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Managing A Firm's Systematic Risk Through Sales Variability Minimization- A Test of Three Competing Techniques

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In this paper, we will intend to introduce the Degree of Economic Leverage (DEL) and its usage as one of the new techniques in explanation of Beta coefficient and identification of the systematic risk and profit planning goal in leverage theoretical conceptual studies as well. Meanwhile, we will consider and analyze it through experimental testing for increasing its justification explanatory potency. After theoretical conceptual studies,it was confirmed that there is no inverse and meaningful relation between interest rate and a firm's sale, but there is a meaningful difference between measure of the Beta calculating by DEL and the Beta computing by CAPM and D-CAPM.

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1. Introduction

This paper manages a firm's systematic risk through sales variability minimization and introduces Degree of Economic Leverage. We extend that original work by separating economic risk from business risk, and we empirically represent the economic risk construct through the use of the term, degree of economic leverage.To better understand the role of sales variability minimization in managing a firm's systematic risk, the multiple dimensions of systematic risk must be conceptually analyzed.

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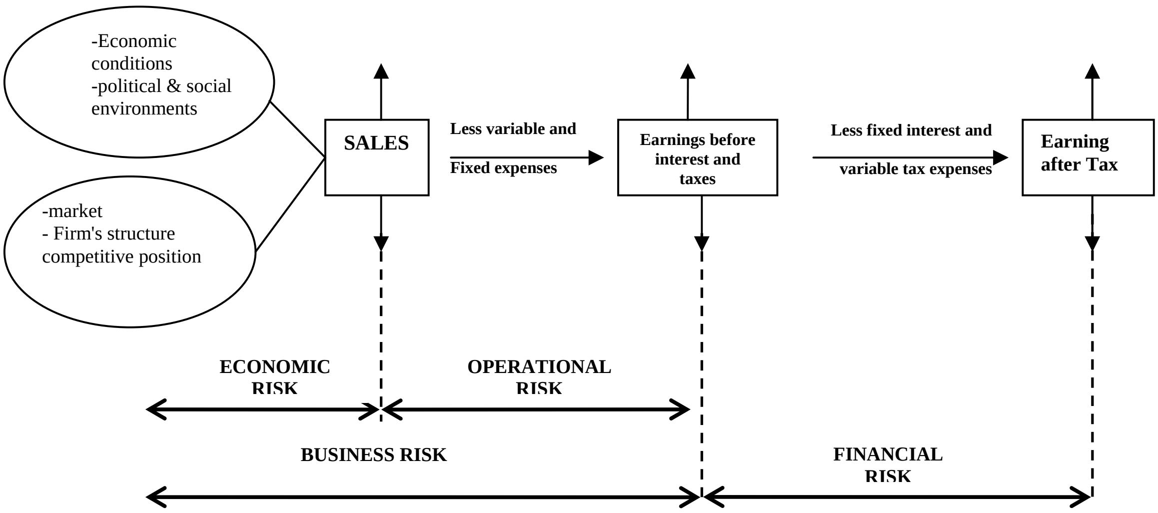
Hawawini and Viallet (1999) provided such an analysis in figure(1) by illustrating financial risk as the relation between earning after taxes (EAT) and earnings before interest and taxes (EBIT), and operational risk as the relation between EBIT and sales. (Griffin & Dugan, 2003). They further specified that sales vary as a result of the uncertainties in the economic, political, social, and competitive environment in which firms operate. Hence, they characterized economic risk as the risk faced by all firms and interpret the combined effect of economic risk and operational risk as business risk.

Figure 1: Analysis of Multiple Dimensions of Systematic Risk.



From: Finance for Executives (1st ed.), by G.Hawawini and C.Viallet 1999.

Mandelker and Rhee (1984) demonstrated that both operational risk and financial risk can be proxied through the respective use of the degree of operating leverage (DOL) and the degree of financial leverage (DFL). Rhee (1986) was the first to decompose systematic risk into a three-component model: business risk, operating risk, financial risk. Rhee suggested that the business risk component is determined by the market-related portion of demand uncertainty, as evidenced by sales variability. Blazenko (1999) recognized the susceptibility to and impact of economic shocks on sales and earnings. Given the information value of firm earnings, Blazenko hypothesized a relation between trading of a firm's shares and firm's sales and added an "economic perturbance" term to his model to account for this relation.

