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EVALUATING FINANCIAL SYNERGY IN BANK MERGER: RANKING MERGER OPTIONS AND ANALYZING INFLUENTIAL FACTORS

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ABSTRACT

Given the excess number of banks, the Central Bank of Bangladesh recently saw mergers as a good solution for economic development in an emerging economy like Bangladesh. Still, the question remained: which bank should merge with whom to create value, known as financial synergy? The study investigates which mergers add value to financial synergy and which do not. Additionally, the study scrutinizes the financial factors that influence the financial synergies resulting from the mergers of the participating banks. This study employs fifty-five possible cases of mergers found in eleven banks, including government, non-government, and specialized banks, to conduct financial synergy valuations on the average of five years of financial information. The methodology employs simulation, sensitivity, trend, scenario, Ordinary Least Squares (OLS), and Mixed Effect Generalized Linear Model (MEGLM) to solve the research questions. The results reveal that mergers between BKB and RAKUB, EXIM and Padma, NBL, and UCB can result in positive financial synergy among the six cases proposed by the central bank. The results also show that financial factors including debt to capital, reinvestment rate, return on capital, cost of debt, and revenues significantly impact the financial synergy. The findings of the study suggest the central bank merge based on the ranking provided in the study, considering the influential factors in mergers among banks. These findings contribute to the existing field of study by optimizing the synergy valuation strategies for bank mergers in a complex environment of bank types.

INTRODUCTION

Synergy is the idea that when different business units inside complex organizations operate together as a unified system, they can create more value than if they were to function independently. This means that if two companies named A and B merge, and the merged company is named AB, the resultant comparative value will be:

$$V_{(AB)} > V_{(A)} + V_{(B)} \quad \text{(i)}$$

From equation (i), if the value of synergy is to be determined, the equation for synergy will be:

$$V_{(Synergy)} = V_{(AB)} - V_{(A)} - V_{(B)} \quad \text{(ii)}$$

Recently, Bangladesh Bank (The central bank of Bangladesh) has decided to amalgamate weak banks with strong banks (Dhaka Tribune, March 13, 2024). After that, Bangladesh Bank published a guideline for the merger of the banks on April 04, 2024. Later, the question of which banks to merge with whom was uncovered with eleven banks namely Sonali Bank PLC to merge with Bangladesh Development Bank PLC (Case 1), Bangladesh Krishi Bank (BKB) to merge with Rajshahi Krishi Unnayan Bank (RAKUB) (Case 2), BASIC Bank PLC to merge with City Bank PLC (Case 3), EXIM Bank Limited to merge with Padma Bank PLC (Case 5), and National Bank Limited to merge with United Commercial Bank PLC (Case 6) (Somoy Business Desk, 2024). It was also though earlier that BASIC Bank PLC could be merged with Agrani Bank PLC (Case 4) (TBS Report, 2024). The study is relevant because, Bangladesh has more scheduled banks in number

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than required to serve the money market. The growing Non-Performing Loans (NPLs), shortage of liquidity, depositors' lacking confidence, and financial distress are making the existence of most of these banks vulnerable. The central bank assumed this problem and decided to merge among banks. From the dilemma of which bank to merge with whom, the problem statement of the study is the picking of the best options out of the fifty-five possible solutions of valuation. Also, there exists a concern that which financial factors actually contribute most to the financial synergy, because such factors can be controlled and optimized for increasing synergy value. The study aims to provide a solution of ranking based on financial synergy out of the existing possible options of banks. Additionally, the study estimates the factors that impact the financial synergies of the merged banks, which is its second research objective.The novelty of the study is using synergy valuation and econometric techniques to rank and identify influential financial factors in emerging economy banks, providing a basis for further research in merger and acquisition.

The study begins by introducing the concept and its relevance, followed by a review of existing literature from key research objectives and theoretical backgrounds. Next, the materials and methods explain the techniques used to determine synergy values for different options and factor analysis. Later, the results and discussions provide the outcomes and explanations that align with the objectives. Finally, the study concludes with key insights, novelty, and future research avenues.

LITERATURE REVIEW

Mergers tend to form across the world under different dimensions. To generate financial synergy out of it, forecasting becomes a great task to solve, also the factors influencing these values should be identified properly. This section details earlier studies that meet the research objectives criterion.

Mergers and Financial Synergies

Mergers are a common practice in corporate finance and restructuring that enhance a company's growth and competitiveness (Sui et al., 2016; Gaughan, 2018). The merger is the process of combining the assets of two companies who have decided to merge their activities (Ben Letaifa, 2017). The merger enhances revenue and reduces costs by fostering synergy between the acquiring and target companies (Majumdar et al., 2012). Firms engage in mergers and acquisitions (M&A) primarily to expand their operations, as growth is essential for their survival (Akinbuli & Kelilume, 2013). A study on power plants of USA was done where 5% synergy in operating efficiency has been observed (Demirer & Karaduman, 2022). A study on US banks found that mergers are inefficient in improving X efficiency and scale efficiency, and that factors affecting performance also affect their performance (Peristiani, 1997). A study on the context of North Macedonia showed that banks' efficiency falls 83.33% to 70.06% after merger in 2011 and to 66.36% in 2020 (Fotova Čiković et al., 2022). A study on merger of 52 horizontal bank in Europe from 1994 to 1998 shows that merger don't contribute to greater market power (Huiziniga et al., 2001). Another study from 1994 to 2001, done on 134 individual banks on 11 EU countries to understand the impact of merger on banks prove that merger and consolidation is beneficial in technical aspects (Ebodume & Omarov, 2007). A study on European Commission institutions over 492 takeovers show that mergers between domestic and cross-border banks of similar size have a substantial positive impact on the performance of the merged institutions (Vennet, 1996). If the scenario is shifted to Indian economy, analysis conducted on bank mergers from 2019 to 2020 reveals a rise in the financial value of the banks being acquired, benefiting their owners (Herwadkar et al., 2023).

In Bangladesh, merger in banking industry is being experienced after a long time, thus, the question is highly relevant whether such mergers will cause synergistic value, and if yes, which mergers will do so.

Factors Affecting Mergers and Synergies

The value of synergy has been properly modeled in a paper where synergy has been categorized in operating synergy and financial synergy (Damodaran, 2005). In this study, the author has provided a beautiful elaboration of how financial synergy can be calculated. The factors that have been considered are mostly the inputs to the calculation of the financial synergy. In a study on understanding the impact of different factors on mergers and acquisitions (Mucenieks, 2018), the author identified few financial factors which contribute the M&A. In Nepal, its' been found that the factors that are the inputs to calculation of financial synergy are significantly impactful to financial synergy (Sharma, 2018). A study investigated the determinants of the anticipated synergy resulting from a merger or acquisition, based on an analysis of previous mergers and acquisitions in the banking sector of a European Union country. Two out of the five elements have been modeled using dynamic simulation based on high-quality research and found significant impacting synergy value (Yiannis et al., 2007). A study on the mechanical engineering companies of Czech Republic indicated a statistically significant correlation between the indicators derived from cash flow and the value of synergy (Režňáková & Pěta, 2018). A study on SAARC and ASEAN regions found that Free Cash Flows have positive impact on synergy while firm size is insignificant (Khan & Bin Tariq, 2023).

Theoretical Background

The financial synergy is mainly generated from diversification, cash slack and tax benefits (Damodaran, 2005). To consider the fragmentation of all these factors, financial statements' outputs were considered. A study was done to find out factors impacting financial synergy where key financial factors are chosen as independent variables to judge the synergy (Darayseh & Alsharari, 2022). Simulation strategy was used in measuring impacts of variables on synergy (Yiannis et al., 2007).) A study used key financial factors to compare against synergy to find the significance (Mucenieks, 2018).

This study focuses on banks in emerging economies, including government and non-government commercial and specialized banks, as previous literature only focuses on pre-event and post-event analysis, lacking simulation methodology to judge every dimension of values from synergy valuation.

Purpose of the Study and Hypothesis

The purpose of the study is to prepare a ranking list of best options of banks, mergers between which will result in maximum financial synergy. The study afterward finds the influential financial factors that contribute to the financial synergy. For meeting the second objective, the hypothesis will be as follows:

H_a: There exists significant relationship between different financial factors and the synergy value.

