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Dynamic Risk Factors in Expedition of Capital Asset Pricing Model for Measuring Required Rate of Return Intended for Equity Valuation

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Abstract

Investment in shares of the company has its own charm. Investors can invest in many financial instruments including equity shares of public limited companies. However, unlike debt instrument, it's very difficult to decide the required rate of return for investing in equity share mainly because uncertainty attached to the market return and systematic risk possessed by the company under consideration. CAPM model establishes a link between Risk and Required return for investing in equity and this rate is being considered while carrying out valuation of equity. CAPM converts the risk-return relationship into a formula, where in, the risk factors and their weightage are put on one side and required return, to justify the risk being taken, is derived on another side. CAPM initially considered 'Market' as the only risk factor and this risk was denoted by beta(β). later, different researchers developed many variants of CAPM such as Zero beta CAPM, CCAPM, ICAPM. Over a period, like Assets Pricing Model, Basic CAPM formula also added many other risk factors namely, size, momentum, liquidity, investment, and profitability. The present research paper tries to trace the journey of CAPM from One Factor to six factor model. The author will discuss various variants of CAPM, journey of CAPM, some crucial conceptual as well as empirical studies which either supported or opposed these models.

Keywords: CAPM, Markets, Required Rate of Return, Risk factors, variants.

1. INTRODUCTION

Investor is always eager to know whether he is rightly being rewarded for risk undertaken by him or not. In case of equity shares, the investor receives two types of return i.e., capital return and current return. He earns current return in terms of dividend. Ideally, equity divided should be in line with the risk being undertaken by equity investors, but equity dividend is rarely paid according to the required rate of return. However, he gets additional return in term of capital return which is result of change in price of equity share. And these capital return arrives from the retained earning created and used by company. So, the shareholder's justified return is received in two components dividend and price appreciation. CAPM tries to find out 'the rate of return' that should be paid to equity shareholders for their investment in the equity share. Investor can compare the required rate of return with the total return(current and capital) received by him for deciding whether he is receiving true value or not. In the field of CAPM, the journey started with one factor i.e Market factor but as time passed some other risk factors, kept on being added and the model grew from one

factor to six factor model. The present research paper is going to trace the journey by addressing some conceptual and empirical studies in the field.

II. Literature Review:

The present research article includes literature review related to Capital Asset Pricing Model. The article addresses conceptual as well as empirical studies carried out in India as well as in the world. The paper discusses different models considering different risk factors. William F. Sharpe & John Lintner considered 'Market' as sole risk factor in 1964 & 1965 respectively. The Fama & French's 3 factors (FF3) model considered 'size' as well as 'value' over and above 'Market' (Fama & French, 1993). Carhart's model (1997) add up 'momentum' the 4th risk factor to FF3. (Carhart, 1997). The 'q-factor' also known as HXZ model believed 4 factors i.e 'Market', 'Size', 'Investment', and 'Profitability' (Hou, Mo, Xue, & Zhang, 2018). On the one hand, Fama & French's FF5 recognized 'Market', 'Size', 'Value', 'Profitability', 'Investment' as risk reasons but on the other hand FF4 drops the 'value'. like q-factor model the FF4 considered the 4 factors only by dropping 'value'. Campbell added the sixth factor, that is, 'Human Capital' to FF5 (Campbell, 1996). The detailed journey is discussed in this research paper.

III. Research Methodology

Objective of the study

1. Discuss Role of CAPM in valuation of equity shareholder's return.

2. Discuss various variants of CAPM and tracing the journey of CAPM from 1 factor model to 6 factor model.

Data: Secondary data collected referring various research articles from journals, books and websites.

Theoretical framework:

Valuation:

The 'price' and the 'value' are two different terms. The price is, what we pay, and the value is what we receive. So, while spending money for investment one need to be assured that he or she is paying price according to value received or to be received. Many theories and methods are being used for calculating this 'true value'. In contrast, Capital Assets pricing model calculates true value of required rate of return for equity share holder for respective risk undertaken by them. Thus, CAPM makes an attempt to arrive at true required rate of return for equity share holder. This rate of return is considered while carrying out valuation of equity share.

Equity shareholder's return

Being owner, the equity shareholder's bear the maximum risk. So, they should be rewarded with appropriate return. The equity shares holders are rewarded in two parts i.e., capital return and current return. The capital return is the earned when the invested equity shares of company are sold to others by the investor, and it is one time return while the current return is required rate of return being earned by equity share holder. One should not misinterpret the dividend return as required rate of return. Most of time dividends are paid randomly or considering some other factors rather than risk undertaken. But CAPM helps us to calculate true required rate of return for risk undertaken by investing stock.

