CAPM – Empirical Study of NSE stocks

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ABSTRACT One of the significant contributions to the theory of financial economics occurred during the 1960s, when a number of researchers, among whom William Sharpe was the leading figure, used Markowitz's portfolio theory as a basis for developing a theory of price formation for financial assets, the so-called Capital Asset Pricing Model (CAPM). The CAPM formula states that the return on each risky security or portfolio is simple the risk free rate plus some risk premium for investing in the risky security. This paper examines the applicability of CAPM on the emerging markets (India) to see whether the return of risky securities is simply dependent on Risk-free interest and beta or there are other economic factors associated.

The model takes into account the asset's sensitivity to non-diversifiable risk (also known as systematic risk or market risk), often represented by the quantity beta (β) in the financial industry, as well as the expected return of the market and the expected return of a theoretical risk-free asset. CAPM "suggests that an investor's cost of equity capital is determined by beta." The CAPM has been extensively employed for estimating cost of capital and evaluating the performance of managed funds.

Literature review

The CAPM was introduced by Jack Treynor (1961, 1962), William Sharpe (1964), John Lintner (1965) and Jan Mossin (1966) independently, building on the earlier work of Harry Markowitz on diversification and modern portfolio theory. Despite its empirical flaws and the existence of more modern approaches to asset pricing and portfolio selection, the CAPM still remains popular due to its simplicity and utility in a variety of situations.

Various studies have been done on emerging markets using CAPM, and they had mixed results. Michailidis, Tsopoglou, Papanastasiou, Mariola (2006) tested the model on the Greek market as one of emerging markets, and came to the conclusion that, contrary to the main hypothesis of the model, a greater risk (beta) does not mean higher yields. Kapil and Sakshi Choudhary (2010) reached the same conclusions researching the Indian capital market. As for Croatia, there is a small number of tests conducted. Fruk and Huljak (2004) tested Sharpe-Lintner model on the Zagreb Stock Exchange, and showed that there is a definite positive relationship between returns and beta coefficients, but the question remains whether the beta coefficients can be used for making investment decisions. Perković (2011) also achieves similar results, and finds that the regression model is not representative and therefore questions the relationship between the beta and the return. Considering the specific characteristics of the emerging markets and a relatively small number of tests that assessed the effectiveness of the CAPM, it was interesting to examine whether the beta was a valid measure of risk in these markets.

The objective of this paper is to make use of CAPM on Indian Stocks to determine their expected return. Nifty (Market Portfolio of 50 stocks) has been used to indicate the market, for the purpose of study. And Treasury bills of 91 days have been used as Risk free asset.

About the model

According to CAPM, there exists a positive linear relationship between the required rate of return on securities and the related risks in a portfolio context. The expected rate of return equals the sum of return on risk free asset and the risk premium that reflects diversification. The model is based on a set of basic assumptions and establishes that for higher more inevitable corporate risk investors expect a higher return, and that there is market equilibrium.

Assumptions of the CAPM model are:

1) Investors evaluate portfolios taking into account the expected rate of return and standard deviation over one-period horizon.
2) Investors prefer a portfolio with higher returns.
3) Investors are risk averse.
4) There is a risk-free rate of return at which it is possible to lend and borrow.
5) The property is indefinitely divisible.
6) All investors have one-period holding horizon.
7) Information is currently free and available to all investors.
8) The market portfolio is assumed to consist of all assets in all markets, but many assets such as real estate, human capital and others are not included. Thus the market portfolio is a limited version of the real market portfolio.
9) Investors plan to invest over the same time horizon and are interested in only one period ahead. They make their investment decisions at the beginning of the period and there are no changes during the investment horizon.
10) Investors have homogeneous expectations regarding the expected rate of return, standard deviation and covariance of securities.

The equation for the CAPM model which describes the expected return on a portfolio or security "i" is as follows:

$$E(R_i) = R_f + \beta_i [E(R_m) - R_f] \quad\quad ---------- (1)$$

Where

$E(R_i)$ is the expected return on security calculated based on its risk to market portfolio.

R_f is the risk-free interest rate

$E(R_m)$ is the expected return on the market portfolio

And β_i indicates the sensitivity of change of return on a security to changes in return on market portfolio.

The equation used for calculating beta for each individual security, β_i is as follows :

$$\beta_i = Cov\ (R_i, R_m) / \sigma_m^2 \qquad \text{--------- (2)}$$

where Cov (R_i, R_m) is the covariance of return on security i (R_i) and return on the market portfolio (R_m), & σ_m^2 is the variance of the market portfolio.

Data and Methodology

Monthly prices (closing basis) of individual securities and nifty (which will serve as market portfolio) are taken from Nov'2010 to Oct'2013. For the same period, yields on 91 day Treasury Bills are taken and monthly average is computed for each month from weekly figures.

From the prices, monthly returns are calculated using the following formula-

$$R = LN\ (P_t/P_{t-1})*100 \qquad \text{-------- (3)}$$

Average return has then been calculated and used to find covariance and Beta, using the formula described above.

Following are some of the important results of the study, which will help calculate expected returns using CAPM:-

The average return on risk free asset (here 91day T-Bill), R_f = 8.231% pa

The average return on Market Portfolio (here Nifty), R_m = 2.462% pa

Beta Values of different securities calculated are as follows:

Table 1 : Securities with Beta Values calculated for Nov 2010 to Oct 2013

Securities	Beta Value
HDFC Bank	0.998
DLF	1.538
Hindustan Unilever	0.207
Page Industries	0.065

Therefore, using equation (1), expected returns of the securities (using CAPM) are:

Table 2: Calculated Expected Returns of securities from Nov 2010 to Oct 2013 (using CAPM)

Securities	Expected Return (R_i) (%pa)
HDFC Bank	2.474
DLF	-0.642
Hindustan Unilever	7.037
Page Industries	7.856

However the actual returns on these securities during Nov 2010 to Oct 2013 are not in line with the CAPM and are as follows-

Table 3 : Actual returns of securities during Nov 2010 to Oct 2013

Securities	Actual Return (%pa)
HDFC Bank	14.45
DLF	-23.13
Hindustan Unilever	26.95
Page Industries	39.83

Results & Analysis

The results CAPM is giving for the data selected show no correlation with the actual returns of the same securities during the same time period. The flaws can be analysed with the help of following points-

Return on market portfolio, R_m, is 2.462%, whereas that on the risk free asset, R_f, is 8.231%. Ideally, return on market portfolio should be greater than risk free asset, as it involves some amount of risk. But here, its the opposite case, i.e. the investor is better off investing in risk free asset and still getting a higher return.

Because $R_m < R_f$, the expected returns (R_i) are less for high beta stocks and more for low beta stocks.

The spread between Expected Returns and Actual Returns is large and this can be because of several reasons. India is an emerging market and Financial Sector does not only works according to pricing and other models but gets influenced by economic, political reasons as well.

Conclusion

Asset pricing is one of the hottest topics for financial economists worldwide. Different markets have different characteristics, so a model that can be considered better in one market may not work in other environment. CAPM as a pricing model has performed well in some parts of the world and does not work for the other one. Continuous improvements are being made to create a robust model of asset pricing. Many difficulties are being faced when used to analyze the human behaviour. Financial economists have encountered tremendous problems whenever they tried to model investor's psychology and the result for a particular time period might not be representative of actual investment behaviour in subsequent time periods. So it is these difficulties and uncertain future environment that causes divergence between theoretical models and practices.

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