MATERIALS AND METHODS

Research Design (First Research Objective)

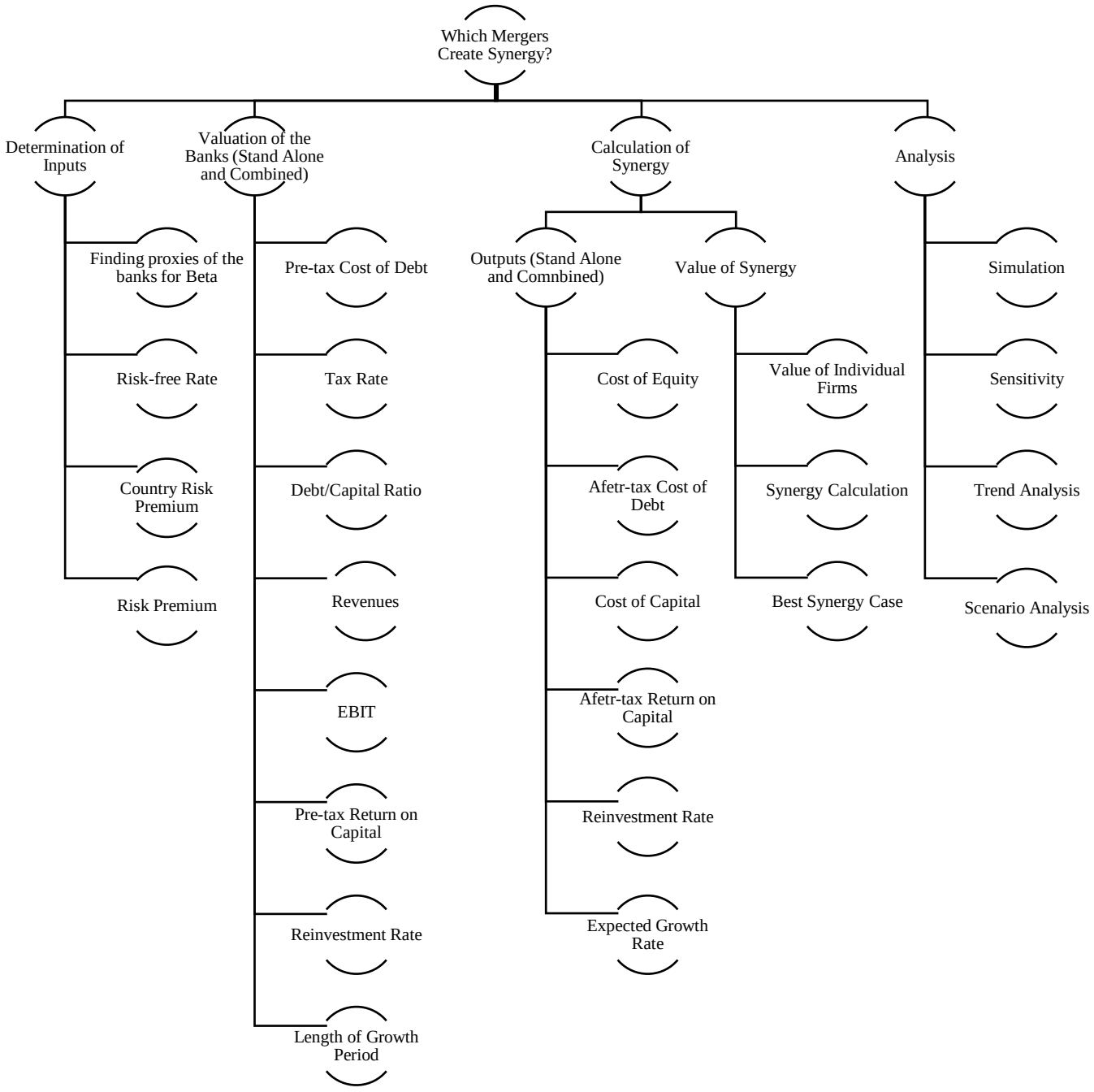


Figure 1. Research Design for First Research Objective

The research design in Figure 1 employs financial inputs for calculating the synergy value which finally contribute as independent variables in Figure 2.

Research Design (Second Research Objective)

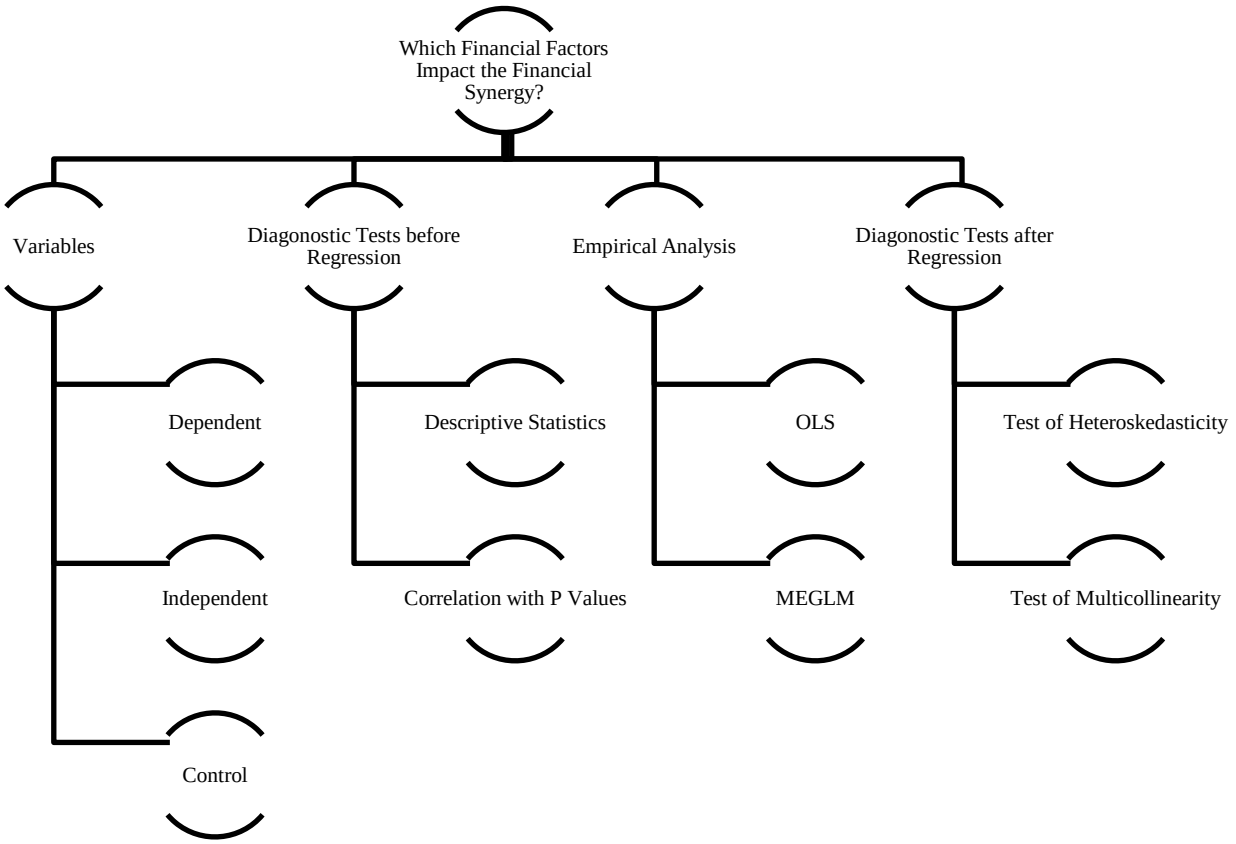


Figure 2. Research Design for Second Research Objective

The Figure 2 provides categories of variables, and tests to be performed to test the hypothesis.

Data

The data is the audited financial statements of the banks for the five years from 2018 to 2022. For Risk-free Rate calculation, average of 5 years' 10-year Treasury Bond cut-off yield data collected from the Bangladesh Bank is used. For country risk premium, as of a study in NYU (Damodaran, 2024), the data has been considered for Bangladesh. The risk premium is calculated from the average DSEX return for the last five years.

Variables

The second research objective requires the same independent and dependent variables including few control variables.