Whereas, nowadays, the financing for material mentioned as a strategy and all of the researched companies in the automobile industry apply this strategy, so we can expect increasing financial expenses as well as enhancing the interest rate. Therefore, we can forecast if financial expenses increase, products cost will increase too. So we will have disadvantage goods and will lose sales. Thus, testing the effect of the interest rate as an exogenous economic disturbance seems to be necessary.

2. Literature Review

2.1. Degree of Economic Leverage (DEL)

Leverage is the use of fixed cost in an attempt to increase profitability. The Mandelker's and Rhee's model (1984) provided the theoretical framework for the Degree of economic leverage through their explicit deconstruction of beta into its component parts of intrinsic business risk and operating and financial leverage. The degree of economic leverage is the percentage change in a firm's sales resulting from a unit percentage change attributable to an exogenous economic disturbance (Z_t). The evidence supports the DEL's role in explaining systematic risk at both the industry and portfolio levels, and mixed results at the firm level. (Griffin & Dugan, 2003)

2.2. Classical Capital Asset Pricing Model (CAPM)

For over 30 years, academics and practitioners have been debating the merits of the CAPM, focusing on whether beta is an appropriate measure of risk. CAPM is the result of the formation and development of the capital market theory which was established by Markowitz with the introduction of portfolio theory. Most of these discussions are by and large empirical; that is, they focus on comparing the ability of beta to explain the cross section of returns to that of alternative risk variables. Most of these discussions, however, overlook where beta as a measure of risk comes from, namely, from equilibrium in which investors display mean-variance behavior (MVB). In other words, from an equilibrium in which investors maximize a utility function that depends on the mean and variance of returns of their portfolio. CAPM explains the relation between risk –return and asset according to market return. By this model, during a period of time, return rate of common stock is measured when stock price is available and the result is used as market indices for measurement of stock operation. In CAPM method, all of the assets are considered. But practically there are some problems for measurement of return of all the assets or gaining general market index. In order to meeting to the goals, common stock is used for explaining of the model. First hypothesis of CAPM is a kind of linear relationship between stock return of each activity and stock market return during some periods. (Reilly & Brown, 2004)

Model calculation formula, by at least squares sum (regression analysis) is as follows:

$K_j = \alpha + \beta K_m + e$

Where:

K_j = return rate of common stock in company, α = constant value, β = sensitiveness coefficient (beta), e = error in regression equation, K_m = return rate of market portfolio. According to mathematical expectation supposition, error is equal to zero in regression equation (points distances from estimated line).

In CAPM, beta coefficient is very important for experimental tests. Because it is used for portfolio assessment and it is useful. The main reason is that beta coefficient of a share is less constant towards portfolio beta from one period to another period. In addition, researchers have shown that beta of common share during a long period (more than a period) tends to one. CAPM has been formed on the base of market risk premium (risk premium) model. It means it is supposed that investors expect to gain higher return by accepting more risks. Also, they expect to gain acceptable return from the asset which can be risked. In CAPM, if we suppose short term treasury papers of a company as an asset which can be risked, according to this model, investors should gain a return more than return of treasury paper, because they accept more risk. According to CAPM supposition the equation is used for line calculation of securities market:

$K_j = R_F + \beta(R_M - R_F)$

Where:

R_F = risk free rate of return, β = beta coefficient, R_M = return rate based on market index, $R_M - R_F$ = premium or excessive return of market (risk premium) towards risk free rate of return. CAPM explains that expected return rate of an asset is a function of two parts: risk free rate of return and risk premium. So:

K_i = Risk free rate of return + Risk premium

The main variable of this model is beta coefficient that determines the amount of demanded premium (bonus) by investors for portfolio investment, for each of the securities; beta coefficient is measured according to sensitiveness coefficient of securities return rate towards market. CAPM can relate expected return rate of each of securities like i (or P portfolio) with suitable standard of securities risk, i.e. its beta. Beta is suitable standard of risk that can not change it through variety and investors should consider its own portfolio management in decision processes.In the classical CAPM framework, an investor's utility is fully determined by the mean-variance returns of the portfolio, i.e. the higher the return is and the lower the risk is, the better the investment would be. The risk of an asset i if taken individually is then measured by the asset's standard deviation of returns (δ_i), which is calculated as: (Estrada, 2002)

$$\delta_i = \sqrt{E\left[(R_i - \mu_i)^2\right]}$$

Where R denotes returns and μ denotes mean returns of a stock. Standard deviation of returns is one of the risk factors that we will regress returns with. When asset i is just one out of the many in a fully-diversified portfolio, however, its risk is measured by its covariance with respect to the market portfolio (δ_{iM}):

$$\delta_{iM} = E\left[(R_i - \mu_i)\times(R_M - \mu_M)\right]$$

Where m indexes represent the market portfolio. Beta as asset i (β) then equals the covariance between asset i and the market portfolio divided by the variance of the market portfolio:

$$\beta = \frac{\delta_{iM}}{\delta^2_M} = \frac{E\left[(R_i - \mu_i)\times(R_m - \mu_m)\right]}{E\left[(R_m - \mu_m)^2\right]}$$

