculation reveals that when the bad loan ratio of a bank is greater than 10.6% (93th percentile), the negative effect of non-interest income share on idiosyncratic risk can be completely offset by the interaction effect. Therefore, at least, Japanese banks hardly increase their idiosyncratic risks by raising their non-interest income shares.[14] One interpretation of this result is that banks that are better equipped to manage credit risk of their loans may also be better prepared to handle changes in total risks accompanied by revenue diversification.

For other control variables, we find that equity-asset ratios have significant, negative effects on the total risk of banks, which suggests that banks that increase their leverages likewise increase their total risks. The coefficients of other control variables (i.e., bank size, cost-to-income ratio, bad loan ratio, loan growth rate, and ROA) are generally non-significant, although most of them displayed expected signs.

Next, we split total risk into idiosyncratic component and systematic component (market beta). Tables 5 and 6 report the estimated results of our analyses that employ idiosyncratic risk and market beta as the respective dependent variables. Column 1 in Table 5 shows that the coefficient of non-interest income share is negative, but not statistically significant. This suggests that banks are generally unable to decrease their idiosyncratic risks by raising their non-interest income shares. Column 2 summarizes the results of the non-linearity test. While the coefficient of non-interest income share is not statistically significant, the coefficient of its quadratic term is negative and statistically significant ($p < .05$). As a result of the joint test (which is not reported in the table), we confirm that these two coefficients are jointly significant at the 1% level. This demonstrates that the relationship between non-interest income share and idiosyncratic risk is also inverse U-shaped.

[14]To quantitatively examine this effect, we also compare the effect of non-interest income share on total risk between banks with a higher bad loan ratio (75th percentile = 0.0715) and banks with a lower bad loan ratio (25th percentile = 0.0363). This calculation reveals that although the total effect of non-interest income share on total risk in the former group of banks is -0.107, the effect in the latter group is -0.217, indicating that the risk-reducing effect of non-interest income share in banks with a lower bad loan ratio is twice as large as that of banks with a higher bad loan ratio.

However, we confirm that for the majority of Japanese banks, the relationship is downward slowing, because our calculation reveals that idiosyncratic risk is maximized at a non-interest income share of 23.7%, which approximately corresponds to the 20th percentile. Column 3 demonstrates that the coefficients of trading income share and fee income share are significantly negative. Of particular note, the negative relationship between fee income share and idiosyncratic risk is stronger than the relationships of other components, which suggests that banks are able to decrease idiosyncratic risk by devoting themselves to the fee-based business. Stock market investors may expect that fee income will represent a stable source of bank revenue as a result of the series of deregulations in the late 1990s and early 2000s. Column 4 confirms that that revenue diversity does not significantly affect idiosyncratic risk.

In Columns 5-7, we add the interaction terms of non-interest income share with the variables for organizational form and performance in traditional banking. The analyses associated with these columns produce qualitatively similar results to those that evaluated total risk (Table 4). Specifically, the coefficients of the interaction terms of non-interest income share with the BHC dummy and loan growth rate are not statistically significant. In contrast, the coefficient of the interaction term of non-interest income share with a bank's bad loan ratio is positive and statistically significant. This suggests that the negative effect of non-interest income share on idiosyncratic risk is contingent upon the quality of bank loans. Banks with lower loan credit risk can decrease their idiosyncratic risks by increasing their non-interest income shares, while those with higher loan credit risk are generally unable to mitigate their idiosyncratic risks.[15] Therefore, the benefit of revenue diversification seems greater for banks that are better equipped to manage the credit risk of their loans.

[15] The estimated coefficients imply that, when bad loan ratio of a bank is more than 10.6 % (93th percentile), the negative effect of non-interest income share on idiosyncratic risk is completely offset by the interaction effect between non-interest income share and bad loan ratio. At least, banks hardly increase their idiosyncratic risks by raising their non-interest income shares.

As for other control variables, the coefficient of equity-asset ratio is negative and significant in all cases. Similarly, the coefficient of the cost-to-income ratio is consistently significantly positive. An increase in a bank's leverage and cost inefficiency tends to increase their idiosyncratic risks. In addition, ROA is universally shown to have a significant negative relationship with idiosyncratic risk, indicating that the more profitable a bank is, the lower its idiosyncratic risk. Loan growth rate is also negatively associated with idiosyncratic risk in some cases. Given the estimated effects of ROA and loan growth rate, we surmise that lower performance of banks will tend to increase their idiosyncratic risks.