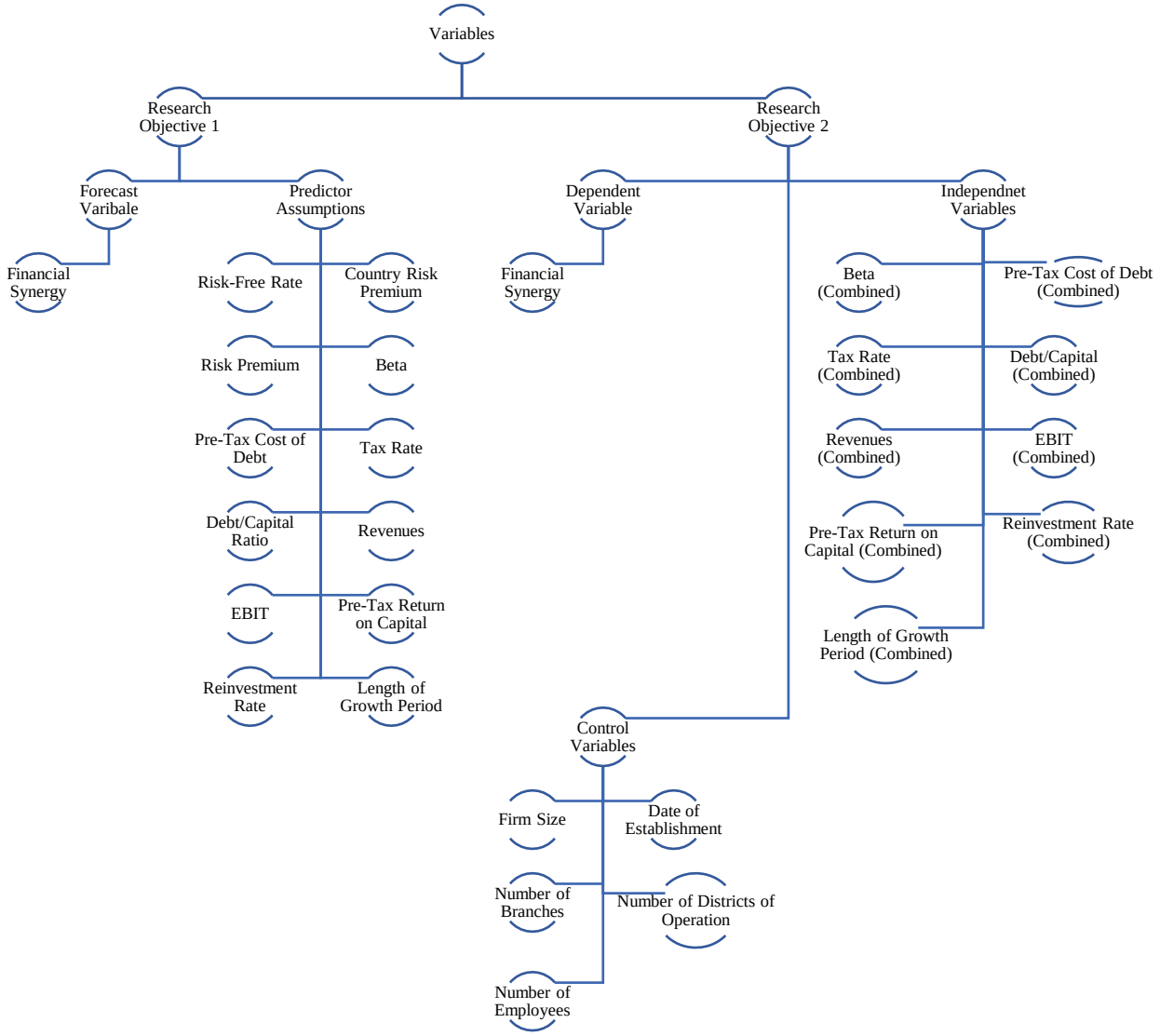


Figure 3. Identification of Variables

The inputs to synergy have been considered independent variables (Damodaran, 2005). Studies have found that firm size has been a significant variable in determining synergy (Moeller et al., 2004; Ellis, 2005; Susanti & Restiana, 2018; Utami, 2023). Firm size significantly impacts the success of a merger (Chen, 1991; Fama & French, 1993). A study was done on firm's value and firm structure that incorporate year of establishment as a control variable (Al-Saidi & Al-Shammari, 2014; Susanti & Restiana, 2018). There is a good correlation between number of branches and banks' performances that finally contribute to the banks' enterprise value (Hirtle, 2005). A study on understanding branch network structure and bank's profitability tried to implicate the impact of branch networks on profitability that meets the enterprise value (Fuchs et al., 2024). A study on the relation between human capital and firm value (Sisodia et al., 2021) revealed a significant relation between the employee size and firm value (Sisodia et al., 2021). Thus, the study has incorporated firm size, date of establishment, number of branches, number of districts of operation, and number of employees as control variables.

Methodology for Determining Variables

Table 1. Characteristics of the Data

Type of data	**Quantitative**
Scale of data	Ratio level
Source of data	Audited financial statements from 2018 to 2022
Model based variables	Cross-sectional
Dependent variable	One
Independent variables	Nine
Control variables	Five

The formulas of the research are derived from (Damodaran, 2005), (CFI, 2024) and authors' own analysis.

Table 2. Derivation of Dependent Variable

Particular	Formula
Financial Synergy	(Value of the merged firms) – ∑Value of the firms standalone

Table 3. Derivation of Formulas for Independent Variables

Particulars	Formula
Risk-free Rate (R_f)	$\frac{\sum_{2018}^{2022} 10\ year\ BGTB\ Cutoff\ Yield}{5}$
Country Risk Premium	6.58%
Risk Premium (R_p)	$\frac{\sum_{2018}^{2022} DSEX\ Index\ Return + Country\ Risk\ Premium - Riskfree\ Rate}{5}$
Beta (β) (Standalone)	$\frac{\sum_{2018}^{2022} Weighted\ Average\ Beta\ for\ Proxy\ Banks\ Listed\ in\ DSEX}{5}$
Pre-Tax Cost of Debt (Standalone)	$\frac{\sum_{2018}^{2022} \frac{Interest\ expenses}{Total\ longterm\ debt}}{5}$
Tax Rate (T_c) (Standalone)	$\frac{\sum_{2018}^{2022} \frac{Tax\ expenses}{Earning\ Before\ Tax\ (EBT)}}{5}$
Debt/Capital Ratio (D/C) (Standalone)	$\frac{\sum_{2018}^{2022} \frac{Total\ Debt}{Total\ Capital}}{5}$
Revenues (Standalone)	$\frac{\sum_{2018}^{2022} Total\ Revenues}{5}$
Earnings before Interest and Taxes (EBIT) (Standalone)	$\frac{\sum_{2018}^{2022} EBIT}{5}$
Pre-Tax Return on Capital (Standalone)	$\frac{\sum_{2018}^{2022} \frac{EBIT}{Total\ Capital}}{5}$
Reinvestment Rate (Standalone)	$\frac{\sum_{2018}^{2022} \frac{Net\ Capital\ Expenditure + Change\ in\ Net\ Working\ Capital}{EBIT(1 - Tax\ Rate)}}{5}$
Length of Growth Period (Standalone)	The continuing period of profit or, diminishing rate of loss.
Beta (Combined)	$\left[\frac{\beta 1}{1 + \left\{(1 - \text{Tc1}) \times \frac{\frac{D}{C}1}{1 - \frac{D}{C}1}\right\}} \times \frac{Enterprise\ Value\ (EV)\ 1}{Enterprise\ Value\ (EV) 1 + Enterprise\ Value (EV)\ 2}\right] + \left[\frac{\beta 2}{1 + \left\{(1 - \text{Tc2}) \times \frac{\frac{D}{C}2}{1 - \frac{D}{C}2}\right\}} \times \frac{Enterprise\ Value\ 2}{Enterprise\ Value\ (EV)\ 1 + Enterprise\ Value\ (EV)\ 2}\right]$
Pre-Tax Cost of Debt (Combined)	$\frac{(Pretax\ Cost\ of\ Debt1\ \times EV1) + (Pretax\ Cost\ of\ Debt2\ \times EV2)}{EV1 + EV2}$
Tax Rate (Combined)	$\frac{(Tc1\ \times EV1) + (Tc2\ \times EV2)}{EV1 + EV2}$
Debt/Capital Ratio (Combined)	$\frac{(D/C1\ \times EV1) + (D/C2\ \times EV2)}{EV1 + EV2}$
Revenues (Combined)	Revenue 1 + Revenue 2
EBIT (Combined)	EBIT 1 + EBIT 2
Pre-Tax Return on Capital (ROC) (Combined)	$\frac{(Pretax\ ROC1\ \times EV1) + (Pretax\ ROC2\ \times EV2)}{EV1 + EV2}$
Reinvestment Rate (RR) (Combined)	$\frac{(RR1\ \times EV1) + (RR2\ \times EV2)}{EV1 + EV2}$
Length of Growth Period (n) (Combined)	Average of the banks' growth.

Here, "1" stands for 1st company and "2" stands for 2nd company applicable for merger.

In case of standalone valuation, the inputs to these calculations are of individual banks. On the other hand, in case of combined valuation or merger, the inputs are those which are calculated for the combined cases.

Table 4. Outputs to Calculate Financial Synergy (Both for the Cases of Standalone and Combined)

Particular	Formula
Cost of Equity (K_e)	$R_f + \beta \times R_p$
After-Tax Cost of Debt (K_d)	Pre-Tax Cost of Debt × (1-T_c)
Cost of Capital (K_c)	$\{K_e \times (1\text{-}D/C)\} + (K_d \times D/C)$
After-tax Return on Capital	Pre-Tax Return on Capital × (1- T_c)
Expected Growth Rate (g)	Reinvestment Rate × After-tax Return on Capital
PV of FCFF	$\{EBIT \times (1-Tc) \times (1-RR)\} \times (1+g) \times \{1 - \frac{(1+g)^n}{(1+kc)^n}$
Terminal Value (TV)	$EBIT \times (1-Tc) \times (1+g)^n \times (1+Rf) \times \frac{(1-Rf)}{Kc}{Kc-Rf}$
Enterprise Value (EV)	PV of FCFF $+\frac{TV}{(1+Kc)^n}$
Value of the Firm (Standalone)	EV1+EV2

Here, "1" stands for 1st company and "2" stands for 2nd company applicable for merger.

Methodology for Analysis for Research Question 1

Crystal Ball, a valuation software, determines financial synergy for multiple cases, with a total of fifty-five possible cases for synergy valuation using the combination method (iii).

$$C(n, r) = \frac{n!}{r!(n-r)!} \quad \text{(iii)}$$

The study evaluates the financial synergy of six merger proposals from Bangladesh Bank through 10,000 simulations. Sensitivity analysis identifies sensitive factors, trend analysis predicts maximum and minimum synergy values, and scenario analysis determines changes in synergy value for 0% to 100% changes in independent variables.

