Diversification and Portfolio Performance: A Study on the Banking Sector of Bangladesh

Syeda Mahrufa Bashar[1], Jubairul Islam Shaown[2]
[1]*Institute of Business Administration, University of Dhaka, Bangladesh*
[2]*BRAC Business School, BRAC University, Bangladesh*
Corresponding Author: Syeda Mahrufa Bashar

Abstract: *The banking sector is one of the thrust and booming sectors in Bangladesh. The study measures the performance of portfolios constructed of selected banks such as The City Bank Limited, BRAC Bank Limited, Islami Bank Bangladesh Limited, Pubali Bank Limited and National Bank Limited. The study conducts a portfolio performance analysis based on the monthly return data of 2012-2017. Individual performance of these companies is also compared with that of different portfolios. In the process, the effect of diversification achieved in the portfolio construction process is also highlighted. In order to evaluate portfolio performance, measures such as Sharpe Ratio, Treynor Ratio, M-squared Ratio are used. The degree of non-systematic risk reduction is also calculated based on different number of stock inclusion in the constructed portfolios. In conducting the research, excel functions were used to calculate the return and volatility of the individual assets as well as portfolios of securities. The study shows that significant level of risk reduction can be attained through portfolio construction in this sector. However, in terms of return, only the portfolio consisting of The City Bank Ltd and BRAC Bank Ltd offers positive risk adjusted return.*
Keywords: *Diversification, Optimization, Volatility, Sharpe, Treynor, M-squared Ratio*

I.   Introduction

The financial sector of Bangladesh is dominated by the banking sector. For sustainable economic growth and resource mobilization, role of the banking sector cannot be overlooked (Khatun, Banking sector for sustainable growth, 2016). There are currently 57 banks operating in this industry and more banks are expected to join in the upcoming period. As the number of banks are increasing, the market is becoming highly competitive as per the HHI index showed below:

As a result, the competition is getting tougher day by day. The non-performing loan is also increasing as few of the new banks are suffering from loan defaults. The gross NPL ratio was 10.5 percent at end-March 2017, which was 9.2 percent at the end of December 2016 and 9.9 percent at the end of March 2016. As said earlier, 14 banks have touched the double-digit figure for NPL with state-owned commercial banks contributing the highest percentage. Top 5 banks in terms of NPL contributes 48.1% of the total non-performing loan. This figure is 65.5% when top 10 banks are considered (Chowdhury S. K., 2017) . Given this scenario, an investor in the stock market targeting bank stocks cannot expect that all the stocks will perform good. Good company stocks need to be targeted. But at the same time diversification if assets are also necessary in order to ensure that un-systematic risk does not affect the return volatility of the investor.

Any single security contains both systematic and un-systematic risk. As more assets which are not perfectly positively correlated are added to the portfolio, the un-systematic portion of the risk goes down (Keith C. Brown, 2016). For a properly well-diversified portfolio, it is theoretically possible to remove all the non-systematic risk. Risk can be reduced by constructing portfolios of less correlated assets. But at the same time, return is also a matter of great concern to investors. So, it needs to be measured whether the return goals are achieved as well. For that there are portfolio performance measures proposed at different points in time. Among the most used ones, there are Sharpe ratio, Treynor Ratio, Jensen's Alpha measure and M-squared Ratio.

Figure 1: HHI Model Trend (all variables)

Figure 3: Top 5 Banks based on NPL (2017) (Chowdhury S. K., 2017)

The main objective of this study is to check while adding new assets or securities is it possible to achieve significant level of risk reduction and whether diversification is effective in the banking sector. The study also measures the performance of the formed portfolios with the market using different performance measurement ratios and also comments on the consistency of the findings.

II. Literature Review

Bangladeshi Banking Industry

Banking sector has played a significant role in the growth of the economy of this country. The financial inclusion growth of the country has significantly facilitated resource mobilization. However, in recent times because of higher number of market players, the banking sector is suffering from bad loan disbursement practices. Among the South Asian countries, Bangladesh stands second, only after Pakistan in terms of NPL as a share of total loan (Khatun, Banking Sector - Time for a massive clean up, 2017). The state-owned banks of the country have 45% share in the total NPL size of the industry. In terms of the share of NPL in their individual loan size, there is a huge divergence amongst banks. Even though DFIs provide only 3.5 percent of the aggregate loan of this industry, their share of NPL as a percentage of loan is the highest. In 2017, Tk. 20 Bn, was allocated to SCBs for recapitalization purposes (Bangladesh banking sector faces challenges, 2017). As the banking sector has a lot to go through right at this point in time, there is lot of unsystematic risk in this industry right now. From an investor's perspective, caution and proper analysis is needed while investing in this sector.