Table 6 summarizes the results of the estimation that use the market beta (systematic risk) as the dependent variable. In Column 1, the coefficient of non-interest income share is negative, but statistically insignificant. This indicates that banks are generally unable to decrease their systematic risk by increasing their share of non-interest income. Column 2 demonstrates an inverse U-shaped relation between non-interest income share and systematic risk. Our calculation determines that market beta is maximized when the bank's non-interest income share is 28.7%, which approximately corresponds to the 40th percentile. As a result, the positive and negative relationships appear to be mixed, which yields a non-significant test of linearity for non-interest income share as confirmed in Column 1. Column 3 demonstrates that banks with a higher share of fee income have lower systematic risks. Therefore, the stock market may anticipate that the correlation between the return on market portfolio and fee income will be relatively low relative to other revenue sources. This is likely that the result of the expectation that fee income will become a stable source of bank revenue as a result of the above-described deregulations.[16] Column 4 shows that revenue diversity does not

[16] We actually calculate the ex post correlation between the annual return on market portfolio and the annual growth rate of each revenue category. We find that the correlation between the return on market portfolio and the growth of fee income ($\rho = 0.170$) is lower than that between the return on market portfolio and the growth of interest income ($\rho = 0.301$) in the first half of the period (2000–2006). On the other hand, the former ($\rho = 0.339$) is higher than the latter ($\rho = –0319$) in the second

have a significant effect on beta.

In Columns 5-7, we add the interaction terms of non-interest income share and with the variables for organizational form and performance in traditional banking. Whereas the coefficients for the interaction term of non-interest income share with the BHC dummy is not statistically significant, the coefficients for the interaction terms of non-interest income share with loan growth rate and bad loan ratio are significantly positive ($p < .01$). This indicates that banks that perform well in traditional banking business can more effectively mitigate their systematic risk than those banks that perform badly by raising their non-interest income shares. Further, our calculations confirm that most banks do not exacerbate their systematic risks by increasing their non-interest income shares.[17]

These analyses also reveal that the coefficient of the equity-asset ratio is negative and statistically significant in all cases, which indicates that an increase in leverage of banks tends to increase their systematic risks. Contrarily, the coefficients for other control variables (i.e., bank size, cost efficiency, loan growth rate and bad loan ratio, and ROA) are not statistically significant in most cases. As a result, there is no evidence that these control variables affect a bank's systematic risk.

7. Robustness checks

In this study, we considered the possibility of endogeneity between the diversification measures and return or risk measures. As described in section 5.3, to mitigate the endogeneity associated with unobserved heterogeneity, this paper employs within-effects model. Although this strategy may limit

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half of the period (2007–2011). The negative correlation between the return on market portfolio and the growth of interest income may reflect that the amount of bank lending hardly decreased due to the policies of the Japanese government (such as capital injections or the emergency credit guarantee program) during the crisis after the failure of Lehman Brothers, although the stock market collapsed and the real economy slowed down.

[17] The estimated coefficients imply that when the bad loan ratio of a bank is greater than 7.57 % (78th percentile) and loan growth rate is less than -4.0 % (9^{th} percentile), the negative effect of non-interest income share on systematic risk is completely offset by the interaction effect. Therefore Japanese banks hardly increase their systematic risks by raising their non-interest income shares.

the likelihood of endogeneity in some cases, it may not be sufficient to control other types of endogeneity (e.g., reverse causality). Therefore, we also use instrumental variable regressions to control endogeneity more explicitly. Consistent with the work of Elsas et al. (2010), we use the variables for the diversification measures lagged with one more year as instruments. In doing so, we incorporate a two–year lag between return or risk measures (dependent variables) and diversification measures because explanatory variables have been already lagged for one year.

In spite of these steps, the lagged diversification measures may not be completely exogenous. Therefore, we consider additional instrumental variables associated with regulatory changes. For example, in almost every year since 1997, Japanese banks have faced various types of deregulations associated directly or indirectly with functional diversification or financial conglomerates. These regulatory changes are considered to be exogenous to bank operations. However, since all Japanese banks are faced with the same regulatory changes, it is difficult to directly use the variable for regulatory changes as instruments.[18] Therefore, we focus on the bank reactions to those regulatory changes. More specifically, we consider banks' reactions to the regulatory changes to be different among bank types, since business strategy or customer needs vary greatly between them. The differences in bank reactions by type are expected to indirectly affect return or risk through the non-interest income shares. Therefore, these divergent reactions can be used as instruments. In the estimation, we use the interaction terms between the dummy variable for year and the variable for the types of banks as instrumental variables because it is unclear in advance how the different types of banks would react to different types of deregulation. Bank size is used as a proxy for type of banks.[19]

[18] The effect of each regulatory change is absorbed by year dummy variables.

[19] Furthermore, when we replace bank size with a dummy variable indicating bank category, (i.e., bank holding companies, city banks, trust banks, and regional banks) as a proxy for type of bank, we obtain the qualitatively similar results to those summarized in Table 7.

The results estimated for two-stage least squares regressions with instrumental variables are reported in Table 7. In the first step, we regress the measures for diversification on instrumental variables and other control variables. In the second step, we regress franchise value or risk measures on the fitted values from first stage and other control variables. In the odd columns (1,3,5 and 7), the non-interest income share is instrumented, and in the even columns (2,4,6 and 8) the fee income, trading income, and other non-interest income shares are instrumented in the first stage. We use Tobin's Q (franchise value) as the dependent variable in Columns 1 and 2. Column 1 shows that the coefficient on non-interest income share is positive and statistically significant ($p < .01$), which indicates that the positive effect of non-interest income share on a bank's franchise value of banks is robust even when controlling for endogeneity. Column 2 shows that the statistical significance of the positive effect of fee income share disappears, but that of trading income share remains robust.

