

## CONSTRUCTION OF OPTIMAL EQUITY PORTFOLIO USING THE SHARPE INDEX MODEL WITH REFERENCE TO BANKING AND INFORMATION TECHNOLOGY SECTORS IN INDIA FROM 2009-2013

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### **Abstract**

*Indian securities market is a highly volatile and sensitive market where portfolio construction is highly important to get good returns. Thus the main focus of this research is to construct an optimal equity portfolio with the help of Sharpe index model. In this research, media and entertainment sector has been taken into consideration for constructing the optimum portfolio. Twenty companies like PVR, Sun Network, INOX, Raj television have been selected and excess to beta ratio has been calculated and ranked the companies based on that ratio. The cut-off point was calculated based on the highest value and cut-off point should be used to calculate the proportion of money to be invested in each stocks. This research findings and suggestions would be helpful to investors for investing in media and entertainment sector.*

**Keywords:** *Risk, Return, Portfolio, Residual Variance, Sharpe.*

### **Introduction**

Indian securities market came into existence as a most predominant market due to the globalisation and liberalisation which happened in the year of 1990's. Though it happened to be a predominant market, only less than 2% of total population invests in stocks. Primarily it has been divided into two parts, Primary market and secondary market. IPO happens in primary market and trading of issued shares will happen in secondary market. Security analysis and portfolio management will help to construct the optimum portfolio for the equities market and helps to make the right decision for investment. Generally, Security Analysis is broadly classified into three categories:

### **Fundamental Analysis**

Fundamental Analysis refers to the evaluation of securities with the help of certain fundamental business factors such as financial statements, current interest rates as well as competitor's products and financial market. Financial statements are nothing but proofs or written records of various financial transactions of an investor or company. Financial statements are used by financial experts to study and analyze the profits, liabilities, assets of an organization or an individual.

### **Technical Analysis**

Technical analysis refers to the analysis of securities and helps the finance professionals to forecast the price trends through past price trends and market data.

### **Quantitative Analysis**

Quantitative analysis refers to the analysis of securities using quantitative data. There are many theories present in Security Analysis and Portfolio Management. Harry Markowitz was the first who had given "Modern portfolio theory" and he is called as Father of Modern Portfolio Theory. He provided analytical tools for analysis and selection of optimal portfolio. This portfolio approach won him Nobel Prize in 1990. There was numerous complex calculation should be done for the construction of portfolio in Markowitz

model. So, Markowitz work was extended by William Sharpe Model to reduce the complexity and the concept of Sharpe model is “Don’t put all eggs in the same basket”. William Sharpe model will be the best model for Long-term investment and it has been given as single index model because Individual market return in relation with the market return is taken into consideration for the construction of optimum portfolio.

The Indian media and entertainment industry has out-performed the Indian economy and is one of the fastest growing sectors in India. The Media and Entertainment industry generally tends to grow faster when the economy is expanding. The Indian economy has been growing at a fast clip over the last few years, and the income levels too have been experiencing a high growth rate. Even the consumer spending on the media and entertainment industry also increased due to the sustained increase in the disposable income. Optimum portfolio will help the securities market investors who are investing in Media and Entertainment industry to get the maximum returns.

### **Statement of Problem**

The portfolio should not be constructed based on the brand identity, current performance etc because that would not help investors in achieving the anticipated return. The main aim of portfolio construction is diversification and to maintain perfect negative correlation between the securities. Also, holding two or three stocks is always better than holding one. The optimum portfolio gives the investors a better clarity to invest the right proportion of money in the right stock and it helps the investors to get maximum returns with minimal risk. Media and Entertainment sectors are growing sectors in India. Hence, Media and Entertainment sector have been considered

### **Objective of the Study**

1. To study the relative market performance of 20 companies belonging to Media and Entertainment sector, listed in National Stock Exchange, India.
2. To construct an optimal portfolio and analyze its risk and return, for the investments made by investors.
3. To calculate the proportion of money to be invested by investors out of their investment.
4. To guide investors to find out the company that gives the maximum return with minimum risk
5. To study the volatility of companies in comparison with the market.
6. To analyze the investment pattern of investors in Media and Entertainment sector.
7. To find out the stocks to be held and sold based on the portfolio made.