Portfolio Risk and Return
In order to control or reduce risk of an investment, portfolio construction is of paramount importance where the assets included are less positively correlated (Richard A Brealey, 2001). According to Modern Portfolio Theory, given an investment opportunity set, for every level of return, a portfolio with minimum variance can be plotted through un-systematic risk reduction. There is also an optimal portfolio for which the reward to volatility ratio is the highest given the investment options (Markowitz, 1952). The risk reduction is achieved through reducing the unsystematic portion of the total risk. Risk consists of two portions:

Total Risk = Systematic Risk + Unsystematic Risk

Through selecting assets that are less positively or highly negatively correlated, the unsystematic portion can be reduced or even taken down to zero (CFA Institute, 2017). Investors are also rewarded for taking the systematic risk as the unsystematic portion of the risk can be diversified away. For return calculation of a portfolio, weighted average of stock return is used while for risk calculation, standard deviation is the measure.

Diversification
Diversification is needed to ensure that the risk of the portfolio is reduced. However, for this, adding more and more assets to the portfolio will help achieving the target as long as the assets are not perfectly positively correlated. The benefit of diversification is present even though the degrees may vary from time to time. A study on the US market also reveals that diversification has its benefits both in normal and contagion periods, though the extent of that benefit varies (Mohamed Arouri, 2014).

Performance Measures
There are multiple measures to assess the performance of a portfolio over a period. Among these, Sharpe ratio and Alpha are the two most popular ones (Levy, 2016). However for investors with typical borrowing constraints, the geometric mean can be used as an alternative measure of performance.
The Sharpe ratio is a measure that helps the investors to find out the excess return per unit of portfolio volatility (Keith C. Brown, 2016). This ratio calculates how much excess return over the risk free rate the investors are reviving for taking risk (Marte, 2012). As a measure of risk, it considers total risk rather than only the systematic portion of the risk. To overcome his limitation, Treynor Ratio can be used where the excess return is calculated over the systematic risk of the portfolio. Another measure giving the performance on a risk adjusted basis is Modigliani–Modigliani measure which is the extended version of the Sharpe ratio. The portfolio with positive value indicates its performance to be better than that of the market. There have been few studies on the portfolio performance of various industries. In the pharmaceutical industry of Bangladesh, diversification helps in terms of risk reduction but its is not the case in return generation (Chowdhury F. , 2015). Also, in studies on mutual fund performance in the country it has been found out that managers are capable of generating alpha returns for their investors (Das, 2016).

III.   Research Methodology
Research Purpose
The purpose of this study is to apply the concepts of portfolio construction to find out the effect of diversification in the banking sector of Bangladesh and measure the level of risk reduction achieved. The diversification effectiveness and portfolio performance result will guide the investors in making decisions about allocating their funds in this sector.

Objective of The Study
The broad objective of the study is to measure the return and risk performance of the portfolio constructed in the banking sector of Bangladesh. Specifically, this study aims to:
1. Measure individual return and volatility of the selected assets
2. Measure the portfolio returns and risks for different asset combinations
3. Find out the level of un-systematic risk reduction with increasing number of stocks
4. Measure the performance of the portfolios with that of the benchmark index

IV.   Methodology
The study starts with a judgmental sampling method where 5 stocks are selected from the banking industry for inclusion in the portfolio. The 5 stocks are The City Bank Limited, BRAC Bank Limited, Islami Bank Bangladesh Limited, Pubali Bank Limited and National Bank Limited. The monthly price data is collected from secondary sources such as Dhaka Stock Exchange, Lanka Bangla Finance Portal. These monthly price data

are used to calculate monthly returns and volatility of individual stocks. The data is collected for the period of July 2012- June 2017. The monthly return is calculated using the below formula:

$$R_t = \frac{I_t}{I_{t-1}} - 1 \qquad (1)$$

After the calculation of monthly returns, the AVERAGE function of Excel is used to calculate the arithmetic average of the monthly returns based on the 5 years historical return data. Simultaneously, the individual stock standard deviations are also calculated using the STANDARD DEVIATION function which gives the volatility measure of the stocks on a stand-alone basis. Later on, using the same monthly return data, the co-variance of stock returns is calculated using a co-variance matrix in the below format. These results are then used to calculate the portfolio variance for different combination of assets. Also, using these portfolio variances, the level of risk reduction with changing number of assets in the portfolio is measured and portrayed in a graph. Using these data, we check for the effects of diversification and performance of the portfolios.

