Are Managers Measuring the Financial Risk in the Right Manner? An Exploratory Study

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The basic problem with corporate finance is that it deals with the fundamental analysis issues while the tools used are those applicable for technical analysis. That is the reason why finance managers often arrive at wrong decisions which snowball into issues like the subprime crisis.

Initially, Markowitz model was used to calculate risk for portfolio management. It gave importance only to systematic risk as unsystematic risk could be avoided through diversification. Later on, CAPM model was developed for corporate finance and project finance for calculation of risk. Finance models dealing with risk management are applicable only for a short period and that too for an average of a large number of companies. The approach to apply risk measurement technique suitable for portfolio management to corporate finance is not correct. Even the econometric techniques applied to validate calculation of risk for portfolio management should be different from those applied for corporate finance.

The present article analyses the problems of applying such risk measurement techniques for corporate finance purpose.

A company faces mainly two types of risks: liquidity risk and bankruptcy risk. In case a company suffers from bankruptcy threat (which may or may not lead to actual bankruptcy), i.e., possibilities of closure due to losses, there will be two possibilities:

- The company may move with market index in normal times while it may come down suddenly with index and may not bounce back (Kink in the beta curve), as in the case of MTNL and Jet Airlines.
- There may be a sudden bankruptcy threat as in the case of Satyam.

The latter case does not allow investors to react. However, corporate managers will have to take account of the first possibility of bankruptcy risk which cannot be ignored by assuming beta to be constant. This paper examines three companies, Mastek, Jet Airlines, and MTNL, in this category. The author suggests that instead of segregating risk into systematic and unsystematic risk, it should be segregated into bankruptcy and liquidity risk. In this way, unsystematic risk is also priced while determining the value of a company.
A company faces mainly two types of risks: liquidity risk and bankruptcy risk. Volatility is the proxy for liquidity risk and not bankruptcy risk. Liquidity risk refers to the time taken by the share price to reach its original price if the price decreases after its purchase. No investor wants to incur loss and would want to at least break-even before he sells his share. Hence, if the price decreases (and assuming that the company is not facing bankruptcy), the investors will have to wait till the price bounces back. This waiting period is called liquidity risk. As Kahneman and Tversky (1979) have proved in their prospect theory, investors are risk-seekers when they are incurring losses and become risk-averse when they start making profit. Investors tend to wait to avoid losses.

In contrast, an investor faces bankruptcy risk when the price of the shares of a company that he has bought starts decreasing with no hope of return to its original level in the near future. The investor loses only the time value of money when taking liquidity risk while he faces a permanent shortfall in his value of portfolio when taking bankruptcy risk. A person may be risk-averse and risk-seeker at the same time. When the market hits rock bottom, he may be risk-seeking with respect to the amount already invested and risk-averse as to the cash held by him. That is the reason why turnover falls when the market sinks.

When the Capital Asset Pricing Model (CAPM) was developed, it was thought that all the diversified risk could be assimilated into beta (which is the coefficient of correlation * standard deviation of share price of the company/standard deviation of index). Various tests showed that additional factors like size of the company and book value to market value ratio should be used as proxy for probability of bankruptcy to get a robust result. Fama and French (1992; 1993) took size of the company and book value to market value ratio into account in their three-factor model. Their logic was that small-sized companies and low book value to market value ratio should be used as proxy for probability of bankruptcy which was not captured by beta in CAPM. Hence, the Fama-French model converted these three factors into systematic risk. Still, bankruptcy risk remained a major question. The Fama-French model tried to explain bankruptcy risk as inbuilt in small firms and in cases of low book to market value ratio.

The question remains whether bankruptcy is a systematic risk or an unsystematic risk. It is very important from the managerial decision making perspective. As per CAPM, in case we conclude that it is an unsystematic risk, then it can be avoided by diversification and hence not get priced. A simple test to prove whether bankruptcy is systematic or unsystematic risk is to calculate the correlation between probability of bankruptcy [through Altman Z model (Altman, 1968) or Ohlson model (Ohlson, 1980)] and its return in later periods. If the correlation is positive, then bankruptcy is an unsystematic risk. Various empirical studies (Opler & Titman, 1994; Asquith, Gertner, & Sharfstein, 1994; Dichev, 1998) found that bankruptcy was mostly due to idiosyncratic factors, thus suggesting that bankruptcy risk is unrelated to systematic risk.

The authors have not come across any article which is able to prove effectively that bankruptcy is a systematic risk. Data collected by the authors have also shown no correlation between bankruptcy risk and future returns. Dichev (1998) study revealed that Pearson Correlation Coefficient between Ohlson Index and return was -0.010. Ohlson Index is a measure of financial distress. A higher Ohlson Index means higher probability of bankruptcy. Empirical data collected by the authors revealed the correlation coefficient of -0.027 for top 500 companies of the National Stock Exchange in terms of sales turnover. This implies that companies with higher bankruptcy risk may not, on average, earn higher returns.

Firms with higher bankruptcy risk tend to be smaller in size and have higher book-to-market price ratio but earn lower than average future returns. The line of causation between size and book to market value ratio and bankruptcy is quite illogical. All small companies may not be potentially sick. Similarly, there may be many companies with low book to market value ratio but are potentially good investments because investors are valuing their market price at a premium. This shows that bankruptcy is an unsystematic risk. In any case, the success of Altman (1968) and Ohlson (1980) models in predicting bankruptcy with 98-99 percent accuracy even up to five years prior to the event itself proves that price decline in case of the bankrupt firms is not unpredictable and is highly auto-correlated. This shows that Market Efficiency Hypothesis is not applicable in case of companies facing bankruptcy threat. In fact, why will anyone try to buy shares in such companies and see their share price decrease over a period of time. Only private
equity or vulture capital firms may be interested in such companies.

The only known textbook valuation method which takes account of bankruptcy cost is the Adjusted Present Value (APV) method developed by Myres (1974). In cases of rapid change in debt-equity ratio and the absolute amount of debt, APV is advocated. It first calculates the value of a company if financed totally by equity and then adjusts for interest tax shield of debt and incremental bankruptcy cost.

\[ \text{APV} = \text{All equity NPV} + \text{Tax shield of debt} - \text{Incremental bankruptcy cost} \]

The problem with this method is that it takes into account bankruptcy only due to increase in debt while ignoring the strategic reasons. A company may face bankruptcy due to incapable management, increase in competition or unfavourable external business environment. This should be reflected in the cost of capital which is ignored at present by the existing theories. The present study tries to remove this anomaly.