The results associated with the risk measures: the estimated results for market beta, idiosyncratic risk, and total risk are shown in columns 3–4, 5–6, and 7–8, respectively. Columns 3, 5, and 7 illustrate that non-interest income share does not significantly affect any of the risk measures (market beta, idiosyncratic risk, and total risk). In contrast, the results of Columns 4, 6, and 8 show that the coefficients on fee income share are significantly negative ($p < .01$) for all risk measures. These results suggest that an increase in fee income share reduces all types of bank risks, even when controlling for endogeneity. Previous results (Tables 3-6) coupled with the results of the instrumental variables regressions (Table 7) provide strong evidence that revenue diversification by increasing non-interest income share increases their franchise value. However, there is no strong evidence to suggest that it reduce their risks. Furthermore, these results provide robust evidence that an increase in fee income share reduces all risk measures for banks.

8. Conclusion

This paper empirically investigates whether banks actually derive benefit from revenue diversification across different activities. Specifically, we examine the effects of bank's revenue diversification on firm value and risk using stock market data. Our analyses focus on the Japanese banking sector, which is well known as a bank-centered financial system. This paper also explores the possibility that the effect of revenue diversification may be contingent upon organizational form or performance in traditional banking business.

In the analyses, we find a positive effect of revenue diversification on a bank's franchise value, by using non-interest income share as a measure for revenue diversification. Because Japanese banks have established a strong customer base and close ties with their client firms, stock market investors may anticipate that revenue diversification would be more beneficial for Japanese banks. In contrast, we can not obtain strong evidence to suggest that non-interest income share decreases bank risk. However, banks are found to be able to decrease all types of risks (i.e., systematic, idiosyncratic, and total risk) by raising fee income share. Because of a series of deregulation measures in the late 1990s and early 2000s, stock market investors are likely to expect that fee-based income will become a more stable source of bank revenue than trading income and other non-interest income. The results reported here suggest that revenue diversification by increasing non-interest income share is beneficial to most stakeholders in the Japanese banking industry because it increases franchise value without increasing risk. In particular, a shift toward fee income-generating activities seems to be particularly desirable in terms of decreasing total, systematic, and idiosyncratic risk. However, in the future, when Japanese banks expend the benefits derived from various deregulations, fee-based business is likely to be more competitive among banks. Therefore, future research can benefit from a consideration of a longer time span.

We also find that the positive effect of revenue diversification on the franchise value of banks is

more pronounced for BHC organizations than for independent banking organizations. We further find that the risk-reducing effects of revenue diversification are greater for banks with lower loan credit risk than banks with higher loan credit risk. This implies that banks that have better skills to manage the credit risk of their loans are likewise equipped to handle the change in their risks that comes with revenue diversification. As such, these results may provide bank regulators or supervisors with important insights about how they should change or improve the regulations related to bank diversifications or financial conglomerates in the future because our observations suggest that the effects of bank's revenue diversification on franchise value and risk measures are affected by particular bank characteristics such as organizational form and performance of traditional banking business. Deeper investigations of the variables that affect the relationship between revenue diversification and bank's return or risk would therefore pose an interesting and fruitful avenue for future research.

Appendix

A.1. Revenue categories

The measures for revenue diversification are based on consolidated financial statements. We use ordinary income in Japanese bank accounting as total operating income, according to the definition of the Japanese Bankers Association. In consolidated financial statements, total operating income (ordinary incomes) is composed of six items of account: (a) interest income, (b) fees and commissions, (c) trading revenue, (d) other operating income, (e) other income, and (f) commissions from trust accounts[20].

[20] The item "other operating income (d)" is composed of the six sub-item accounts: gain on foreign exchange transactions (d1), gain on trading account securities transactions (d2), gain on sales of bonds (d3) and redemption of bonds (d4), income from derivatives other than for trading or hedging

- Noninterest income = total oprating income - interest income(a)
- Fee Income = fees and commissions (b)
- Trading Income = trading revenue (c) + other operating income (d)
  + gain on sales of stocks and other securities
- Other Noninterest Income = Noninterest Income - Fee Income - Trading Income

where the item "gain on sales of stocks and other securities" in trading income is actually unavailable in consolidated accounts because it is included in the item of other income (e). Therefore, we substitute the value of "gain on sales of stocks and other securities" in unconsolidated (single-entity) accounts of banks to calculate the value of trading income[21]. With respect to financial groups with multiple subsidiary banks, we calculate the values of financial groups by adding up the values of their subsidiary banks.

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(d5), and other (d6). With respect to banks with trading assets accounts, there are no sub-item accounts (d1) and (d2) in other operating income.

[21] We consider the value of trading income not to be unduly distorted by using the value of capital gain from stock sales in unconsolidated accounts because the capital gain from stock sales in bank-affiliated security firms is counted in the item on trading revenue (c) in consolidated financial statements. Therefore, the value of "gain on sales of stocks and other securities" in consolidated accounts, even if available, is expected to be mostly similar to that in unconsolidated accounts.