V.   Calculation of Variables

Standard Deviation: Standard deviation is applied to the annual rate of return of an investment to measure the investment's risk. The excel function used to calculate the volatility is: STDEV.P (Return over the 5-year period)

Covariances: It measures the level of co-movement between two variables. Lesser values of co-variace is desired for portfolio risk reduction purpose. Excel measures the co-variance using the stated function: COVAR (Return of Asset 1, Return of Asset 2). As the number of stocks increase in the portfolio, so does the number of distinct co-variance terms. For a two-asset portfolio, there are 2 covariance terms, for a three-asset portfolio the figure is 6, for a four-asset portfolio, 12, and finally for a five-asset portfolio the number of terms is 20.

Portfolio Return: Portfolio return calculation is simple as it is the weighted average of the returns earned by the individual stocks considered in the portfolio. The weights assigned to each stock is equal for this study. The return includes both capital gain and dividend income. Portfolio Variances: The calculation of portfolio variance gets complicated as the number of securities included in the portfolio increases.

$$\sigma_p^2 = \sum_i w_i^2 \sigma_i^2 + \sum_i \sum_{j \neq i} w_i w_j \sigma_i \sigma_j \rho_{ij}, \qquad (2)$$

$$R_P = \sum_{i=1}^n w_i r_i \quad Where \sum_{i=1}^n w_i = 1 \qquad (3)$$

The variance of a portfolio is a function of the weights allocated to each of the securities, the individual standard deviations of the securities and finally the co-variance or co-relations among the asset classes. As the number of securities increase, the co-variance terms play a major role in determining the overall portfolio variance. For simplification purposes, it is assumed that all the asset incorporated in the portfolio will be assigned equal weight. So, for a two-stock portfolio, each security is given 50% weight and for a five-stock portfolio, the individual asset are given 20% weight. For calculating portfolio return and portfolio variance the two formulas stated below are used. Here, w represents the weights of each asset, and r represents the returns on the assets. In the below formula, ρij is the correlation coefficient between the returns on assets i and j:

Effects of Diversification: In order to measure the level of risk reduction through different portfolio constructions, the study construct a X-Y graph in order to check whether and to what degree the un-systematic risk reduces to as more and more assets are added. For this number of stock is taken on the X axis and risk is measured on the Y axis.

Portfolio Performance: Once the portfolio construction and level of risk reduction is measured, the study measures the performance of the portfolio using various measures. Three measures of performance are taken. However, there are other measures which can be used to measure performance of the constructed portfolios.

Sharpe Ratio: Sharpe ratio is measured as the ratio of excess return earned per unit of total risk or standard deviation of the portfolio.
In order to calculate the excess return, the determination of risk free rate is necessary. For this study as monthly returns are considered, return data of 30-day T-bill of Bangladesh Bank is taken for the last 5 years. Then the average of these historical risk-free rate is calculated to find out the risk-free rate which is applied to this performance measure calculation.

$$SharpeRatio = \frac{R_p - R_f}{\sigma_p} \qquad (4)$$

Treynor Ratio: Treynor ratio measures the excess return per unit of systematic risk of the portfolio which is measured by the portfolio beta. For portfolio beta calculation, the study first calculates individual stock betas by running regression with the monthly returns of the individual stocks over that of DS30 index. Once these individual betas are ready, weighted average of these betas are taken to calculate the portfolio beta.

Here, portfolio i's return is ri, risk free rate of return is rf and portfolio i's beta is βi.

$$\text{Treynor Ratio} = \frac{r_i - r_f}{\beta_i} \qquad (4)$$

Modigliani–Modigliani Measure: Modigliani–Modigliani measure, also called M2, measures the risk adjusted returns of the portfolio. For using this method of performance measurement, the study calculates the return and risk of the DS30 index in the same measure as it did for th individual stocks. T (5) nula used for this measure is:

M2 = (Rp -Rf)* σM/σP - (Rm- Rf)

The portfolio returns (Rp) and portfolio standard deviation (σP) of individual portfolio calculated above are used here to estimate this measure of performance. Rm and σM is the return and volatility of the market index.