Even for portfolio management, it would be more realistic if the portfolio managers take bankruptcy risk into account while arriving at values of abnormal returns. It has long been recognized that investors typically do not view as risky those returns which are above the minimum that they must earn in order to achieve their investment objectives. They believe that risk has to do with bad outcomes (i.e., returns below a required target), not the good outcomes (i.e., returns in excess of the target) and that losses weigh more heavily than gains. These views have been noted by researchers in finance, economics, and psychology, including Sharpe (1964). Under certain conditions, the Mean Variance Analysis (MVA) can be shown to lead to unsatisfactory predictions of (investor) behaviour. Markowitz (1952) suggested that a model based on semi-variance would be preferable; in light of the formidable computational problems, however, he based his MVA analysis on the mean and standard deviation.

Sortino ratio was developed by Frank A Sortino (2009) to differentiate between good and bad volatility in the Sharpe ratio. This differentiation of upwards and downwards volatility allowed the calculation to provide a risk-adjusted measure of a security or fund’s performance without penalizing it for upward price changes. It is calculated as follows:

\[ \text{Sortino Ratio} = \frac{E(R) - R_f}{\sigma_d} \]

where,

- \( E(R) \) - Expected return
- \( R_f \) - Risk-free rate of return
- \( \sigma_d \) - Standard deviation of negative asset returns

This ratio gives better result of portfolio managers’ abnormal returns because it only takes standard deviation of negative asset returns which is a proxy for bankruptcy risk which other ratios like Sharp ratio and Treynor ratio tend to ignore.

**UNIQUE FEATURES OF MEASURING RISK IN CORPORATE FINANCE**

In case of portfolio management, since investors or financial institutes on behalf of investors invest in diversified portfolios, most of the bankruptcy risk can be averaged out. But this is not possible in case of corporate finance where, while calculating cost of capital, only specific company risk is calculated. Hence, there is no way by which the unsystematic risk can be avoided. In fact, a corollary can be drawn between systematic risk and liquidity risk on the one hand and unsystematic risk and bankruptcy risk on the other. While liquidity risk can be both systematic and unsystematic, bankruptcy risk has to be unsystematic. Macro events can perpetuate bankruptcy but that cannot be categorized as systematic risk because the index does not fall to the same extent as price of shares of bankrupt companies. Hence, beta tends to get highly unstable for such companies. The cause and effect relation between the decrease in index and share price of a respective company is also unclear. For example, if the Reliance Industries Limited (RIL) goes bust in a day and as a result Nifty falls by, say ten percent, then will this be a systematic risk or an unsystematic risk for RIL?

**Systematic and Unsystematic Risk**

Corporate Finance has come a long way since the development of four main pillars, viz., Modigliani-Miller Model of Capital Structure (Modigliani & Miller, 1958); Fama Model to test Market Efficiency (Fama, 1991) which is the backbone of capital budgeting and valuation of financial assets; Markowitz model to arrive at optimum portfolio (Markowitz, 1952); and Black Scholes model to
value options (Black & Scholes, 1973). Of late, these models are under severe criticism. The generally accepted theory is that financial markets tend towards equilibrium, and on the whole, discount the future correctly. All the four models assume that the participants have perfect knowledge about the situation based on which they can value financial assets accurately. Recent researches have shown that this is not the case. Information cost is not merely a transaction cost. Lack of information not only changes the way market works and the assets are priced, but also the way the participants behave.

Stiglitz (1967) proved the Modigliani-Miller Model to be flawed because of capital rationing and bankruptcy fear due to information asymmetry, thereby making capital structure relevant. Kahneman & Tversky (1979) showed that investors were inherently irrational and tended to be risk-averse when making profit and risk-seeker when incurring loss. Hence risk is not only a person-specific attribute but also situation-specific based on the information set available with him at a given time. The same person may be risk-averse at one point of time and risk-seeker at another point of time and the participants’ thinking affects the situation to which it refers.

Warren Buffett (2005) has time and again said that Markowitz (1952) and Sharp (1964) theories are incorrect because investors cannot remove diversification risk without incurring additional cost. He is a proponent of the value-based investment model whose main proposition is that the market is always wrong. Buffett is of the view that only those investors diversify who do not have adequate information about the companies whose financial assets they are purchasing. Hence diversification is not a sign of risk-averse investors but of an ignorant investor. The more research an investor does, the less will be the need to diversify and the more will be the return. Mind you, these are the words of one of the richest man on earth.

Black-Scholes (1973) model was based on risk-neutral assumption, which meant that ultimately, all the assets in the long run earned returns equal to risk-free interest. Soros (1988) tried to explain the rules of playing in the derivatives market through his theory of Reflexivity, according to which financial markets cannot possibly discount the future correctly because they do not merely discount the future; they help to shape it. In certain circumstances, financial markets can affect the so-called fundamentals which they are supposed to reflect. When that happens, markets enter into a state of dynamic disequilibrium and behave quite differently from what would be considered normal by the theory of efficient markets.

In perfectly efficient markets, it makes sense to distinguish between systematic and unsystematic risk. Through diversification, unsystematic risk could be reduced to a level where \( \Sigma e_t \) tends to zero as time increases. If we look at the problem from the managers’ perspective, there is no luxury of diversification of portfolio for them. In fact, unsystematic risk becomes a major component of the total risk, which cannot be ignored. Grossman and Stiglitz (1980) proved that efficient market was impossible to exist.