### **Scope of the Study**

Scope of the study is to construct the optimum portfolio in Media and Entertainment sector to reduce its risk and maximise the profits. Based on the historical performance, risk and return of those companies should be analysed and top companies should be selected for construction of portfolio.

### **Limitations**

1. Portfolio is constructed based only on risk and return
2. Study is restricted only to a particular sector (Media and Entertainment) and also limited to only 20 companies listed in National Stock Exchange.
3. Stock prices considered only for 5 years so that the real impact cannot be found.
4. All the calculations could not be brought into the report.
5. This research should not be suitable for short-term investment

## Review of Literature

Kwok Wai Yu, Xiao Qi Yang, Heung Wong (2007), explained the applications of the Sharpe rule in portfolio measurement and management. It proposes that a portion of the portfolio value should be invested in some other assets for portfolio improvement. With the help of Sharpe rule they determined that the new stocks are worthy of adding to the old portfolio if they satisfy a condition, in which the average return rate of these stocks is greater than the return rate of the old portfolio multiplied by the sum of the elasticity of the Value at Risk and 1. The main focus of this paper is Diversification of assets. Nancy Beneda (2004), explained a simplified model for quantifiably measuring and managing various types of risk, as a portfolio of risks. An asset management firm may face a variety of risks due to the broad nature of various investments. The technique utilizes computerized simulation and optimization modeling. The software used to administer the simulations is Crystal Ball. The use of simulation allows risk managers to combine the various categories of risk a firm faces into one risk portfolio. These techniques will enable risk managers to have the information needed to achieve the desired level of overall firm risk and the expected cost of managing risk. Woo Gon Kim, Jun Zhong, Ming-Hsiang Chen and Ersem Karadag (March 2009) evaluated the risk-adjusted performance of three restaurant segments between 1 January 1998 and 31 December 2004. The Jensen, the Treynor and the Sharpe indexes were adopted as an analytical framework. The findings here are not entirely consistent with those of Kim and GU (2003) because they show that the quick-service segment outperforms the other two segments. However, using NASDAQ, NYSE and S&P 500 as benchmarks, this study illustrates that the performance of the economy/buffet segment tops the quick-service and full-service segments. It further indicates that the restaurant industry carries too much unsystematic risk, which it needs to reduce. Andrea L. (July 2003), presented empirical evidence on the efficiency and effectiveness of hedging U.S.-based international mutual funds with an Asia-Pacific investment objective. The case for active currency risk management is examined for a passive and a selective hedge, which is constructed with currency futures in the major currencies. Both static and dynamic hedging models are used to estimate the risk-minimizing hedge ratio. The results show that currency hedging improves the performance of internationally diversified mutual funds. Such hedging is beneficial even when based on prior optimal hedge ratios. Further, efficiency gains from hedging, as measured by the percent change in the Sharpe Index, are greatest under a selective portfolio strategy that is implemented with an optimal constant hedge ratio. John A Haslem (2003), he used Data envelopment analysis (DEA) to identify the large-cap mutual funds in the 1999 Morningstar 500 that are efficient or inefficient. An attempt is made to identify the financial variables that differ significantly between efficient and inefficient funds, and to determine the nature of these relationships. According to study findings, there are identified input/output and profile variables that are significantly different between the 1999 Morningstar 500 large-cap mutual funds that are DEA performance-efficient and inefficient. The Sharpe index represents the DEA output variable. That is, the findings indicate the variables that are significantly different between performance-efficient and inefficient funds and the nature of their relationships. The variable values associated with efficient funds are relatively conservative in nature, not aggressive. Markus Ebner and Thorsten Neumann (2008), this paper explained the correlation instabilities in US stock returns and derive Variance – Covariance Matrices from time-varying factor model estimates. So, they used three different estimation approaches to overcome the problem: (1) moving window least squares, (2) flexible least squares and (3) the random walk model. The results suggest that a time-varying estimation of return correlations fits the data considerably better than time-invariant estimation and thus, increases the efficiency of risk estimation and portfolio selection. Rachel Campbell(2001), said about optimal portfolio selection is that a portfolio selections a model which allocates financial assets by maximizing expected return subject to the constraint that the expected maximum loss should meet the Value-at-Risk limits set by the risk manager. Similar to the mean-variance

