

Did Efficiency Improve? Megamergers in the Japanese Banking Sector

Kimie Harada



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Executive Summary

This paper examines the technical efficiency implications of Japanese city banks to evaluate their pre- and post-consolidation efficiency. Using a sample from the period of 1999 to 2003, we consider questions such as whether efficiency improved after consolidation and whether consolidation of two weak banks created a strong bank.

The study has some significant findings. First, average technical efficiency scores worsened in the late 1990s compared with the estimates of earlier literature. Second, larger banks exhibited higher scores, especially in the late 1990s. The findings supported our hypotheses that consolidation of healthy and unhealthy banks would not create healthy banks and that consolidations between weak banks would not strengthen them. Finally, it is also suggested that banks acted with short-term horizons when they included adjustable sub-items like other business income in their income.

JEL Classification: G21; G34; D21

Keywords: Consolidation; Data Envelope Analysis; Efficiency Analysis

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Did Efficiency Improve? Megamergers in the Japanese Banking Sector ^{*)}, ^{**)}

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I. Introduction

The business environment for Japanese banks worsened rapidly during the second half of the 1990s. After a listed bank failed in August 1995, for the first time since World War II, many banks were bankrupted, and others were nationalized and put under state control. Even surviving banks

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^{##)} This paper is released ahead of a collaborative research with professor Jenny Corbett, Ms. Mariejoe Bousaid, professor Takatoshi Ito and Kimie Harada. The joint study aims at measuring the efficiency of Japanese banks including regional and shinkin banks as well as city banks but it is not fully implemented.

applied for public funds, and merged or had a business tie-up with other banks for survival.

Few empirical studies analyze the reorganization or mergers of Japanese banks. Mergers of financial institutions have as much of an impact on the market as failures but the only earlier studies related to mergers are those of Tachibanaki and Haneda (1999) or Drake and Hall (2003). This is surprising when compared with other industrialized countries where banking systems are undergoing dramatic consolidation and there are many studies on mergers and acquisitions. There are two possible causes for Japan's situation.

First, by the first half of the 1990s, financial institutions in Japan were protected by regulations such as the so-called "convoy system." Therefore, there were few mergers of financial institutions during that period, apart from some government-led mergers undertaken as a measure to absorb failed banks. For example, to restrict competition between banks in an area, regulations limiting the number of branches and their operating locations were imposed. New entry of ordinary banks was restricted, with some exceptions such as Japanese branches of foreign banks. Moreover, new entry of a trust bank or a long-term credit bank was not accepted in practice or by regulation; these (editor's note: Unclear as to what these refers to) were liberalized in 1993. Examples of relatively large mergers during the regulated periods of the 1990s are Mitsui Bank and Taiyokobe Bank in 1990, Kyowa Bank and Saitama Bank in 1991, and Mitsubishi Bank and Bank of Tokyo in 1996. Other examples are mergers of minor financial institutions including mutual banks (See Appendix Table A1). Overall, there was no significant change in the number of banks until the latter half of the 1990s. The number of banks fell to 150 in fiscal year 1995 from 156 in 1985, and to 130 in March 2003 (or fiscal year 2002): see Table 1.

Table 1. Number of Banks

Japan	FY1985	FY1990	FY1995	FY1998	FY1999	FY2000	FY2001	FY2002
City banks	13	12	11	9	9	9	7	6
Long-term Credit banks	3	3	3	1	2	2	3	2
Trust banks	7	7	7	7	7	7	5	5
Regional banks	64	64	64	64	64	64	64	64
The second regional banks	69	68	65	57	55	54	54	53
Sum	156	154	150	138	137	136	133	130

Source: Japanese Bankers Association, Bank of Japan.

Compared with these few consolidation cases in Japan, the number of banks operating outside Japan, especially in the US and the UK, declined substantially as a result of bank mergers and acquisitions. In the US, the number fell by more than 40 percent, from 14,406 in 1980 to 8,505 in 1999 (see Table 2). The reduction was 18 percent in the UK, to 418 in 1999 from 507 in 1990 (see “Group of Ten, Report on Consolidation in the Financial Sector” for more detail). With so many mergers and acquisitions, a large amount of theoretical and empirical literature focusing on these countries has accumulated. For example, Berger and Humphrey (1997) surveyed 130 earlier papers on financial institution efficiency. The survey covers 21 countries but more than half of the studies applied efficiency analysis to financial institutions in the US.

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Table 2. The Number of Banks at Major Countries

Japan	1980	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Number of banks	147	144	143	141	140	140	139	136	136	130	-
Number of branches	-	14325	14632	14782	14804	14823	14693	14597	14395	13817	-
Deposits/Assets ratio	76.40%	76.2%	74.6%	76.6%	77.5%	78.3%	77.8%	77.2%	75.0%	75.6%	-
Capital/Assets ratio	2.60%	3.2%	3.3%	3.6%	3.7%	3.7%	3.3%	3.4%	2.8%	4.4%	-
pretax ROAA	0.19%	0.36%	0.32%	0.26%	0.19%	0.11%	-0.17%	0.34%	-0.50%	-0.76%	-
U.S.	1980	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Number of banks	14406	12195	11791	11348	10867	10359	9854	9466	9065	8698	8505
Number of branches	50804	61377	62494	62842	63317	65211	66518	67389	69185	70304	71383
Deposits/Assets ratio	79.80%	78.1%	78.3%	77.0%	74.3%	71.6%	70.2%	69.9%	68.4%	67.8%	67.0%
Capital/Assets ratio	5.80%	6.4%	6.7%	7.5%	8.0%	7.8%	8.1%	8.2%	8.3%	8.5%	8.4%
Pretax ROAA	1.05%	0.71%	0.76%	1.34%	1.75%	1.74%	1.80%	1.83%	1.89%	1.78%	1.98%
U.K.	1980	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Number of banks	346	507	491	469	462	458	484	467	468	448	418
Number of branches	-	-	-	-	-	-	-	-	-	-	-
Deposits/Assets ratio	65.00%	68.6%	68.9%	69.9%	71.2%	70.7%	71.4%	63.8%	60.7%	61.0%	60.2%
Capital/Assets ratio	5.30%	6.5%	6.9%	6.4%	6.4%	6.5%	6.2%	6.2%	8.0%	8.2%	8.5%
pretax ROAA	-	0.74%	0.53%	1.04%	0.60%	1.15%	0.81%	0.77%	0.78%	0.91%	-

Source: BIS(2001)

Secondly, the original Japanese Antimonopoly Law enacted in 1947 prohibited establishing or operating a holding company; however, the law was amended in 1997. Under the new Article 9 of the law, establishment and operation of a holding company is permitted. Along with the amendment of the Banking Law in 1998, Japanese banks could establish holding companies and become subsidiaries of them.¹⁾

This paper analyzes the efficiency implications of megamergers in the Japanese banking sector using data envelope analysis, a nonparametric frontier approach. The reason for analyzing consolidations in institutions concerning (sometimes more than two institutions are merged) city banks and big assets is that strategic mergers and acquisitions have been less frequent in Japan. Mergers and acquisitions have been carried out as a result of liquidation or bankruptcy of failed or weak banks. Healthy institutions that were willing to pay premiums for a branch network or other incentives usually took over those banks up until 1995. The first case of a failure of a bank listed in the stock exchange took place in 1995; following the failure of a regional bank, Hyogo Bank. Other major banks failed in 1997 and 1998. Appendix Table 2 shows bankruptcy cases after 1995. Houston, James and Ryngaert (2001) stated that examining only large bank mergers enables them to identify valuation consequences of management's primary rationale for the acquisitions. This kind of analysis is important because the consolidated banks resulting from these megamergers dominate the industry with their size, and affect the level of intermediation as well as corporate activities in the economy.

1) Japanese industries repeatedly requested the Japanese government to lift the ban on holding companies as a means for efficient restructuring (<http://www.kojimalaw.jp/HoldingCompanies.html>). For an English translation of the Banking Law, see <http://www.japanlaw.info/banking/1981.htm>.

Section II of this paper will review two types of earlier literature, namely papers analyzing bank consolidation and those analyzing efficiency changes in Japanese banks. Section III briefly describes the process toward consolidation. In section IV, a nonparametric frontier framework that is available for analyzing productivity growth and efficiency is presented. The data source and specified bank output and input variables are also explained in section IV. Section V shows the empirical results, and section 6 concludes the paper.

II. Brief Literature Review

1. Financial Consolidation outside Japan²⁾

There was a high level of consolidation among financial institutions across many industrial countries in the 1980s and 1990s. From the beginning of the consolidations, economists analyzed efficiency, improvement in competitiveness, and policy implications of bank consolidation. Calomiris and Karceski (1998) and Calomiris (1999) divided the literature into three broad areas: (1) cross-regime comparisons; (2) analysis of the causes of consolidation; and (3) econometric studies of the consequences for individual bank performance of consolidations. The main analysis examined consolidation effectiveness including event studies of stock price responses and performance analysis using financial statements. Calomiris (1999) placed these econometric analyses in the third category, and stated that post-merger performance studies have found small average benefits from consolidations. Calomiris and Karceski (1998) explained why econometric analyses such as event studies failed in assessing large efficiency gains from bank consolidation, and argued that detailed case studies of some consolidations help the understanding of the effect of

2) There are many ways for firms to combine. The most common approaches are mergers and acquisitions, which combine independent firms under common control, and joint ventures and strategic alliances, which enhance interfirm cooperation without combining separate entities (Group of Ten 2001). This paper uses the broader definition for forms of combination and consolidation.

consolidation more precisely.³⁾ Houston, James and Ryngaert (2001) also pointed out that empirical studies examining stock market reactions to consolidation announcements find little evidence of wealth creation. One interpretation given in Houston, James and Ryngaert (2001) is that bank acquisition results in value destruction for acquiring firm shareholders due to managerial hubris or corporate control problems. Similarly, Berger (1998) also expressed negative ideas about estimating the effects of consolidation through event studies and similar methods. The lack of econometric evidence of efficiency gains is surprising as there have been several massive bank consolidations over the past two decades.