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Table 1 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Performance and risk measures					
Tobin's Q (Franchise Value)	991	0.9937	0.0206	0.9450	1.1638
Market beta	991	0.8061	0.3607	−0.0813	2.3129
Idiosyncratic risk	991	0.2751	0.0978	0.0928	0.9042
Total risk	991	0.3353	0.1128	0.0950	0.9126
Measures for revenue diversification					
Non-interest income share	991	0.3116	0.0967	0.1007	0.7637
Fee income share	991	0.1191	0.0443	0.0318	0.2977
Trading income share	991	0.1402	0.0948	0.0035	0.5696
Other non-interest income share	991	0.0523	0.0640	0.0018	0.3886
Revenue diversity	991	0.6066	0.1571	0.2014	0.9986
Other control variables					
Bank size	991	14.9819	1.0301	13.2962	19.1342
Equity-to-assets	991	0.0482	0.0134	0.0011	0.1210
Cost-to-income	991	0.9622	0.2388	0.5823	2.4727
Bad loan ratio (B/L)	991	0.0577	0.0314	0.0099	0.3540
Loan growth rate	991	0.0056	0.0396	−0.2190	0.2303
Profitability (ROA)	991	0.0049	0.0052	−0.0247	0.0558

Table2 Correlation Matrix

Panel A Correlation matrix of main variables

Variables	NIS	RD	FI	TI	ONI	Size	E/A	C/I	B/L	LG	ROA
Non-interest income share (NIS)	1.0000										
Revenue diversity (RD)	0.8633	1.0000									
Fee income share (FI)	0.1635	0.1651	1.0000								
Trading income share (TI)	0.6837	0.5963	−0.2697	1.0000							
Other non-interest income share(ONI)	0.3857	0.3074	−0.0456	−0.2606	1.0000						
Bank size	0.4195	0.3712	0.2473	0.2933	0.0286	1.0000					
Equity-to-assets (E/A)	0.0397	0.0173	0.0841	0.1113	−0.1630	0.0234	1.0000				
Cost-to-income (C/I)	−0.0838	−0.0985	−0.2193	−0.0376	0.0807	−0.0656	−0.4674	1.0000			
Bad loan ratio (B/L)	−0.0040	−0.0428	−0.2058	−0.0212	0.1676	−0.2228	−0.2956	0.4802	1.0000		
Loan growth rate(LG)	0.0922	0.0536	0.2194	−0.0336	0.0373	−0.0298	0.2729	−0.3974	−0.2885	1.0000	
Profitability (ROA)	0.0413	0.0260	0.0149	−0.0052	0.0598	0.0970	−0.1657	0.6682	0.3175	−0.1539	1.0000

Panel B Correlation matrix of main variables after within-transformation

Variables	NIS	RD	FI	TI	ONI	Size	E/A	C/I	B/L	LG	ROA
Non-interest income share (NIS)	1.0000										
Revenue diversity (RD)	0.7719	1.0000									
Fee income share (FI)	0.1659	0.1938	1.0000								
Trading income share (TI)	0.7499	0.5126	−0.3367	1.0000							
Other non-interest income share(ONI)	0.1651	0.1951	−0.0619	−0.2934	1.0000						
Bank size	0.1306	0.1185	0.3039	0.0390	−0.1615	1.0000					
Equity-to-assets (E/A)	0.1430	0.1216	0.3911	−0.0732	0.0031	0.1403	1.0000				
Cost-to-income (C/I)	−0.2764	−0.2107	−0.2975	−0.0962	−0.0051	−0.1451	−0.5697	1.0000			
Bad loan ratio (B/L)	−0.0503	−0.0058	−0.3071	0.0171	0.2014	−0.4103	−0.2932	0.3931	1.0000		
Loan growth rate (LG)	0.2164	0.1260	0.3405	−0.0057	0.0572	0.0782	0.3698	−0.3500	−0.1852	1.0000	
Profitability (ROA)	−0.1404	−0.0683	0.0439	−0.1540	0.0061	0.0074	−0.2200	0.6697	0.1965	−0.1086	1.0000