approach a performance index like the Sharpe index is constructed. Furthermore when expected returns are assumed to be normally distributed, it is shown that the model provides almost identical results to the mean-variance approach. Fikriyah Abdullah, Taufiq Hassan, and Shamsheer Mohamad (2007) said like one of the implications of Islamic investment principles is the availability of Islamic financial instruments in the financial market. The main aim of this research is to observe the differences in terms of performance between Islamic and conventional mutual fund in the context of Malaysian capital market. To achieve the major objectives of these paper standard methods were used for evaluating the mutual funds performance, for example, Sharpe index and adjusted Sharpe index, Jensen Alpha, Timing and selectivity ability. The basic finding of the paper is that Islamic funds performed well than the conventional funds during bearish economic trends while, conventional funds showed better performance than Islamic funds during bullish economic conditions. Kim Hiang liow (2001) regarding the long-term investment performance, this paper examines the investment performance of Singapore real estate and property stocks over the past 25 years. Evaluations using coefficient of variation (CV), Sharpe index (SI) and time-varying Jensen abnormal return index (JI) suggested that real estate outperformed property stocks on a risk-adjusted basis. Results also indicate that risk-adjusted investment performance for residential properties remained superior to performance for other real estate types and property stocks. David Moreno, Paulina Marco and Ignacio Olmeda(2005),analyzed, from an investor's perspective, the performance of several risk forecasting models in obtaining optimal portfolios. Specifically, it studies whether ARCH-type based models obtain portfolios whose risk-adjusted returns exceed those of the classical Markowitz model. The same analysis is performed with models based on the Lower Partial Moment (LPM) which take into account the asymmetry in the distribution of returns. The results suggest that none of the models achieve a clearly superior average performance. It is also found that models based on semi variance perform as well as those based on the variance, but not better than, even if the evaluation criterion is based on the Reward-to-Semi variance ratio.

### Methodology

Descriptive study has been done for the construction of portfolio of stocks where results obtained on the selected companies. Secondary data is taken for the study and data has been collected from various sources like National stock exchange website, Reserve Bank of India website and from databases like EBSCO, Proquest. Data collected for 5 years from April 2007 to March 2013.

Sample Population : 50 Media and Entertainment companies.

Sample Size : 20

Sampling Technique: Random Sampling.

The steps in constructing the portfolio using the Sharpe Method are as follows. (All calculations are done in MS Excel).

- i. Find the excess return to ratio
- ii. Arrange the calculated excess return to ration in the descending order.
- iii. Find the cut-off points

### Tools used for Discussion

#### Beta Coefficient

Beta coefficient is the relative measure of non-diversifiable risk. It is an index of the degree of movement of an asset's return in response to a change in the market's return.

$$= \text{Correlation} * \frac{(Y)}{(X)}$$

Where, (Y) = Standard Deviation of Individual Stock,  
(X) = Standard Deviation of Market

### Return

The total gain or loss experienced on an investment over a given period of time, calculated by dividing the asset's cash distributions during the period, plus change in value, by its beginning-of-period investment value is termed as return.

$$\text{Return} = ((\text{Today's market price} - \text{Yesterday's market price}) / \text{Yesterday's market price}) * 100$$

### Efficient Portfolio

A portfolio that maximizes return for a given level of risk or minimizes risk for a given level of return is termed as an efficient portfolio.