Methodology for Analysis for Research Question 2

Table 5. The Definition and Codes for the Variables

Codes	Definition	Codes	Definition
Beta_C	The combined Beta	RR_C	The combined reinvestment rate
COD_C	The combined pre-tax cost of debt	lgr_C	The combined length of growth period
Tax_C	The combined tax rate	FirmSize	The average of the firm sizes of merging banks
D/C_C	The combined debt to total capital	Est	The average of the banks' years of establishments
Revenues_C	The combined revenues	Branch	The average of the banks' number of branches
EBIT_C	The combined Earnings before Interest and Taxes	Districts	The average of the number of districts the banks have operation
ROC_C	The combined pre-tax return on capital	HR	The average of number of employees of the banks

The Model Estimation

The research question 02 required two models to estimate. One is the Ordinary Least Square (OLS) and the other is Mixed Effect Gaussian Generalized Linear Model (MEGLM). The basic OLS model is shown below:

$$Y = \alpha + \beta ixi + \varepsilon \quad \text{(iv)}$$

From equation (ii), the derived OLS model for this research is shown below:

$$Y = \alpha + \beta_1 Beta\_c + \beta_2 ln\_COD\_C + \beta_3 Tax\_C + \beta_4 D/C\_C + \beta_5 Revenues\_C + \beta_6 EBIT\_C + \beta_7 ROC\_C + \beta_8 RR\_C + \beta_9 lgr\_C + \beta_{10} ln\_FirmSize + \beta_{11} ln\_Est + \beta_{12} Branch + \beta_{13} Districts + \beta_{14} ln\_HR + \varepsilon \quad \text{(v)}$$

For ensuring normality of data principle, cost of debt, date of establishment, HR and Firm Size are log normalized in OLS and only cost of debt in MEGLM. From equation (iii), for building a model for MEGLM, almost everything in the OLS is reiterated except for link and identity functions. The basic MEGLM function is shown below:

$$g(E(Yi)) = E(Yi) = \alpha + \beta ixi + \varepsilon \quad \text{(vi)}$$

From equation of the regarding link and identity, the following parameters are conventionally used:

Table 6. GLM Specification

Distribution	Natural Parameter	Canonical Link
Gaussian (Normal)	μ	Identity

From the Table 3, the final model to be followed is shown below:

$$g(\mu) = \alpha + \beta_1 Beta\_C + \beta_2 ln\_COD\_C + \beta_3 Tax\_C + \beta_4 D/C\_C + \beta_5 Revenues\_C + \beta_6 EBIT\_C + \beta_7 ROC\_C + \beta_8 RR\_C + \beta_9 lgr\_C + \beta_{10} FirmSize + \beta_{11} Est + \beta_{12} Branch + \beta_{13} Districts + \beta_{14} HR ++ \varepsilon \quad \text{(vii)}$$

Here,

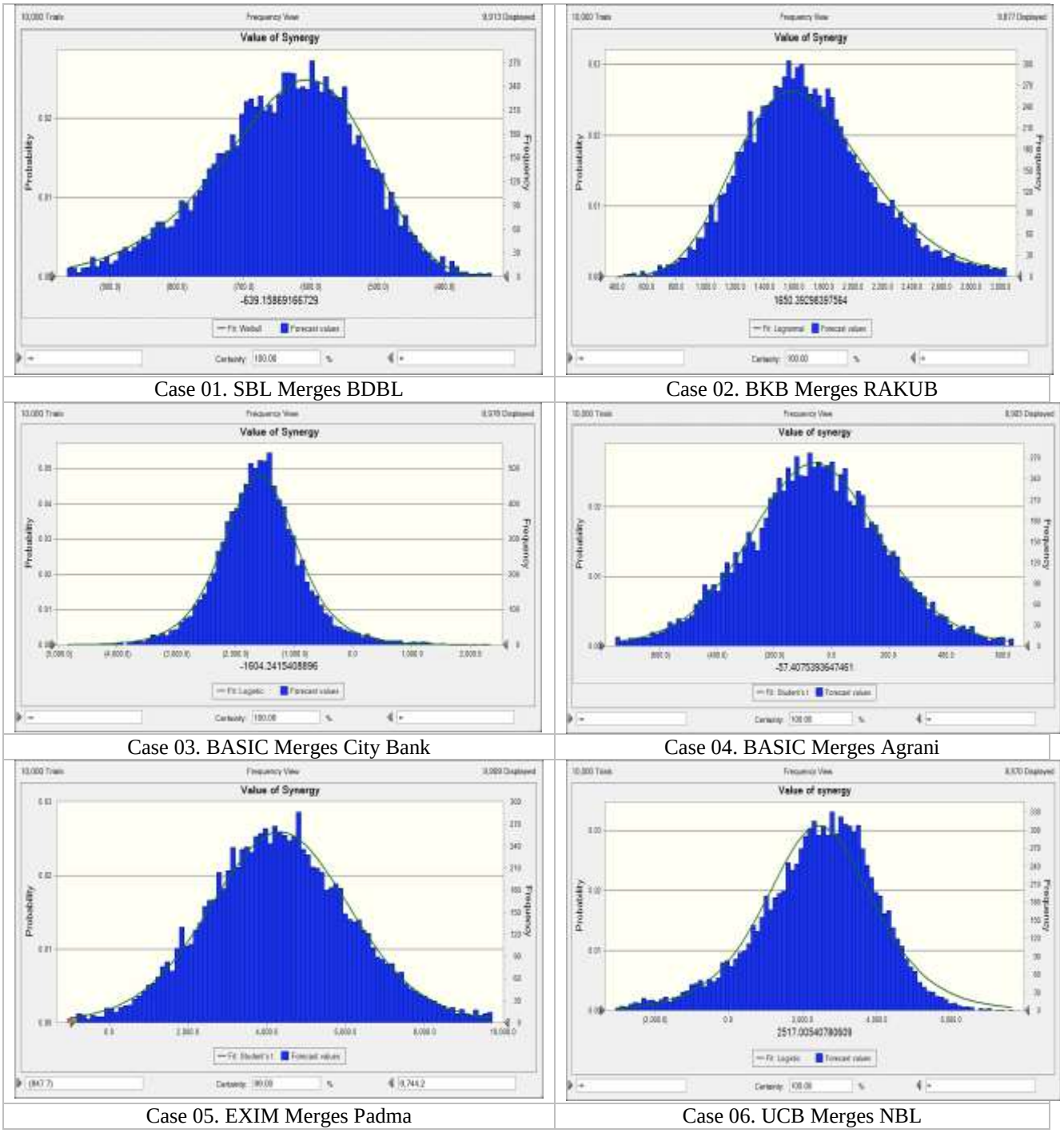
Y and g(μ) are the representatives of value of synergy which is the dependent variable. The α stands for the constant terms, βi stands for the coefficients and ε stands for the random error terms.

RESULTS

Results from Research Question 01

The results of six cases of mergers are summarized below:

Simulation Results for Six Cases (Figures in Crore of BDT)



Case 01. SBL Merges BDBL | Case 02. BKB Merges RAKUB

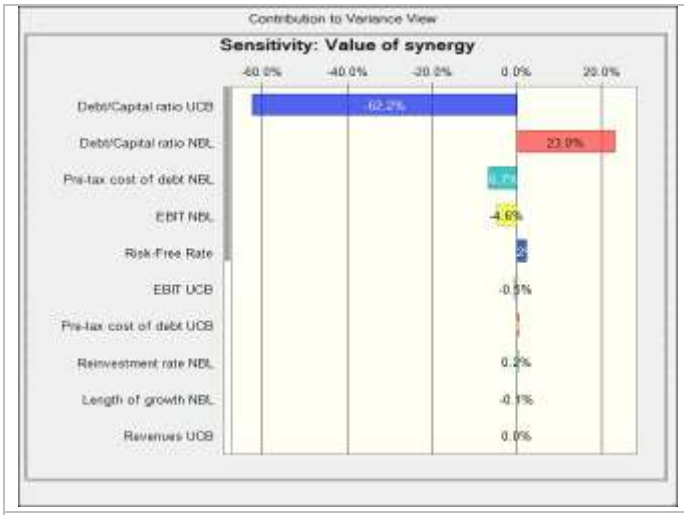
Case 03. BASIC Merges City Bank | Case 04. BASIC Merges Agrani

Case 05. EXIM Merges Padma | Case 06. UCB Merges NBL

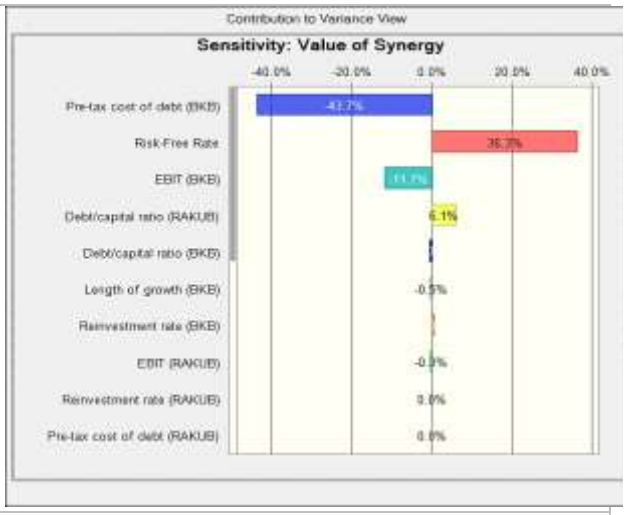
Figure 4. Simulation Results for Six Cases of Proposed Mergers (Figures in Crore of BDT)

The simulation using 10,000 trials in Crystal Ball, results from Figure 4 show that case 2, 5, and 6 result in positive financial synergy while others end in negative financial synergy.