2.3. Downside Capital Asset Pricing Model (D-CAPM)

There are only a few non-CAPM based models, of which the best known and most relevant is developed by Estrada (2002). It overcomes one of the most serious weaknesses of the CAPM; specifically, that investors are assumed to be averse to variance or total risk. In fact, as already mentioned, investors are motivated by their aversion to downside risk, that is, downside and upside swings are not equally important for the investors, as his or her pivotal goal when selecting an investment target is a desire to avoid an economic loss. (Estrada, 2003). Estrada (2002) introduced the Downside Capital Asset Pricing Model (hereinafter referred to as the D-CAPM) to deal with the above mentioned problem. In general, the cost of equity calculated under the D-CAPM is higher than that of the CAPM and lower than that of the models double-counting the risk; therefore the D-CAPM should not only explain returns in developed countries, but in emerging market as well. The usage of semi-variance and downside beta is the only difference between the D-CAPM and the CAPM. The formula of the cost of equity under the D-CAPM therefore is as follows:

$$K_j = R_F + \beta^D \times (R_M - R_F)$$

Where β^D is the downside beta. (Devyzis & Jankauskas, 2004)

In the D-CAPM, mean-semi variance (or downside variance) returns of the investor's portfolio determines its utility. The risk of an asset i taken individually is measured by the asset's downside standard deviation (S_i semi deviation) of returns, calculated as;

$$S_i = \sqrt{E\left\{Min\left[(R_i - \mu_i), O\right]^2\right\}}$$

Where μ_i is the mean return of asset i, which can be replaced with any benchmark return.

Downside covariance (cosemivariance) of asset i to the market portfolio is then:

$$\delta_{i,m} = E\{Min[(R_i - \mu_i), O] \times Min[(R_m - \mu_m), O]\}$$

Consequently, downside beta of asset i, equivalently to the CAPM beta, is equal to cosemivariance divided by the market's semivariance of returns:

$$\beta^D = \frac{\delta_{im}}{\delta_m^2} = \frac{E\{Min[(R_i - \mu_i), O] \times Min[(R_m - \mu_m), O]\}}{E\{Min[(R_m - \mu_m), O]^2\}}$$

2.4. The Effect of Financial Leverage on Beta

A stock’s expected return, its dividend yield plus expected price appreciation is related to risk. Risk-avers investors must be compensated with higher expected returns for bearing risk. The presence of debt in a firm’s capital structure has an impact on the risk borne by its shareholders. With financial leverage, the beta on a firm’s stock reflects both business and financial risk. This beta is called levered beta, β^L. In the absence of debt, shareholders are subjected only to basic business or operating risk. The stocks beta therefore reflects the systematic risk inherent in the firm’s basic business operations. With no financial leverage, this beta is the stock’s unlevered beta, β^U. This business risk is determined by factors such as the volatility of a firm’s sales and its level of operating leverage. As compensation for incurring business risk, investors require the premium in excess of the return they could earn on a riskless security such as a Treasury bill. Thus, in the absence of financial leverage, a stock’s expected return can be thought of as the risk-free rate plus a premium for business risk. For investors to hold the shares of firms with debt in their capital structures, they must be compensated for the additional risk generated by financial leverage. The additional risk premium associated with the presence of debt in a firm’s capital structure is the financial risk premium. (Kester, 2005).

