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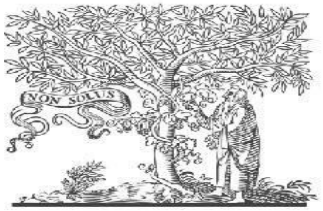

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IMPLICATION OF CAPITAL ASSET PRICING MODEL

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ABSTRACT

The paper intends to establish the importance of expectations and confidence of Indian investors on the financial market in India. For this how a risky asset is priced? It is necessary to know. It is the theory of equilibrium between risk and return. The findings of this paper support Capital Asset Pricing Model in Indian stock market in establishing the trade-off between risk and return and also help in understanding the importance of diversification in India. For individual security perspective, the security market line (SML) is made use of and its relation to expected return and systematic risk (beta) to show how the market must price individual securities in relation to their security risk class. The SML enables us to calculate the reward-to-risk ratio for any security in relation to that of the overall market. Therefore, when the expected rate of return for any security is deflated by its beta coefficient, the reward-to-risk ratio for any individual security in the market is equal to the market reward-to-risk ratio.

Capital market has become an integral part of the economies of all countries. The manner in which securities are priced in capital market has attracted the attention of researchers for long. Investment in securities market requires the study of the relationship between risks and returns. The foundations for the development of asset pricing models were laid by Markowitz (1952) and Tobin (1958). Early theories suggested that the risk of an individual security is the standard deviation of its returns – a measure of return volatility. Thus, the larger the standard deviation of security returns the greater the risk. An investor's main concern, however, is the risk of his/her total wealth made up of a collection of securities. The CAPM is a model for pricing an individual security (asset) or a portfolio. It is used in finance to determine a theoretically appropriate required rate of return (and thus the price if expected cash flows can be estimated) of an asset, if that asset is to be added to an already well-diversified portfolio, given that asset's non-diversifiable risk. Thus

Individual security's / beta =
Market's securities (portfolio)
Reward-to-risk ratio
Reward-to-risk ratio

$$\bar{r}_a = r_f + \beta (\bar{r}_m - r_f)$$

where

r_f = Risk free rate
β_a = Beta of the Security
$\bar{r}_m$ = Expected market Rate

The CAPM formula 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. The general idea behind CAPM is that investors need to be compensated in two ways: time value of money and risk. The time value of money is represented by

the risk-free (rf) rate in the formula and compensates the investors for placing money in any investment over a period of time. The other half of the formula represents risk and calculates the amount of compensation the investor needs for taking on additional risk. This is calculated by taking a risk measure (beta) that compares the returns of the asset to the market over a period of time and to the market premium (Rm-rf).

The CAPM says that the expected return of a security or a portfolio equals the rate on a risk-free security plus a risk premium. If this expected return does not meet or beat the required return, then the investment should not be undertaken. The security market line plots the results of the CAPM for all different risks (betas).

Beta is calculated using regression analysis, and you can think of beta as the tendency of a security's returns to respond to swings in the market. A beta of 1 indicates that the security's price will move with the market. A beta of less than 1 means that the security will be less volatile than the market. A beta of greater than 1 indicates that the security's price will be more volatile than the market. For example, if a stock's beta is 1.2, it's theoretically 20% more volatile than the market.

Many utilities stocks have a beta of less than 1. Conversely, most high-tech Nasdaq-based stocks have a beta of greater than 1, offering the possibility of a higher rate of return, but also posing more risk.

Stock Beta

A stock beta is used to mathematically describe the relationship between the movements of an individual stock versus the market itself. Investors can use a stock's beta to measure the risk of a security versus the market.

Expected Market Return

The expected market return is the return the investor would expect to receive from a broad stock market indicator such as the S&P 500. Over the last 17 years or so, the S&P 500 has yielded investors an average annual return of around 8.10%

Risk Free Interest Rate

The risk free interest rate is the interest rate the investor would expect to receive from a risk free investment. Typically, US Treasury Bills are used for US dollars and German Government bills are used for the Euro.

Equity Market Premium

The equity market premium is simply the difference between the expected stock market return and the risk free interest rate. This is the premium paid to those investing in stocks and is normally higher than the risk free rate. This compensates investors for taking on the additional risk associated with buying stocks.

Expected Return on Capital Asset

This is the predicted return the investor can expect to receive based on the capital asset pricing model, or CAPM. For this stock, risk is determined by the stock's beta and the CAPM formula calculates the appropriate return for the investor based on that risk.