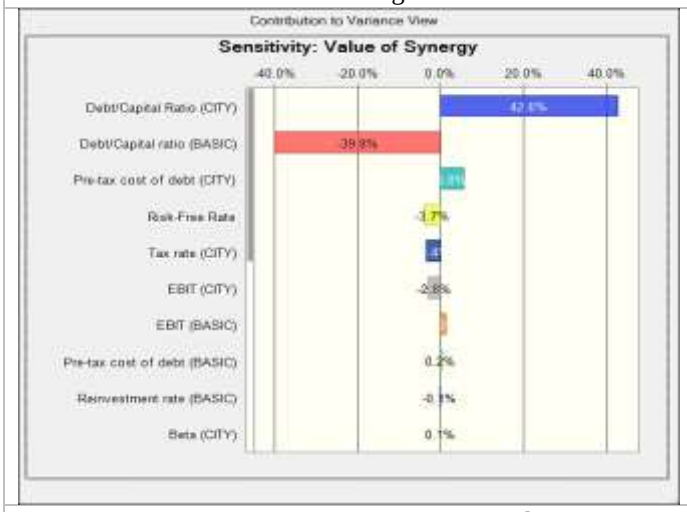
Sensitivity Results for Six Cases



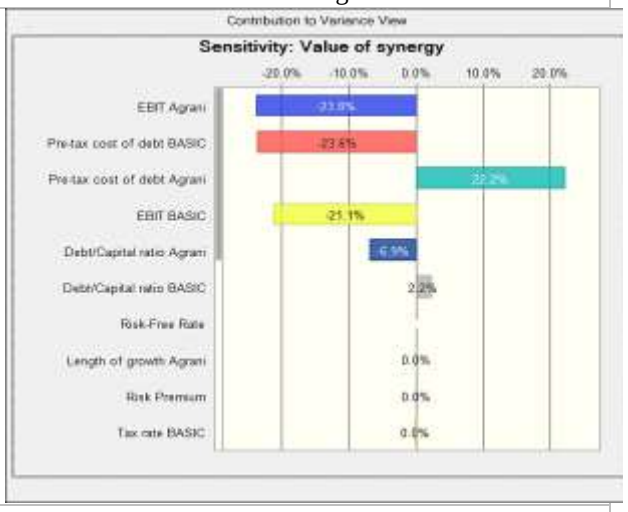
Case 01. SBL Merges BDBL



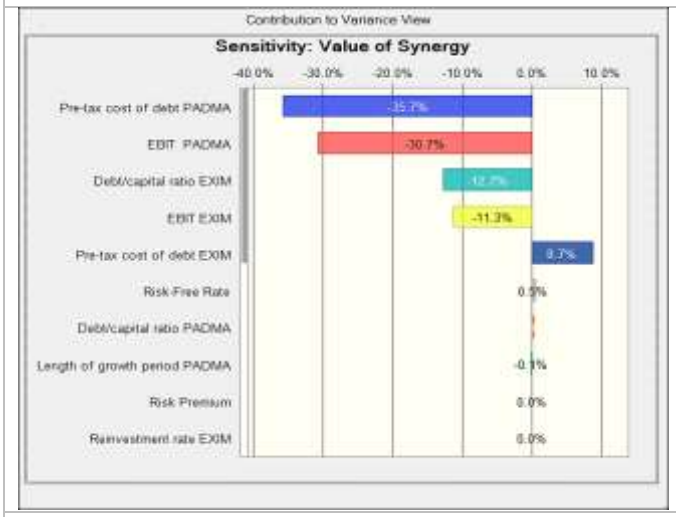
Case 02. BKB Merges RAKUB



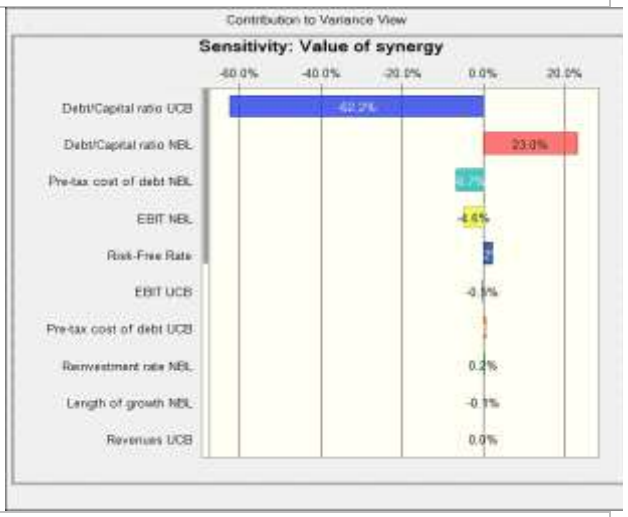
Case 03. BASIC Merges City Bank



Case 04. BASIC Merges Agrani



Case 05. EXIM Merges Padma

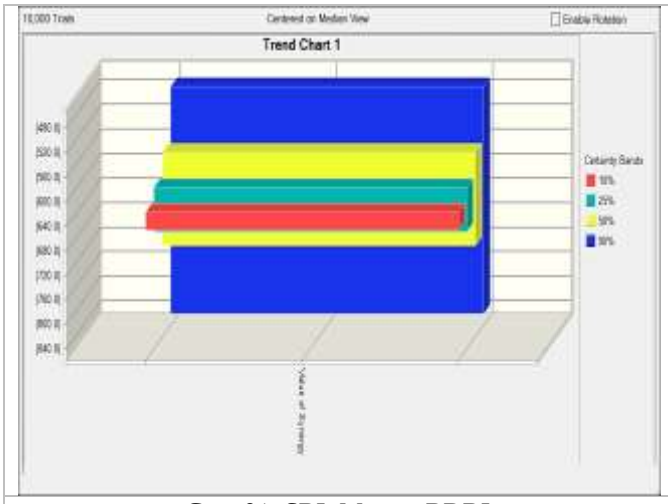


Case 06. UCB Merges NBL

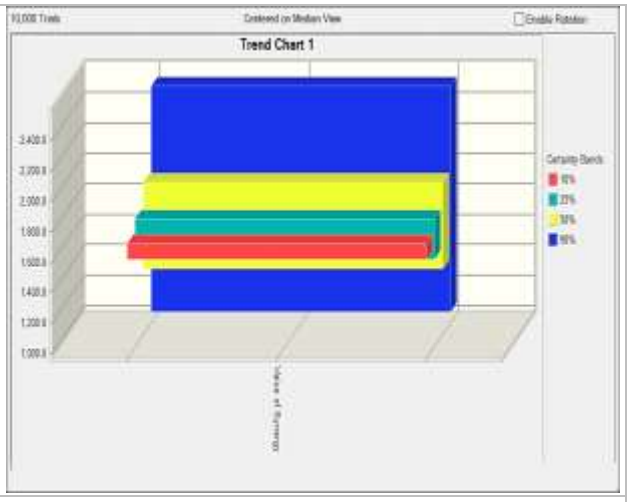
Figure 5. Sensitivity Results for Six Cases of Proposed Mergers

The sensitivity using 10,000 trials in Crystal Ball, results from Figure 5 show that the most sensitive factors in all cases have been debt to capital ratio, pre-tax cost of debt, EBIT, and risk-free rate.