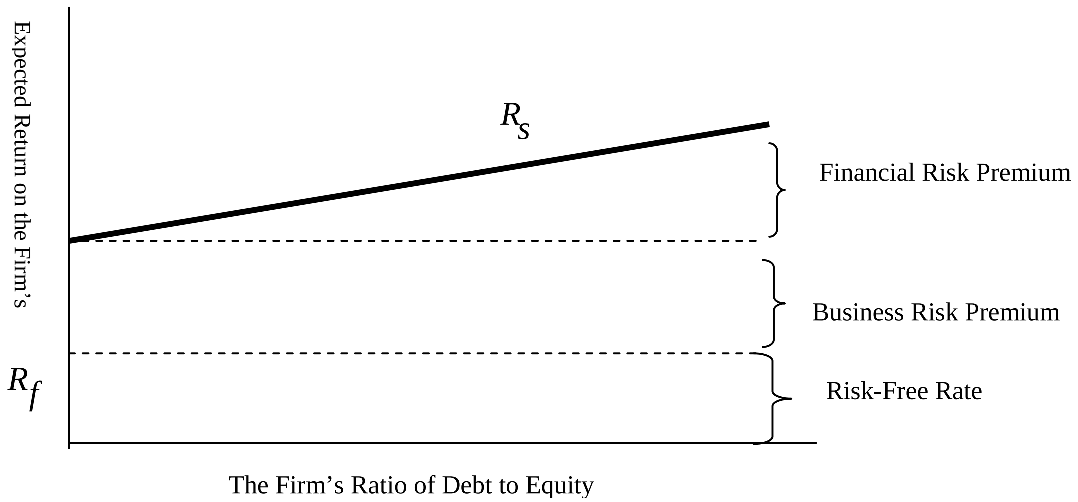
The expected return on a firm’s stock is the risk free rate plus a premium for risk:
Expected return = Risk-free rate + Risk premium
The risk premium consists of a premium for business risk and a premium for financial risk.
Expected return = Risk-free rate + Business risk premium + Financial risk premium
This relation can be formulated as follow:

$$R_s = R_f + BRP + FRP$$

This relation is illustrated graphically in figure (2).

F

igure 2: The Relation between a Firm's Financial Leverage and the Expected Return on Its Stock.



From: Kester, W., 2005. Case Problems in Finance. Mc Graw-Hill, first edition, 473.

Under the assumptions of the CAPM, there is a simple relation between levered and unlevered betas:

$$\beta^L = \beta^U (1 + \frac{D}{E})$$

Alternatively,

$$\beta^U = \frac{\beta^L}{1 + \frac{D}{E}}$$

The CAPM can be employed to decompose a stock's expected return into its basic components. This can be accomplished by combining the equation relating levered and unlevered beta and the basic CAPM expression, the SML. The general and CAPM version of this decomposition are:

$$R_S = R_F + \beta^U (R_M - R_F) + \beta^U (\frac{D}{E})(R_M - R_F)$$

Alternatively,

$$R_S = R_F + \beta^U (R_M - R_F) + (\beta^L - \beta^U)(R_M - R_F)$$

Thus, the expected return on a stock can be decomposed into:

1. The risk-free rate.
2. a business risk premium presented with no debt in a firm's capital structure

3. The additional risk premium created by the existence of debt in the capital structure.

3. Methodology

The objective of the present research is to demonstrate the degree of economic leverage as a determinate of systematic risk, and the assessment of the incremental explanatory power of the DEL through empirical testing. Research method is according to survey method and is of a correlation type which its main goal is to definite the relationship among some quantitative variables. Population of this research is all the accepted automobile and automotive parts manufacture companies in Tehran Stock Exchange which have operated for 10 years, since 21 March 1996 to 21 March 2006. Iranian automobile and automotive parts sector is 32 companies. 18 companies have operated on the years are under study. We use Mandelker and Rhee model to provide the theoretical framework for the DEL.

$$DEL = \frac{\%\Delta Q}{\%\Delta Z} = \frac{\left(\dfrac{\tilde{Q}_{j,t}}{Q_{j,t-1}} - 1\right)}{\left(\dfrac{\tilde{Z}_{j,t}}{Z_{j,t-1}} - 1\right)} \quad 1)$$

$$\beta_j = (DEL)(DFL)(DOL)\beta^o{}_j \quad 2)$$

Where

$$\beta_j^o = \frac{COV\left[\left(\dfrac{\pi_{j,t-1}}{Z_{j,t-1}}\right)\left(\dfrac{\tilde{Z}_{j,t}}{E_{j,t-1}}\right), \tilde{R}_{m,t}\right]}{\delta_{m,t}^2} \quad 3)$$

The first term within the covariance is a constant that represents the last period's earnings after taxes ($\pi_{j,t-1}$) that already reflect the economic disturbance ($Z_{j,t-1}$) that may have occurred in that period. The second term within the covariance includes an expectation that a firm's equity market value ($E_{j,t-1}$) already reflects anticipated future economic disturbance ($\tilde{Z}_{j,t}$). It is the covariance of the product of these two terms with the market return that represents the intrinsic business risk faced by the firm. This β_j^o is different from similar terms expressed in the analytical models of Rhee (1986) or Mandelker and Rhee (1984). The Rhee β_j^o represents a firm's intrinsic risk after the business, operating, and financial risk

are isolated. The Mandelker and Rhee β_j^o represent a firm's intrinsic risk in the absence of operating and financial leverage
Based on the above literature, this study seeks to test the following hypotheses:

H_1: There is a meaningful relation between interest rate and company's sale.