### Correlation

A statistical measure of the relationship between any two series of numbers representing data of any kind is known as correlation.

### Risk-Free Rate of Return (Rf)

Risk-free rate of return is the required return on a risk free asset, typically a three month treasury bill.

### Excess Return-Beta Ratio

$$\text{Excess Return-Beta Ratio} = R_i - R_f / \beta_i$$

Where,  $R_i$  = the expected return on stock,

$R_f$  = the return on a riskless asset,

$\beta_i$  = the expected change in the rate of return on stock associated with one unit change in the market return.

### Cut-off Point

$$C_i = ( \beta_i * (R_i - R_f) / \sigma_{ei} ) / (1 + \beta_i * \sigma_{ei}^2)$$

Where  $\sigma_{ei}$  = variance of the market index

NRV = variance of a stock's movement that is not associated with the movement of market index that is stock's unsystematic risk.

### Investment to be made in each Security

$$X_i = \frac{Z_i}{\sum_{i=1}^N Z_i}$$

Where,  $X_i$  = the proportion of investment of each stock.

And  $Z_i = \beta_i / \sigma_{ei} (R_i - R_f - \beta_i C_i)$

Where,  $C_i$  = the cut-off point.

### Analysis and Discussions

The best model to measure the risk is standard deviation and beta and using this stock return is calculated.

**Table 1.1** Return, Standard Deviation, Beta and Residual Variance of Individual Stock base (Ranked according to Excess to beta ratio)

Company	Return			(Ri-Rf)/
Raj	94.54926	0.76809	13.51172	112.4989
Dish	87.01187	1.114463	12.80916	70.771163
Saregama	62.13007	0.860263	16.77058	62.759918
Suntv	52.29318	0.737356	10.41018	59.880401
HT media	29.38171	0.562181	9.495695	37.784473
PVR	20.58594	0.628267	8.872269	19.809965
Entertainment	8.919558	0.896388	12.6614	0.8696662
Eros	7.116498	0.616347	6.787634	-1.660594
INOX	-4.55245	0.943092	14.16736	-13.45833
ZEE entertainment	-3.92457	0.774433	11.2023	-15.57858
tv today	-13.5832	0.854406	11.15139	-25.42493
Relianceb	-20.4423	0.832257	11.95925	-34.34305
Den	-13.1421	0.478854	10.11703	-44.44383
Wire	-62.4086	1.169244	19.16456	-60.33689
Deccan	-77.7532	1.076775	15.13198	-79.76889
ZEE news	-57.3842	0.615747	12.79717	-106.4142
Reliancem	-119.086	1.002703	11.85559	-126.883
Primefocus	-51.9409	0.383169	24.8807	-156.7997
TV 18	-621.66	0.265754	14.12262	-157.0683
NDTV	-171.311	0.918358	11.52791	-195.4046

Sharpe has provided a model for the selection of appropriate securities in a portfolio. The excess return of any stock is directly related to its excess return to beta ratio. It measures the additional return on a security (excess of the risk less asset return) per unit of systematic risk. The ratio provides a relationship between potential risk and reward. Ranking of stocks will be given based on excess to beta ratio. By excess to beta ratio it has been shown that Raj Television yields the maximum return followed by Dish TV and NDTV yields lower return among the selected companies.