One of the reasons why CAPM has become successful with corporate managers is that it is not only simple to apply but also does not require any arbitration process which is required in case of various types of Arbitration Pricing Model (APM) (Ross, 1976). Arbitration process is made redundant in CAPM because it assumes risk-free rate of interest. Hence, various companies with same beta will end up giving the same return which is not the case with APM. That is the reason why arbitration process is required in case of APM but not in the case of CAPM. But the question still remains as to whether CAPM is able to segregate systematic and unsystematic risk effectively or not. In CAPM, variance can be segregated into systematic and unsystematic risk as follows:

\[
\sigma^2_p = \beta^2_p \sigma^2_m + \sigma^2_{ep} \tag{1}
\]

In equation 1, \( \beta^2_p, \sigma^2_m \) are systematic risk and \( \sigma^2_{ep} \) is unsystematic risk. As the coefficient of correlation between concerned portfolio and market index tends to one, \( \sigma^2_{ep} \) will tend to zero. This is because \( \sigma^2_{ep} \) is equal to \((1-r^2) \sigma^2_{ep}\) where \( r \) is coefficient of correlation.

The distinction between systematic and unsystematic risk is based on coefficient of correlation between index and portfolio. The question is: What is the validity of the index, which theoretically is considered to be risk-return efficient? Mostly, the companies included in the index are an afterthought. Any company whose share price has dropped significantly is dropped from the index and the company whose price has risen significantly is included. Hence risk-return efficiency of an index is an afterthought. Benchmarking the portfolio returns with
Nifty returns to segregate risk into systematic and un-systematic return is invalid. It is impossible to claim beforehand as to whether index is risk-return efficient or not. Efficiency of index is also put to question because many mutual funds, net of all fees and expenses, except load charges, outperformed index funds on a risk-adjusted basis (Ippolito, 1989, 1993; Grinblatt et al., 1986). Grossman and Stiglitz (1980) did not discard the elements of Efficiency Market Theory, but rather added a dynamic element to explain how information got embedded in price. They introduced the simple proposition that gathering information was costly. Market participants that do nothing to enhance their knowledge of the financial conditions and prospects of firms can expect to be on the unprofitable side of trade vis-a-vis participants that do collect information. Informed investors thus earn higher gross returns, adjusted for risk, although they also incur more expenses. In equilibrium, informed and uninformed investors can expect to earn the same return net of expenses. If mutual fund managers have superior investment talent, then they may be able to capture the rents from their talent in the form of higher fees or perquisites obtained through higher expenses. By examining the performance of mutual funds through gross returns, which do not have transaction costs, fees or other expenses netted, articles of both Ippolito (1989) and Grinblatt and Titman (1986) concluded that mutual funds did earn abnormal returns.

Liquidity Risk and Bankruptcy Risk

When an investor invests in a specific company, they take two types of risks: liquidity risk and bankruptcy risk. Since project selection or corporate valuation can not ignore unsystematic risk, they should become a part of the total risk while calculating cost of capital. At present, only systematic risk is used to calculate cost of capital which is not the correct method. It can be accepted in portfolio management but certainly not in corporate finance and project finance.

Now, the question that arises is how to calculate liquidity risk and bankruptcy risk and how that will be different from systematic and unsystematic risk. Fama and Macbeth (1973) developed a two-stage model to calculate the robustness of systematic beta. Later on, Fama realized the shortcomings of that model and developed the Fama-French (1992) Model, which included size of the company and book to market value ratio in addition to beta as proxy for systematic risk. Later, econometric studies proved this method to be inadequate. Hence, Merton (1973) in his Inter-temporal capital asset pricing model, tried to prove that the conditionally expected return on an asset should be jointly linear in its conditional market beta and hedge portfolio betas, where the hedge portfolios hedge against changes in the investment opportunity set. Empirical evidence shows that the hedging motives are not very important.

Static CAPM holds only if the covariance between the conditional beta of asset and the conditional market risk premium is zero for all assets. However, in general, the conditional risk premium on the market portfolio and the asset betas are correlated. In bad times, the expected market risk premium may be relatively high and firms “on the fringe” and more levered firms may have higher conditional equity betas during such times. Jagannathan and Wang (1996) applied conditional CAPM to deal with this problem using Generalized Method of Moments instead of OLS method. The reason was that they held that in case of CAPM, beta calculated through times series had errors which could not be used as a variable in the second stage of CAPM. This is because GMM estimates are robust in the presence of non-normality and temporal dependencies in the data. Normality and IID assumptions are generally made in testing asset-pricing models because finite sample properties are derived with these assumptions (Campbell, Lo & Mackinlay, 2006). Temporal dependence of the returns or heteroskedasticity in Indian stock market has been reported by various studies including Pradhan and Narasimhan (2002). Conditional CAPM gave fairly good results. The conclusion of conditional CAPM was that it was not beta but change in beta, which was the true measure of risk. This article would take this point further and try to prove that volatility measures liquidity risk while change in volatility measures bankruptcy risk.

Time Variation in Beta

Time variation in beta of the Indian stocks has been reported by various studies. Using Kalman filter and Bayesian structural break model, Verma (1988) found evidence for time variation in beta of Indian stocks. Moonis and Shah (2001a) used a modified Kalman filter that could accommodate heteroskedasticity and reject constancy of beta for 26 of the 50 liquid stocks for the time period 1996-2000. Also variation of stock betas for two interest
rate regimes (high interest and low interest) was reported by Moonis and Shah (2002b). Amanullah and Kamiah (1997) parameterized the second moment (variance and covariance) of the returns as ARCH, ARCH-M, GARCH and GARCH-M processes and found support for conditional CAPM. They also found that GARCH (1, 1) performed better than other ARCH and GARCH family processes in explaining the second moment of returns. Singh (2008) showed that beta values of Indian stocks were highly unstable. Time variation in beta could be used as proxy for bankruptcy risk. By assuming beta to be constant, bankruptcy risk was being completely ignored.

Analysis of the Research Problem

The point which authors are trying to make could be explained through an example. The return will be in percentage without converting to logarithmic so that it is simple to understand.

Suppose we take two companies, A & B.

A has the following returns from period 1 to period 10:
-2, -2, -2, -2, -2, -2, -2, -2, -2, -2

B has the following returns from period 1 to period 10:
-2, +2, -2, +2, -2, +2, -2, +2, -2, +2

In case of A, standard deviation is zero while in case of B, it is 2.1. An investor who has seen this trend in past ten periods and is thinking of investing in either A or B will accept that B is more risky than A. Let us convert this into absolute figures and see the differences.