Table3 Franchise value regression

	Dependent Variable:Tobin's Q (Franchise Value)							
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
(Revenue Diversification)								
Non-interest income share (NIS)	0.0259**	0.0284**	0.0670*			0.0143	0.0266**	0.0108
	(0.0112)	(0.0112)	(0.0396)			(0.0112)	(0.0117)	(0.0171)
(Non-interest income share)^2			−0.0554					
			(0.0625)					
Fee income share				0.0764*				
				(0.0442)				
Trading income share				0.0314***				
				(0.0119)				
Other non-interest income share				0.0312				
				(0.0219)				
Revenue diversity					0.0139**			
					(0.0058)			
NIS * Financial Holdings						0.1040**		
						(0.0407)		
NIS*Loan growth rate							0.1217	
							(0.0805)	
NIS* Bad loan ratio								0.3009
								(0.2005)
(Control variables)								
Bank size	−0.0130	−0.0141	−0.0136	−0.0128	−0.0134	−0.0137	−0.0133	−0.0135
	(0.0109)	(0.0110)	(0.0108)	(0.0106)	(0.0107)	(0.0107)	(0.0110)	(0.0106)
Equity-to-assets	−0.1962	−0.2266	−0.2236	−0.2330	−0.2348	−0.1828	−0.2438	−0.2147
	(0.1909)	(0.1862)	(0.1880)	(0.1835)	(0.1883)	(0.1718)	(0.1847)	(0.1894)
Cost-to-income	0.0023	−0.0079	−0.0076	−0.0075	−0.0076	−0.0066	−0.0084	−0.0080
	(0.0034)	(0.0050)	(0.0051)	(0.0051)	(0.0050)	(0.0048)	(0.0051)	(0.0051)
Bad loan ratio	−0.0536	−0.0515	−0.0549	−0.0418	−0.0554	−0.0535	−0.0476	−0.1554**
	(0.0401)	(0.0382)	(0.0380)	(0.0389)	(0.0387)	(0.0380)	(0.0379)	(0.0704)
Loan growth rate	0.0273**	0.0245*	0.0268*	0.0233*	0.0280*	0.0292**	−0.0211	0.0257*
	(0.0134)	(0.0138)	(0.0162)	(0.0127)	(0.0163)	(0.0143)	(0.0325)	(0.0146)
ROA		0.5018***	0.4938***	0.4712***	0.4767***	0.4615***	0.5036***	0.5623***
		(0.1533)	(0.1511)	(0.1481)	(0.1505)	(0.1442)	(0.1547)	(0.1519)
Constant	1.1946***	1.2198***	1.2064***	1.1956***	1.2107***	1.2117***	1.2092***	1.2160***
	(0.1620)	(0.1650)	(0.1603)	(0.1580)	(0.1595)	(0.1592)	(0.1650)	(0.1593)
Number of observations	991	991	991	991	991	991	991	991
R_sq (Within)	0.480	0.490	0.492	0.492	0.490	0.504	0.491	0.493
Number of groups	113	113	113	113	113	113	113	113

Significance at 1%,5% and 10% level are denoted by "***" "**" and "*". The figures in parentheses indicate the standard errors. Year dummy variables are included in each regression.

Table4 Total risk regression

	Dependent Variable: Total risk						
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
(Revenue Diversification)							
Non-interest income share (NIS)	−0.1481*	0.4129*			−0.1171	−0.1395	−0.3310***
	(0.0852)	(0.2226)			(0.0940)	(0.0864)	(0.1154)
(Non-interest income share)^2		−0.8041***					
		(0.2591)					
Fee income share			−0.8498**				
			(0.3295)				
Trading income share			−0.1893**				
			(0.0912)				
Other non-interest income share			−0.2308				
			(0.1452)				
Revenue diversity				0.0053			
				(0.0438)			
NIS * Financial Holdings					−0.2294		
					(0.1889)		
NIS*Loan growth rate						−0.5866	
						(0.5740)	
NIS* Bad loan ratio							3.1273***
							(1.1555)
(Control variables)							
Bank size	−0.0039	0.0031	−0.0241	−0.0103	−0.0047	−0.0077	0.0023
	(0.0586)	(0.0581)	(0.0670)	(0.0575)	(0.0575)	(0.0582)	(0.0572)
Equity-to-assets	−2.2547***	−2.2114***	−2.1619***	−2.1332***	−2.3513***	−2.1717***	−2.1312***
	(0.5937)	(0.5929)	(0.5835)	(0.5978)	(0.5924)	(0.5971)	(0.5844)
Cost-to-income	0.0379	0.0426*	0.0325	0.0417	0.0351	0.0404	0.0367
	(0.0265)	(0.0250)	(0.0264)	(0.0270)	(0.0260)	(0.0260)	(0.0244)
Bad loan ratio	0.2121	0.1631	0.0727	0.1848	0.2166	0.1933	−0.8680*
	(0.2534)	(0.2508)	(0.2421)	(0.2550)	(0.2558)	(0.2536)	(0.4519)
Loan growth rate	−0.1000	−0.0670	−0.0806	−0.1150	−0.1102	0.1201	−0.0876
	(0.0850)	(0.0799)	(0.0829)	(0.0904)	(0.0851)	(0.2227)	(0.0752)
ROA	−1.0486	−1.1648	−0.5867	−0.9008	−0.9596	−1.0574	−0.4202
	(0.8788)	(0.8216)	(0.9396)	(0.8982)	(0.8783)	(0.8689)	(0.7610)
Constant	0.5011	0.3077	0.8746	0.5438	0.5188	0.5520	0.4620
	(0.8852)	(0.8841)	(1.0214)	(0.8729)	(0.8686)	(0.8802)	(0.8588)
Number of observations	991	991	991	991	991	991	991
R_sq (Within)	0.500	0.508	0.511	0.496	0.502	0.501	0.507
Number of groups	113	113	113	113	113	113	113

Significance at 1%,5% and 10% level are denoted by "***" "**" and "*". The figures in parentheses indicate the standard errors. Year dummy variables are included in each regression.