IV. Analysis & Discussion

CAPM is employed for carrying out valuation of securities, stocks, and assets by connecting risk and expected rate of return. As per CAPM, investors will be ready to invest in an asset only if he/She is compensated 'time value of money' & 'risk undertaken'. According to CAPM investor is rewarded for 'time value of money' through Risk-free rate (Rf), which an investor earns if he invests in risk free securities. In addition to this, investor of security faces systematic as well as non-systematic risk also.

The 'non-systematic' risk can be reduced or eliminated by creating well diversified portfolio but 'Systematic' risk is often 'general risk' effecting all stocks in the economy so it cannot be reduced hence, investor should be offset for this risk. Basic formula of CAPM uses a beta(β) to indicate non diversifiable risk i.e systematic risk. Security with higher beta signals that the Security is substantially affected by macro-economic fluctuations, so such security needs to be rewarded with higher return. while, Security with low beta signals that less impact of market changes so the required return can be relatively lower.

The widely used formula of CAPM, derived through The Sharpe-Lintner-Black(SLB)model is ,

Ri=Rf+βa (Rm−Rf).

Here: Ri=Expected Return of Investment, Rf=Risk-Free Rate, βa=Beta of the Investment 'a', (Rm−Rf)=Market Risk Premium

The CAPM (Capital Asset Pricing Model) is originated from 'Modern Portfolio Theory' & 'diversification theory' originated by Harry Markowitz. CAPM was developed parallel by Jack Treynor, William F. Sharpe, John Lintner and Jan Mossin in 1961, 1964, 1965 & 1966 respectively. They all were developing CAPM contemplating different viewpoints and different mathematical notation'. All these economists did not realize that they all are saying same thing possibly due to different mathematical formulas, notations, and different style of presenting their viewpoints. However, A very careful reading of the papers discloses that the key equations are more or less the same (Sullivan, 2006).

History has recognized John Lintner, William F. Sharpe, and Jan Mossin for their share in development of CAPM but Jack Treynor hasn't been appreciated for building foundation of CAPM. However, "Market Value, Time, and Risk", and "Toward a Theory of Market Value of Risky Asset"- the two unpublished work of Jack Treynor circulated in 1960s among many theorists, including William F. Sharpe. Surprisingly, it was William F. Sharpe and not Jack Treynor who was awarded the Nobel Prize for developing CAPM (Harrison, 2016). Jack Treynor developed the earliest version of the CAPM.

William F. Sharpe (1964) discovered that the return on ' security' or ' portfolio' should equivalent to its Cost of Capital. Here, CAPM measures association between Systematic risk (β) and required return of an asset at given Market rate and risk-free rate of return. Thus, the model is used for valuing 'individual security' or 'portfolio'. William F. Sharpe analyses CAPM from an individual investor's view point who is picking up stocks. While John Lintner thought about CAPM from the view point of the perspective of a corporation issuing shares of stock. The CAPM equation according to Sharpe and Lintner is : Ra=Rf+βa (Rm−Rf)

where: Ra=Expected Return on Security, R=Risk-Free Rate, Rm=Expected Return of Market, Ba =The Beta of Security & (Rm−Rf)=Equity Market Premium.

Where beta of the security: $\beta a = \frac{COV\ (Ra,Rm)}{\sigma m^2}$

Jan Mossin had a chapter in his dissertation, "Studies in the Theory of Risk Bearing," which formed basis of his CAPM analysis. However, Mossin was prompt in appreciating the importance of his efforts because he published his paper in 1968, that is, two years before completing his thesis (Sullivan, 2006). Even though all four authors were working on same model, each Author's paper reveals a different standpoint. Treynor was mainly concerned about capital budgeting/ cost-of-capital issues. therefore, he stressed upon Proposition I of MM theory, that says the capital structure of a firm is irrelevant to its value. Lintner focused on a firm issuing equities. Contrasting to Modigliani and Miller, Lintner believed that a firm's financial policy has impact on firm's value. Sharpe concentrated on optimum portfolio selection; obviously, his work was inspired by the work of his mentor Harry Markowitz. Lastly, Mossin worked on portfolio theory but emphasized mainly on identifying equilibrium conditions in the asset market (Sullivan, 2006).