Share price of A is as follows:
100, 98, 96.04, 94.12, 92.22, 90.4, 88.58, 86.81, 85, 83.37

Share price of B is as follows:
100, 98, 99.96, 97.96, 99.91, 97.92, 99.88, 97.89, 99.84, 97.84

In case of A, standard deviation is 4.84 while in case of B, it is 1.05.

It has been stated that volatility calculated currently is suitable only for technical analysis. The variable used to measure volatility is weekly or monthly return. There is an error in this approach. For example, if an investor buys a stock for ₹1,000 and afterwards, if the price falls by 2 percent every week for 10 weeks, then it cannot be said that there is no risk because volatility is zero. Of course, the investor is facing bankruptcy risk which is ignored by the current methodology used to calculate risk. There are two major flaws in the current methodology. One, that volatility of rate of return is taken into account instead of the original price. Two, that the change in price should be cumulative in order to measure the bankruptcy risk. If the price falls by 2 percent every week for 10 weeks, then risk increases as the period under study is increased, if price rather than rate of return, is taken as variable. This is the change in methodology that the authors are talking about. Price is a stock concept while return is a flow concept. Since bankruptcy risk leads to a consistent decline in the price of shares, it can better assimilate risk than returns. One of the main reasons why financial economists focus their attention on returns rather than on price is that most dynamic general equilibrium model often yield non-stationary prices but stationary returns (Campbell et al., 2006). But the problem with this method is that only liquidity risk for technical analysis can be studied and bankruptcy risk is ignored. Bankruptcy risk can be analysed only with the trending of prices and not by volatility of returns. Lots of information is lost while calculating risk based on return rather than share price.

The methodology used in this article is the modified version of CUSUM test (Brown, Durbin, & Evans, 1975) which is based on the cumulative sum of the recursive residuals. In this model, cumulative sum of changes in actual share prices will be considered and not the residuals. The variables will be absolute share prices and not returns as is the case in most of the CUSUM tests applied in the areas of finance.

The current methodology tends to analyse the empirical evidence at the aggregate level. That is the reason why testing of asset pricing models and risk models take returns of 20 to 25 portfolios into account. This hides the bankruptcy risk. The basic presumption is that if one out of 25 companies goes bankrupt, there may be another company which may be making windfall gain and portfolio returns will even out. One must realize that bankruptcy for the portfolio manager of a financial institute is a matter of probability but it is a certainty for the corporate manager. The corollary is that death of a policy holder is a matter of probability for the insurance company but it is a certainty for the person concerned. Only thing that...
may be unknown is when he will die. Similarly, no company can survive till eternity. Hence, bankruptcy risk should not be averaged out. Index never faces bankruptcy risk because any company whose share price decreases will be dropped from the index and a successful company whose price is increasing will be added. After all, how many times does it happen that the price of share of a company has fallen steadily by 50 percent and has reached the original position within a year. How many times in the history of NIFTY and SENSEX has a company been dropped from the index and has been taken back after its share price has increased?

RESEARCH METHODOLOGY

Objective of the Study

The objective of the study is to find the degree of risk that an investor will face if he wants to invest on March 2, 2010 based on price trajectory followed by prices of shares from March 1, 2005 to March 1, 2010. The degree of risk is segregated into bankruptcy and liquidity risk. The rationale for taking price instead of returns is that variation in price is better able to measure both liquidity risk and bankruptcy risk. In contrast, variation in return is able to measure only liquidity risk and completely ignores bankruptcy risk. The probable reason is that price is a stock concept while return is a flow concept. Bankruptcy risk could be measured only if the decision maker has the information of the historical behaviour of prices. The share prices of the companies and Nifty have been retrieved from Capital line data base.

Rationale for Selection of Companies

Three companies have been selected for analysing the problem under study, viz., Mastek, Jet Airlines, and MTNL. Index companies and not already bankrupt companies have been deliberately chosen because in such companies, small investors may still be interested. Although share prices for Jet Airlines and MTNL have eroded to a great extent, yet most of the shareholders do not expect these companies to close down. The rationale for the choice of companies is as follows:

Mastek – A highly volatile but financially sound company. It was part of the Information Technology Index of National Stock Exchange and was dropped because of its high volatility. It faces only liquidity risk. The nature of this risk is analysed in Table 1.

Jet Airlines and MTNL – Both the companies were a part of Nifty but were dropped after consistent decrease in their prices. Jet Airlines share price decreased from ₹1,300 on March 14, 2005 to ₹115 in March 12, 2009. Similarly, MTNL’s share price decreased from ₹166.6 in March 1, 2005 to ₹75.7 on February 19, 2010. Both these companies face bankruptcy risk in addition to liquidity risk.

Criteria for Recording Significant Reversal of Prices

Change in price – either 50 percent of the original price (in either direction) or 50 percent of the new price — whichever is less is recorded. For example, 50 percent of 168 is 84; so, if price increase is ₹100, it will be included. Similarly, if price increases from 120 to 518, then it will be included because 50 percent of 120 is 60.

One can see from Table 1 that Mastek has price reversal of direction on seven occasions, while it was only once in the case of Jet Airlines. On the other hand, there is no price reversal in case of MTNL shares. In case of Nifty index, price reversal has taken place thrice. Mastek has

**Table 1: Preliminary Results of Significant Reversal of Prices**

<table>
<thead>
<tr>
<th>Date</th>
<th>Share Price (₹)</th>
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<th>Share Price (₹)</th>
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<td>03/01/2005</td>
<td>168</td>
<td>03/01/2005</td>
<td>166</td>
<td>14/03/2005</td>
<td>1,300</td>
<td>03/01/2005</td>
<td>2115</td>
<td></td>
<td></td>
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<tr>
<td>10/03/2006</td>
<td>362</td>
<td>03/01/2005</td>
<td>166</td>
<td>14/03/2005</td>
<td>1,300</td>
<td>03/01/2005</td>
<td>2115</td>
<td></td>
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<tr>
<td>13/06/2006</td>
<td>279</td>
<td>19/02/2010</td>
<td>75.7</td>
<td>12/03/2009</td>
<td>115</td>
<td>07/01/2008</td>
<td>6287</td>
<td></td>
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<tr>
<td>18/09/2006</td>
<td>365</td>
<td>22/01/2010</td>
<td>518</td>
<td>24/10/2008</td>
<td>2584</td>
<td></td>
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<tr>
<td>03/08/2007</td>
<td>266</td>
<td>18/01/2010</td>
<td>5271</td>
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<tr>
<td>09/01/2008</td>
<td>346</td>
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<tr>
<td>10/12/2008</td>
<td>158</td>
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<td>25/11/2009</td>
<td>350</td>
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more number of price reversals than Nifty. MTNL and Jet Airlines have less number of price reversals than the Nifty. This shows that companies facing high liquidity risk and low bankruptcy risk tend to have more price reversal while companies facing low liquidity risk and high bankruptcy risk have very few or no price reversal as compared to the Nifty.