Another type of study concerning the examination of consolidation or consolidation announcements is an analysis based on individual bank performance, for example by examining motives behind consolidation activity. Calomiris and Karceski (1998) recommended applying case studies to the causes of consolidation. However, James (1998) pointed out that case studies of bank consolidations are questionable because it is not clearly explained why they tend to show more favorable results from consolidation. Therefore, academic literature on the gains from bank consolidation lacks a definite conclusion; neither is there any consensus between academics and market participants. The Group of Ten (2001) stated that research results and views of industry participants regarding the potential for efficiency gains from consolidation may differ because of differences in perspective. Market

3) They raise four methodological problems in stock price event studies: (1) poor measures of market perceptions; (2) lack of benchmarks for comparison (estimates of what a merging bank's performance would have been if no consolidation had taken place); (3) unclear means for measuring success or failure (time spans of event studies are too short for judging long-run gains); and (4) less consistency in bank performance and a sufficient measure of economic efficiency.

participants may not look for cost reductions or revenue enhancement, which usually interest researchers.⁴⁾

Key findings of the Group of Ten (2001) are as follows. There was a high level of merger and acquisition activity in the 1990s among financial firms, and a significant number of large financial institutions were created. Most mergers and acquisitions involved firms competing in the same industry and the same country. Cross-border mergers and acquisitions were less frequent: acquisitions of banking firms accounted for 60 percent of all cases. Therefore the number of banking firms decreased in almost every country; a high degree of interdependency would suggest a possibility of systemic risks. Most of these findings hold for Japan over the past three years. As is shown in section III of this paper, Japan's major city banks consolidated, becoming megabanks, and are now under the umbrella of holding companies.

It seems that there is no perfect measure for examining bank consolidation. However, research into the efficiency analysis of financial institutions is becoming popular. Berger and Humphrey (1997) documented 130 papers that measured x-efficiency or frontier efficiency of financial institutions, and mentioned that 116 of the papers are dated 1992 or later. X-efficiency estimation mainly considers cost efficiency (whether consolidations reduce costs per unit of output) using before and after profit efficiency, comprising both cost efficiency and revenue effects. It is suggested that analysis of profit is more appropriate for evaluating consolidation because outputs tend to change or increase substantially following a consolidation, and changes in

4) Further reasons are that: (1) research results are for typical consolidations, while some consolidations result in efficiency gains; and (2) past consolidations may have suffered from restrictive regulations. See Group of Ten (2001) for more detail.

output scale cannot be a problem in estimating the efficiency (see Harimadani 2003 and Matsuura and Takezawa 2000 for the case of Japan). The merits of frontier analysis are twofold. It gives numerical efficiency values, and automatically selects the best performance firm within the analyzed firms or industry. Even without sufficient knowledge or experience in the field, it is easier to relate results to policy implications or research interests.

This paper analyzes efficiency implications of megamergers in the Japanese banking sector with a methodology of frontier analysis, data envelope analysis, or nonparametric frontier approach. It also follows Houston, James and Ryngaert (2001) who analyzed only large bank consolidations for a longer period of 12 years, and takes a close look at each consolidation process, purpose and gains.

2. Financial Consolidation in Japan

There were large-scale consolidations of financial institutions in Japan after 2001, but until then the number of consolidations was very limited, due partly to the two reasons raised in the introduction: fewer strategic mergers or acquisitions, and the 1947 enactment of the Japanese Antimonopoly Law.⁵⁾ Consequently, academic research on Japanese bank consolidations is limited, as discussed above.

Tachibanaki and Haneda (1999) examine indicators such as stock price, productivity, profitability, and fund-raising costs for five cases of consolidation of Japanese city banks between 1967 and 1996. They found less evidence of gains from consolidation than expected. Papers indirectly remarking on

5) Ito and Harada (2005) present a chronological review of the banking crisis in Japan in the 1990s and bank consolidations that followed in the beginning of this century.

consolidation are Ohashi et al. (2001), Matsuura and Takezawa (2000), and Drake and Hall (2003).⁶⁾ Matsuura and Takezawa (2000) estimate a two-output translog production function using unbalanced panel analysis with consolidation dummy variables between 1988 and 1997. The main purpose of that paper, however, is to distinguish unhealthy banks from seemingly healthy banks, and the dummy variable works as a control variable for consolidations. Consolidation did not have a strong impact on production in Matsuura and Takezawa (2000). Drake and Hall (2003) use the nonparametric frontier approach to analyze efficiency in the Japanese banking sector with 149 banks for fiscal year ending 1997 (March 1998). Based on the cross-section analysis, Drake and Hall (2003) suggest that it would be very difficult to predict the outcome of consolidation because larger banks had the least x-efficiency gains, and had no economies of scale either. One weak point of the paper, however, is that trust banks and long-term credit banks are included in the estimation. As characteristics of Japanese banks differ among types of banks (see Appendix Table A5), trust banks at least should be separately estimated. Tachibanaki et al. (1997) focus only on trust banks, and examine portfolio selection and efficiency in the management of trust banks.

3. Efficiency of Banks

Two main types of empirical study have been used to conduct efficiency studies of the Japanese banking sector. One uses the parametric approach of traditional single-output econometric techniques that focuses on economies

6) Ohashi et al. (2001) is a translated version of a summary regarding Japanese consolidation from the Group of Ten (2001) report. In this report, megamergers after 2001 are not covered.

of scale and scope. The other is the nonparametric efficiency estimation approach.

Studies using parametric efficiency estimation include Tsutsui (1986), Kasuya (1989), Tachibanaki et al. (1997), Hori (1998), Matsuura and Takezawa (2000), Kunikata (2002), and Harimadani (2003). Kasuya (1989) estimated frontier cost functions and found that city banks were relatively efficient while smaller banks were less efficient between 1975 and 1986; the study also finds that economies of scale were observed for most banks regardless of the size of the banks' assets.⁷ In contrast, Tsutsui (1986) found that larger banks were inefficient compared with other smaller banks after estimating cost functions. Tachibanaki et al. (1997) employed the frontier production function to evaluate the efficiency of trust banks, and found that ranking of efficiency varies dramatically each year. Kunikata (2002) used several parametric efficiency estimation methods and found that the inefficiency level of banks did not differ among the methods employed; also, economies of scale were not observed when interest income was used as an output, while they were apparent when fees and commissions (income on service and transactions) were applied as another output. Harimadani (2003) focused on the difference in financial statements data because all earlier studies used unconsolidated statements; the study estimated frontier cost functions using two types of financial statements data, unconsolidated statements and consolidated statements, from fiscal year 1998 to 2001.⁸ As

7) Kasuya (1989) and Hori (1998) provided a survey of earlier studies on efficiency analysis in the Japanese banking sector.

8) Consolidated financial statements for banks and financial companies have been available since fiscal year 1998. The previous standard of consolidation was ineffective in preventing manipulation to hide bad performance by transferring losses or bad assets from a parent company's own accounts to subsidiaries (Hoshi and Patrick 2000).

the results based on unconsolidated statements and consolidated statements were different, Harimadani (2003) pointed out that parent banks are less likely to control consolidated accounting.^{9),10)}

As for the second type of efficiency estimation study, Fukuyama (1993), Fukuyama (1995), and Drake and Hall (2003) all employed the nonparametric frontier approach, called Data Envelope Analysis, or DEA. Fukuyama (1993) investigated 143 Japanese commercial banks' efficiency structures using a 1991 sample of cross-sectional data, dividing overall technical efficiency into pure technical efficiency and scale efficiency. The study showed that the major cause of overall technical inefficiency was pure technical inefficiency rather than scale efficiency. Fukuyama (1995) examined panel data from 1989 to 1991 using the same methodology, and concluded that the average values of technical efficiency were stable over the three years despite the collapse of the bubble economy that affected each bank differently. Drake and Hall (2003) also examined technical efficiency and scale efficiency of 149 Japanese banks using a 1997 sample of cross-sectional data.

9) Under the old disclosure system, subsidiaries were defined only in terms of the percentage of stocks held by a parent bank. As such subsidiaries were common, many paper companies purchased parent banks' nonperforming loans. Harimadani (2003) describes examples concerning Hyogo Bank and Hanwa Bank.

10) Other papers that examine the efficiency changes of Japanese banks are Hasan and Hunter (1996), Honma et al. (1996), Altunbas et al. (2000), and Takeda (1998).

III. Recent Changes in Japanese Bank Consolidation¹¹⁾

The primary motives for consolidation are usually cost savings and revenue enhancements. According to the Group of Ten (2001) report, the most important forces encouraging consolidation are improvement in information technology, financial deregulation, globalization of markets, and increased shareholder pressure for financial performance.

In this section, we briefly look at each consolidation process. Generally speaking, 10 leading banks merged to create five megabanks: Mizuho Financial Group, UFJ Financial Group, Sumitomo Mitsui Financial Group, Mitsubishi Tokyo Financial Group, and Resona Holdings.

Dai-Ichi Kangyo Bank (DKB), Industrial Bank of Japan (IBJ), and Fuji Bank

Three large banks, Dai-Ichi Kangyo Bank (DKB), Fuji Bank, and the Industrial Bank of Japan (IBJ) announced a merger in August 1999. The merger was completed in September 2001 as Mizuho Holdings.

The merger was unusual when compared with Western bank mergers since the three banks were amalgamated on an equal basis and it took more than two years to complete the merger.

11) See Appendix Tables A2 and A4 for bankruptcies and consolidations, respectively, and Appendix Figures A1 to A5 for flowcharts of each consolidation.

On April 2002, these three banks were reorganized under Mizuho Holdings. Mizuho Bank, Mizuho Corporate Bank and Mizuho Asset Trust and Banking were newly created.

A complicating factor is that a new financial holding company named Mizuho Financial Group was created in January 2003 as a result of reorganizing the whole group.

There are many subsidiaries under the new holding company, including the three banks, and the holding company directly manages other subsidiaries. Mizuho Bank mainly serves individuals while Mizuho Corporate Bank serves corporate customers, such as large corporations, financial institutions, and overseas corporations (Appendix Figure A1).

Tokyo Mitsubishi Bank

In April 2001, the Bank of Tokyo Mitsubishi, Mitsubishi Trust and Banking, Nippon Trust Bank, and Tokyo Trust Bank established a new bank holding company, Mitsubishi Tokyo Financial Group (MTFG). The three trust banks merged to become the Mitsubishi Trust and Banking Corporation (MTB) in October 2001 (Appendix Figure A2).

Sanwa Bank and Tokai Bank

In April 2001, UFJ Holdings was established, and Sanwa Bank and Tokai Bank were merged to form UFJ Bank in January 2002 (Toyo Trust, the group's trust bank, was renamed UFJ Trust). The merger announcement was placed in June 2000 but the merger was not completed until June 2002.