H_2: The explanatory power of the DEL through market return is more than DFL and DOL.

H_3: The explanatory power of the DEL through expected return is more than DFL and DOL.

H_4: There is a meaningful differentiation between accumulated beta by DEL and accumulated beta by CAPM and D-CAPM.

4. Hypothesis Testing

Correlation and regression analysis were conducted on the data to test the hypothesis one to four. Results of correlation in table 1 provide a support to hypothesis 1 which states the existence a conceptual relation between sale and interest rate with confidence level of 95% is not accepted. Hypothesis 2 that states "explanation ability of degree of economic leverage with market return is higher than the considered degree of operational leverage and degree of financial leverage" has accepted. Table 2 represents a support to the hypothesis, first the relation between degree of economic, operational and financial leverages with market return are measured by Spearman correlation test and then the correlation amount between the variables obtained by this test are compared with one another. The obtained P amount for the entire variables in a conceptual level is greater than 0.05 that it proves the non-existence of a conceptual relation between these variables by the confidence level of 95%. But in relation to the explanation ability of these variables, because the obtained Spearman correlation coefficient between the degree of economic leverage and market return is higher than two operational and financial leverages, the explanation ability of this leverage with the market return is higher than the explanation ability of degree of financial leverage and degree of operational leverage. Hypothesis 3 that states "explanation ability of degree of economic leverage with expected return is higher than the considered degree of operational leverage and degree of financial leverage" has accepted. Table 3 provides a support to this hypothesis as well as table 2.

Results of comparing levered and unlevered beta and expected return in real and predictable manner through DEL, CAPM, D-CAPM models have been summarized in table 4; respond to the main question of research which is the purpose of research. The claim is the existence a conceptual difference between the calculated Beta by DEL and the calculated Beta by the two other methods. For this purpose, first by using the annual real data, we have calculated the amount of Beta from three methods of DEL, CAPM and D-CAPM for years 2001 to 2006 and then by using the average of five-year growth rate (1996-2001), we have predicted each of the variables for years 2001 to 2006 and the amount of

Beta has been predicted from each three mentioned methods for this period of time. Finally, by using the real and predicted lever Beta (β^l), the amount of non lever Beta (β^u) and expected return (R_s) for these five years has been reality and predictability calculated and compared. Through comparing the real and predicted amounts in each three methods, we will attain this result that total predicted amounts of all variables (lever Beta, non lever Beta and expected return) are closer to the reality in compare with other two methods through helping of DEL method for all existent companies and our claim will be accepted in this hypothesis, that is the calculated Beta by DEL has a conceptual difference with the calculated Beta by CAPM, D-CAPM method. Furthermore, it is considerable that not only the calculated predicted return by DEL is closer to the reality in compare with the two other methods, but also we can say that the reason of this issue is the interference of the number of very important variables such as financial expense and net interest in the β_j^o accounting method and as a result the calculated Beta amount.

Table 1: Testing correlation between sale & interest

Correlations: R-%SALE; R-%I
Spearman correlation of R-%SALE and R-%I = 0.189   P-Value = 0.076

Table 2: Testing correlation between Market Return & DEL, DOL, and DFL

Correlations: R- DEL; R - Rm
Spearman correlation of R- DEL and R - Rm = 0.160
P-Value = 0.132

Correlations: R- DOL; R - Rm
Spearman correlation of R- DOL and R - Rm = 0.026
P-Value = 0.808

Correlations: R- DFL; R - Rm
Spearman correlation of R- DFL and R - Rm = 0.017
P-Value = 0.874

Table 3: Testing correlation between Expected Return & DEL, DOL, and DFL

Correlations: R - Rs; R- DEL
Spearman correlation of R - Rs and R- DEL = 0.202
P-Value = 0.057

Correlations: R - Rs; R- DOL
Spearman correlation of R - Rs and R- DOL = -0.017
P-Value = 0.870

Correlations: R - Rs; R- DFL
Spearman correlation of R - Rs and R- DFL = 0.153
P-Value = 0.150

Table 4: Comparing Levered and Unlevered Beta and Expected Return in Real and Predictable Manner through DEL, CAPM, D-CAPM Models