**Importance of the Study**

The current method taught in business schools to measure financial risk for calculation of cost of capital and valuation of financial asset is based on the distinction between Systematic risk (SR) and Unsystematic risk (UR). All the focus till now has been on SR while UR is totally ignored by assuming that:

- **Diversification can overcome UR.** This may be true for portfolio managers of mutual funds companies or insurance companies but not project managers or corporate managers of companies.

- **Companies have perpetual continuity.** In reality, we all know that companies have life cycle and have limited life. Hence BR should be a part of cost of capital. BR is a part of UR.

- **Promoter and company are two separate entities.** This assumption may not be always valid. Promoters have to bear UR because they do not have the luxury of diversification. Since the strategy of a company is formulated by promoters, the degree of UR plays a part in deciding the future course of action which the company will take.

- **Beta based on volatility of index is a perfect measure of SR.** There are many flaws in calculation of index and calculation of beta. This is because UR is avoided.

- **Financial risk involved for technical and fundamental analysis is the same.** LR is a short-term problem and hence could be used for technical analysis while BR is a long-term problem, hence it could be used for fundamental analysis.

Risk need to be modelled on segregation between Bankruptcy risk (BR) and Liquidity risk (LR). The current article deals with the justification for analysing BR and LR.

It is important to model the risk so that cost of capital could be calculated by categorizing risk into liquidity and bankruptcy risk. Five problems mentioned below will be solved by such categorization of risk.

1. Unsystematic risk is not assumed to be priced away.
2. No need to average out risk amongst portfolio containing shares of large number of companies. Hence, perpetual continuity of the company is not assumed.
3. Separation of management and ownership is not assumed. Only small investors can diversify their risk in order to minimize their unsystematic risk. Promoters do not have this luxury of diversifying risk. Hence current distinction between systematic and unsystematic risk may not be applicable for promoters who have invested significant portion of their wealth in one company.
4. No need to depend on index to benchmark company’s risk and calculate beta.
5. Liquidity risk could be used for technical analysis while bankruptcy risk could be used for fundamental analysis.

**ECONOMETRIC TECHNIQUES APPLIED AND THEIR RATIONALE**

1. **Unit Root Test**

A series is said to be stationary if the mean and autocovariance of the series do not depend on time. Any series that is not stationary is said to have unit root. A company which do not face liquidity and bankruptcy risks have stable price changes, which could be captured by drift (Value of a) and trend (Value of b) of the first order auto-regression [AR(1)] equation.

\[ Y_t = a + bT + cY_{t-1} + u \]

Coefficient ‘c’ will have value of significantly less than one and hence will be stationary. In case the company is facing high risk, the above equation will have value of coefficient ‘c’ which is equal to one. Such companies will have unit root in their AR (1) equations. The reason for this behaviour is that in case the risk is high, \( Y_{t-1} \) will influence \( Y_t \) to a greater extent than when the risk for the company is low. Hence, the series tends to diverge. In case the risk for the company is low, the share price tends to behave in random manner which is not the case if the risk is high. In order to test this hypothesis, we applied ‘Augmented Dickey-Fuller’ (ADF) tests (Dickey & Fuller, 1979).
2. Co-integration Test

While companies facing liquidity risk are co-integrated with Index, companies facing bankruptcy risk are not. The price of companies facing liquidity risk tends to converge to change in index while it will continuously diverge in case of companies facing bankruptcy risk.

The study applies both Engle-Granger test (Engle & Granger, 1987) and Johansen test (Johansen, 1991) to determine whether the share price of the companies under study are co-integrated with Nifty. Since three companies with very high risk were deliberately chosen, there was high possibility that share prices of all the three companies would be having unit root. Hence the authors try to find the stationary of the first difference to see if they have unit root or not. Co-integration could be applied only if both the series showed unit root but the difference between them showed stationary trend.

3. Causality Test

In case of companies facing high liquidity risk, index still has some influence on the change in their price while this is not the case with companies facing bankruptcy risk. The price of companies facing bankruptcy risk tends to diverge from the index and it is no longer able to influence the price of shares of such companies. The study applies Granger Causality test (Granger, 1969) at lag of one to see if Nifty Granger causes respective share price or not. In case Nifty Granger causes share price of a company, the company will face liquidity risk; if it does not, then it will face bankruptcy risk.

4. Validity of Beta

Beta has been a main measure of risk in the CAPM. It only takes account of liquidity risk and ignores bankruptcy risk. Stability of beta is analysed by comparing the mean, standard deviation, maximum and minimum of weekly and monthly beta for all the three companies under study.

5. Segregation of Liquidity Risk and Bankruptcy Risk

The methodology to segregate total risk into liquidity risk and bankruptcy risk can be modeled for measuring cost of capital. Volatility before the bad news may be considered as liquidity risk and increase in volatility over a period of time after the bad news is released may be considered as bankruptcy risk. The study tries to develop a simple method to segregate the two types of risk.