UFJ Bank established some subsidiary companies, such as UFJ Strategic Partner, with Merrill Lynch and UFJ Equity Investments for transferring its

nonperforming loans (Appendix Figure A3).^{12), 13)}

Sumitomo Bank and Sakura Bank

In April 2001, Sumitomo Mitsui Banking Corporation (SMBC) resulted from a merger between Sakura Bank and Sumitomo Bank, which had roots in old Zaibatsu. This was a straightforward merger of two competing banks with similar nationwide branch networks. They agreed to merge on October 4, 1999 and to form a banking group by April 2002, but later accelerated the process to merge in April 2001.¹⁴⁾ SMBC established a holding company named Sumitomo Mitsui Financial Group (SMFG) in December 2002. SMBC then became a wholly owned subsidiary of SMFG (Appendix Figure A4).

Sakura Bank was created in 1990 after Mitsui Bank and Taiyo Kobe Bank were merged. The bank operated as Taiyo Kobe Mitsui Bank until 1992. Sakura Bank announced a hostile takeover bid to Minato Bank in June 2000 and acquired the bank in July 2001.

12) UFJ admitted that it had systematically deceived the Financial Services Agency (FSA) inspectors; the FSA is laying criminal charges against UFJ (Financial Times, July 29, 2004).

13) The Sumitomo Trust and Banking, a trust bank of SMFG, had a deal to merge with UFJ Trust and Banking before UFJ and MTFG announced that they planned to merge on July 19, 2004. Then SMFG said that it was interested in a full merger with UFJ Holdings and won an injunction from the Tokyo District Court. The Tokyo District Court injunction halted MTFG and UFJ merger negotiations; the Tokyo High Court, however, overturned its lower court's ruling on August 11. The UFJ Holdings and MTFG will be in the final stage of negotiations to sign a merger deal. The merger would create the biggest bank in the world in terms of assets.

14) In March 2000, when Sanwa Bank announced it would merge with Tokai Bank, Asahi Bank was also intended to join them to create a multiregional financial group. In June 2000, Asahi Bank abruptly pulled out of the consolidation plan.

In addition, there was a mysterious merger case. In December 2002, when SMBC established SMFG, they agreed to merge with one of its wholly owned subsidiaries, Wakashio Bank, in March 2003 in order to limit the effect of unrealized losses. Under the merger plan, SMBC was dissolved, leaving Wakashio as the surviving bank. However, Wakashio Bank was renamed SMBC after the merger. It is estimated that unrealized losses of SMBC on holding equities of about 700 billion yen were completely disposed of by the merger.¹⁵⁾

Asahi Bank and Daiwa Bank

In April 2001, Daiwa Bank merged with Kinki Osaka Bank and Nara Bank to establish Daiwa Bank Holdings. In September 2001, Daiwa Bank Holdings and Asahi Bank agreed on consolidation. Through an exchange of shares, Asahi Bank became a subsidiary of Daiwa Bank Holdings in March 2002. Daiwa Bank Holdings was renamed as Resona Holdings in October 2002. Under Resona Holdings, Resona Bank and Saitama Resona Bank were established following reorganization of the subsidiary banks in March 2003.

However, Resona Holdings went under state control on May 17, 2003 and was set to become the first “Special Support Financial Institution (SSFI),” which effectively nationalized the bank.¹⁶⁾ SSFI does not imply a

15) Explicit merger accounting does not exist in Japan. Based on current accounting, the pooling-of-interests method of accounting that allows posting profit from consolidation is widely used when banks merge. Profit from consolidation means paper profits obtained by consolidation. UFJ and Mizuho Holdings used the pooling-of-interests method of accounting.

16) On May 17, 2003 for the closing of the accounting period of March 2003, the accounting firm decided that Resona Bank could not count more than three years' possible tax assets. It was then announced that Resona Bank was found to be subject to prompt corrective action.

bankruptcy but is understood as a virtual nationalization.¹⁷⁾

As we have seen, there was a major change in Japanese banking. After the consolidations of several banks and trust banks, five major banking groups emerged. Due to the consolidations, most banks are not comparable before and after these consolidations.¹⁸⁾ Furthermore, it seems that merging two or three banks was difficult and did not yield benefits, at least in the short term, and that bureaucratic corporate governance, egalitarian promotion, and long-term employment practices prevented Japanese banks from reaping benefits from consolidation (Ito and Harada 2005).

17) It is recognized that while there is no nationalization, there are virtual nationalization or temporary voting rights of preferred stocks to be exercised, conversion of preferred stocks into common stocks, and reinjection of public funds. Temporary nationalization refers to a form of post-bankruptcy resolution scheme that Japan Long-Term Credit Bank and Nippon Credit Bank implemented.

18) For example, the before-merger stock price and the after-merger price have different units. The listed stocks are no longer those of individual banks and the holding companies own 100 percent of the banks. Other financial institutions have sometimes been put under the holding companies.

IV. The Non-parametric Methodology¹⁹⁾

1. Efficiency Measurement Concept

The nonparametric approach was applied to measure the degree of efficiency of banks. And Data Envelope Analysis (DEA) is widely used in empirical estimates examining financial institution efficiency. There are two types of approaches for estimating frontier function (either cost frontier function or production frontier function): a parametric approach and a nonparametric approach.²⁰⁾ DEA, initially an idea from Farrell (1957), is a nonparametric approach that solves linear programming problems to find a set of best-practice frontier observations. The objective of DEA is to determine which firms operate on their efficiency frontier and which do not. Therefore, the nonparametric approach provides a piecewise linear frontier by enveloping the data used in the analysis without requiring explicit specification of functional form for either cost or production function.

There are now enough frontier efficiency studies of financial institutions to make comparisons of average efficiency levels across both measurement techniques and countries, as well as outline the primary results of the many applications of efficiency analysis to policy and research issues (Berger and Humphrey 1997). However, one weakness of DEA is that it does not assume

19) This subsection is based on Harada (2005) that uses data envelope analysis to measure the changes in technical efficiency of Korean banks.

20) There are many approaches to measuring frontier efficiency and no consensus has been reached. Greene (1997) provided a survey of frontier production function.

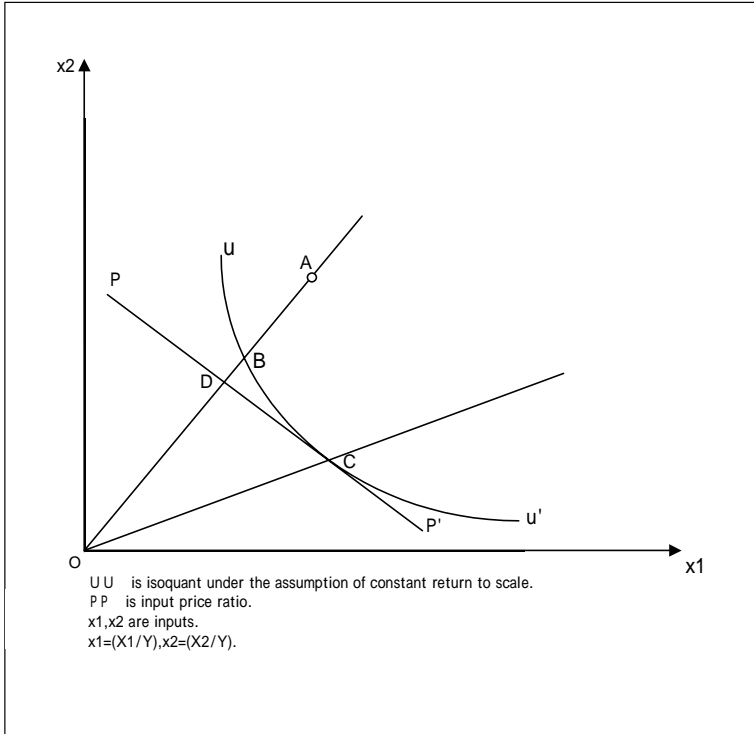
a random error term but assumes that there is no measurement error in constructing the frontier. Deviation from the efficient frontier is regarded as inefficiency for some units and, because of this tendency; DEA is likely to overstate the true levels of inefficiency.

Despite this weakness, this paper employs the nonparametric approach because it has two theoretical properties that are especially useful for interpretations. One is that the DEA model is mathematically related to a multi-objective optimization problem in which all inputs and outputs are defined as multiple objectives. The other property is that DEA efficiency scores are independent of the units in which inputs and outputs are measured (Yue 1992). As Drake and Hall (2003) pointed out, given the wide diversity across the banking institutions in Japan in both size and business mix, these features of DEA are important.

A firm's efficiency consists of two components: technical efficiency, which reflects the ability of a firm to obtain maximal output from a given set of inputs, and allocative efficiency, which reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices (Coelli 1997). These two measures of efficiency are combined and described as overall efficiency.

Because the measure of efficiency in DEA analysis varies from model to model, we employ the input-oriented measure. The treatment below mainly follows Farrell (1957) and Coelli (1997). For a simple case, two inputs (x_1 and x_2) are used to produce an output (y) under the assumption of constant return to scale. In Figure 1, the unit isoquant of the fully efficient firm is represented by UU' and the input price ratio is represented by the line PP' . As the fully efficient firm is not known in reality, this isoquant is estimated from observations. Firms on the isoquant have overall efficiency, and the efficiency level is 1 under the assumption of constant returns to scale.

Figure 1. Technical and Allocative Efficiencies



If a firm uses quantities of inputs defined by point A, this point is not only technically efficient but also allocatively efficient. Any firm on the line OA produces output with the same inappropriate input mix, but the firm located on A is able to choose B where it requires fewer inputs without changing the input mix. The distance BA could represent the technical inefficiency of that firm, which is the amount by which two inputs could be proportionately reduced without reduction in output. That is, the distance BA is the additional cost attributing to the inappropriate technology. By producing output at point B, that firm can reduce cost by the ratio BA/OA and is fully technically efficient because technical efficiency is measured by

the ratio OB/OA , which will take a value between 0 and 1. If a firm takes 1, which lies on the isoquant, that indicates that the firm is fully technically efficient.

Producing output at B, however, is allocatively inefficient in choosing an inappropriate input mix. The firm at C is both technically and allocatively efficient in choosing the cost minimizing production process given the relative input price. Therefore, a technically efficient firm located at point B can attain point C by changing the input mix. Producing output at C is equivalent to producing the same level of output as the input required at D. The allocative efficiency of the firm operating at A is defined as the ratio OD/OB because the distance DB represents the reduction in production costs that would occur if production point C were chosen. Therefore, by producing output at point C, the firm can attain an allocatively and technically efficient point.