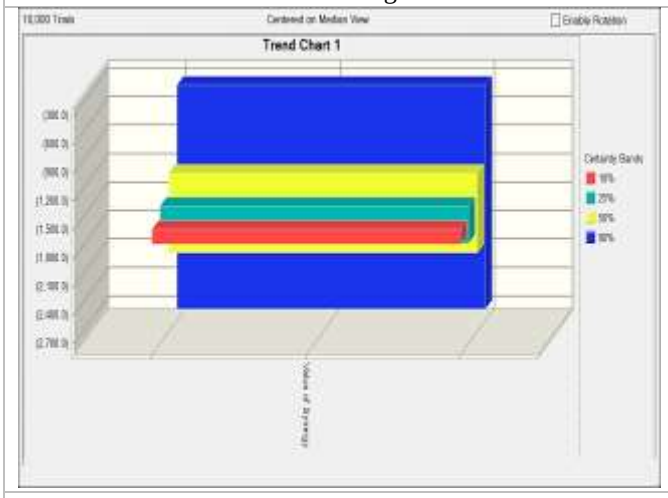
Trend Analysis for Six Cases



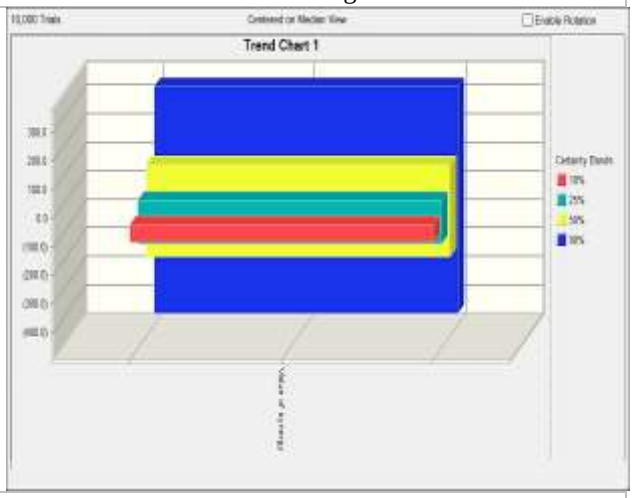
Case 01. SBL Merges BDBL



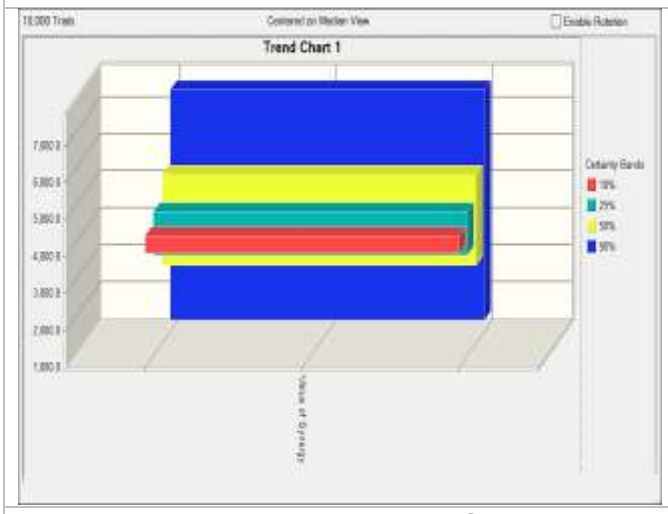
Case 02. BKB Merges RAKUB



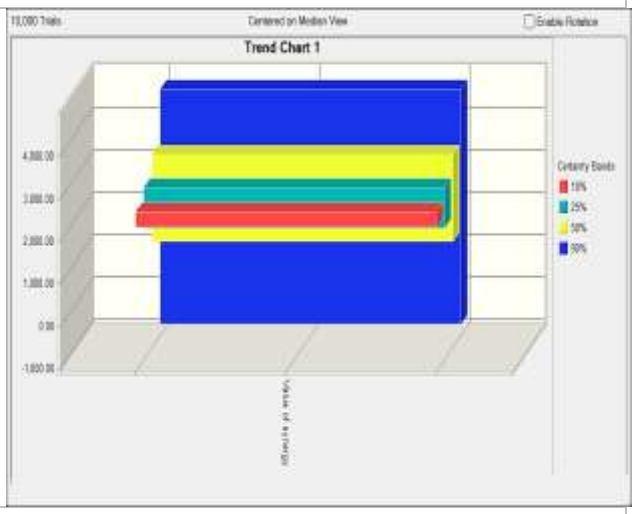
Case 03. BASIC Merges City Bank



Case 04. BASIC Merges Agrani



Case 05. EXIM Merges Padma



Case 06. UCB Merges NBL

Figure 6. Trend Analysis for Six Cases of Proposed Mergers

The results, using 10,000 trials in Crystal Ball in Figure 6, show that case 2, 5, and 6 have positive and less risky spectrum of trend of synergy value. On the other hand, case 1, 3, and 4 have negative and bigger spectrum of trend of synergy value.

Scenario Analysis (In Crore of BDT)

Table 7. Scenario Analysis for the Six Cases

Cases	Mean	Standard Deviation	Minimum	Maximum
Case 01: SBL Merges BDBL	-640.8	113.2	-1,392.90	-254.7
Case 02: BKB Merges RAKUB	1,704.70	461.1	-70.8	6,423.70
Case 03: BASIC Merges City Bank	-1,556.00	739.1	-4,998.00	5,279.40
Case 04: BASIC Merges Agrani	-59.4	246.8	-2,206.90	1,035.50
Case 05: EXIM Merges Padma	4,297.90	1,904.80	-6,748.70	13,831.10
Case 06: NBL Merges UCB	2,303.90	1,871.00	-33,092.50	29,892.20

The scenario, using 10,000 trails in Crystal Ball, analysis shows that in case of 0.1% change takes place in each of the independent variables, the mean stands negative for case 1, 3, and 4. The variability is higher in case 5 and 6. The optimum synergy is found in case 2, 5, and 6.

Possible Merger Solution of Forty-Nine Cases for 10,000 Trials Each Case (In Crores of BDT)

Table 8. Ranking of Value of Possible Mergers

Number of Simulated Cases	Merger Parties	Mean Synergy	Minimum Synergy	Maximum Synergy	Most Sensitive Factor (Positive)	Most Sensitive Factor (Negative)	Synergy Range (90% Confidence)	Synergy Range (75% Confidence)	Rank
01	Agrani & City Bank	(1,089.9)	(18,425.9)	2,682.2	Debt/Capital Ratio (Agrani)	Debt/Capital Ratio (City Bank)	(1,000) to (1,100)	(900) to (1,300)	41
02	Agrani & EXIM	(872.98)	(4,541.7)	452.6	Debt/Capital Ratio (Agrani)	Debt/Capital Ratio (EXIM Bank)	(820) to (890)	(780) to (950)	38
03	Agrani & Padma	1,468.8	(77.1)	3,587.5	Risk-Free Rate	EBIT (Padma)	1,420 to 1,510	180 to 1,580	29
04	Basic & EXIM	(923.8)	(2,544.5)	3,516.1	Debt/Capital Ratio (EXIM Bank)	Debt/Capital Ratio (Basic)	(850) to (950)	(810) to (1,010)	39
05	Basic & Padma	1,681.1	3,418.6	790.8	Risk-Free Rate	Pre-tax Cost of Debt (Padma)	1640 to 1710	1,590 to 1,790	26
06	BDBL & Agrani	23.8	(206.8)	356.4	Tax Rate (BDBL)	Debt/Capital Ratio (BDBL)	10 to 30	02 to 39	34
07	BDBL & Basic	358.5	95	881.8	Debt/Capital Ratio (Basic)	Pre-tax Cost of Debt (Basic)	348 to 365	330 to 378	33
08	BDBL & BKB	1,719	788.1	8,568.6	Risk-free Rate	Pre-tax Cost of Debt (BKB)	1,680 to 1,730	1,590 to 1,820	25
09	BDBL & City Bank	(1,138.2)	(1,857.8)	(495)	Pre-tax Cost of Debt (City Bank)	Debt/Capital Ratio (City Bank)	(1,100) to (1,150)	(1,050) to (1,200)	42
10	BDBL & EXIM	(734.6)	(2,332.2)	(230)	Pre-tax Cost of Debt (EXIM)	EBIT (EXIM)	(710) to (740)	(680) to (780)	37
11	BDBL & NBL	3,273.2	1,695.5	6,578.4	Risk-free Rate	Pre-tax Cost of Debt (NBL)	3,190 to 3,320	3,100 to 3,420	14
12	BDBL & Padma	1,736.1	738.6	4,117.9	Risk-free Rate	Pre-tax Cost of Debt (Padma)	1,690 to 1760	1,620 to 1830	24
13	BDBL & RAKUB	622.6	253.4	1,796	Debt/Capital ratio (RAKUB)	Pre-tax Cost of Debt (RAKUB)	605 to 640	580 to 660	31
14	BDBL & UCB	(608.5)	(879)	(434.2)	Pre-tax Cost of Debt (UCB)	Debt/Capital Ratio (UCB)	(595) to (613)	(584) to (625)	35
15	BKB & Agrani	1,469.2	433.3	5,894.4	Risk-free Rate	Pre-tax Cost of Debt (BKB)	1,410 to 1,500	1,370 to 1,580	28
16	BKB & Basic	1,530.2	425.3	6,827.2	Risk-free Rate	Pre-tax Cost of Debt (BKB)	1,490 to 1,560	1,400 to 1,640	27
17	BKB & City Bank	2,897.8	(23,058.5)	26,138	Pre-tax Cost of Debt (City Bank)	Pre-tax Cost of Debt (BKB)	2,400 to 3,100	1,800 to 3,600	17
18	BKB & EXIM	5,256.3	(5,479.5)	26,049.2	Pre-tax Cost of Debt (EXIM)	Pre-tax Cost of Debt (BKB)	4,900 to 5,500	4,500 to 5,900	08
19	BKB & NBL	5,290.1	1,234.5	21,538.7	Risk-free Rate	Pre-tax Cost of Debt	5,100 to 5,400	5,000 to 5,600	07