In order to segregate bankruptcy risk and liquidity risk, the standard deviation has been calculated for two periods. One is for the period March 1, 2005 to March 1, 2010 (5 years) while another is for the period March 1, 2005 to September 1, 2007 (2.5 years), which is exactly half of the first period. Later on, their coefficient of variance was calculated so that intercompany comparison of risk could be undertaken. Coefficient of variance for the second period is taken as liquidity risk while increase in the value in the first period is considered as bankruptcy risk. The rationale for this method is that if the share prices are unit root and are not co-integrated with Nifty index, it means that their variance will increase as the time period under study is increased. This increase in variance is caused because share price of the company is falling when Nifty is either rising or is stable, which is only possible when investors are perceiving bankruptcy risk.

DATA COLLECTION AND APPLICATIONS

‘E-views’ software package has been used to get the output of the results based on inputs retrieved from capital line data base. In order to apply the tests and to make the inter comparison between three companies possible, share prices have been converted into index with March 1, 2005 price as the base price. Prices of shares have been adjusted taking account of corporate actions like dividend payments, stock splits, and bonus issues. These are the values which have been used to test unit root, co-integration, and causality tests. In order to apply Augmented Engle-Granger Test to test co-integration, residuals have been calculated by subtracting Nifty index with the index of the respective companies and tested to see whether these residuals are stationary or not.

RESEARCH FINDINGS

1. Unit Root

All the three companies – MTNL, Jet Airlines, and Mastek – have unit root. As per Table 2, all the three companies have ADF test statistic less than critical values at 10 percent rejection level. Since a series which does not show stationary trend has increasing mean, volatility, and covariance over a period of time, this increase in variance is what we call bankruptcy risk. The empirical evidence shows that any company whose price is changing significantly in either direction (liquidity risk) or in single
direction (bankruptcy risk) tends to have unit root.

2. Co-integration Test

As per Table 3, the first difference of the share prices of the three companies and Nifty are stationary because ADF test statistic is significantly higher than critical values at one percent level. Return on Investment is nothing but relative first difference of the share price. Hence, Table 3 could be interpreted as stationarity of returns. This shows that returns could be stationary even if companies are facing fairly high liquidity and bankruptcy risk. This means that now we can test co-integration of Nifty with share prices of all the three companies under study.

Table 4 shows that only Mastek is co-integrated with Nifty while MTNL and Jet Airlines do not show any such relation. AEG test statistic of -2.783397 for Mastek is significantly higher than the critical value of -2.5899 at 10 percent significance level. In case of Jet Airlines, AEG test statistic is -1.745636 while it is -1.320383 in case of MTNL, which is less than the critical value.

MacKinnon critical values at 10% for rejection of hypothesis of a unit root is -3.1298.

MacKinnon critical values at 1% for rejection of hypothesis of a unit root is -3.9704.

Table 2: Unit Root Test of Share Prices (March 1, 2005 to March 1, 2010)

<table>
<thead>
<tr>
<th>Value of Parameters</th>
<th>MTNL</th>
<th>Jet Airlines</th>
<th>Mastek</th>
<th>Nifty</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF Test Statistic</td>
<td>-2.363868</td>
<td>-1.599542</td>
<td>-2.285102</td>
<td>-1.631289</td>
</tr>
<tr>
<td>Coefficient of t-1</td>
<td>-0.008816</td>
<td>-0.004845</td>
<td>-0.007759</td>
<td>-0.004264</td>
</tr>
<tr>
<td>Drift</td>
<td>1.371446</td>
<td>NA</td>
<td>2.333962</td>
<td>NA</td>
</tr>
<tr>
<td>Trend</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>R-square</td>
<td>0.004389</td>
<td>0.003006</td>
<td>0.004148</td>
<td>0.002193</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>0.002820</td>
<td>0.001373</td>
<td>0.002576</td>
<td>0.000620</td>
</tr>
<tr>
<td>Schwarz Criteria</td>
<td>5.457852</td>
<td>8.749789</td>
<td>7.320925</td>
<td>11.50708</td>
</tr>
<tr>
<td>Durbin Watson Stat</td>
<td>1.858567</td>
<td>1.853085</td>
<td>1.983324</td>
<td>1.871488</td>
</tr>
<tr>
<td>F-statistic</td>
<td>2.797184</td>
<td>1.840786</td>
<td>2.638463</td>
<td>1.394430</td>
</tr>
</tbody>
</table>

MacKinnon critical values at 10% for rejection of hypothesis of a unit root is -3.1298.

Table 3: Unit Root Test on First Difference of Share Prices (March 1, 2005 to March 1, 2010)

<table>
<thead>
<tr>
<th>Value of parameters</th>
<th>MTNL</th>
<th>Jet Airlines</th>
<th>Mastek</th>
<th>Nifty</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF test Statistic</td>
<td>-33.31184</td>
<td>-32.53914</td>
<td>-35.38400</td>
<td>-33.46684</td>
</tr>
<tr>
<td>Coefficient of lag</td>
<td>-0.933428</td>
<td>-0.929335</td>
<td>-0.995285</td>
<td>-0.937920</td>
</tr>
<tr>
<td>Drift</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Trend</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>R-square</td>
<td>0.466707</td>
<td>0.464630</td>
<td>0.497424</td>
<td>0.469019</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>0.465866</td>
<td>0.463753</td>
<td>0.496629</td>
<td>0.468181</td>
</tr>
<tr>
<td>Schwarz Criteria</td>
<td>5.458585</td>
<td>8.747517</td>
<td>7.326257</td>
<td>11.50585</td>
</tr>
<tr>
<td>Durbin Watson Stat</td>
<td>1.993845</td>
<td>1.999812</td>
<td>1.998909</td>
<td>2.00020</td>
</tr>
<tr>
<td>F-statistic</td>
<td>554.8395</td>
<td>529.3993</td>
<td>626.0157</td>
<td>560.0155</td>
</tr>
</tbody>
</table>

MacKinnon critical values at 1% for rejection of hypothesis of a unit root is -3.9704.