As technical efficiency is OB/OA and allocative efficiency is OD/OB , the overall efficiency is defined, by adding both efficiencies, as the ratio OD/OA ($=OB/OA+OD/OB$). The distance DA is interpreted in terms of a cost reduction.

2. Data Envelope Analysis

DEA constructs a nonparametric envelopment frontier over the data points that all the observed points lie on or below the production frontier when input-oriented measures are adopted. Assuming constant return to scale, the following duality in the linear programming problem needs to be solved:

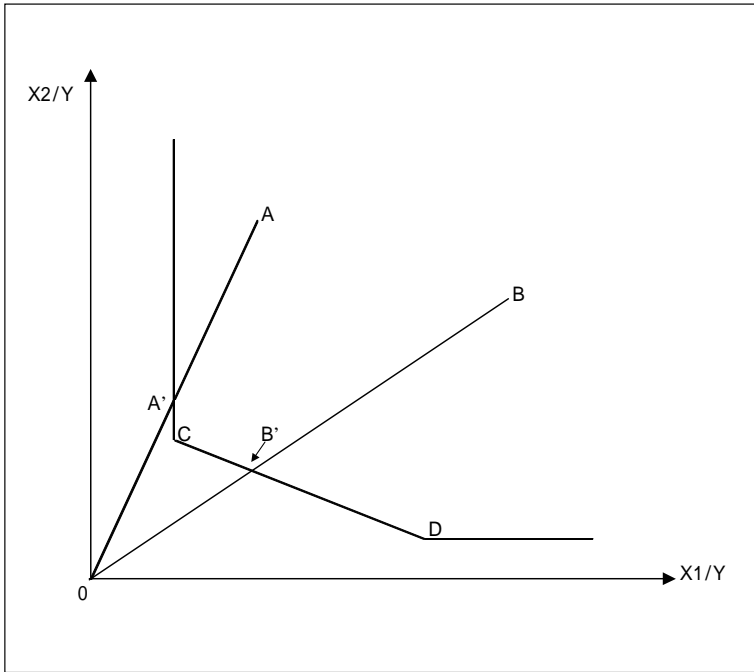
$$\begin{aligned}
 & \min_{\lambda, \theta} \theta \\
 \text{s.t.} \quad & -y_i + Y\lambda \geq 0, \\
 & \theta x_i - X\lambda \geq 0, \\
 & \lambda \geq 0.
 \end{aligned} \tag{1}$$

where θ is a scalar and will satisfy $\theta \leq 1$. A value of $\theta = 1$ indicates that it is a point on the frontier and a technically efficient point. λ is a $N \times 1$ column vector. In this problem, K inputs and M outputs of N firms are assumed so that the $K \times N$ input matrix, X , and the $M \times N$ output matrix are used as the data. That is, $y_i = (y_1, y_2, \dots, y_m)$ is a vector of outputs produced by a particular firm and $x_i = (x_1, x_2, \dots, x_k)$ is a vector of inputs utilized by the firm. The obtained value of θ will be the efficiency score for firm i . This linear programming must be solved N times for each firm and θ will then be obtained.²¹⁾

As pointed out in earlier literature by Coelli (1997) or Greene (1997), these efficiency measures assume that there is a production function of the fully efficient firm. In empirical estimation, the efficient isoquant must be estimated from the sample data; a piecewise-linear convex isoquant might occasionally be observed as shown in Figure 2. This piecewise-linear convex isoquant leads to a problem known as “slacks.”

21) Following Coelli (1997), the best way to introduce DEA is via the ratio form. For each firm, the ratio of all outputs over all inputs needs to be obtained. They are, for example, $u' y_i / v' x_i$ where u is an $M \times 1$ output weights vector and v is $K \times 1$ vector of input weights. The first programming problem is to select optimal weights. By finding values for u and v , efficiency measures are maximized. See Coelli (1997) for a detailed explanation.

Figure 2. Piecewise-linear Convex Isoquant



Based on the analysis in the previous subsection, points A and B are not technically nor allocatively efficient points, and points A' and B' are not always efficient although they are points on the isoquant. This is because producing on the line between C and D is efficient, and using input combinations C and D defines the frontier. At point A', a firm could reduce the amount of input x_2 used by the amount CA' , so it is doubtful whether a point on the isoquant is an efficient point. The amount CA' is known as "slack." DEA tends to treat inefficiency caused by slack as allocative inefficiency; however, the firm would not be able to improve its efficiency level without changing technology, even where there are output slacks. A suggestion for finding stricter efficient points is to use multistage DEA where a sequence of linear programming is conducted to identify the

efficient point.²²⁾ Multistage DEA conducts a sequence of radial linear programming and removes inefficiency caused by slacks.

A DEA model to account for variable returns to scale (VRS, i.e. increasing return to scale and decreasing return to scale) is also provided as an extension of the constant returns to scale (CRS) DEA. The CRS assumption is valid only when all firms are operating at an optimal scale. Following Coelli (1997), the CRS linear programming problem may be easily modified by adding a constraint: $N1' \lambda = 1$ into equation (1).

$$\begin{aligned}
 & \min_{\lambda, \theta} \theta \\
 \text{s.t.} \quad & -y_i + Y\lambda \geq 0, \\
 & \theta x_i - X\lambda \geq 0, \\
 & N1'\lambda = 1 \\
 & \lambda \geq 0.
 \end{aligned} \tag{2}$$

Where $N1$ is an $N \times 1$ vector of ones. The addition of this constraint provides more accurate technical efficiency scores, which are greater or equal to those obtained using the CRS DEA. This is because CRS DEA results in measuring technical efficiency are confused by scale efficiency when not all firms are operating at an optimal scale (which is understood in the context of microeconomics, that is it corresponds to the flat portion of the long-run average cost curve).

22) Strict technical efficiency is defined by Koopman (1951). See Ferrier and Lovell (1990) for more detail regarding multistage DEA. Of course, if an infinite sample size were available, the slack issue would be ignored.

3. The Data

In this section, we describe the data of consolidations analyzed in the paper. The nonparametric frontier approach explained in the previous section requires input and output data. Data concerning the consolidations of city banks were collected.²³⁾ Some consolidations are very complex, as shown in the appendix figures, so banks' consolidated financial statements are used as a single unit. For example, Mizuho Financial Holdings has two big banks under its umbrella, and the holding company comprises these banks and many other financial institutions. In this case, consolidated financial statements of the holding company include not only the two banks but also other financial institutions; therefore, consolidated statements for each bank are used respectively in the analysis. The difference between consolidated and unconsolidated statements is usually due to the inclusion or exclusion of some smaller financial subsidiaries and overseas-incorporated subsidiaries.²⁴⁾ It is therefore assumed that a bank under a holding company should itself act as a unit and maximize profits and minimize costs. The primary reason for using consolidated statements is that new accounting rules enacted in March 1999 require consolidated accounting with market value accounting of financial assets. The new rules are considered to be

23) Japanese banks are separated along the lines of businesses (see Appendix Table A5). They are divided into five types of banks: city banks; regional banks; second regional banks; trust banks; and long-term credit banks. As all megamergers that occurred after 2000 included only city banks, our focus is restricted to consolidations of city banks.

24) Matching balance sheets before and after consolidation is not easy in practice. At the time of consolidation, some assets, such as real estate and goodwill, might be revalued, so they may not match. See, for example, the special case of Wakashio Bank and Sumitomo Mitsui Bank.

more consistent with International Accounting Standards (Hoshi and Patrick 2000). Harimadani (2003) stated that window dressing settlement became more difficult under the new consolidated financial statements regime.

The most important step in using DEA to examine relative efficiency is the selection of appropriate inputs and outputs. This is particularly true for banks because there is considerable disagreement over the appropriate inputs and outputs for banks (Yue 1992).²⁵⁾ In addition to the selection issue, there are some specific issues regarding the Japanese banking sector, namely nonperforming loans and “evergreening” lending. Fear of falling below the capital adequacy standards has led many banks to continue to roll over loans to insolvent borrowers (Caballero, Hoshi and Kashyap 2003). If continued rollover of credit, otherwise known as “evergreening,” is taken into account, interest income might be deceptively seem increased.²⁶⁾ Worse, banks were reluctant to force nonperforming customers to fail, so nonperforming assets were included in their outstanding loan assets. Consequently, the true state of the health of Japanese banks was hidden, especially after the collapse of the bubble economy.

In this paper, following the discussion in Matsuura and Takezawa (1999) and Harimadani (2003), banks are regarded as institutions that utilize labor, capital, and other expenses to produce returns from loans and

25) There are two main approaches: “intermediation” and “production” (see Berger and Humphrey 1997 and Yue 1992). The first approach views banks as financial intermediaries whose primary business is to borrow funds from depositors and to lend money to others. Under the alternative approach, banks are perceived as institutions that use capital and labor to produce loans and other services. Banks’ inputs are labor, capital, and operating costs while their outputs are their accounts and transactions.

26) Fukao (2000) found that banks were lending more to already heavily indebted firms to prevent their loans from becoming nonperforming.

investments.²⁷⁾ The two types of outputs and five types of inputs are as follows (all units are one million yen except for the number of employees):

Y1 = Interest income + fees and commissions – reserve for possible loan losses

Y2 = Interest income + fees and commissions + other business income
– reserve for possible loan losses

X1 = Number of employees

X2 = Capital

X3 = Total movables and real estate

X4 = General and administrative expenses

X5 = Other ordinary expenses

Reserves for possible loan losses incorporated in the analysis are excluded from income to reflect both that banks' income might be overstated in their financial statements and that it is not easy to judge the extent of nonperforming loans.

As suggested in Drake and Hall (2003), other business income is included in Y2 due to diversified banking business such as fee-income generating business (See Table 4 for a detailed description of subitems, and Appendix Table A3 for part of the data). All data is taken from the Analysis of Financial Statements of All Banks published by the Japanese Bankers' Association.

27) Under the production approach, banks' interest expenses are not included among their inputs.