						(BKB)			
20	BKB & Padma	3,258.9	1,063.8	19,664.4	Risk-free Rate	Pre-tax Cost of Debt (BKB)	3,180 to 3,300	3,020 to 3,460	15
21	BKB & UCB	6,006	(24,080.5)	22,357.1	Risk-free Rate	Pre-tax Cost of Debt (BKB)	5,700 to 6,200	5,300 to 6,600	04
22	City Bank & EXIM	(1,891.7)	(26,665.3)	2,617.5	Debt/Capital Ratio (City Bank)	Debt/Capital Ratio (EXIM)	(1,800) to (1,950)	(1,700) to (2,080)	45
23	City Bank & Padma	1,925.6	(33,634.9)	11,562.5	Pre-tax Cost of Debt (City Bank)	Debt/Capital Ratio (City Bank)	1,700 to 2,200	1,200 to 2,600	22
24	NBL & Agrani	2,944.8	6,295.8	1,047.9	Risk-free Rate	Pre-tax Cost of Debt (NBL)	2,900 to 2,980	2,850 to 3,100	16
25	NBL & Basic	3,290.1	1,575.7	6,947.4	Risk-free Rate	Pre-tax Cost of Debt (NBL)	3,220 to 3,340	3,160 to 3,470	13
26	NBL & City Bank	16,952.1	(21,337.4)	39,378.8	Pre-tax Cost of Debt (City Bank)	EBIT (NBL)	16,400 to 17,200	156,00 to 18,000	02
27	NBL & EXIM	2,335.6	(11,013.2)	8,486.1	Debt/Capital Ratio (NBL)	Debt/Capital Ratio (EXIM)	2,200 to 2,450	1,800 to 2800	20
28	NBL & Padma	4,738.8	2,055.2	9,801.8	Risk-free Rate	Pre-tax Cost of Debt (Padma)	4650 to 4810	4,500 to 4,950	10
29	RAKUB & Agrani	1,313.4	(2,458)	6,212.3	Pre-tax Cost of Debt (RAKUB)	Debt/Capital Ratio (RAKUB)	1,260 to 1,320	1,180 to 1,440	30
30	RAKUB & Basic	502.3	195.6	1,779.9	Risk-free Rate	Pre-tax Cost of Debt (RAKUB)	485 to 510	460 to 530	32
31	RAKUB & City Bank	(5,719.7)	(32,048.5)	(527.7)	Pre-tax Cost of Debt (City Bank)	Debt/Capital Ratio (City Bank)	(5,500) to (5,900)	(5,200) to (6,300)	49
32	RAKUB & EXIM	(3,361.2)	(11,656)	4,191.8	Pre-tax Cost of Debt (EXIM)	Debt/Capital Ratio (EXIM)	(3,150) to (3,400)	(2,960) to (3,700)	48
33	RAKUB & NBL	3,761.8	1,678.4	7,737.3	EBIT (NBL)	Risk-free Rate	3,750 to 3,800	3,600 to 3,980	12
34	RAKUB & Padma	2,019.9	743.2	5,219.1	EBIT (Padma)	Risk-free Rate	1,990 to 2,060	1,900 to 2,100	21
35	RAKUB & UCB	(2,611.5)	(16,653.5)	2,985	Debt/Capital Ratio (UCB)	Pre-tax Cost of Debt (UCB)	(2,580) to (2700)	(2,490) to (2,850)	47
36	SBL & Agrani	2,503.2	(353.9)	5,666.9	Pre-tax Cost of Debt (SBL)	Risk-free Rate	2,420 to 2,530	2,330 to 2,680	19
37	SBL & Basic	2,861.3	1,263.9	6,154.3	Pre-tax Cost of Debt (SBL)	Risk-free Rate	2,820 to 2,900	2,740 to 3,060	18
38	SBL & BKB	6,204.8	(1,180.7)	31,519.2	Pre-tax Cost of Debt (BKB)	Risk-free Rate	5,900 to 6,500	5,500 to 6,800	05
39	SBL & City Bank	16,731.5	(45,430.3)	143,583.6	EBIT (SBL)	Pre-tax Cost of Debt (City Bank)	16,300 to 16,800	15,800 to 17,000	03
40	SBL & EXIM	1,910.3	(16,199.2)	7,129.5	Debt/Capital Ratio (SBL)	Debt/Capital Ratio (EXIM)	1,800 to 2,100	1,500 to 2,300	23
41	SBL & NBL	5,805.2	1,565.4	13,260.6	Risk-free Rate	Pre-tax Cost of Debt (NBL)	5,700 to 5,850	5,500 to 6,200	06
42	SBL & Padma	4,300.7	417.7	9,558.9	Risk-free Rate	Pre-tax Cost of Debt (Padma)	4,220 to 4,480	3,900 to 4,620	11
43	SBL & RAKUB	(2,412.7)	(7,735.9)	12,244.8	Risk free Rate	Debt/Capital Ratio (SBL)	(2,300) to (2,500)	(2,110) to (2,690)	46
44	SBL & UCB	19,839.7	1,387.6	39,630.3	Pre-tax Cost of Debt (UCB)	EBIT (SBL)	19,600 to 20,100	18,700 to 20,900	01
45	UCB & Agrani	(698.2)	(5,434.7)	1,108.3	Debt/Capital Ratio (UCB)	Debt/Capital Ratio (Agrani)	(660) to (720)	(590) to (810)	36
46	UCB & Basic	(950.7)	(3,466.4)	8,964	Debt/Capital Ratio (UCB)	Debt/Capital Ratio (Basic)	(880) to (1,020)	(780) to (1,110)	40
47	UCB & City	(1,801.6)	(9,246.2)	1,050.4	Pre-tax Cost of Debt (City Bank)	Debt/Capital Ratio (City Bank)	(1,780) to (1,820)	(1,560) to (1,950)	44

48	UCB & EXIM	(1,471.4)	(5,448.4)	50.3	Pre-tax Cost of Debt (EXIM)	Debt/Capital Ratio (City Bank)	(1,440) to (1,500)	(1,380) to (1,570)	43
49	UCB & Padma	5,033.8	(6,858.9)	14,364.8	Pre-tax Cost of Debt (UCB)	Pre-tax Cost of Debt (Padma)	4,800 to 5,200	4,600 to 5,500	09

The ranking in Table 8 allows the opportunity to provide solution to the decision of which bank should merge with whom. The table provides insights about mean, minimum, and maximum synergy values for each case. In case of sensitivity, both negative and positive factors are summarized in the table. Basing on 25% and 75% confidence, the range of synergy is shown for each case. Finally, the ranks are shown in the last column.

Table 9. Solution to Research Question 01 (The Best Mergers Possible)

Merging Bank	Best Case	Position	Merging Bank	Best Case	Position
Sonali Bank PLC	UCB	1	BASIC Bank PLC	NBL	13
Bangladesh Development Bank PLC	NBL	14	United Commercial Bank PLC	SBL	1
Agrani Bank PLC	NBL	16	EXIM Bank Limited	BKB	8
Bangladesh Krishi Bank	UCB	4	National Bank Limited	City Bank	2
Rajshahi Krishi Unnayan Bank	NBL	12	Padma Bank PLC	UCB	9
City Bank PLC	NBL	2			

Table 9 shows the best merging option for each bank with the other bank. It may happen from Table 8 that one bank is suited for merger for many banks. But, Table 9 allows the merging suitability for every bank with the other.

Table 10. Solution to Research Question 01 (Based on Proposed Mergers by Bangladesh Bank)

Proposed Cases	Synergy Value (In Crore of BDT)	Which Plausible Solutions are Synergistic
SBL and BDBL	-639.2	Negative
BKB and RAKUB	1,650.39	Beaten (BKB-UCB)
BASIC and City Bank	-1,604.20	Negative
BASIC and Agrani	-57.4	Negative
EXIM and Padma	4,317.40	Positive
UCB and NBL	2,517	Positive

Based on the proposed 6 cases of the central bank, Table 10 shows which of these six cases hold the positive synergy. It's seen that case 2 (BKB-RAKUB merger) not only is positive, but also beats rank 4 option (BKB-UCB merger).

Results from Research Question 02

In this segment, "***" "**", and "*" indicate "significance at 99%, 95%, and 90% confidence interval respectively.

Table 11. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Synergy	55	2208.453	4591.168	-5719.71	19839.74
Beta_C	55	0.010264	0.026387	-0.03711	0.105892
COD_C	55	0.06695	0.028571	-0.07662	0.16903
Tax_C	55	0.032156	0.508118	-2.10363	1.016814
DC_C	55	1.061882	0.33539	0.076925	2.292402
Revenues_C	55	3199.862	2141.443	237.752	10610.75
EBIT_C	55	-1178.21	1949.99	-6991.82	1636.093
ROC_C	55	-0.06387	0.130302	-0.80718	0.156549
RR_C	55	0.004807	0.028564	-0.0401	0.198211
lgr_C	55	3.454545	1.408548	1	10
FirmSize	55	6.13E+11	4.05E+11	7.72E+10	1.60E+12
Est	55	1987.455	9.121237	1972	2011
Branch	55	408.8182	288.0571	54.5	1133.5
Districts	55	46.16364	10.35618	19	64
HR	55	5836.909	3147.027	929.5	14465.5

Table 11 provides the summary of the data where it's seen that the data set has a great level of variability. The minimum and maximum values have huge distances with symmetric distribution in values. There are 55 observations and all will be applicable in regression analysis.

Table 12. Corelation with P Values

	Synergy	Beta_C	DC_C	EBIT_C	ROC_C	RR_C	lgr_C	ln_COD_C	ln_Tax_C	Revenues_C	ln_Est	ln_HR	Branch	Districts	FirmSize
Synergy	1.0														
Beta_C	0.0	1.0													
	0.8														
DC_C	0.1	**0.5*** **	1.0												
	0.4	0.0													
EBIT_C	**-0.6*** **	0.1	0.1	1.0											
	0.0	0.6	0.6												
ROC_C	**-0.3** **	0.0	**-0.4** **	0.2	1.0										
	0.0	0.8	0.0	0.1											
RR_C	**-0.2***	-0.1	**-0.6*** **	0.2	**0.5*** **	1.0									
	0.1	0.5	0.0	0.1	0.0										
lgr_C	0.1	0.1	-0.2	0.1	0.1	**0.6*** **	1.0								
	0.6	0.5	0.2	0.4	0.5	0.0									
ln_COD_C	**0.5*** **	0.1	**0.6*** **	**-0.4** **	**-0.7*** **	**-0.8*** **	0.2	1.0							
	0.0	0.5	0.0	0.0	0.0	0.0	0.2								
ln_Tax_C	**-0.5** **	-0.1	**-0.4***	-0.1	**0.6** **	0.4	0.0	**-0.4***	1.0						
	0.0	0.7	0.1	0.8	0.0	0.1	1.0	0.1							
Revenues_C	0.1	0.0	-0.1	0.2	0.1	0.0	0.0	**-0.3** **	0.2	1.0					
	0.4	0.7	0.6	0.2	0.4	1.0	0.8	0.0	0.5						
ln_Est	**-0.2***	-0.1	-0.1	0.2	**-0.3** **	-0.1	-0.1	0.1	-0.3	**-0.6*** **	1.0				
	0.1	0.5	0.7	0.2	0.0	0.4	0.5	0.4	0.3	0.0					
ln_HR	**0.3** **	-0.1	-0.1	**-0.2***	0.2	0.1	0.0	-0.1	0.1	**0.6*** **	**-0.9*** **	1.0			
	0.0	0.7	0.7	0.1	0.2	0.5	0.9	0.3	0.8	0.0	0.0				
Branch	**0.3***	0.2	0.1	**-0.3***	0.1	0.0	0.1	-0.1	0.0	**0.5*** **	**-0.8*** **	**0.9*** **	1.0		
	0.1	0.1	0.3	0.1	0.3	0.9	0.7	0.6	1.0	0.0	0.0	0.0			
Districts	0.1	**-0.2***	-0.2	-0.2	**0.4** **	0.2	0.1	-0.1	-0.2	**0.5** **	**-0.6*** **	**0.6*** **	**0.4** **	1.0	
	0.4	0.1	0.1	0.2	0.0	0.1	0.3	0.5	0.4	0.0	0.0	0.0	0.0		
FirmSize	0.1	**-0.3** **	-0.2	0.0	0.2	0.1	0.1	-0.2	-0.1	**0.6*** **	**-0.5** **	**0.6*** **	**0.4*** **	**0.6*** **	1.0
	0.4	0.0	0.1	1.0	0.2	0.5	0.4	0.2	0.6	0.0	0.0	0.0	0.0	0.0	