Table 4: Engle Granger Co-integration Test (March 1, 2005 to March 1, 2010)

<table>
<thead>
<tr>
<th>Value of Parameters</th>
<th>Mastek &amp; NIFTY</th>
<th>Jet Airlines &amp; NIFTY</th>
<th>MTNL &amp; NIFTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEG test Statistics</td>
<td>-2.783397</td>
<td>-1.745636</td>
<td>-1.320383</td>
</tr>
<tr>
<td>Coefficient</td>
<td>-0.012125</td>
<td>-0.002585</td>
<td>-0.001976</td>
</tr>
<tr>
<td>Drift</td>
<td>-0.135163</td>
<td>0.480562</td>
<td>0.348110</td>
</tr>
<tr>
<td>Trend</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>R-square</td>
<td>0.006063</td>
<td>0.002487</td>
<td>0.001371</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>0.005281</td>
<td>0.001671</td>
<td>0.000585</td>
</tr>
<tr>
<td>Schwarz Criteria</td>
<td>6.803493</td>
<td>5.190272</td>
<td>4.982940</td>
</tr>
<tr>
<td>F-statistic</td>
<td>7.747299</td>
<td>3.047246</td>
<td>1.743411</td>
</tr>
<tr>
<td>Prob (F-statistic)</td>
<td>0.005459</td>
<td>0.081126</td>
<td>0.186945</td>
</tr>
</tbody>
</table>
Augmented Engle-Granger critical values at 10% for rejection of hypothesis of a co-integration is 2.5899.

In order to cross-check these results, Johansan co-integration test was applied and the same conclusion as the Engle-Granger test was arrived at. As per Table 5, the likelihood ratio of 10.15307 for Mastek is higher than the critical value of 9.53. It is 7.88219 for Jet Airlines and 6.463121 for MTNL, which are lower than the critical value.

Table 5: Johansan Co-integration Test (March 1, 2005 to March 1, 2010)

<table>
<thead>
<tr>
<th>Value of Parameters</th>
<th>Mastek &amp; NIFTY</th>
<th>Jet Airlines &amp; NIFTY</th>
<th>MTNL &amp; NIFTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eigen value</td>
<td>0.007750</td>
<td>0.006413</td>
<td>0.004976</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>10.15307</td>
<td>7.88219</td>
<td>6.463121</td>
</tr>
</tbody>
</table>

Likelihood Ratio critical values at 10% for rejection of hypothesis of a Co-integration is 9.53.

While Mastek and Nifty are co-integrated, the other two companies are not. Hence there is regular convergence between Mastek and Nifty, which is not the case with the other two companies. Companies facing only liquidity risk are co-integrated, which is not the case if they face bankruptcy risk also.

3. Causality Test

Table 6: Granger Causality Test at Lag of One (March 1, 2005 to March 1, 2010)

<table>
<thead>
<tr>
<th>Value of Parameters</th>
<th>Mastek &amp; NIFTY</th>
<th>Jet Airlines &amp; NIFTY</th>
<th>MTNL &amp; NIFTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>3.01447</td>
<td>0.03289</td>
<td>0.15038</td>
</tr>
<tr>
<td>Prob (F-statistic)</td>
<td>0.04943</td>
<td>0.85613</td>
<td>0.86040</td>
</tr>
</tbody>
</table>

Note: The results of whether respective companies under study Granger causes change in Nifty has not been shown because that is not important for the problem under study.

As per Table 6, F statistic shows that Nifty index changes do cause changes in Mastek share prices because with value of 3.01447, it has significance value of less than 5 percent. This is not the case with Jet Airlines and MTNL. Both have very low F-statistic which shows that change in Nifty index does not Granger cause a change in price of shares of these companies.

4. Validity of Beta

According to Table 7, the average weekly beta of Mastek at 1.328017 is higher than that of Jet Airlines (0.836899) and MTNL (0.963949) even though the prices of Jet Airlines and MTNL have declined more than Mastek. Same is the case with monthly beta. Even though Jet Airlines price has fallen more than MTNL, still average beta of MTNL is more than Jet Airlines. This shows that beta represents only liquidity risk and ignores bankruptcy risk.

If this faulty beta (as a variable) goes into the calculation of risk premium (as a coefficient) in the second stage of CAPM as per Fama-MacBeth model, then even that will have error.

5. Segregation of Liquidity Risk and Bankruptcy Risk

Table 8 shows that prices of Jet Airways and MTNL were falling regularly while it increased in case of Mastek. If we consider the period between March 14, 2005 to September 3, 2007, the share price of Jet Airlines fell by 37 percent while that of MTNL was stable even though Nifty index had more than doubled. Even though Mastek is a highly volatile stock, as has been shown in Table 1, it still kept pace with the change in the Nifty index. In the second period, price of Jet Airlines and MTNL fell approximately by 50 percent while Nifty index increased by around 400 points. This shows that Mastek is basically facing liquidity risk while other two companies are facing bankruptcy risk.

Table 7: Degree of Stability of Beta (March 1, 2005 to March 1, 2010)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Standard Deviation of Beta</th>
<th>Average Beta</th>
<th>Minimum Beta</th>
<th>Maximum Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastek (Weekly beta)</td>
<td>0.261564</td>
<td>1.328017</td>
<td>0.9323</td>
<td>1.7077</td>
</tr>
<tr>
<td>MTNL (Weekly beta)</td>
<td>0.048659</td>
<td>0.963949</td>
<td>0.8753</td>
<td>1.0378</td>
</tr>
<tr>
<td>Jet Airlines (Weekly beta)</td>
<td>0.065435</td>
<td>0.836899</td>
<td>0.74</td>
<td>0.9307</td>
</tr>
<tr>
<td>Mastek (Monthly beta)</td>
<td>0.264292</td>
<td>1.32152</td>
<td>0.9346</td>
<td>1.7053</td>
</tr>
<tr>
<td>MTNL (Monthly beta)</td>
<td>0.049911</td>
<td>0.96371</td>
<td>0.8794</td>
<td>1.0381</td>
</tr>
<tr>
<td>Jet Airlines (Monthly beta)</td>
<td>0.075712</td>
<td>0.812219</td>
<td>0.617</td>
<td>0.9289</td>
</tr>
</tbody>
</table>
Volatility before the bad news could be considered as liquidity risk and increase in volatility over a period of time after the bad news is released could be considered as bankruptcy risk.