**Table 3. Related Literature on Consolidation
and Efficiency of Japanese Banks**

	Frontier Analysis		Others
	with Parametric model	DEA	
Efficiency	Kunikata (2002)(J), Hasan/Hunter (1996), Kasuya (1989)(J), Honma/Jinmon (?)/ Teranishi (1996)(J), Tachibanaki/Ozaki/Kasamatsu (1997)(J), Matsuura/Takezawa (2000)(J), Altunbas/Liu/Molyneux/Seth (2000), Harimadani (2003)(J)	Fukuyama (1993), Fukuyama (1995), Fukuyama (1996), Dreak/Hall (2003)	Takeda (1998)(J), Hori (1998)(J)
	Analysis of consolidation		Others
	Event study, performance analysis, case study	DEA	
Con- solidation	Tachibanaki/Haneda (1999)(J)	Harada (2004)	Matsuura/Takezawa (2000)(J) (with consolidation dummy), Ohashi/Hamada/Sumida (2001)(J)(G10's report), Dreak/Hall (2003)

Note: (J) stands for papers written in Japanese.

Table 4. The Data

(Unit: million yen except number of employees)

Financial Statements items	Subitems	Detail
Outputs		
Interest Income	Interest on Loans and Bills Discounted	Loan interest arising from loans and discounts on bills accepted as a result of bill discounts. Includes benefit profits.
	Interest and Dividends on Securities	Interest on securities and stock dividends arising from securities holdings.
	Interest on Call Loans	Interest income arising from call loans.
	Interest on Bills Bought	Interest income arising from bills bought.
	Interest on Deposits Due from Banks	Interest income arising from deposits. Includes interest rate on CDs.
	Interest Received on Interest Rate Swaps	Interest equivalents transferred under interest rate swap contracts. Posted as excess acceptances.
Other Interest Received	Interest received on foreign exchange, interest on commercial paper and other debt purchased, other interest rate received.	
Fees and Com-missions/ Income on Service Transactions , etc.	Commissions Earned	Commissions earned in the domestic exchange business. Commissions earned in the foreign exchange business. Includes guarantee fees received in connection with foreign exchange.
	Other Commissions/ Other Income on Service Transactions	Commissions earned other than the above. Includes agency loans received as remuneration for acceptances and guarantees, guarantee fees received pertaining to general debt guarantees. Also, income received as consideration for the provision of other services.

Table 4. Continued

Other Business Income	Profits on Foreign Exchange Transactions	Trading profit and loss, and conversion profit and loss pertaining to foreign currency-denominated assets, etc. Includes option fee settlement differences on currency options transactions and gains on currency futures transactions.
	Profits on Trading in Trading Securities	Profit on trading in trading securities. Includes options fee settlement differences on trading securities and gains on securities futures transactions.
	Profits on Sales of Government Bonds, etc.	Profit on sales of government bonds, etc, under "Securities." Includes options fees receivable in connection with "Government bonds, etc." and gains on securities futures transactions.
	Profit of Redemptions of Government Bonds, etc.	Profit of Redemptions of Government Bonds, etc., under "Securities."
	Income from Financial Derivatives	Actual and variation gains in the current period relating to non-hedging interest and bond derivatives. Entered from the year ending March 2002 (FY2001).
	Other business Income	Trading profit on gold, security loan fees.
Outputs Adjustment		
Reserve for Possible Loan Losses		Reserve set aside against contingent losses on loans, etc., which have become irrecoverable. Included reserves for support of specific debtors, specific loan-loss provisions and overseasclaim loss reserves. Enteredfrom the year ending March 2001 (FY2000).

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Table 4. Continued

Inputs		
Total Shareholder's equity		
Number of Employees		
Total Movables and Real Estate	Premises and Equipment/ Land, Buildings and Movables	Land, buildings and furniture for business use, and real estate and movables owned.
	Suspense Payments for Construction	Contract money, deposits, etc., to be paid until the completion of buildings under construction, land under development, etc.
	Surety Deposits and Intangibles/Guarantee Money and Key Money	Deposits, guarantee money arising from the use or acquisition of real estate and movables. Intangible fixed assets such as leaseholds, key money, telephone subscription rights, etc.
General and Administrative Expenses		Expenses and general administrative expenses necessary for running operations. Personal expenses, premises and equipment expenses, taxes and public dues.
Other Ordinary Expenses	Provisions for Possible Loan Loss Reserve	Provisions for possible loan loss reserve. Includes provisions for overseas claim loss reserves.
	Bad Debts Written-off	Write-offs of loans and discounted bills. Includes write-offs of accrued income and temporary payments which have the character of loans and bills discounted.
	Losses on Sales of Stocks and Other Securities	Losses on sales other than "Losses on Sales of Government Bonds, etc." from losses on sales under the "Securities" account. Includes option fees payable pertaining to "Stocks, etc." and losses on securities futures transactions.
	Write-offs of Stocks and Other Securities	Write-offs other than "Depreciation of Government Bonds, etc." under write-offs in the "Securities" account.
	Losses on Money Trusts	Losses on "Money Trusts."
	Enterprise Tax	Elements of enterprise tax do not take profits as a taxation base.

Table 4. Continued

	Transfer to Reserve for Possible Losses on Sales of Loans	Transfer to reserve for possible losses on sales of loans.
	Other Ordinary Expenses	Other ordinary expenses.

V. Estimation Results

1. Estimation Results

The DEA scores and returns to scale measures are presented in Table 5 (Y1 as output) and Table 6 (Y2 as output). In each table, year-by-year results of efficiency scores are shown in subtables to allow comparison of efficiency changes. All Japanese city banks have consolidated during the five years examined.²⁸⁾ As far as we know, this is the first study to directly examine cost efficiency changes of consolidation participants either pre- or post-consolidation. An argument may be made that a bank created as a result of consolidation of two or three weak banks might be still weak if the efficiency scores do not change both before and after consolidation. In the tables, “crste” and “vrste” stand for technical efficiency scores given by the constant returns to scale model and the variable returns to scale model, respectively. “Scale” is pure technical efficiency that takes the same level with or larger than “vrste.”²⁹⁾ If

28) The number of larger banks has shrunk from 12 in 1997 to five holdings in 2002: Mizuho Financial Group, the world’s largest by assets; Mitsubishi Tokyo Financial Group; Sumitomo Mitsui Financial Group; UFJ Holdings; and Resona Holdings. The government in 2003 rescued the latter. Other large banks like Hokkaido Takushoku Bank went bankrupt in 1997, and Long-Term Credit Bank of Japan and Nippon Credit Bank were both nationalized in 1998.

29) Coelli (1997) explained that technical efficiency scores obtained from CRS DEA are divided into two components, one due to scale inefficiency and one due to outright technical inefficiency. Conducting both a CRS and a VRS DEA on the same data performs this division. Any difference in the two efficiency

the “scale” for a bank is 1, the bank operates at the optimal level. “Irs” and “drs” in the rightmost column mean increasing returns to scale and decreasing returns to scale are observed.

It is clear from Tables 5 and 6 that Japanese city banks exhibited considerable overall poor efficiency in the late 1990s. The average “scale” scores for city banks, as shown in Tables 5 and 6, are only 0.784 and 0.808 in 1998, respectively. In 1999, they are 0.749 and 0.751. Fukuyama’s (1993) DEA study finds that city banks’ pure technical efficiency in fiscal year 1990 is 0.999, while Drake and Hall (2003) put it as 0.956 in fiscal year 1996. Compared with earlier studies’ scores in the first half of the 1990s, Japanese banks’ scores worsened in the following years. Even worse is that some banks’ scores are much lower than others’. For example, the most inefficient banks in 1998 and 1999 in both tables are Daiwa Bank and Asahi Bank, which later created Resona Holdings and accepted capital injections from the government; their pure technical efficiency scores, “scale”, are all below 0.50. In general, it is observed that larger banks exhibit higher “scale” scores, especially in the late 1990s (banks’ asset sizes are provided in Appendix Table A3). In 1998, among the five banks whose efficiency scores are above average, four banks have above average assets. In 1999, among those five, only three banks’ assets are above average. One exception is Tokai Bank, which is one of the healthier Japanese city banks and has fewer nonperforming loans. In the case of Tokai Bank, its efficiency scores are all 1 before the consolidation with UFJ, but turn out in Table 5 to be 0.354 in 2001 and 0.587 in 2002.

An interesting observation is that Tokai Bank has lower efficiency scores after joining UFJ Holdings in which Sanwa Bank dominated the management

scores for a bank indicates that the bank has scale inefficiency that can be calculated from the difference between the two “crste” and “vrste” scores.

board. This suggests that a consolidation of healthy and unhealthy banks would not create a healthy bank. The same result is obtained in Table 6. Based on the result regarding Daiwa and Asahi Banks, it might also be true that consolidation of two weak banks does not result in a strong bank. Resona Bank, however, gets 1 as its "scale" efficiency in fiscal year 2002, which indicates that the bank performs on the frontier line. This result is puzzling because the government rescued Resona Holdings with a capital injection of 1,906 billion yen. One interpretation is that there might have been some manipulation of accounting, such as the holdings inflating total deferred tax assets. Sakura Bank and Sumitomo Bank's "scale" scores are generally above average before consolidation, but postconsolidation scores are obviously below average. This implies that consolidation itself does not yield performance improvement. Bank of Tokyo Mitsubishi, which is said to be the healthiest of the city banks and does not have any government support, performed steadily and its scores are better than other banks'.

Finally, most of the results in Table 5 carry over to Table 6 but the rank in terms of "scale" efficiency among city banks changes more dramatically in Table 6 where other business income is included as the output. Other business income includes sub-items such as profits on foreign exchange transactions, profits on trading in trading securities, profits on sales of government bonds, profit of redemptions of government bonds, and income from financial derivatives. It might therefore be the case that banks have sold financial products such as securities and government bonds to dress up ordinary income for year-end settlement of accounts. In that case, Table 6 shows banks' short-term activity because those trading incomes might have been generated to cover up a loss.