Table5 Idiosyncratic risk regression

	Dependent Variable: Idiosyncratic risk						
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
(Revenue Diversification)							
Non-interest income share (NIS)	-0.1303	0.2745			-0.1140	-0.1232	-0.2907***
	(0.0799)	(0.2139)			(0.0886)	(0.0811)	(0.1086)
(Non-interest income share)^2		-0.5802**					
		(0.2520)					
Fee income share			-0.7036**				
			(0.2836)				
Trading income share			-0.1634*				
			(0.0835)				
Other non-interest income share			-0.2040				
			(0.1481)				
Revenue diversity				-0.0004			
				(0.0414)			
NIS * Financial Holdings					-0.1211		
					(0.1454)		
NIS*Loan growth rate						-0.4864	
						(0.4876)	
NIS* Bad loan ratio							2.7413**
							(1.1245)
(Control variables)							
Bank size	-0.0232	-0.0182	-0.0398	-0.0286	-0.0236	-0.0263	-0.0178
	(0.0582)	(0.0577)	(0.0644)	(0.0575)	(0.0576)	(0.0579)	(0.0567)
Equity-to-assets	-2.2785***	-2.2473***	-2.2028***	-2.1767***	-2.3295***	-2.2097***	-2.1702***
	(0.5667)	(0.5657)	(0.5561)	(0.5736)	(0.5741)	(0.5717)	(0.5598)
Cost-to-income	0.0497**	0.0532**	0.0453**	0.0527**	0.0483**	0.0519**	0.0487**
	(0.0228)	(0.0218)	(0.0228)	(0.0232)	(0.0226)	(0.0227)	(0.0210)
Bad loan ratio	0.1922	0.1569	0.0786	0.1713	0.1946	0.1766	-0.7546*
	(0.2674)	(0.2630)	(0.2527)	(0.2688)	(0.2683)	(0.2690)	(0.4152)
Loan growth rate	-0.1473*	-0.1234	-0.1311	-0.1607*	-0.1527*	0.0352	-0.1363*
	(0.0799)	(0.0786)	(0.0801)	(0.0839)	(0.0804)	(0.2013)	(0.0728)
ROA	-1.8139**	-1.8978**	-1.4346*	-1.6850**	-1.7669**	-1.8212**	-1.2631*
	(0.7801)	(0.7447)	(0.8491)	(0.8024)	(0.7857)	(0.7779)	(0.7174)
Constant	0.7686	0.6290	1.0767	0.8065	0.7780	0.8108	0.7343
	(0.8779)	(0.8756)	(0.9815)	(0.8698)	(0.8693)	(0.8747)	(0.8505)
Number of observations	991	991	991	991	991	991	991
R_sq (Within)	0.388	0.394	0.398	0.384	0.389	0.389	0.396
Number of groups	113	113	113	113	113	113	113

Significance at 1%,5% and 10% level are denoted by "***" "**" and "*". The figures in parentheses indicate the standard errors.
Year dummy variables are included in each regression.

Table6 Market beta regression

	Dependent Variable:Market beta						
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
(Revenue Diversification)							
Non-interest income share (NIS)	−0.2805	1.2875*			−0.1696	−0.2056	−1.2327***
	(0.1929)	(0.6864)			(0.1977)	(0.1942)	(0.2541)
(Non-interest income share)^2		−2.2476**					
		(0.8828)					
Fee income share			−1.8220*				
			(0.9568)				
Trading income share			−0.3629*				
			(0.2154)				
Other non-interest income share			−0.5498				
			(0.3803)				
Revenue diversity				0.0726			
				(0.1102)			
NIS * Financial Holdings					−0.8219		
					(0.9483)		
NIS*Loan growth rate						−5.1360***	
						(1.6418)	
NIS* Bad loan ratio							16.2811***
							(3.7747)
(Control variables)							
Bank size	−0.0950	−0.0755	−0.1419	−0.1095	−0.0980	−0.1284	−0.0630
	(0.1769)	(0.1731)	(0.1980)	(0.1778)	(0.1741)	(0.1764)	(0.1613)
Equity-to-assets	−4.1275**	−4.0067**	−3.9261**	−3.8342**	−4.4738**	−3.4013*	−3.4847*
	(1.8715)	(1.8777)	(1.8791)	(1.8310)	(1.8052)	(1.9116)	(1.7953)
Cost-to-income	0.0948	0.1081	0.0824	0.1062	0.0849	0.1174	0.0888
	(0.0759)	(0.0737)	(0.0747)	(0.0757)	(0.0750)	(0.0748)	(0.0752)
Bad loan ratio	−0.2480	−0.3849	−0.5499	−0.3379	−0.2318	−0.4126	−5.8711***
	(0.5839)	(0.6114)	(0.5991)	(0.6012)	(0.5957)	(0.5753)	(1.3701)
Loan growth rate	−0.1913	−0.0988	−0.1445	−0.2171	−0.2278	1.7360***	−0.1264
	(0.2551)	(0.2306)	(0.2432)	(0.2576)	(0.2498)	(0.5700)	(0.2275)
ROA	−3.3539	−3.6787	−2.3097	−3.0606	−3.0350	−3.4308	−0.0823
	(2.6714)	(2.5620)	(2.8388)	(2.6810)	(2.6905)	(2.5267)	(2.7764)
Constant	1.9160	1.3753	2.7788	1.9933	1.9795	2.3616	1.7123
	(2.6606)	(2.6234)	(3.0150)	(2.6759)	(2.6169)	(2.6534)	(2.4108)
Number of observations	991	991	991	991	991	991	991
R_sq (Within)	0.606	0.612	0.611	0.605	0.608	0.612	0.624
Number of groups	113	113	113	113	113	113	113