**DISCUSSION ON THE FINDINGS**

Any company with very high risk, either bankruptcy or liquidity, will have a high auto correlation since news comes in clusters. Managers should apply unit root test to determine whether their company is being perceived to be risky or not. If the share price is showing a stationary trend, then there is no need for any further testing and it could be concluded that company is facing less risk. Once the managers have arrived at the conclusion that its share price is having unit root, they should decide whether the company is facing liquidity risk or bankruptcy risk.

In the present study, all the companies are found to have unit root, which means that they are highly risky companies.

Co-integration test should be applied to decide whether the company is facing bankruptcy risk or liquidity risk. If the share price is not co-integrated with the Index, then it could be concluded that the company is facing bankruptcy risk. We have seen that Jet Airlines and MTNL are not co-integrated while Mastek is co-integrated. The share price of a company will not be co-integrated with the index if the company is facing high bankruptcy risk. The price of share may diverge from index when the price of share is falling and the index is rising; in another eventuality, price of share may be falling when index is stable or has fallen slightly. In either of these cases, there is no possibility of a long-run equilibrium relation between company share price and index. Managers should therefore apply the Engle Granger co-integration test and Johansan co-integration test.

If there is no co-integration between the two variables, then in such situations, Granger Causality test will fail in any case. In case the company share price is co-integrated with index, it will have to be confirmed whether the index

---

**Table 8: Preliminary Results of Price Variation**

<table>
<thead>
<tr>
<th>Companies</th>
<th>Jet Airways</th>
<th>M T N L</th>
<th>Mastek</th>
<th>Nifty (S&amp;P CNX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14/03/2005</td>
<td>1304.2</td>
<td>136.70</td>
<td>189.68</td>
<td>2146.35</td>
</tr>
<tr>
<td>03/09/2007</td>
<td>829</td>
<td>141.75</td>
<td>260.90</td>
<td>4474.75</td>
</tr>
<tr>
<td>19/02/2010</td>
<td>467.55</td>
<td>75.70</td>
<td>353.4</td>
<td>4844.9</td>
</tr>
</tbody>
</table>

As per Table 9, risk in terms of standard deviation is high at 44 for the period 2005-2007 in case of Mastek while it is low at 20.26 and 12.16 in case of Jet Airlines and MTNL respectively. The change in standard deviation over the two periods is only 2.33 in case of Mastek, while it is 5.54 and 8.99 in case of Jet Airlines and MTNL respectively. As per Table 9, liquidity risk is very high at 11.38 for Mastek while it is fairly low at 1.72 and 6 for MTNL and Jet Airlines respectively. Bankruptcy risk is very high at 6.7 (12.7-6) for Jet Airlines and 4.29 (6.012-1.72) for MTNL, while it is low at 1.42 (12.8-11.38) for Mastek. In case of Mastek, although initial variance is quite high, change in variance is negligible. This is not the case with MTNL and Jet Airlines where although initial variance is quite low, change in variance is quite high. Hence one can see that liquidity risk is very high for Mastek. Bankruptcy risk is fairly high for MTNL, while it is very high for Jet Airlines. This analysis makes it clear that change in coefficient of variation measures bankruptcy risk which has been ignored by the current method of arriving at cost of equity shares. The reason being, firstly, it ignores bankruptcy risk and secondly, it only analyses the trend when the price is increasing and ignores the risk when the price is falling. Markowitz theory concludes that diversification can lead to a decrease in unsystematic risk, which is based on the assumption that risk remains constant for each stock over a period of time. As shown in Table 9, in case of bankruptcy risk, volatility tends to increase over a period of time. Hence, if risk of a stock increases over a period of time, diversification may not necessarily decrease unsystematic risk.

The methodology to segregate liquidity risk and bankruptcy risk could be modeled for measuring cost of capital.

**Table 9: Measuring Cumulative Risk**

<table>
<thead>
<tr>
<th>Company</th>
<th>March 1, 2005 to March 1, 2010</th>
<th>March 1, 2005 to September 1, 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Standard Deviation Variance/Mean</td>
<td>Mean Standard Deviation Variance/Mean</td>
</tr>
<tr>
<td>Jet Airlines</td>
<td>52.28 25.8 12.7</td>
<td>68.21 20.26 6</td>
</tr>
<tr>
<td>MTNL</td>
<td>74.55 21.15 6.012</td>
<td>86.14 12.16 1.72</td>
</tr>
<tr>
<td>Mastek</td>
<td>167.8 46.33 12.8</td>
<td>170.36 44 11.38</td>
</tr>
</tbody>
</table>
changes are Granger causing the change in price of the company or not. Sometimes, in case of heavy weight companies like Reliance Industries Limited or Infosys Technologies Limited, causality may run from the company to the index. Hence if the company is having unit root in its share prices and is co-integrated with the index and it is Granger causing change in the share price, then in such cases, the company is facing only liquidity risk and not bankruptcy risk. In this study, Mastek share price not only has unit root and is co-integrated with index, but is also Granger caused by changes in index, which means that Mastek is facing only liquidity risk. In case of Jet Airlines and MTNL, they both have unit root but are not co-integrated with the index. Hence these companies are facing bankruptcy risk.

Once managers have segregated the companies facing liquidity risk and bankruptcy risk, they will have to calculate the extent to which companies are facing these two types of risks. A company facing bankruptcy risk will have increasing variance as the period for which risk is calculated is increased, whereas in the case of liquidity risk, it remains fairly stable. Hence change in coefficient of variance over these two periods could be considered as proxy for bankruptcy risk. By this method, Mastek is having high liquidity risk while MTNL and Jet Airlines are having high bankruptcy risk.

CONCLUSION

The basic problem with corporate finance is that it deals with the fundamental analysis issues while the tools used are those applicable for technical analysis. That is the reason why finance managers arrive at wrong decisions which snowballs into issues like subprime crisis.

The present methodology to calculate cost of capital with the help of systematic risk is faulty because corporate finance has to deal with both systematic and unsystematic risk. Bankruptcy risk is mainly an unsystematic risk which plays a very important role in determining cost of capital for the company. Hence this article advocates that instead of segregating risk into systematic and unsystematic risk, it should be segregated into bankruptcy and liquidity risk. In this way, unsystematic risk is also priced while determining the value of a company. Future research should focus on developing robust models of asset pricing based on this classification of risk.

REFERENCES


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