Table 5. Result (with output A)

5-1. FY1998(1998 April-1999March)

Name	Crste	Vrste	Scale	
DKB	0.474	0.601	0.788	irs
Sakura Bank	0.887	0.917	0.967	irs
Fuji Bank	0.963	0.964	0.988	drs
Bank of Tokyo Mitsubishi	1.000	1.000	1.000	-
Asahi Bank	0.422	0.886	0.476	irs
Sanwa Bank	0.535	0.700	0.764	irs
Sumitomo Bank	0.542	0.767	0.707	irs
Daiwa Bank	0.352	1.000	0.352	irs
Tokai Bank	1.000	1.000	1.000	-
mean	0.686	0.817	0.784	

Note: Output A = interest income +Fees and Commissions - Reserve for possible loan losses

5-2. FY1999

Name	Crste	Vrste	Scale	
DKB	0.379	0.671	0.565	irs
Sakura Bank	0.836	0.948	0.882	irs
Fuji Bank	1.000	1.000	1.000	-
Bank of Tokyo Mitsubishi	0.916	1.000	0.916	drs
Asahi Bank	0.326	0.845	0.386	irs
Sanwa Bank	0.805	1.000	0.805	irs
Sumitomo Bank	0.769	0.906	0.848	irs
Daiwa Bank	0.335	1.000	0.335	irs
Tokai Bank	1.000	1.000	1.000	-
mean	0.707	0.930	0.749	

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Table 5. Continued

5-3. FY2000

Name	Crste	Vrste	Scale	
DKB	1.000	1.000	1.000	-
Sakura Bank	1.000	1.000	1.000	-
Fuji Bank	1.000	1.000	1.000	-
Bank of Tokyo Mitsubishi	0.896	0.982	0.913	drs
Asahi Bank	0.849	0.866	0.980	irs
Sanwa Bank	0.759	0.806	0.942	irs
Sumitomo Bank	0.811	0.814	0.997	irs
Daiwa Bank	0.989	1.000	0.989	irs
Tokai Bank	1.000	1.000	1.000	-
mean	0.923	0.941	0.980	

5-4. FY2001

Name	Crste	Vrste	Scale	
DKB	0.483	0.994	0.486	irs
Fuji Bank	1.000	1.000	1.000	-
Bank of Tokyo Mitsubishi	1.000	1.000	1.000	-
Asahi Bank	0.885	0.997	0.887	irs
UFJ(=Sanwa+Tokai)	0.349	0.986	0.354	irs
MitsuiSumitomo(=Sakura+Sumitomo)	0.575	0.984	0.585	irs
Daiwa Bank	1.000	1.000	1.000	-
mean	0.756	0.994	0.759	

Table 5. Continued

5-5. FY2002

Name	Crste	Vrste	Scale	
Mizuho Corporate(=DKB+Fuji+IBJ)	0.823	0.990	0.832	irs
Bank of Tokyo Mitsubishi	1.000	1.000	1.000	-
UFJ(=Sanwa+Tokai)	0.700	0.990	0.707	irs
MitsuiSumitomo(=Sakura+Sumitomo)	0.577	0.983	0.587	irs
Resona(Asahi+Daiwa)	1.000	1.000	1.000	-
Mizuho(=DKB+Fuji+IBJ)	1.000	1.000	1.000	-
mean	0.850	0.994	0.854	

Table 6. Result (with output B)

6-1. FY1998 (1998 April-1999 March)

Name	Crste	Vrste	Scale	
DKB	0.456	0.602	0.758	irs
Sakura Bank	0.730	0.796	0.917	irs
Fuji Bank	1.000	1.000	1.000	-
Bank of Tokyo Mitsubishi	1.000	1.000	1.000	-
Asahi Bank	0.360	0.870	0.413	irs
Sanwa Bank	0.640	0.777	0.823	irs
Sumitomo Bank	0.902	0.991	0.910	irs
Daiwa Bank	0.492	1.000	0.492	irs
Tokai Bank	0.960	1.000	0.960	irs
mean	0.727	0.893	0.808	

Note: Output B = interest income +Fees and Commissions +Other business income - Reserve for possible loan losses

Table 6. Continued

6-2. FY1999

Name	Crste	Vrste	Scale	
DKB	0.344	0.648	0.532	irs
Sakura Bank	0.664	0.839	0.790	irs
Fuji Bank	1.000	1.000	1.000	-
Bank of Tokyo Mitsubishi	0.796	0.802	0.993	irs
Asahi Bank	0.277	0.844	0.328	irs
Sanwa Bank	0.799	1.000	0.799	irs
Sumitomo Bank	0.975	1.000	0.975	irs
Daiwa Bank	0.342	1.000	0.342	irs
Tokai Bank	1.000	1.000	1.000	-
mean	0.689	0.904	0.751	

6-3. FY2000

Name	Crste	Vrste	Scale	
DKB	1.000	1.000	1.000	-
Sakura Bank	1.000	1.000	1.000	-
Fuji Bank	1.000	1.000	1.000	-
Bank of Tokyo Mitsubishi	0.809	1.000	0.809	drs
Asahi Bank	0.796	0.844	0.943	irs
Sanwa Bank	0.735	0.787	0.934	irs
Sumitomo Bank	1.000	1.000	1.000	-
Daiwa Bank	1.000	1.000	1.000	-
Tokai Bank	1.000	1.000	1.000	-
mean	0.927	0.959	0.965	

Table 6. Continued

6-4. FY2001

Name	Crste	Vrste	Scale	
DKB	0.337	0.994	0.339	irs
Fuji Bank	1.000	1.000	1.000	-
Bank of Tokyo Mitsubishi	0.801	0.994	0.805	irs
Asahi Bank	0.757	0.997	0.760	irs
UFJ(=Sanwa+Tokai)	0.318	0.987	0.322	irs
MitsuiSumitomo(=Sakura+Sumitomo)	0.850	0.986	0.862	irs
Daiwa Bank	0.995	1.000	0.995	irs
mean	0.723	0.994	0.726	

6-5. FY2002

Name	Crste	Vrste	Scale	
Mizuho Corporate(=DKB+Fuji+IBJ)	0.809	0.989	0.818	irs
Bank of Tokyo Mitsubishi	1.000	1.000	1.000	-
UFJ(=Sanwa+Tokai)	0.899	0.991	0.907	irs
MitsuiSumitomo(=Sakura+Sumitomo)	1.000	1.000	1.000	-
Resona(Asahi+Daiwa)	1.000	1.000	1.000	-
Mizuho(=DKB+Fuji+IBJ)	1.000	1.000	1.000	-
mean	0.951	0.997	0.954	

2. Remaining Issues

The principal issues remaining are merger accounting, deferred tax assets, and provisioning. In Japan, there is no accounting standard on

mergers and the “pooling-of-interest” method of accounting is used for almost all bank consolidations in Japan. Pooling of interests means that the target bank’s assets, liabilities, and owners’ equities are combined with those of the acquiring bank at book value as though the two banks had always been commonly owned. The reported assets of the merged bank would be equal to the sum of the reported assets of the two merging banks, apart from any real changes in bank assets after the merger (Simon and Wilcox 1999). An accounting method called “purchase accounting” is becoming standard as an international trend.³⁰⁾ Therefore, without applying for a purchasing account, there might be reasonable incentive to utilize paper profits given by a consolidation to cover up unrealized losses (see the consolidation case of Sumitomo Mitsui Bank and Wakashio Bank in the previous section). Estimating pre- and postconsolidation efficiency more accurately with existing financial statements is also a remaining issue. Simon and Wilcox (1999), on the other

30) When a company acquires or merges with another company, it chooses between two ways of accounting for the deal: either purchase accounting, or pooling-of-interest accounting. In purchase accounting, one company purchases the other and then amortizes the cost over many years. The drawback of this type of accounting is “goodwill.” Goodwill, in accounting terms, means the amount of money a purchased company costs above the value of its physical assets. For example, if you paid \$5 billion for a car company whose factories and inventory are worth \$5 billion, you did not pay any goodwill. However, if you paid \$10 billion for that company, you can write off only \$5 billion. The other \$5 billion is goodwill, and it must be subtracted from your future earnings. The Financial Accounting Standards Board (FASB), the organization that sets the ground rules for accounting in the US, allows companies to spread out that goodwill over several years (Business Week November 8, 1998).

hand, pointed out issues regarding purchasing accounting.³¹⁾

Another issue is the deferred tax asset. As provisioning to nonperforming loans must be done from profit after tax, the taxes paid at the time of provisioning should be paid back to a bank when nonperforming loans are written off from a balance sheet and banks produce profits. Japanese banks have accumulated deferred tax assets that they can get back in the future if they show profits and are then liable to pay corporate income tax. This, therefore, is accounting for future profits and future rebates of tax, and is a strange practice that was introduced in 1999 to help banks write off nonperforming loans quickly.

Finally, reserves for possible loan losses are subtracted from banks' output to account for weakness of city banks. There might, however, be a possibility that weak banks do not have enough reserves and that the reserved amount was less than originally required. If this assumption makes sense, banks with large amounts of reserve for possible loan losses are rather healthy banks. Although there are some remaining issues on accounting methods, this paper nevertheless reaches some important findings.

31) A measurement issue in using reported financial data to compare pre- and post-merger operating performance is pointed out in Simon and Wilcox (1999). In mergers where the purchase accounting method is used to account for the business combination, all the assets of the target institution have to be marked to market value before being combined with the acquirer's book assets; the difference between the purchase price and the revised book value of target bank's equity is recorded as goodwill in the surviving bank's book. Simon and Wilcox (1999) stated that these additional assets must be expensed according to the amortization schedule and that this issue becomes critical in empirical analysis.

VI. Conclusions

This paper uses the nonparametric approach, Data Envelope Analysis, to analyze cost efficiency implications of megamergers that took place among Japanese city banks after 2000. This is the first study to directly examine cost efficiency changes of consolidations of Japanese city banks. Such an analysis is important because consolidated banks arising from these mergers may well dominate the overall level of intermediation in the economy. The number of big city banks that operated internationally was twelve in 1990s but dropped to only four after the consolidations. As of August 2004, the battle for control of UFJ Holdings is the latest indication that the consolidation of the country's biggest banks has entered its final stages. If MTFG and UFJ consolidate, the consolidation would reduce the number of big banks in 2005 to only three.

The empirical results reveal some significant findings. First, average pure technical efficiency scores worsened in the late 1990s compared with the estimates of earlier literature. Second, it is observed that larger banks exhibit higher scores, especially in the late 1990s. Our two hypotheses that consolidation of a healthy bank with an unhealthy bank would not create a healthy bank and that consolidations between weak banks would not help create a strong bank were supported. Finally, it is also suggested that banks acted with short-term horizons as an additional item since other business income was included as the output in the model.

Consolidation in the Japanese banking sector involved all city banks and has significantly impacted the financial market. The outcome of these consolidations has not been closely examined yet. Although our results

introduce some interesting aspects, there must be other ways to evaluate the effect and the outcome of consolidations, as these consolidations took place across banking groups and financial services boundaries. This paper focuses on bank consolidations only and tries to avoid problems related to accounting methods. Japanese megabanks seem to be in better shape after the consolidations, as the percentage of nonperforming loans to total loans has decreased from 7.1 percent to 5.1 percent, and they do not record any loss. However, as we have seen, their efficiency levels have not changed dramatically; therefore, remaining weaknesses might be hidden in the merger accounting. For further study, it would be interesting to measure efficiency levels of holding companies rather than of the single banks under their umbrella, in order to evaluate the outcome of consolidations into holding companies that operate across various financial sectors.