**Table 1.2. Cut-off Ppoint Calculation for 20 Companies**

Company	(Ri-Rf)/	((Ri-Rf)/ )/ <sup>2</sup> ei	((Ri-Rf)/ )/ <sup>2</sup> ei	<sup>2</sup> m ((Ri-Rf)/ )/ <sup>2</sup> ei
Raj	112.4989	8.326022079	8.326022079	28.32224573
Dish	70.771163	5.525041183	13.85106326	47.11652378
Saregama	62.759918	3.742262591	17.59332585	59.84640603
Suntv	59.880401	5.752100148	23.345426	79.41306011
HT media	37.784473	3.979116079	27.32454208	92.94863596
PVR	19.809965	2.232795758	29.55733784	100.5438344
Entertainment	0.8696662	0.068686414	29.62602425	100.7774818
Eros	-1.660594	-0.244649974	29.38137428	99.94526729
INOX	-13.45833	-0.949953539	28.43142074	96.7138541

ZEE entertainment	-15.57858	-1.390658685	27.04076205	91.98331452
tv today	-25.42493	-2.279979234	24.76078282	84.22761419
Relianceb	-34.34305	-2.871671558	21.88911126	74.45918135
Den	-44.44383	-4.392971239	17.49614002	59.51581347
Wire	-60.33689	-3.148357321	14.3477827	48.80619142
Deccan	-79.76889	-5.271542028	9.076240674	30.87422976
ZEE news	-106.4142	-8.315449352	0.760791322	2.587948791
Reliancem	-126.883	-10.70237883	-9.941587506	-33.81784021
Primefocus	-156.7997	-6.302063395	-16.2436509	-55.25527893
TV 18	-157.0683	-11.12175378	-27.36540468	-93.0876364
NDTV	-195.4046	-16.95056957	-44.31597425	-150.747608

Company	$\sqrt{2e_i}$	$\sqrt{2e_i}$	1+	$\sqrt{2e_i}$	C*
Raj	0.04366298	0.04366298		1.04366298	27.13734824
Dish	0.09696406	0.14062704		1.140627042	41.30756334
Saregama	0.04412806	0.18475511		1.184755106	50.51373547
Suntv	0.05222715	0.23698226		1.236982258	64.19902919
HT media	0.03328324	0.27026550		1.270265501	73.17260518
PVR	0.04448909	0.31475459		1.31475459	76.47346143
Entertainment	0.06346148	0.37821607		1.378216066	73.12168559
Eros	0.05596697	0.43418304		1.43418304	69.68794396
INOX	0.06277975	0.49696279		1.496962786	64.60671904
ZEE entertainment	0.05353785	0.55050063		1.550500633	59.3249126
tv today	0.06546359	0.61596422		1.615964219	52.12220247
Relianceb	0.05791770	0.67388192		1.673881916	44.48293553
Den	0.02266487	0.69654679		1.696546787	35.08056125
Wire	0.07133648	0.76788327		1.767883265	27.60713469
Deccan	0.07662213	0.84450540		1.844505395	16.7384871
ZEE news	0.02962723	0.87413263		1.874132628	1.380878148
Reliancem	0.08480504	0.95893767		1.958937666	-17.2633569
Primefocus	0.00590091	0.96483858		1.96483858	-28.1220449
TV 18	0.00500084	0.96983942		1.969839422	-47.2564592
NDTV	0.07315995	1.04299937		2.042999371	-73.7873981

Table 1.3. Selection of Stocks among 20 Companies

Company	C*
Dish	41.30756
Saregama	50.51374
Suntv	64.19903
HT media	73.17261
PVR	76.47346

**Table1. 4. Proportion of Funds Invested**

Company	Xi	Zi
Dish	7.24%	0.294934
Saregama	13.45%	0.695432
Suntv	13.95%	0.957043
HT media	24.79%	1.991325
PVR	40.58%	3.525645
Sum	100.00%	7.464379

**Table 1.5. Proportion of Investment in each Stock**

Company	Xi
Dish	7.24%
Saregama	13.45%
Suntv	13.95%
HT media	24.79%
PVR	40.58%
Sum	100.00%

**Cut-off Point**

The selection of the stocks depends on a unique cut-off rate such that all stocks with higher ratios of excess return to beta are included and stocks with lower ratios are left out. The cumulated values of  $C_i$  start declining after a particular  $C_i$  and that point is taken as the cut-off point and that stock ratio is the cut-off ratio  $C$ . In Table 2 the highest value of  $C_i$  is taken as the cut-off point that is  $C^*$ . Here PVR has the highest the cut-off rate of  $C^* = 76.47346143$ . All the stocks having  $C_i$  greater than  $C^*$  can be included in the portfolio but in this research paper except Raj television, everything has included for portfolio construction.