Capital Market Line (CML)

A line used in the capital asset pricing model to illustrate the rates of return for efficient portfolios depending on the risk-free rate of return and the level of risk (standard deviation) for a particular portfolio.

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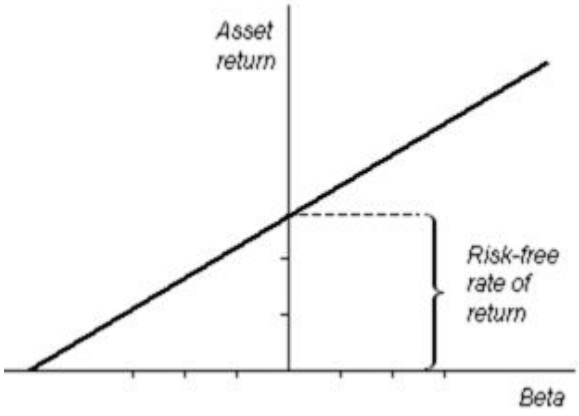
The CML is derived by drawing a tangent line from the intercept point on the efficient frontier to the point where the expected return equals the risk-free rate of return.

The CML is considered to be superior to the efficient frontier since it takes into account the inclusion of a risk-free asset in the portfolio. The capital asset pricing model (CAPM) demonstrates that the market portfolio is essentially the efficient frontier. This is achieved visually through the security market line (SML).

Security Market Line (SML)



The Security Market Line, seen here in a graph, describes a relation between the beta and the asset's expected rate of return.

A line that graphs the systematic, or market, risk versus return of the whole market at a certain time and shows all risky marketable securities. Also referred to as the "characteristic line". The SML essentially graphs the results from the capital asset pricing model (CAPM) formula. The x-axis represents the risk (beta), and the y-axis represents the expected return. The market risk premium is determined from the slope of the SML.

The security market line is a useful tool in determining whether an asset being considered for a portfolio offers a reasonable expected return for risk. Individual securities are plotted on the SML graph. If the security's risk versus expected return is plotted above the SML, it is undervalued because the investor can expect a greater return for the inherent risk. A security plotted below the SML is overvalued because the investor would be accepting less return for the amount of risk assumed.

Asset Pricing

Once the expected return, $E(R_i)$, is calculated using CAPM, the future cash flows of the asset can be discounted to their present value using this rate ($E(R_i)$), to establish the correct price for the asset.

In theory, therefore, an asset is correctly priced when its observed price is the same as its value calculated using the CAPM derived discount rate. If the observed price is higher than the valuation, then the asset is overvalued (and undervalued when the observed price is below the CAPM valuation).

Alternatively, one can "solve for the discount rate" for the observed price given a particular valuation model and compare that discount rate with the CAPM rate. If the discount rate in the model is lower than the CAPM rate then the asset is overvalued (and undervalued for a too high discount rate).

Asset-specific required return

The CAPM returns the asset-appropriate required return or discount rate - i.e. the rate at which future cash flows produced by the asset should be discounted given that asset's relative riskiness. Betas

exceeding one signify more than average "riskiness"; betas below one indicate lower than average. Thus a more risky stock will have a higher beta and will be discounted at a higher rate; less sensitive stocks will have lower betas and be discounted at a lower rate. The CAPM is consistent with intuition - investors (should) require a higher return for holding a more risky asset.

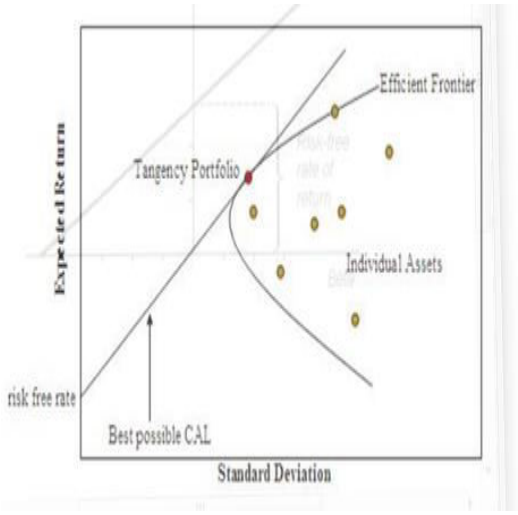
Since beta reflects asset-specific sensitivity to non-diversifiable, i.e. market risk, the market as a whole, by definition, has a beta of one. Stock market indices are frequently used as local proxies for the market - and in that case (by definition) have a beta of one. An investor in a large, diversified portfolio (such as a mutual fund) therefore expects performance in line with the market.

