PORTFOLIO DIVERSIFICATION IN THE KARACHI STOCK EXCHANGE

Aakash Ahuja

ABSTRACT

Investment in stocks and expected return from such investment always comes with risk. Financial economists and financial analysts have been working for years to find ways to minimize risk. What all financial analysts believe is that creating well-diversified portfolio can minimize risk. Fama (1976), Elton & Gruber (1977), Evans & Archer (1968) and many other analysts have shown that well-diversified portfolios can actually minimize risk and have suggested the minimum number of stocks required for a well-diversified portfolio. In this paper portfolio diversification theory is applied for the investors investing in the Karachi Stock Exchange. Fifteen (15) securities were randomly selected and equally weighted portfolios were created. Standard Deviations for all portfolios were calculated and the results were analyzed. The study concluded that a portfolio of 10 stocks can diversify away significant amount of risk.

1. INTRODUCTION

Investments in stocks (and all other financial assets) have two basic parameters: Risk and Return. These two parameters have an inverse relationship and all investors face a trade-off between risk and return. There are two types of risks: systematic and unsystematic risk. Systematic risk is the risk that exists inherently with investment due to changes in the whole economy and is unavoidable. The major factors for such risks are economic political and social conditions. Systematic risk is non-diversifiable. Unsystematic risk, however, is firm-specific and is diversifiable. It is contributed by problems and risks involved in one company.

Modern Portfolio theory suggests that number of securities in a portfolio increases the portfolio risks decrease. It basically implied that by investing in more securities investors can avoid the specific risks involved in individual firms. This paper applies this theory on securities traded on the Karachi Stock Exchange. Starting from making a portfolio with 100% investment in one security to an equally weighted investment in 15 securities, the paper analyzes the risk pattern of portfolios.

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2. LITERATURE REVIEW

Markowitz (1952, 1959) developed a basic and most accepted model for portfolio selection, by introducing the usage of expected rate of return and expected risk for a portfolio. He identified the risk-reduction benefits associated with holding a diversified portfolio of assets. Fama (1976) tested the theory of diversification by randomly selecting 50 New York Stock Exchange (NYSE) listed securities and calculated their standard deviation based on monthly data from July 1963 to June 1968. Fama (1976) selected one security noted its standard deviation, and then went on adding securities and creating equally weighted portfolios. The standard deviation continually decreased and almost all diversification was achieved in the first 10-15 stocks.

Evans and Archer (1968), in a similar study, suggested that as few as 20 securities are adequate to have a well diversified portfolio. They further concluded that a randomly selected and equally weighted portfolio provides a little risk reduction to be obtained from a expanding portfolio beyond 10 to 15 securities.

Elton and Gruber (1977) studied and discussed the previous literature and developed an exact expression formula for determining the effect of diversification on risk. By using this approximation they found that total risk goes down at lower rate as more securities are added. They recommend that 15 stocks would appear to be significant for good diversification. Statman (1987) analyzed the return of 500 stock portfolio traded in NYSE and S&P index. The study concluded that a well-diversified portfolio must contain at least 30 stocks.

A recent study by Boscaljion, Filback and Cheng-Ho (2005), suggested that a randomly selected portfolio of 30 stocks or less selected from industry leaders and equally weighted stocks could provide the same level of diversification as the S&P 500 Index. The conclusions of this study were consistent with a study by Statman (1987). This study analyzed the return of 500 stock portfolio traded in NYSE and S&P index. The study concluded that a well-diversified portfolio must contain at least 30 stocks.

A study on diversification in the Malaysian Stock Market by Zulkifli, Basarudin, Narzaidi and Siong (2008) concluded that 15 stocks are enough to diversify away a satisfied amount of diversifiable risk. A simple approach for constructing portfolios is constructing equally weighted portfolios. DeMigeul, Garlappi and Uppal (2005,2007) studied the efficiency of the equal weights to all assets in a portfolio and concluded that this strategy is not inefficient and it outperforms models, such as sample-based mean variance model, minimum variance and value-weighted portfolio model, for selecting an optimal portfolio. Therefore the 1/N strategy is a good benchmark for constructing portfolios and testing portfolio diversification.

In a very recent study Duchin and Levy (2009) also concluded that the 1/N strategy for individual portfolios outperforms another renowned strategy for portfolio selection, called Markowitz's Mean-Variance rule.
3. METHODOLOGY

3.1 Hypothesis

The hypothesis for this research was that the theory of risk reduction through portfolio diversification is applicable to the Karachi Stock Exchange. More precisely, a significant reduction in risk can be achieved by constructing a portfolio consisting as many as 15 securities.

3.2 Data

Daily closing prices, for 3 years; 2007, 2008 and 2009, were taken of 15 randomly chosen securities (See, Appendix 1 for the list of Securities). The data for prices was taken from The Financial Daily website. www.thefinancialdaily.com. Data for the period 28th August 2008 to 14th December 2008 was ignored for all securities due to lock on the Karachi Stock Exchange. This was done in order to avoid the effect of such rare circumstances in the market. The variance of all securities would have been underestimated and the covariance overestimated due to the lock on the market.