The results from Figure 12 show that the variables are not properly correlated to each other that reduces the chance of multicollinearity.

Table 13. Regression Analysis by OLS (with Variance Covariance Estimator)

Number of Observations	P Value	R-squared
55	0.0000***	0.6186

Table 14. Variable-wise Regression Analysis by OLS (with Variance Covariance Estimator)

Variables	Coefficients	Robust Std. Error	t statistics	P Values
Beta_C	13519.11	17265.91	0.78	0.438
DC_C	-10411.12	5208.03	-2.00	0.053*
EBIT_C	-0.31	0.35	-0.89	0.379
ROC_C	27711.32	10741.04	2.58	0.014**
RR_C	-262469.40	100453.40	-2.61	0.013**
lgr_C	409.61	599.19	0.68	0.498
ln_COD_C	10336.42	4196.39	2.46	0.018**
Revenues_C	0.64	0.33	1.93	0.061*
ln_Est	-113398.70	220693.60	-0.51	0.61
ln_HR	769.11	3097.43	0.25	0.805
Branch	-0.85	4.61	-0.18	0.855
Districts	-135.00	73.38	-1.84	0.073*
Tax_C	-2827.76	3013.21	-0.94	0.354
ln_FirmSize	418.82	963.64	0.43	0.666
constant	889784.20	1693895.00	0.53	0.602

From Table 13 it is found that there exists significant relationship between different financial factors and financial synergy value, and the null hypothesis can be rejected. The R-squared shows that changes in financial synergy value can be predicted by 61.86% by the changes in the independent variables. In Table 14, it's found that combined debt to capital, revenues, districts are significant at 90% confidence interval, while combined return on capital, reinvestment rate, and log normal value of cost of debt are significant at 95% confidence interval.

Table 15. Test of Multicollinearity

Variable	VIF	1/VIF
RR_C	9.28	0.11
ROC_C	7.19	0.14
ln_COD_C	7.00	0.14
DC_C	6.32	0.16
Tax_C	4.05	0.25
ln_HR	3.90	0.26
EBIT_C	3.81	0.26
ln_Est	3.64	0.27
Branch	3.52	0.28
ln_FirmSize	3.24	0.31
Districts	3.21	0.31
Revenues_C	2.80	0.36
Beta_C	1.87	0.53
lgr_C	1.20	0.83
Mean VIF	4.36	

The mean VIF score is 4.36 found from Table 15 that shows less scope of multicollinearity in the model. Using Breusch-Paga / Cook-Weisberg test for heteroskedasticity, the p value is 0.2967 that accepts the null hypothesis for homoskedasticity or, constant variance.

Table 16. Mixed Effect Generalized Linear Model with Variance-Covariance Estimator (VCE)

Number of Observations	P Value	Wald chi^2
55	0.0000***	127.52

Table 17. Variable-wise Mixed Effect Generalized Linear Model with Variance-Covariance Estimator (VCE)

Variables	Coefficients	Robust Std. Error	z Statistics	P Values
Beta_C	26135.76	13157.09	1.99	0.047**
DC_C	-8697.77	3955.14	-2.20	0.028**
Revenues_C	0.59	0.30	1.96	0.05**
EBIT_C	-0.35	0.28	-1.26	0.21
ROC_C	25257.98	8407.77	3.00	0.003***
RR_C	-235175.30	84752.21	-2.77	0.006***
lgr_C	565.06	504.91	1.12	0.26
FirmSize	0.00	0.00	-0.52	0.60
HR	0.87	0.64	1.36	0.17
ln_Est	-74757.55	142221.70	-0.53	0.60
ln_COD_C	9557.37	3271.60	2.92	0.003***
Tax_C	-2374.56	2486.13	-0.96	0.34
Branch	-7.03	5.00	-1.41	0.16
Districts	-129.43	61.20	-2.11	0.034**
constant	606984.80	1089697.00	0.56	0.58

The MEGLM with VCE results in Table 16 and 17 show that the null hypothesis can be rejected. Also, beta, debt to capital, revenues, and districts are significant at 95% confidence interval, while return on capital, reinvestment rate, log normal value of cost of debt are significant at 99% confidence interval.

DISCUSSIONS

The study has found that out of the proposed mergers, case 2, 5, and 6 result in positive synergy, while case 2 is the most optimum synergy option. Out of the ranking, Table 9 provided the best matching solutions for merger by meeting the research question 1. Though especially using financial inputs to predict financial synergy no exact studies have been done yet, still studies of (Mucenieks, 2018), (Darayseh & Alsharari, 2022), (Sharma, 2018), and (Yiannis et al., 2007) which worked to identify impact of financial factors on financial synergy are worthy of mentioning. The studies outlined significant relationship between dependent and independent variables. In the research objective 2, this study rejects the null hypothesis by accepting that financial factors significantly impact the financial synergy.

Findings from Figure 05 and Table 8 represent that synergy values of almost all of the cases are mostly positively sensitive to Pre-tax Cost of Debt by 35% and, Risk-free Rate by 32.72%., Debt/Capital ratio by 23.36% and 8.92% by other factors on average. On the other hand, synergy values are mostly negatively sensitive to Pre-tax Cost of Debt by 43.36%,

Debt/Capital ratio by 36.36%, and 20.28% by other factors on average. The trend results from figure 6 show at 10% and 25% confidence, how much the synergy values can fluctuate which contribute to solutions found at Table 9 and Table 10. Table 7 represents the scenario of the cases with mean, maximum, minimum, and standard deviation variabilities.

The OLS with VCE output shown in Table 13 represents that there exists a significant relation between the dependent and independent variables where, DC_C, ROC_C, RR_C, ln_COD_C, Revenues_C and control variable Districts are significant which ultimately rejects the null hypothesis. The MEGLM with VCE results also affirm the OLS results with VCE robustness showing significant relation in the model by 99% confidence interval. Here, additionally one independent variable Beta_C is also significant. Thus, the null hypothesis can be rejected concluding that there exists significant relation between the financial factors and synergy value.

The study has confirmed that of the models used, both the OLS and MEGLM provide almost identical results for predicting the synergy value. Finally, it can be said that the methodologies employed in the study meet both of the research objectives, and the ideas are well-conceived.

There are some findings:-

- The study has found that out of the proposal suggested by Bangladesh Bank in merger, only case 2, case 5, and case 6 add value to synergy after merging. And, considering the combination options, the case 2 beats the rank 04 merger between BKB and UCB. Thus, the solution is to proceed the three cases of mergers with maximum priority to implement case 2.
- The study rejects the null hypothesis by accepting that there exists significant relationship between different financial factors and the synergy value. The study found that the merged independent variables debt to capital ratio, return on capital, reinvestment rate, and cost of debt, revenues, and control variable districts are significant to predict the changes in the value of financial synergy after merger. In OLS with VCE regression model and gaussian MEGLM with VCE, debt to capital ratio, reinvestment rate and districts are negatively sloped to the synergy value of mergers while other significant variables are positively sloped to the synergy value of mergers.
- The study affirms that in an emerging economy like Bangladesh, mergers in the banking sector can result in positive synergy value.

CONCLUSIONS

The study reveals that out of the central bank's proposed mergers, cases 2, 5, and 6 significantly enhance financial synergy after merging, and financial factors significantly impact the value of financial synergy. This article introduces a unique approach to the existing research domain by utilizing a combination of simulation and econometric analysis to assess the merger options of various bank types, such as government, non-government, and specialized banks, and by implementing a ranking methodology to determine the optimal merger solution. Additionally, the study presents a novel approach to identifying the financial factors that influence the value of financial synergy. The study has validated the theory of synergy through mergers in the banking sector of an emerging economy such as Bangladesh, and it recommends more mergers based on the ranking strategy provided by the study using proper methodology. The study makes minimal assumptions about the mergers' growth forecasts, which may pose a constraint in situations where external factors influence the economy. The study reveals opportunities for complex merger evaluations across other industries in emerging economies.

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