Variable	DEL			CAPM			D-CAPM		
	Actual	**Forecast**	**Difference**	**Actual**	**Forecast**	**Difference**	**Actual**	**Forecast**	**Difference**
B^l	**-0.01**	**0.001**	**0.01**	**2.20**	**-0.32**	**2.53**	**5.03**	**1.01**	**4.01**
B^u	**0.0016**	**0.00005**	**0.0015**	**0.52**	**-0.05**	**0.57**	**1.24**	**0.21**	**1.02**
(%) R_S	**16.70**	**17.01**	**0.31**	**8.97**	**-7.60**	**16.57**	**-0.92**	**93.7**	**94.6**

5. Conclusion and Recommendation

After theoretical conceptual studies by using Regression analysis and Pearson correlation testing, the first hypothesis, which is the inverse and meaningful relation between interest rate and a firm's sales, was not achieved. From another hypothesis test it was confirmed that there is no relation between Degree of Economic Leverage and market return and expected return. Degree of Economic Leverage explains both the expected return and the market return better than Degree of Operational Leverage and Degree of Financial Leverage. Also there is a meaningful difference between measure of the Beta calculating by DEL and the Beta computing by CAPM and D-CAPM. By combining CAPM with leverages (financial, operational and economic leverages), we found a new model which we will call it Revised CAPM (R-CAPM). In this model to achieve more accurate prospecting predicted return, we focus on systematic and unsystematic risk as well as historical and estimating data completely. Regarding the results of research, it is suggested that, the beta Coefficient of degree of economic leverage is used for determining the systematic risk and predicting the expected return rate and also the economic leverage is used beside other leverages for making decision about sale changes and profitableness of companies.

References

Blazenko, G.W. 1999. “Corporate Sales, Equity Trading, and Risk', *Journal of Business Finance and Accounting*“, vol. 26, pp. 477-504.

Devyzis, L. & Jankauskas, G. 2004. “Explaining the cost of Equity in Central and Eastern Europe*', Rigas Ekonomikas Augstskola*“, pp.11-16.

Estrada, J. 2000. “The Cost of Equity in Emerging Markets: a Downside Risk Approach'*, Emerging Markets Quarterly*“, pp. 19–30.

Estrada, J. 2002. “Systematic Risk in Emerging Market: The D-CAPM', *Emerging Market Review*“, pp.365-79.

Estrada, J. 2003. “Mean-Semi variance Behavior: The D-CAPM', *Research Paper*“, pp.493-515.

Estrada, J. 2005. “Mean-Semi variance Behavior: Downside risk and capital asset pricing'*, International Review of Economics & Finance*“.

Griffin, H.F. Dugan, M.T. 2003. “Systematic Risk and Revenue Volatility', *Journal of Financial Research*“, vol. 2, pp.179-89.

Harvey, C. 1995. “Predictable Risk and Returns in Emerging Markets', *Review of Financial Studies*“, pp.773–816.

Harvey, C. 2000. “Drivers of Expected Returns in International Markets', *Emerging Markets Quarterly*“, pp.32–48.

Kester, W. 2005, Case Problems in Finance, Mc Graw-Hill, First Edition, pp.470-85.

Kothari, P. & Shanken, J. & Richard, G. & Sloan. 1995. “Another Look at the Cross Section of Expected Stock Returns', *Journal of Finance*“, vol. 50, no.2, pp.185-224.

Lim, K., 1989, “A New Test of The Three-Moment Capital Asset Pricing Model', *Journal of Financial and Quantitative Analysis*“, vol. 24, no. 2, pp. 205-16.

Post, T. & Vliet, P. 2004. “Conditional Downside Risk and CAPM', ERIM, *Report series Research in management*“.

Reilly, F.K. & Brown, K.G. 2004, Investment Analysis and Portfolio Management, Thomson South Western, Seventh Edition.

Rouwenhorst, G. 1999. “Local Return Factors and Turnover in Emerging Stock markets', *Journal of Finance*“, vol. 54, pp.1439–64.

Serra, A.P. 2003. “The Cross-sectional Determinants of Returns. Evidence from Emerging Markets’ stocks', *Journal of Emerging Markets Finance*“, vol. 2, pp. 123–62.

Sears, R. & Wei, j. 1998. “The Structure of Skewness Preference in Asset Pricing Models With Higher Moments', *Financial Review*“, Vol. 23, no. 1, pp. 25 -38.

Van Horn, J.C. and Wachowicz J.M, 2005, Fundamental of Financial Management, Prentice Hall, Twelfth Edition, pp. 413-33.