3.3 Model

The model for calculating portfolio risk is:

\[ \sigma_p^2 = \sum_{j=1}^{n} w_j^2 \sigma_j^2 + \sum_{j=1}^{n} \sum_{k=1, k \neq j}^{n} w_j w_k \sigma_{jk} \]

Where
- \( \sigma_p^2 \) - Portfolio variance
- \( \sigma_j^2 \) - Variance of asset j in the portfolio
- \( \sigma_{jk} \) - Covariance between asset j and k in the portfolio
- \( w_j \) - Weighted of invested amount in each asset

Under the example of equal variances we may also write

\[ \sigma_p^2 = \sum_{j=1}^{n} \left( \frac{1}{N} \right)^2 \sigma_j^2 + \sum_{j=1}^{n} \sum_{k=1, k \neq j}^{n} \left( \frac{1}{N} \right) \left( \frac{1}{N} \right) \sigma_{jk} \]

In this paper the matrix method is used to determine the portfolio variance. The matrix is also called a variance-covariance matrix and is given:
Two other matrices, both having the same values for weights, were constructed. First a horizontal \((1 \times N)\) matrix is multiplied by this variance/covariance matrix. Next, the results form this are multiplied by a \((N \times 1)\) vector. The final result is the portfolio variance.

### 3.4 Procedure

A security (Arif Habib Sec. Ltd) was randomly chosen and its variance was calculated. Next, this security was combined with (also randomly selected) to form an equally weighted portfolio of 2 securities. Step by step more securities were randomly added to the portfolio until all 15 securities were included.

### 4. RESULTS & ANALYSIS

The standard deviation of the first randomly chosen security (Arif Habib sec. Ltd) came out to be 4.1804%. After combining one more security the standard deviation fell to 2.8568%. This is a reduction of 31.66211%.

<table>
<thead>
<tr>
<th>No. of Securities</th>
<th>Std. Deviation</th>
<th>Change in Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.1804%</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>2.8568%</td>
<td>-31.66211%</td>
</tr>
<tr>
<td>3</td>
<td>2.5230%</td>
<td>-11.68357%</td>
</tr>
<tr>
<td>4</td>
<td>2.4260%</td>
<td>-3.84830%</td>
</tr>
<tr>
<td>5</td>
<td>2.3359%</td>
<td>-3.71388%</td>
</tr>
<tr>
<td>6</td>
<td>2.2303%</td>
<td>-4.52020%</td>
</tr>
<tr>
<td>7</td>
<td>2.2047%</td>
<td>-1.14470%</td>
</tr>
<tr>
<td>8</td>
<td>2.0571%</td>
<td>-6.69663%</td>
</tr>
<tr>
<td>9</td>
<td>2.0495%</td>
<td>-0.37090%</td>
</tr>
<tr>
<td>10</td>
<td>1.9750%</td>
<td>-3.63440%</td>
</tr>
</tbody>
</table>
It can be observed that there is a continuous reduction in portfolio risk up to 10 securities: a reduction of 52.6%.

We observe an unsteady behavior after 10\textsuperscript{th} security. Portfolio risk shows a rising behavior (adding 11\textsuperscript{th} and 14\textsuperscript{th} security) and a declining behavior at trend 12, 13 and 15. And finally at the 15\textsuperscript{th} security the portfolio decreases. This unsteady trend in the risk after the 10\textsuperscript{th} security can be due to high risk securities with high correlation with other securities being added at a later stage in the portfolio. This occurred because the selection of the securities was random. The overall portfolio risk reduces from 4.1804\% to 1.9963\%: a reduction of 52.25\%. This is less than the reduction of 52.6\% when only equally weighted 10 securities were included.

<table>
<thead>
<tr>
<th></th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>2.0636%</td>
<td>2.0508%</td>
<td>1.9907%</td>
<td>2.0128%</td>
<td>1.9963%</td>
</tr>
<tr>
<td></td>
<td>4.48859%</td>
<td>-0.62322%</td>
<td>-2.93137%</td>
<td>1.11371%</td>
<td>-0.81890%</td>
</tr>
</tbody>
</table>

Figure I Number of Securities & Portfolio Risk
5. CONCLUSION

From the findings it can be concluded that the Portfolio Diversification theory is applicable for Karachi Stock Exchange: a reduction of 52.25% in risk was achieved.

The results also indicate that 10 securities can bring significant reduction in risk. After the first 10 securities the portfolio standard deviation kept increasing and decreasing. The portfolio consisting of 10 securities had a standard deviation of 1.975%, whereas the portfolio consisting of 15 securities had a standard deviation of 1.9963%. The change in risk from 14 to 15 securities was 0.8189%. This indicates that there is little capacity for further reduction in risk.

Thus, it can be concluded that a portfolio of equally weighted 10 securities can diversify away significant amount of risk for the investors of Karachi Stock Exchange.

APPENDIX

1. List of Securities randomly chosen for the study.

<table>
<thead>
<tr>
<th>Arif Habib Sec</th>
<th>Attock Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allied Bank</td>
<td>EFU General</td>
</tr>
<tr>
<td>FFBQ</td>
<td>Habib Sugar</td>
</tr>
<tr>
<td>Hub Power</td>
<td>Int. Industries</td>
</tr>
<tr>
<td>Jah Sidd Co</td>
<td>Lucky Cement</td>
</tr>
<tr>
<td>National Foods</td>
<td>Nishat Mills</td>
</tr>
<tr>
<td>Netsol</td>
<td>Pak Reinsurance</td>
</tr>
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<td>UBL</td>
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</table>
6. ACKNOWLEDGEMENTS

The idea behind this study came from a term project, similar to this study, which I submitted at my Financial Economics course teacher I would like to thank Mr. Ejaz Rasheed to arrange and guide me during the process of this research work.

I am also thankful to Mr. Syed Iftikhar Ali for appreciating my idea at the Mathematics colloquium on Risk Management at IoBM.

REFERENCES

1. Boscaljion.B., Filback, and Ho C.C.(2005), How Many Stocks are Required for a Well-Diversified Portfolio? Advances in Financial Education