The Basic CAPM is very simple and widely used model even in today's modern world. However, it has been criticized by many theorists for its unrealistic assumptions. A general criticism of CAPM as a financial model is that it assumes investors are anxious about an investment's volatility of returns only thus, the model results into exclusion of other factors. Stephen Ross (1976) criticized the model for considering β as 'the only risk factor' faced by investors. According to Ross, the return of the security is being affected by many factors and not only by β (Ross, 1976). However, he did not define those 'many factors 'in his Asset Pricing Theory (APT) model. Roll & Ross supported APT proposed by Ross and noted that 3 to 4 'priced factors' are found in their empirical test of APT (Roll & Ross, 1980). Further, Chen et al. Explored set of microeconomic factors. that have systematic influence on the prices of Assets. Chen et al. studied the range between long run and short run interest rates, inflation-both expected & unexpected, production by industries , and rage of high- and low-grade bonds for investigating whether the risk undertaken due to these factors is rewarded by market or not (Chen, Roll, & Ross, 1986).

Empirical application of CAPM constructed by Sharpe as well as Lintner was very limited. Since adoption of CAPM numerous experimentations have tried to investigate it empirically and in the process many variants of the CAPM such as ICAPM & CCAPM have also been created to tackle impractical assumptions (Elbannan, 2015).. For Example, In 1972 Black highlighted that unlimited risk-less lending and borrowing is an impractical hypothesis and to overcome this limitation, he developed a variant of the CAPM excluding postulate of risk-less lending and borrowing, this variant is popular as Black's CAPM or zero β CAPM, that drops the assumption of the presence of a risk-less Asset, contained a flatter trade off of average return for market beta so it is empirically more useful (Fama & French, 2004). In the year 1973, Merton extended the CAPM which is known as Inter-temporal CAPM i.e. ICAPM. The ICAPM assumes investors hedge risky positions and it applied 'Utility Maximization' to obtain accurate predictions of expected returns of security via multifactor. According to Merton 1973, the ICAPM measures fluctuations in investors' wealth in response to fluctuation in 'labour', 'income', 'the prices of consumption goods' and 'the nature of portfolio opportunities.' (Elbannan, 2015). Campbell argued that inter temporal asset pricing theory has turn into unreasonably complicated due to the nonlinearity of the inter temporal budget constraint and proposed a log-linear approximation to the constraint (Campbell, 1993).

During late 1970s, research started considering variables namely, momentum, size, and different price ratios that further clarified average returns considering β (Fama & French, 2004).such as, Basu's (1977) studied the impact of high or low P/E multiple on market price of stock discovered that the price earnings ratio provides diverse evaluation for the equity as compared to the CAPM, and strongly believed that that the equity with high P/E multiple earn higher returns in future as compared to the returns than assessed through the CAPM (Elbannan, 2015).while, Breeden as well as Lucas expanded the traditional CAPM in 1977 & 1978 respectively and developed the Consumption CAPM i.e. CCAPM which connects stock returns with consumption for understanding and prediction of future asset prices (Elbannan, 2015).

Fama and French (1992) informed and integrated the proof on the empirical disappointments of the CAPM using the Cross-Section Regression approach, Asset-Pricing Tests, Sharpe-Lintner-Black (SLB) model and Fama-MacBeth Regressions. CAPM uses only one variable 'β' to describe the returns of stock/ portfolio. The Fama–Macbeth Regression is applied to ascertain determinants of Asset Pricing Models such as βs and Risk Premium for risk factors considered. Fama & French proposed three-factor model(FF3) for calculating the expected returns of risky assets by considering size, debt-equity and other price ratio such as Book to Market Multiple & earnings-price ratio in addition to market beta (Fama & French, 2004)Thus, FF3 uses 3

factors i.e. (1) market risk'β', (2) the outperformance of small V/S big companies, (3) the outperformance of 'High Book to Market Ratio' V/S 'Low Book to Market Ratio' companies. Thus, three-factor model adds two factors to CAPM i.e 'SMB' & 'HML' where SMB stands for "Small Market Capitalization minus Big Market Capitalization " while HML refers to "High Book-to-Market Multiple minus Low Book-to-Market Multiple" represents extra returns of 'Value Stocks' over 'Growth Stocks' (Fama & R.French, 1992).