Risk and Diversification

The risk of a portfolio comprises systematic risk, also known as undiversifiable risk, and unsystematic risk which is also known as idiosyncratic risk or diversifiable risk. Systematic risk refers to the risk common to all securities - i.e. market risk. Unsystematic risk is the risk associated with individual assets. Unsystematic risk can be diversified away to smaller levels by including a greater number of assets in the portfolio. (Specific risks "average out"); systematic risk (within one market) cannot. Depending on the market, a portfolio of approximately 30-40 securities in developed markets such as UK or US (more in case of developing markets because of higher asset volatilities) will render the portfolio sufficiently diversified to limit exposure to systemic risk only.

A rational investor should not take on any diversifiable risk, as only non-diversifiable risks are rewarded within the scope of this model. Therefore, the required return on an asset, that is, the return that compensates for risk taken, must be linked to its riskiness in a portfolio context - i.e. its contribution to overall portfolio riskiness - as opposed to its "stand alone riskiness." In the CAPM context, portfolio risk is represented by higher variance i.e. less predictability. In other words the beta of the portfolio is the defining factor in rewarding the systematic exposure taken by an investor.

The efficient frontier



The CAPM assumes that the risk-return profile of a portfolio can be optimized - an optimal portfolio displays the lowest possible level of risk for its level of return. Additionally, since each additional asset introduced into a portfolio further diversifies the portfolio, the optimal portfolio must comprise every asset, (assuming no trading costs) with each asset value-weighted to achieve the above (assuming that any asset is infinitely divisible). All such optimal portfolios, i.e., one for each level of return, comprise the efficient frontier.

Because the unsystematic risk is diversifiable, the total risk of a portfolio can be viewed as beta.

The market portfolio

An investor might choose to invest a proportion of his or her wealth in a portfolio of risky assets with the remainder in cash - earning interest at the risk free rate (or indeed may borrow money to fund his or her purchase of risky assets in which case there is negative cash weighting). Here, the ratio of risky assets to risk free asset does not determine overall return - this relationship is clearly linear. It is thus possible to achieve a particular return in one of two ways:

1. By investing all of one's wealth in a risky portfolio,
2. By investing a proportion in a risky portfolio and the remainder in cash (either borrowed or invested).

For a given level of return, however, only one of these portfolios will be optimal (in the sense of lowest risk). Since the risk free asset is, by definition, uncorrelated with any other asset, option 2 will generally have the lower variance and hence be the more efficient of the two.

This relationship also holds for portfolios along the efficient frontier: a higher return portfolio plus cash is more efficient than a lower return portfolio alone for that lower level of return. For a given risk free rate, there is only one optimal portfolio which can be combined with cash to achieve the lowest level of risk for any possible return. This is the market portfolio.

Assumption of CAPM

All investors have rational expectations.

· There are no arbitrage opportunities.

· Returns are distributed normally.

· Fixed quantity of assets.

· Perfectly efficient capital markets.

· Investors are solely concerned with level and uncertainty of future wealth

· Separation of financial and production sectors.

· Production plans must be fixed.

· Risk-free rates exist with limitless borrowing capacity and universal access.

· The Risk-free borrowing and lending rates are equal.

· No inflation and no change in the level of interest rate exists.

· Perfect information, hence all investors have the same expectations about security returns for any given time period.

The CAPM draws conclusions from a variety of assumptions. Some are vital to its premise; others cause only minor changes if they are untrue. Since the early 1970s much research into the plausibility and effects of weakness in these assumptions has been conducted by academia. The assumptions that form the basis for the CAPM are:

Investors measure asset risk by the variance of its return over future periods. All other measures of risk are unimportant.

Investors always desire more return to less, and they are risk averse; that is, they will avoid risk if all else is equal.

There are no restrictions on the borrowing and lending of money at the risk-free rate of interest.

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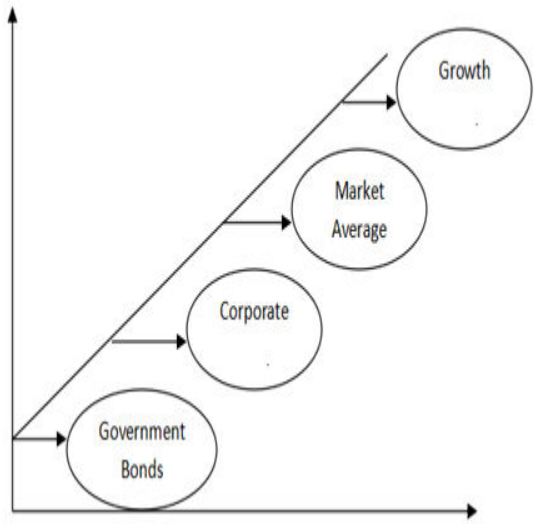

Rf

1.0 **beta (β)**

All possible investments are traded in the market and are available to everyone, the assets are infinitely devisable, and there are no restrictions on short selling.