For portfolio performance studies in this case it is assumed that the investment opportunity set of the investors consists of the five selected stocks: The City Bank Limited, BRAC Bank Limited, Islami Bank Bangladesh Limited, Pubali Bank Limited and National Bank Limited. And for the last measure, DS30 is taken as the index for benchmark comparison because all of the selected stocks are listed on that index; DS30 represents 51% of the total capitalization of the market and includes 30 stocks in the index.

Data Collection
The 5 stocks were picked according to judgmental sampling. The study is conducted using secondary data from DSE. Data from LankaBangla Stock portal is also collected.

Structure of The Article
The paper starts with the literature review in this field both in national and international context. Next, the objectives and the research methodology used in this study are discussed. Subsequently, analysis and findings of the study are described. In the conclusion part, the results implication of this research is explained with focus on further scopes of study.

Limitations of The Study
The stocks selected are based on judgmental sampling method. The results may change slightly if a different sample of stocks are picked from the banking industry.

VI.   Analysis And Findings
For the five selected company stocks data is collected from DSE website to calculate the standard deviation, covariance and portfolio variance.

Standard Deviation:
This is used to measure the total risk of an asset or portfolio of assets. The stand-alone standard deviation for the five banks are:

Table 1: Standard Deviation of Returns

Bank Name	Volatility (Standard Deviation)
The City Bank Limited	34.9%
BRAC Bank Limited	39.9%
Islami Bank Bangladesh Limited	45.8%
Pubali Bank Limited	44.6%
National Bank Limited	31.3%

Covariance: The covariance of returns is calculated based on a co-variance matrix in excel. The co-variance of returns are as follows:

Table 2: Covariance Matrix

Company	City	Brac	Ibbl	National	Pubali
City	0.0102	0.0054	0.0056	0.0050	0.0041
Brac	0.0054	0.0133	0.0067	0.0042	0.0033
Ibbl	0.0056	0.0067	0.0175	0.0060	0.0037
National	0.0050	0.0042	0.0060	0.0166	-0.0003
Pubali	0.0041	0.0033	0.0037	-0.0003	0.0082
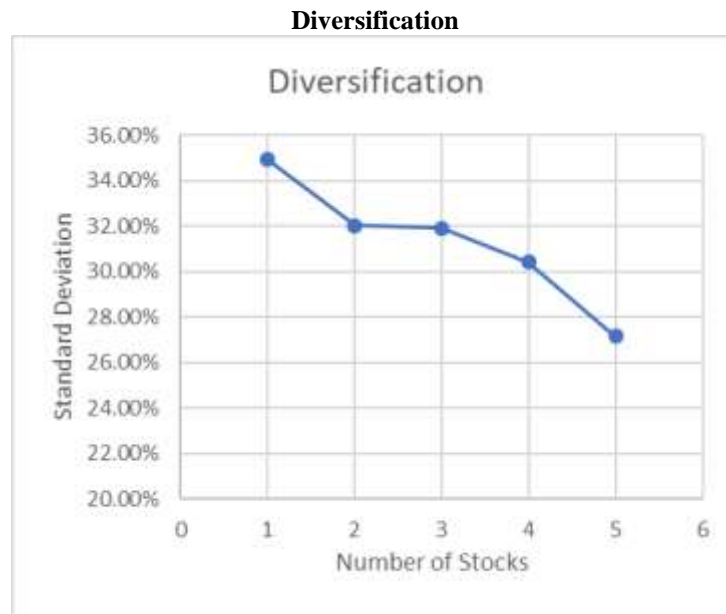
Diversification

Figure 4: Risk Reduction with Increasing Number of Stocks

The impact of diversification on un-systematic risk reduction is measured through a graphical representation. If the stocks are less co-related or negatively co-related, adding that stock to the portfolio reduces the risk of the overall position. The risk reduction is measured by adding stocks one by one to the

Portfolio: Here it is seen from the graph that when there is only City Bank Limited Stock in the portfolio, the portfolio volatility is 34.93%. When BRAC Bank stock is combined, the value reduces to 32.04%. In the three-stock case volatility is 31.92%. Finally, when 5 stocks are added in the portfolio, the portfolio standard deviation goes down to 27.14%. So, it is observed that as the number of stocks increases, the un-systematic portion of the risk goes down at every step. This is because the stocks are less positively and some of them negatively co-related. Hence, the concept of diversification holds in the banking industry and as we keep on adding more assets, the risk of the portfolio goes down.