So, formula for return from equity under Fama & French's FF3 Model (1993) is,

$$Rit-RFt=ai+bi(RMt-RFt)+SiSMB+hiHML+eit$$

Where: $Rit-RFt$ = Expected Return on Assets, RFt = Risk-Free Rate, bi = Beta of the Assets,

RMt =Return of the Stock Market, Si = SMB Coefficient, SMB=Small (Cap) Minus Big i.e Size Here Size is the Market value of Equity, Which is Market Price Per share multiplied by outstanding shares. hi = HML Coefficient, HML = High Book to Price minus Low i.e. Value Wang & Iorio(2007) explored the cross-sectional relationship of stock returns with some firm specific attributes via regression analysis and observed that β lacks explanatory power even when its effect is examined in isolation. In addition to this, 'Size' and 'Book-to-Market ratio' captures volatility in stock returns and have significant impact on predicted price (Wang & Iorio, 2007). Haque & Sarwar (2013) discovered that Equity return performance does not endorse some of the traditional financial models. Book to Market value multiple had a significant negative effect on equity returns so, the study rejected applicability of FF3 for Pakistan during the period 1998- 2009. However, the study supported the pertinence of the CAPM on Pakistan stock market and noted that Pakistani investors paid great consideration to the varying security prices instead of earning components except discretionary accrual that can be manipulated by managers. In all, the study concluded that 'managers' and 'volatility' were the two crucial determinants in Pakistan's equity market during the selected period and for selected sample of 394 non-financial firms from Karachi Stock Exchange (Sarwar, Haque, & Suleman, 2013).

In 1997, Mark Carhart added one more factor namely, 'Momentum' to FF3. As per Mark Carhart, this fourth factor model can calculate security/portfolio returns more accurately as compared to FF3 (Kampman, 2011). like Mark Carhart, Hou et al. (2015) also proposed 4 factors model. However, their model is formerly known as q- factor which considers 'market', 'size', 'investment' and 'return on equity'. Further, The q-factor model is empirical implication of 'Investment CAPM' which was proposed by Zhang in 2017. 'Investment CAPM' calculated the price/value of risky assets from the suppliers'/firms' point of view and not from buyers (investors) perspective. The investment CAPM bear a resemblance to the concept of Net Present Value (Zhang, 2020). Anita and Pavitra Yadav (2014) applied regression analysis and correlation on selected data and concluded that price is substantially affected by the 'book value per share', 'price to book value' and 'dividend yield' (Yadav, Anita, & Pavitra, 2014)

Hou et al. (2018) developed 'q5 model' by adding one more factor i.e 'expected growth' factor to q factor model. They added this fifth factor because they were of opinion that companies with higher expected growth earn higher expected returns than companies with lower expected growth given that the 'investment' and 'expected Profitability' are constant (Hou, Mo, Xue, & Zhang, 2018).further, Fama and French(2015) also expanded their FF3 to FF5 by adding 'Profitability' and 'investment' . Formula for five factor model

$$Rit-RFt=ai+bi(RMt-RFt)+SiSMB+hiHML+riRMW+ciCMA+eit$$

In this equation RMW is the range of returns on diversified portfolios of stocks with vigorous and low operating profitability, and CMA is the range of returns on diversified portfolios of the stocks of conservative investment and

aggressive investment firms (Fama & French, 2015).Chiah et al. (2016), examined the effectiveness of the FF5 for pricing Australian equities and noted that the FF5 explicate more asset pricing variances than many other competing asset pricing models. However, the inclusion of 'profitability' & 'investment' to FF3 makes the HML factor avoidable because HML factor is completely explained by other 4 factors out of 5 factors (Chiah, Chai, & Zhong, 2016). Moreover, the model is not useful for evaluating the small stocks because it fails to catch the deviation in returns of small stocks (Roy & Shijin, 2018). Kubota & Takehara observed that unable to explain the return of Japanese stocks with long-run data from 1978 to 2014 (Kubota & takehara, 2017).Ammar et al. (2018) applied FF5 and found that FF5 cannot explain the returns of 'property' and 'insurance' industry of U.S during 1988 to 2015. So, Study defined an Insurance-Specific 5 asset pricing model, which can explain the cross-section of property/liability insurance-stock returns .They considered 'Market Return', 'Book-to-Market Multiple', 'Return on Equity', 'Short-Term Reversal', and 'the Spread between the property/liability insurance sector and the Market Return' (Ammar, Eling, & Milidonis, 2018). Fama & French(2015) claims that FF5 is an 'Imperfect Equilibrium Model' because of its inability to catch the irregularity in return predictability (Roy & Shijin, 2018)