The market is perfectly efficient. That is, every investor receives and understands the same information, processes it accurately, and trades without cost. There is no consideration of the effects of taxation.

Limitations of CAPM model

· The model assumes that asset returns are (jointly) normally distributed random variables. It is however frequently observed that returns in equity and other markets are not normally distributed. As a result, large swings (3 to 6 standard deviations from the mean) occur in the market more frequently than the normal distribution assumption would expect.

· The model assumes that the variance of returns is an adequate measurement of risk. This might be justified under the assumption of normally distributed returns, but for general return distributions other risk measures (like coherent risk measures) will likely reflect the investors' preferences more adequately.

· The model does not appear to adequately explain the variation in stock returns. Empirical studies show that low beta stocks may offer higher returns than the model would predict. Some data to this effect was presented as early as a 1969 conference in Buffalo, New York in a paper by Fischer Black, Michael Jensen, and Myron Scholes. Either that fact is itself rational (which saves the efficient markets hypothesis but makes CAPM wrong), or it is irrational (which saves CAPM, but makes EMH wrong – indeed, this possibility makes volatility arbitrage a strategy for reliably beating the market).

· The model assumes that given a certain expected return investors will prefer lower risk (lower variance) to higher risk and conversely given a certain level of risk will prefer higher returns to lower ones. It does not allow for investors who will accept lower returns for higher risk. Casino gamblers clearly pay for risk, and it is possible that some stock traders will pay for risk as well.

· The model assumes that all investors have access to the same information and agree about the risk and expected return of all assets. (Homogeneous expectations assumption)

· The model assumes that there are no taxes or transaction costs, although this assumption may be relaxed with more complicated versions of the model.

· The market portfolio consists of all assets in all markets, where each asset is weighted by its market capitalization. This assumes no preference between markets and assets for individual investors, and that investors choose assets solely as a function of their risk-return profile. It also assumes that all assets are infinitely divisible as to the amount which may be held or transacted.

· The market portfolio should in theory include all types of assets that are held by anyone as an investment (including works of art, real estate, human capital...) In practice, such a market portfolio is unobservable and people usually substitute a stock index as a proxy for the true market portfolio. Unfortunately, it has been shown that this substitution is not innocuous and can lead to false inferences as to the validity of the CAPM, and it has been said that due to the in observability of the true market portfolio, the CAPM might not be empirically testable. This was presented in greater depth in a paper by Richard Roll in 1977, and is generally referred to as Roll's Critique. Theories such as the Arbitrage Pricing Theory (APT) have since been formulated to circumvent this problem.

· Because CAPM prices a stock in terms of all stocks and bonds, it is really an arbitrage pricing model which throws no light on how a firm's beta is determined.

Despite limitations, the Capital Asset Pricing Model remains the best illustration of long-term trade offs between risk and return in the financial markets. Although very few investors actually use the CAPM without modification, its principles are very valuable, and may function as a sufficient guide for the average long-term investor.

These principles may be stated as:

1. Diversify—there is no compensation for unsystematic risk.
2. Hold long term—do not worry about timing when to get in or out of the market.
3. To earn a higher return, take on more systematic risk. The more stocks one holds that are sensitive to the business cycle the more average return the portfolio will receive. For shorter term, or more sophisticated investing, other models have been developed. However, unless the model is based on market inefficiencies, or obtaining superior information, it will still have the CAPM basic tenets at its center

Conclusion

The paper examined the implication of CAPM in the Indian stock market in determining the required rate of return of risky securities. Efficient capital market which assumes that investors can get extra return only by bearing extra risk. CAPM assume efficient market in determining the return only by bearing extra risk. The finding of the study provides significant relationship between risk and return. Investors can integrate the performance of their portfolios to the market developments. The significant relationship between portfolios' market risk and expected return suggests that investors are getting extra return for taking extra risk .

As Investors move from low risky portfolios to the higher portfolio, their exposure to non-market risk gets reduced.

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