Significance at 1%,5% and 10% level are denoted by "***" "**" and "*". The figures in parentheses indicate the standard errors. Year dummy variables are included in each regression.

Table7 IV estimation

	Dependent Variable							
	Tobin'Q	Tobin'Q	Beta	Beta	Idiosyncratic	Idiosyncratic	Total risk	Total risk
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
(Revenue Diversification / Instrumented)								
Non-interest revenue share	0.071***		−0.267		−0.153		−0.253	
	(0.025)		(0.460)		(0.143)		(0.157)	
Fee income share		0.021		−2.935***		−0.816***		−1.096***
		(0.043)		(0.786)		(0.243)		(0.265)
Trading income share		0.063**		−0.030		0.001		−0.116
		(0.028)		(0.502)		(0.155)		(0.169)
Other non-interest income share		0.056*		−0.372		−0.541***		−0.520**
		(0.033)		(0.608)		(0.188)		(0.205)
(Control variables)								
Bank size	−0.009	−0.011*	−0.125	−0.264**	−0.013	−0.068*	0.006	−0.051
	(0.006)	(0.007)	(0.110)	(0.119)	(0.034)	(0.037)	(0.038)	(0.040)
Equity-to-assets	−0.111	−0.101	−6.067***	−5.099***	−2.770***	−2.560***	−2.802***	−2.515***
	(0.072)	(0.073)	(1.304)	(1.340)	(0.404)	(0.414)	(0.446)	(0.452)
Cost-to-income	−0.009**	−0.009**	0.072	0.062	0.025	0.010	0.010	−0.002
	(0.004)	(0.004)	(0.070)	(0.073)	(0.022)	(0.022)	(0.024)	(0.025)
Bad loan ratio	−0.054*	−0.060*	−0.688	−1.334**	−0.163	−0.373**	−0.080	−0.316
	(0.030)	(0.031)	(0.540)	(0.572)	(0.167)	(0.177)	(0.185)	(0.193)
Loan growth rate	0.708***	0.733***	−1.514	0.691	−0.761	0.419	0.113	1.220
	(0.151)	(0.161)	(2.733)	(2.939)	(0.847)	(0.908)	(0.934)	(0.991)
ROA	0.018	0.020	−0.130	−0.106	−0.187***	−0.164**	−0.111	−0.093
	(0.013)	(0.013)	(0.231)	(0.234)	(0.072)	(0.072)	(0.079)	(0.079)
Constant	1.109***	1.144***	3.187*	5.588***	0.604	1.517***	0.441	1.405**
	(0.092)	(0.099)	(1.660)	(1.812)	(0.514)	(0.560)	(0.567)	(0.611)
Number of observations	891	891	891	891	891	891	891	891
Number of groups	113	113	113	113	113	113	113	113

Significance at 1%,5% and 10% level are denoted by "***" "**" and "*". The figures in parentheses indicate the standard errors. Year dummy variables are included in each regression.