Performance Measurement:

Before calculating the performance of the constructed portfolio, the individual returns and standard deviations are needed as inputs to calculated the portfolio return and volatility. The same figures are needed for the DS30 index as well.

Table 3: Annual Return-Risk Figures

Company Stock	Annual Return	Annual Volatility
The City Bank Limited	7.90%	34.9%
BRAC Bank Limited	21.45%	39.9%
Islami Bank Bangladesh Limited	-4.32%	45.8%
Pubali Bank Limited	-13.30%	44.6%
National Bank Limited	-4.22%	31.3%
Market	9.78%	19.4%

In the presented data, al the stocks except BRAC Bank fell behind the market. The annual risk-free rate is 7.12%.

Sharpe Ratio:

Before calculating the Sharpe Ratio, risk and return profile of different portfolio of securities is needed. From the profile, the study finds out the following:

Table 4: Portfolio Risk-Return

	Monthly Return	Total Risk (Standard Deviation
1 stock Portfolio	7.86%	34.93%
2 stock Portfolio	14.04%	32.04%
3 stock Portfolio	7.83%	31.92%
4 stock Portfolio	2.48%	30.42%
5 stock Portfolio	1.25%	27.14%

Investors require higher return for taking higher amount of risk due to their risk aversion. Whether a portfolio is strong enough in terms of fulfilling this need of the investors can be measured by Sharpe ratio. The Sharpe ratio for the different portfolio scenarios are as below:

Table 5: Portfolio Sharpe Ratio

	Sharpe Ratio
1 stock Portfolio	0.02
2 stock Portfolio	0.21
3 stock Portfolio	0.02
4 stock Portfolio	-0.15
5 stock Portfolio	-0.22

As observed, the portfolio consisting of The City Bank Limited and The BRAC Bank Limited offeres the highest Sharpe Ratio.

Treynor Ratio:

In order to calculate the Treynor ratio, the study calculates the Beta of the individual stocks followed by the calculation of portfolio betas which is the weighted average of the stock betas included in the portfolios.

Table 6: Portfolio Treynor Ratio

	Portfolio Beta	Treynor Ratio
1 stock Portfolio	0.620	0.012
2 stock Portfolio	0.612	0.113
3 stock Portfolio	0.604	0.012
4 stock Portfolio	0.649	-0.072
5 stock Portfolio	0.608	-0.097

According to this measure, the same two stock portfolio turns out to be the best performing portfolio from this investment opportunity set.

M-Squared (M2) Measure:

This measure also gives the return performance of a portfolio on a risk adjusted basis. But it is easier to interpret as the results are in percentage points rather than in ratio terms. The M-squared values of the different portfolios are as below:

Table 7: M-Squared (M2) Measure

	Excess Return	Market Risk	Portfolio Risk	Rm-Rf	M-squared
1 stock Portfolio	0.73%	19.39%	34.93%	2.66%	-2.25%
2 stock Portfolio	6.92%	19.39%	39.91%	2.66%	0.70%
3 stock Portfolio	0.71%	19.39%	45.78%	2.66%	-2.36%
4 stock Portfolio	-4.64%	19.39%	44.62%	2.66%	-4.68%
5 stock Portfolio	-5.87%	19.39%	31.29%	2.66%	-6.30%

According to the analysis all the three performance measures rank the two-stock portfolio of The City Bank Limited and BRAC Bank Limited at the top.

VII.   Recommendation

From the above findings, it can be stated that diversification works in the banking industry of Bangladesh in terms of reducing un-systematic risk. However, when return is taken into account, adding more stocks does not lead to higher return as the latter stocks did not produce higher return on a standalone basis. Thus, this analysis creates room for skepticism. So, when picking stocks to invest from this sector, for higher return investors have to pick stocks from other industries and combine with these stocks. And while picking stocks they also need to make sure that the stocks are earning good market adjusted return on a stand-alone basis.

VIII.   Conclusion

Creating a portfolio of assets is the best way to reduce exposure to un-systematic risk. But for that investors have to pick assets that are less positively co-related. The banks in this study that did not do well in the investment space historically can focus on their operational efficiency and capital structure to improvise their performance in the stock market.

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