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Appendix Table

Table A1. Consolidation from 1985 to 1995

Announcement date	Consolidation date	Name of bank	Name of bank	
1986-02-15	1991-10-01	Sumitomo Bank	Heiwa Mutual Bank	Consolidation of city banks, for the first time in 48 years.
1989-08-29	1990-04-01	Mitsui Bank*	Taiyo Kobe Bank*	Amalgamation on an equal basis. Merged bank later becomes Sakura Bank.
1990-11-13	1991-04-01	Kyowa Bank*	Saitama Bank*	Amalgamation on an equal basis. Bank name has changed twice (Kyowasaitama Bank, later Asahi Bank).
1990-11-19	1991-04-01	Sanin Godo Bank	Fuso Bank	Sanin Godo Bank absorbed Fuso Bank.
1991-07-25	1992-04-01	Iyo Bank	Touhou Mutual Bank	
1991-08-30	1992-04-01	Kumamoto Bank	Higo Family Bank	Two banks become Kumamoto Family Bank.
1992-10-16	1993-04-01	Ugo Bank	Akita Akebono Bank	Survival bank is Ugo Bank. Ugo bank is now Hokuto Bank.
1995-03-28	1996-04-01	Mitsubishi Bank*	Bank of Tokyo*	Two banks became Bank of Tokyo Mitsubishi.

Notes: 1) There are two reasons for separating cases before and after 1995: (1) the first failure of a listed bank took place in 1995; and (2) Japan's Antitrust Law and bank-related bills were revised in 1997.

2) * indicates a city bank.

Source: Nikkei database etc.

Table A2. Bankruptcies from 1995

Bankruptcy date	Name of bank	Type of failure	Transfer of business, contractual transfer or current name
1995-08-30	Hyogo Bank	Announcement of the failure by MoF	Midori Bank (later Minato Bank)
1996-03-29	Taiheiyo Bank	Announcement of the disposal plan	Wakashio Bank (new bank established by Sakura Bank)
1996-11-21	Hanwa Bank	Orderd suspension of business	Kii Deposits Management Bank
1997-10-14	Kyoto Kyoei Bank	Transfer of business	Kofuku Bank (later bankrupt)
1997-11-17	Hokkaido Takushoku Bank	Transfer of business	Hokuyo Bank and Chuo Trust & Banking
1997- 11-26	Tokuyo City Bank	Transfer of business	The 77 Bank and Sendai Bank
1998-05-15	Midori Bank	Transfer of business	Hanshin Bank
1998-05-22	Fukutoku Bank	Transfer of business	Namihaya Bank (Newly established by the government. Later bankrupt)
1998-05-22	Naniwa Bank	Transfer of business	Namihaya Bank (Newly established by the government. Later bankrupt)
1998-10-23	Long-Term Credit Bank of Japan	Decision to commence special public management and purchase shares	Transfer and purchase of shares to New LTCB Partners. Now Shinsei Bank
1998-12-12	Nippon Credit Bank	Decision to commence special public management and purchase shares	Transfer and purchase of shares to Soft Bank Group (consisting of Soft Bank, Orix, and Tokio Marine). Now Aozora Bank
1999-04-11	Kokumin Bank	Announcement of a failure	Yachiyo Bank
1999-05-21	Kofuku Bank	File for a disposal	Kansai Sawayaka Bank

Table A2. Continued

1999-06-11	Tokyo Sowa Bank	File for a disposal	Tokyo Star Bank
1999-08-06	Namihaya Bank	File for a disposal	Daiwa Bank and Kinki Osaka Bank
1999-10-01	Niigata Chuo Bank	File for a disposal	Taiko Bank, Daishi Bank, Hachijuni Bank, Higashi-Nippon Bank, Gunma Bank, and Towa Bank
2001-12-28	Ishikawa Bank	File for a disposal	(Through Bridge Bank of Japan) Hokuriku Bank, Hokkoku Bank, Firs Bank of Toyama, Kanazawa Shinkin Bank, and Noto Shinkin Bank
2002-03-07	Chubu Bank	File for a disposal	(Through Bridge Bank of Japan) Shimizu Bank, Shizuoka Chuo Bank and Tokyo Star Bank
2003-11-29	Ashikaga Bank	Temporarily nationalized	-

Table A3. Consolidation from 1995

3-1. FY 1998

FY1998	Assets	Total liability	Capital	Reserve for possible loan losses	Interest income	Fees and Com-missions	Other business income	Other operating income
DKB	54,890,444	52,476,636	2,403,075	1,049,708	1,559,357	150,915	165,276	190,367
Sakura Bank	49,015,005	46,536,936	2,174,486	666,692	1,629,912	187,311	104,503	193,710
Fuji Bank	57,933,043	55,349,080	2,175,818	684,674	1,707,350	176,880	515,395	132,698
Bank of Tokyo Mitsubishi	78,600,947	75,694,653	2,757,711	1,155,353	2,790,146	245,454	322,121	479,180
Asahi Bank	29,296,192	27,915,901	1,370,325	428,030	655,705	75,249	48,524	167,318
Sanwa Bank	50,372,153	48,069,909	2,082,169	1,315,749	1,722,625	207,252	345,059	42,008

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Table A3. Continued

Sumitomo Bank	54,973,872	52,618,423	1,757,123	1,267,935	1,705,261	212,090	615,925	37,241
Daiwa Bank	15,459,603	14,605,271	832,757	188,214	321,042	67,032	127,152	63,749
Tokai Bank	31,839,710	30,141,149	1,564,429	315,610	959,239	65,476	130,602	134,148
Average	46,931,219	44,823,106	1,901,988	785,774	1,450,071	154,184	263,840	160,047

3-2. FY 1999

FY1999	Assets	Total liability	Capital	Reserve for possible loan losses	Interest income	Fees and Com-missions	Other business income	Other operating income
DKB	51,998,527	49,508,362	2,456,175	863,510	1,105,177	152,644	104,785	475,011
Sakura Bank	48,495,608	45,967,816	2,208,554	682,188	1,398,941	186,213	99,261	445,593
Fuji Bank	58,246,731	55,611,096	2,247,452	624,291	1,635,326	220,943	492,113	587,065
Bank of Tokyo Mitsubishi	74,795,598	71,792,089	2,853,295	1,058,814	2,157,787	239,020	277,237	867,235
Asahi Bank	28,788,131	27,391,409	1,388,104	458,786	589,148	85,833	24,207	458,668
Sanwa Bank	46,901,986	44,476,158	2,187,952	751,340	1,297,820	160,987	276,360	444,321
Sumitomo Bank	53,767,504	51,383,774	1,804,358	950,499	1,528,031	182,637	589,638	632,855
Daiwa Bank	15,354,825	14,477,716	852,885	187,458	262,831	81,353	66,855	305,260
Tokai Bank	30,549,755	28,844,997	1,584,662	286,749	860,179	69,223	121,885	517,526
Average	45,433,185	43,272,602	1,953,715	651,515	1,203,916	153,206	228,038	525,948

Table A3. Continued

3-3. FY 2000

FY2000	Assets	Total liability	Capital	Reserve for possible loan losses	Interest income	Fees and Com-missions	Other business income	Other operating income
DKB	52,833,682	50,324,170	2,462,443	652,175	975,569	164,840	89,572	265,880
Sakura Bank	51,849,687	49,289,955	2,175,809	512,023	1,107,828	209,261	97,621	281,663
Fuji Bank	62,576,820	59,950,841	2,179,397	693,737	1,564,030	240,136	375,426	525,236
Bank of Tokyo Mitsubishi	89,843,553	86,767,373	2,892,529	1,246,380	1,951,722	325,838	189,719	244,849
Asahi Bank	31,187,697	29,820,461	1,358,711	472,334	556,792	87,000	25,481	269,521
Sanwa Bank	55,016,443	52,859,845	1,915,312	903,801	1,172,695	186,987	134,998	335,570
Sumitomo Bank	67,392,974	64,949,149	1,837,151	756,830	1,328,056	202,836	552,060	558,665
Daiwa Bank	15,522,161	14,686,181	813,305	192,336	254,242	71,804	80,391	67,773
Tokai Bank	34,753,298	33,135,673	1,476,676	358,331	569,557	80,455	83,809	158,688
Average	51,219,591	49,087,072	1,901,259	643,105	1,053,388	174,351	181,009	300,872

3-4. FY 2001

FY2001	Assets	Total liability	Capital	Reserve for possible loan losses	Interest income	Fees and Com-missions	Other business income	Other operating income
DKB	52,766,035	50,709,425	1,875,074	893,858	837,085	165,181	96,203	223,122
Fuji Bank	55,848,696	53,638,646	1,828,779	673,723	1,367,472	250,185	455,204	445,840

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Table A3. Continued

Bank of Tokyo Mitsubishi	80,718,319	77,875,894	2,640,770	1,259,662	1,828,671	351,306	173,977	174,483
Asahi Bank	25,690,303	24,862,920	747,414	585,272	490,305	87,651	47,027	100,687
UFJ (=Sanwa +Tokai)	72,333,368	69,546,294	2,201,066	1,542,756	1,175,819	208,438	360,623	273,760
Mitsui Sumitomo (=Sakura +Sumitomo)	108,005,001	104,108,534	2,912,619	2,159,649	2,176,685	387,280	845,583	240,702
Daiwa Bank	14,746,249	14,326,932	398,088	419,560	230,452	90,961	61,843	53,818
Average	58,586,853	56,438,378	1,800,544	1,076,354	1,158,070	220,143	291,494	216,059

3-5. FY 2002

FY2002	Assets	Total liability	Capital	Reserve for possible loan losses	Interest income	Fees and Com-missions	Other business income	Other operating income
Mizuho Corporate (=DKB+Fuji+IBJ)	69,586,868	67,652,903	1,648,604	1,007,592	828,830	257,310	221,310	70,127
Bank of Tokyo Mitsubishi	79,591,387	76,947,306	2,313,268	1,016,265	1,347,905	377,440	218,914	146,742
UFJ(=Sanwa+Tokai)	74,423,895	71,988,484	1,568,967	1,528,665	1,093,304	302,630	504,709	119,538
MitsuiSumitomo (=Sakura+Sumitomo)	102,394,637	99,226,942	2,142,544	2,201,830	1,817,526	424,235	947,036	154,634
Resona (Asahi+Daiwa)	34,922,723	34,556,698	85,262	666,396	232,444	84,201	48,011	53,051
Mizuho (=DKB+Fuji+IBJ)	68,868,592	66,741,764	1,349,841	1,071,810	1,024,263	137,789	197,052	132,851
Average	71,631,350	69,519,016	1,518,081	1,248,760	1,057,379	263,934	356,172	112,824