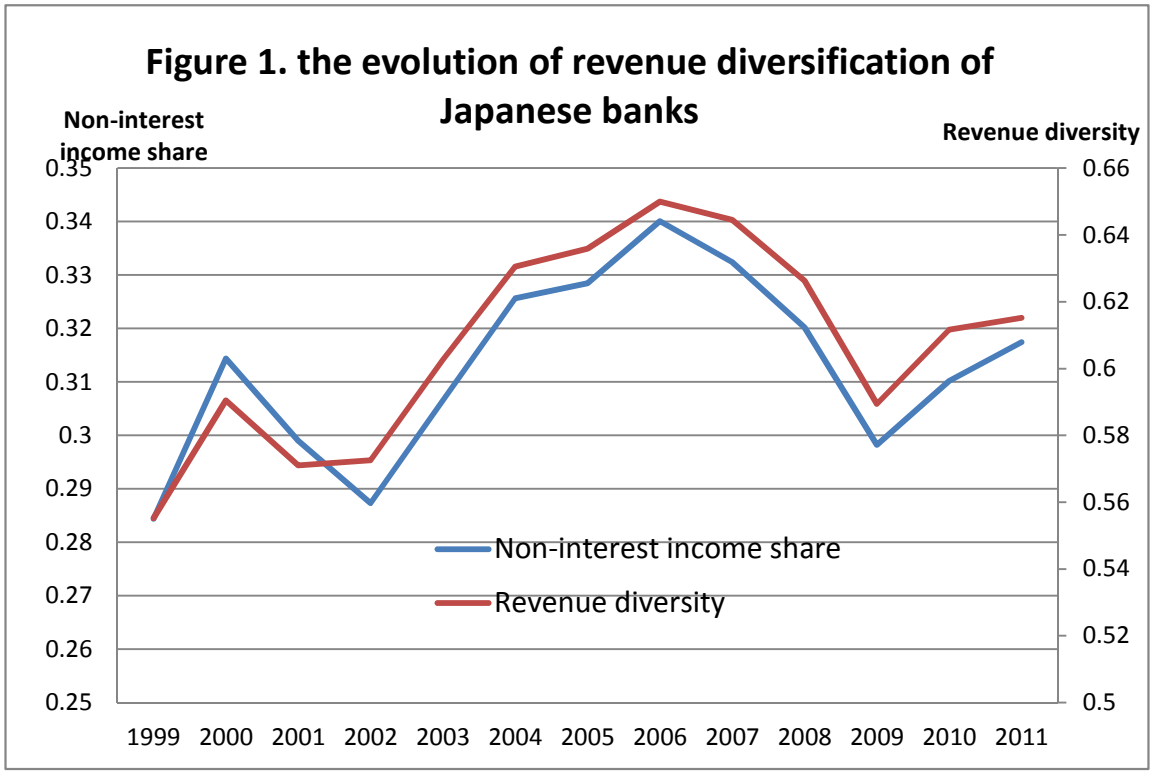
Figure 1. the evolution of revenue diversification of Japanese banks
Non-interest income share
Revenue diversity
0.35
0.34
0.33
0.32
0.31
0.3
0.29
0.28
0.27
0.26
0.25
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0.52
0.5
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
Non-interest income share
Revenue diversity

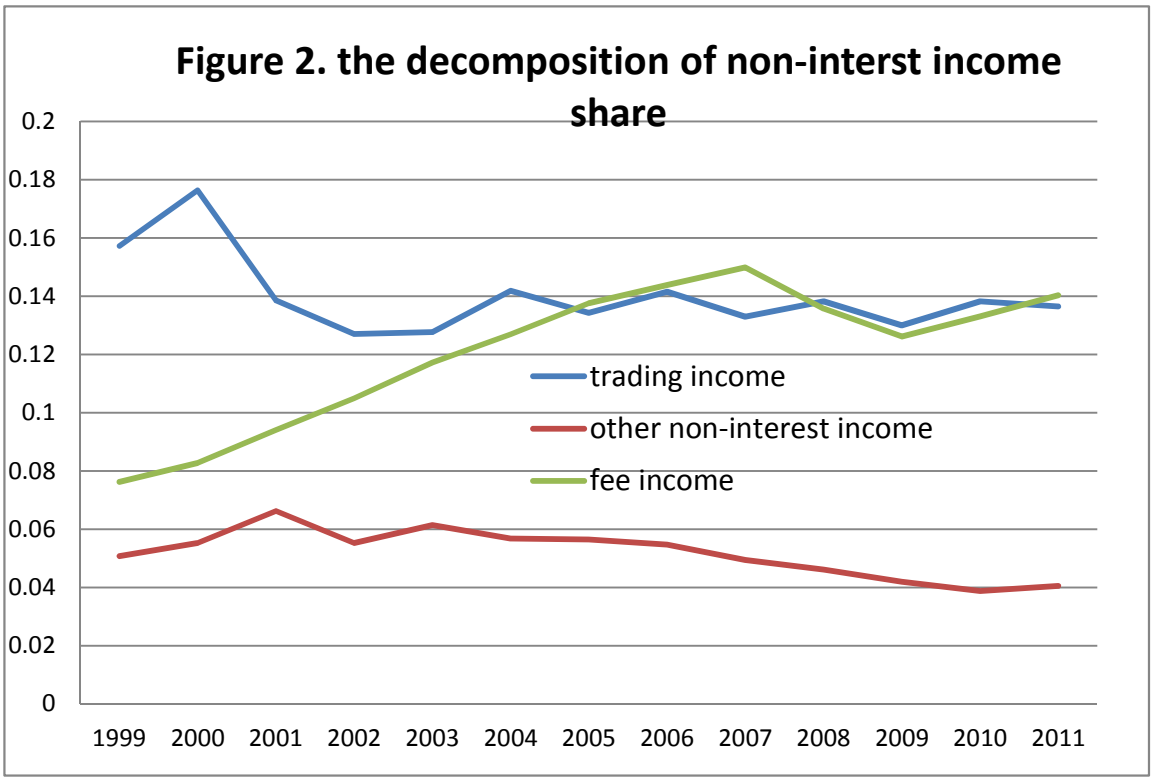
Figure 2. the decomposition of non-interst income share
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
trading income
other non-interest income
fee income