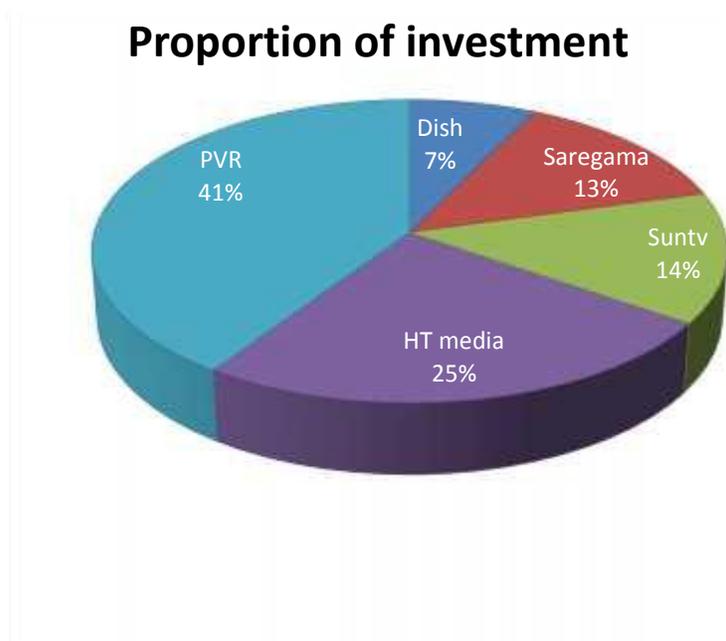
**Portfolio Investment**

Table 5 shows the proportion of investment in each stock. And it indicates the weights on each security and they sum up to 100 percentage. By using Sharpe index model thus we are able to find out the proportion of investments to be made for an optimal portfolio. The maximum investment should be made in PVR with a proportion of 40.58%. Following that HT Media, Sun TV and Saregama are the next three companies where major percentage of investment can be made. Evidently, the companies chosen for the investments are growing at a steady rate in the recent years.

**Findings**

The performance of Media and Entertainment sector are calculated and it is shown that Industry is performing well over the past few years. In securities market, Stock with the high risk will yield the high return. Thus, PVR has high risk and yields higher return compared to the other stocks in the portfolio where Dish TV yields lower return among other companies.

Also from the performance calculated it can be observed that Media and Entertainment Industry is the growing and emerging sector in the securities market.



**Figure: 1.1 Proportion of Investment in various Securities**

### Recommendations

PVR has high proportion of investment in the portfolio and it is about 40.58%. So, investors can invest more in PVR to get maximum return with minimum risk. Following that next choice will be HT media where investor can be advised to invest about 24.79% out of their investment. All companies have beta value less than one, which means risk, is comparatively low so diversification of portfolio may help the investor to eliminate the controllable risk associated with all these companies stocks. The lower proportion of investment of about 7.24% has to be invested in Dish TV.

### Conclusion

Though there are 20 stocks that meet the criteria for being included in the Portfolio, the portfolio is constructed with the top 5 stocks that meet the criteria to be included in the portfolio according to the Sharpe Index Model. Those stocks are PVR, HT media, Sun TV, Saregama, Dish TV. The share market is more challenging, fulfilling and rewarding to resourceful investors willing to learn the trade for having effective returns with minimum risk involved. The optimal portfolio analysis and risk, return trade off are determined by the challenging attitudes of investors towards a variety of economic, monetary, political and psychological forces prevailing in the stock market. Thus the portfolio construction table would help an investor in investment decisions. And the investor would select any company among the 20 companies from the above portfolio table and it helps to make a right investment decision.

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