Campbell added 6th factor, i.e., 'Human Capital' to FF5 following (Mayers, 1973), (Campbell, 1996) which derived adjusted CAPM for an economy in which non traded assets, particularly 'Human Capital' exists. (Roy & Shijin, 2018), Recommended an equilibrium 6 factor asset- pricing model for clarifying the variations in asset returns. They added a human capital component to FF5 (Jagannathan & Wang, 1996), derived an adjusted CAPM by adding 'return on human capital' while calculating aggregate return. Empirical results confirm that seeing 'Human Capital' as a substitute for collective wealth in the economy can forecast stock prices better than the standard empirical CAPM (Shijin, Gopalaswamy, A.K., & Acharya, 2012). (Kim, Kim, & Min, 2011), Roy and shijin proposed 3 factor model, considering 'consumption growth' 'market' 'and 'labor income growth factor' and they also claimed that the projected labor income growth factor is absolutely connected with the FF3 and includes their explanatory power in explaining the cross-section of stock returns. Human capital includes the projecting capability of Fama and French factors and becomes redundant along with Momentum, Dividend Yield, and Bond Market Factors (Roy & Shijin, 2018). Belo et al. empirically tested association between firms' hiring rates and future stock returns in the cross-section and observed steeper relationship between the two for industries that need comparatively high-skill workers as compared to low-skill workers (Belo, Lin, Li, & Zhao, 2017). Kuehn et al. noted that labor search conflicts are crucial contributor of the cross-section of equity returns (Kuehn, Simutin, & Wang, 2014).

V. Summary:

Basic CAPM considered 'Market' the only risk factor: Ra=Rf + bi (RMt −RFt) .....(1)

Variants to basic CAPM were Black CAPM or zero-beta CAPM, ICAPM & CCAPM

Following CAPM formula indicates surplus return over & above risk-free rate of return considering different Risk Factors.

Fama and French (1993) FF3 considered 'Market', 'Size' & 'Value':

$Rit-RFt=ai+bi(RMt-RFt) +SiSMB+hiHML+eit$.....(2)

Fama and French's Five factors model by adding two more factors i.e., 'Profitability' & 'investment'. Thus, FF5 considered 'Market', 'Size', 'Value', 'Profitability', and 'investment'.

$Rit-RFt=ai+bi(RMt-RFt) +SiSMB+hiHML+riRMW+ciCMA+eit$.....(3)

Fama & French's four factor Model by dropping value factor from FF5 Model.so, risk

factor considered were Market, Size, Profitability, and investment.

$Rit-RFt=ai+bi(RMt-RFt) + SiSMB +riRMW+ciCMA+eit$.....(4)

Mark Carhart's Model by adding 'Momentum Factor' to Fama and French (1993) three-factor model:

$Rit-RFt=ai+bi(RMt-RFt) +SiSMB+hiHML+$UiUMD + eit.....(5)

Hou et al. 's q Factor Model (2015) considered 4 risk factors i.e., 'market factor', 'size', 'investment', 'return on equity':

$Rit-RFt=ai+bi(RMt-RFt) +SiSMB+ciCMA+$Ri ROE + eit.....(6)

Hou et al. 's 'q5 model' (2018) considered 5 risk factors i.e. market factor, a size factor, an investment factor, and a return on equity and expected growth rate.

$Rit-RFt=ai+bi(RMt-RFt) +SiSMB+ciCMA+$Ri ROE +gi EG $+eit$.....(7)

Campbell added the sixth factor i.e., human capital to FF5:

$Rit-RFt=ai+bi(RMt-RFt) +SiSMB+hiHML+riRMW+ciCMA+$liLBR$+eit$ .....(8)

Where: $Rit-RFt$ = Expected Return on Assets, RFt = Risk-Free Rate, bi = β of the Assets, RMt =Return of the Stock Market, Si = SMB Coefficient, SMB=Small(Cap) Minus Big i.e. Size. Here, Size is Market Price Per share multiplied by Number of outstanding shares. hi = HML Coefficient, HML = High(Book/Price) Minus Low i.e Value. RWA = Profitability; CMA = Investment; ROE = Return on Equity; LBR = Human Capital.

VI. Conclusion:

Required Rate of Return for Equity is function of risk factors. initially systematic risk was considered as only risk factors but later on many more risk factors are added to CAPM i.e. size, value, profitability, investment. Later, vale was drop from FF5 model. However, other two risk factors namely, expected growth rate and return on equity added to CAPM. Recently, Human capital is added as sixth risk factor to the model. Despite of addition of various risk factors, 'Market' formerly known as 'systematic risk' is still widely used single risk factor.

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