Table A4. Characteristics of Japanese Banks

City Banks	<p>Lent to large customers and received most of their deposits from corporations.</p> <p>National operations, with large branch networks, located primarily in the major urban areas.</p>
Regional Banks	<p>Initially operating only in one prefecture, most had expanded into one or more adjoining prefectures by the early 1970s.</p> <p>Every prefecture was home to at least one.</p> <p>Time deposits of individuals made up a fairly large share of their funds.</p> <p>For these, they faced significant competition from other types of local financial institutions.</p>
Second-tier Regional Banks	<p>Typically operated only in one or few adjoining prefectures.</p> <p>Lent to small businesses.</p> <p>Loans to large customers limited to 20% of total loans.</p> <p>Most were unlisted or only listed on a regional exchange.</p> <p>Some were affiliated with larger city or regional banks; others were independent and sometimes owned by the managers.</p> <p>Generally referred to in English as "mutual [loan and savings] banks" and classed with the credit cooperatives and associations as "financial institutions for medium and small-sized enterprises."</p> <p>Governed by the June 1951 Mutual Loan and Savings Banks Act.</p> <p>Descendants of the <i>mujin</i>, which can be traced back to at least the 15th century (All but two of the 70 <i>mujin</i> operating in 1951 had converted to <i>sogo</i> by 1954).</p> <p>On 1 February 1989 they became regular ordinary banks (except for a small number of weak banks), and became known as regional II banks or, more formally, as members of the Second Association of Regional Banks.</p>
Trust Banks	<p>Individual trust and pension fund management, as well as ordinary bank operations.</p> <p>More than half of funds were loan trust.</p> <p>Were not allowed to engage in short-term financing with trust funds.</p>
Long-term Credit Banks	<p>Lent long-term.</p> <p>Could not take deposits, but were among the few institutions that could issue debentures (with terms up to five years).</p> <p>Limited branching. Created by special legislation.</p> <p>Created by special legislation.</p> <p>Nationalization and privatization of LTCM and NCB in 1998.</p>
Cooperative	<p>In Japanese, these are either <i>kumiai</i> or <i>kinko</i>.</p> <p>Various types of non-agricultural cooperatives basically were divided into two groups: those that deals with non-members and those that operate for members.</p>

Source: Hoshi and Kashyap (2001) and homepage of Financial Services Agency.

Appendix Figures

Figure A1. Mizuho Financial Group

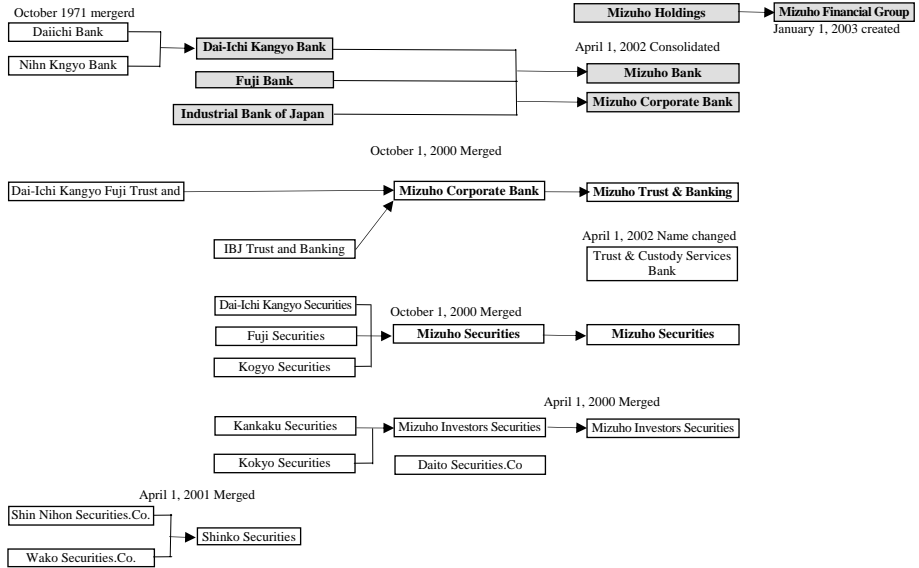


Figure A2. Mizuho Tokyo Financial Group

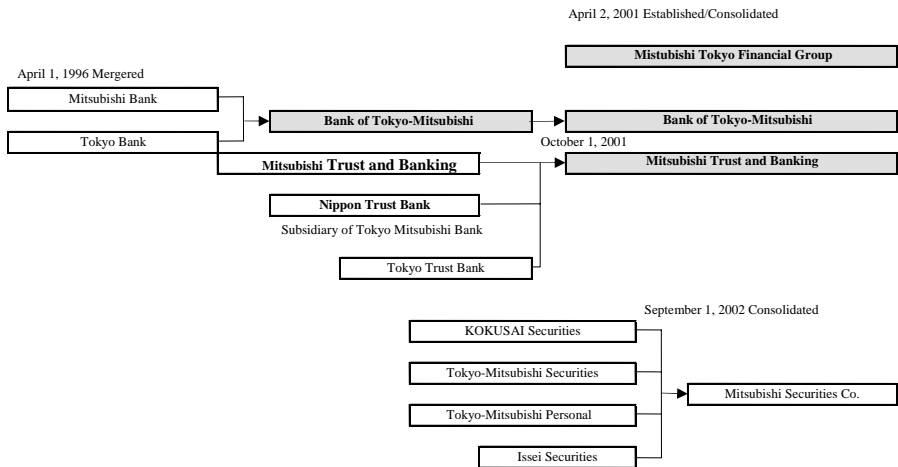


Figure A3. UFJ Group

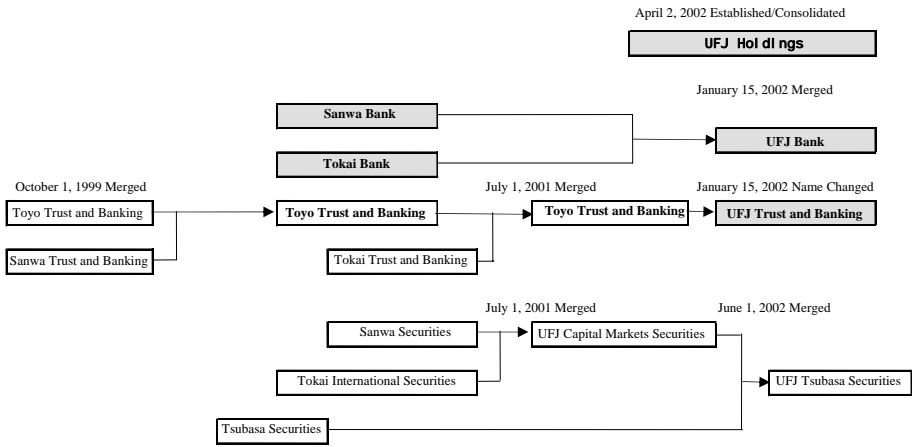


Figure A4. Sumitomo Mitsui Financial Group

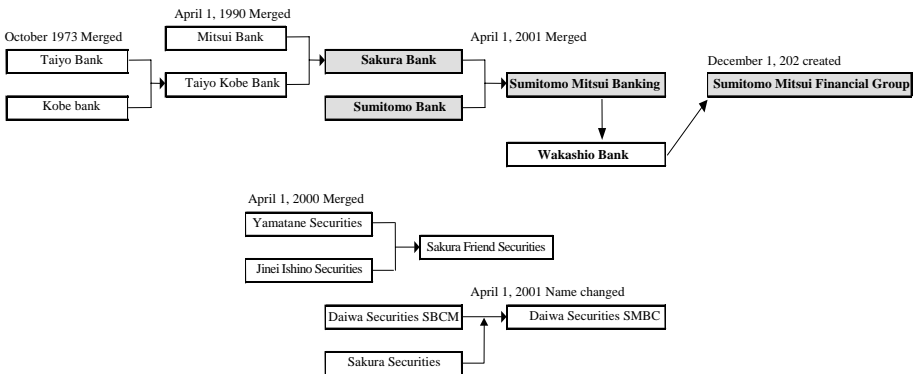
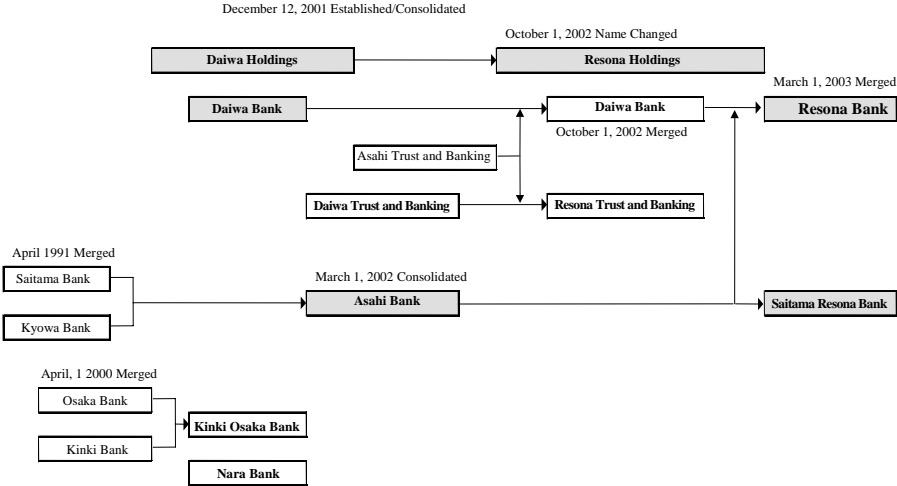


Figure A5. Resona Group



Did Efficiency Improve? Megamergers in the Japanese Banking Sector

Kimie Harada

This paper examines the technical efficiency implications of Japanese city banks to evaluate their pre- and post-consolidation efficiency. Using a sample from the period of 1999 to 2003, we consider questions such as whether efficiency improved after consolidation and whether consolidation of two weak banks created a strong bank.

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