

Analysis of Bank Mergers
For
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Management Summary

The Federal Reserve Bank of Dallas currently has no way to tell what characteristics of a bank make it conducive to forming a successful merger. Further, they are unable to predict what types of mergers will be successful. It has been our goal to develop a model that will determine which types of mergers will be most successful, and what characteristics of a bank promote that success.

The approach we used in developing our model entailed a five-step process. First, we created a merger tree to order and simplify the large data set. Next, we classified each of the mergers by the number of banks acquired. From these categories, we extracted a small sample on which we later performed in-depth analysis. In addition, we verified the data to determine the presence of geographical overlap. Finally, we used the software package, DEA, to produce efficiency ratings based on this data both before and after the merger occurred.

The technical section of our project included computing the improvement ratios of each bank over time. Using these ratios as the principal method of comparison for the banks, we performed extensive numerical and graphical analyses on the data. From these analyses we determined the most significant factors on each bank, the ideal number of banks involved, and the overall optimal model for a successful bank merger.

Background and Problem

The role of our client, the Federal Reserve Bank of Dallas, is to ensure stability and reduce risk in the banking world. This stability and risk reduction encompasses everything in banking from the printing and distribution of money to the success of mergers and acquisitions. However, the Federal Reserve Bank currently has no way to tell what characteristics of a bank make it conducive to forming a successful merger. Furthermore they have no guidelines to predict what types of bank mergers will prove to be successful based on the banks involved.

Our role is to develop a model that will discern what types of mergers will prove to be successful by determining the characteristics of a bank make it conducive to a successful merger.

Process

We were presented with quarterly summary data on all banks from 1984 to 1994. In addition, we obtained information on each bank's merger and acquisition history (See Appendix A). From this data we developed software that constructed a merger tree (See Appendix B). This tree gave a visual representation of each merger that took place in this time period. The output was indexed by the acquiring bank (parent bank) and followed by all of the banks it acquired (child banks).

After analyzing the data, we observed that an accurate model could be constructed from the data in 1993 alone, and that any recent trends in banking mergers and acquisitions would be reflected in that model.

After constructing the merger tree we analyzed the parent banks and grouped them into categories based on the number of banks they acquired. Our categories were as follows:

Category	Number of Child Banks
1	1
2	2
3	3-8
4	9-15

Figure 1

This provided us with a guideline for extracting our sample size from each category. We randomly selected 10 percent of each of the above categories for analysis. This resulted in 30 bank mergers that created an equal small sample representation of each category.

Our next step was to verify the data by comparing the individual data of each bank in the merger with the composite data of the parent bank after the merger (See Appendix C). During the comparison, we saw evidence that geographical sharing of assets occurred in some cases. This led to the creation of two additional categories: overlapping and non-overlapping. To determine this classification, if the data exhibited discrepancies it was classified as an overlapping bank.

We then implemented the software package Data Envelopment Analysis (DEA), which performs three main operations:

1. Converts multiple inputs and outputs into a scalar measure.
2. Measures relative efficiency by constructing an efficient frontier.
3. Uses linear programming to locate frontiers and determine efficiencies.

The software package requires as input a series of six bank data inputs and three bank data outputs as follows:

Bank Data Inputs:

Full Time Employees
Salary Expenses
Fixed Assets
Other Non-Interest Expenses
Total Interest Expense
Purchased Funds

Bank Data Outputs:

Core Deposits
Earning Assets
Total Interest Income

Upon inputting the appropriate bank data, DEA produces as its output an efficiency rating that corresponds to the individual bank or merger.

Technical Description of the Model

DEA was used to analyze the parent banks before and after the merger. We created a separate data file for each merger, and in turn, DEA analyzed the data to yield an efficiency rating for each bank at the two dates specified. We then compared the efficiency ratings to see if there was any improvement.

We chose our before and after dates based on the fact that the majority of the bank mergers occurred in the first two quarters of 1993. The last quarter in which every bank existed as an individual entity was quarter four, 1992. Therefore, this is the data we selected to analyze before the merger. Then, in order to allow time for the merged bank to begin operation as a new entity, we chose to use quarter two, 1994 for our analysis after the merger. Thus, pre- and post-merger turbulence was eliminated before the

efficiency ratings were calculated. This gave us the most accurate comparison of the parent banks both before and after the merger.

Upon determining the efficiency ratings described above, we computed an improvement ratio over time for each parent bank. The improvement ratio was calculated with the following formula:

$$\frac{\text{Parent Bank Efficiency Rating, Q2, 1994}}{\text{Parent Bank Efficiency Rating, Q4, 1992}}$$

We observed that well over 90% of the banks had an improvement ratio greater than one, indicating that nearly every merger improved the efficiency of the parent bank.

Next the data was sorted in descending order by improvement ratio. From these sorted ratios, we grouped the mergers into three equal tiers, the first being the most efficient, and the third being the least efficient (See Appendix D). The second tier was ignored so we could compare the most improved mergers with the least improved mergers.

The statistical analysis of the data involved calculating the main effects of each of the nine DEA inputs (See Appendix E). This enabled us to rank each factor with regard to its effect on the efficiency rating. Separate main effect calculations were done for the first and third tiers. From this comparison we discovered that the significant effects were the same for both tiers. The significant effects were ranked in the following order:

1. Earning Assets
2. Core Deposits
3. Purchased Funds
4. Total Interest Income

The effects of the remaining five factors were negligible.

Finally, to support our conclusions, numerical and graphical analyses were performed on each significant factor (See Appendix F).

Analysis and Managerial Interpretation

From the graphical analysis shown below, we determined the most successful merge category. Although all merge categories showed improvement, category two exhibited the highest improvement ratio.

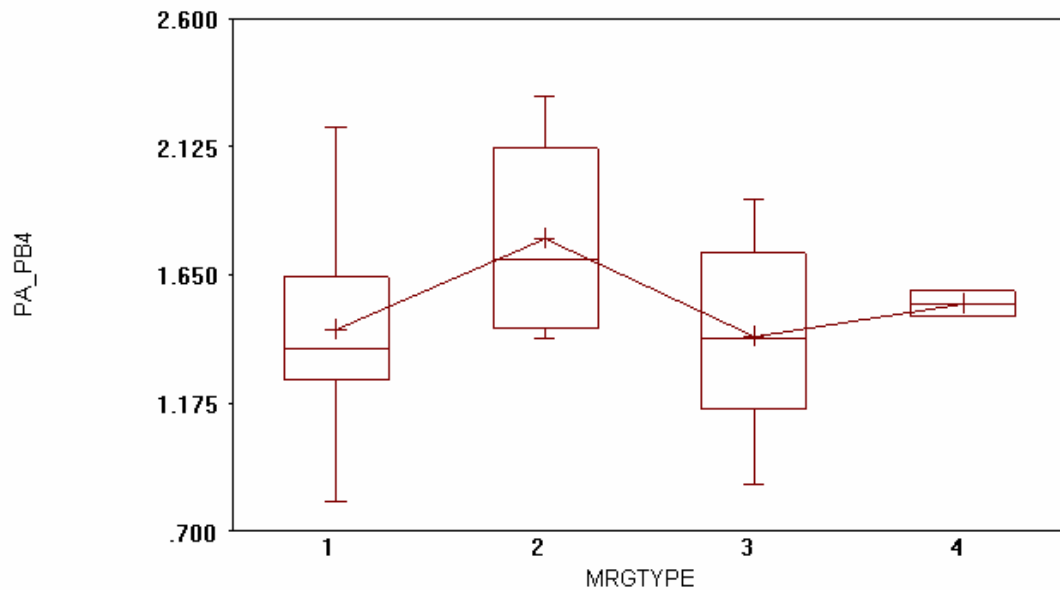


Figure 2

With regard to the categories of geographical sharing of assets, our graphical analyses revealed that overlapping banks had higher improvement ratios and lower variability than non-overlapping banks.

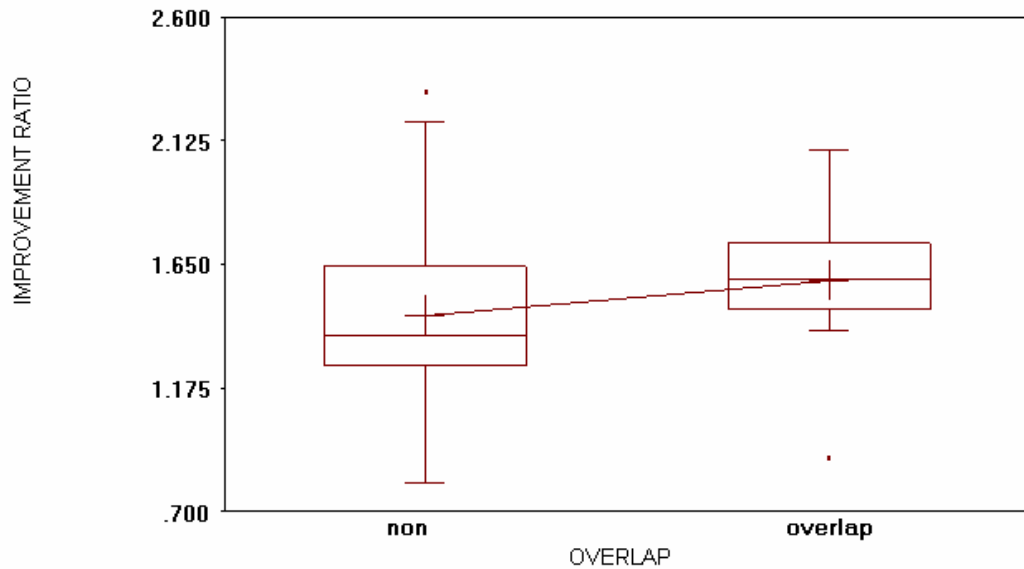


Figure 3

In our final phase, we computed two percentage tables that summarize the data as percentages of the three tiers.

	Tier A	Tier B	Tier C
1	33.3%	23.8%	42.9%
2	50%	50%	0%
3	33.3%	33.3%	33.4%
4	0%	100%	0%

Figure 4

	Tier A	Tier B	Tier C
Overlap	37.5%	50%	12.5%
Non-Overlap	31.7	27.3%	41%

Figure 5

Conclusions

In concluding our analysis, we determined that the optimal bank merger has the following characteristics:

- Category 2- Two banks acquired by one parent bank
- Geographical Overlap
- Earning Assets- higher levels make for a better merger
- Core Deposits- High levels
- Purchased Funds- High levels
- Total Interest Income- Low Levels; Loans that are closer to the end of the payment cycle.

Critique

The analysis of this project could have been improved by the following:

- More complete interpretation of DEA factors.
- Data set spanning more years
- Window analysis on parent over time.