Testing of CAPM in an Emerging Economy: "A Case Study of Pakistan"

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Abstract

The theme of this paper is to test the validity of the Capital Asset Pricing Model of Sharpe [1964] and Lintner [1965] version which is considered as a standard Asset Pricing Model and generally performs poorly in both developed and emerging markets. For this purpose, 45 companies have been selected randomly which are listed at Karachi Stock Exchange. Their daily share price data for a period of five years have been analyzed in order to test the validity of CAPM in an emerging economy taking a case of KSE-100 index. The research finding concludes that CAPM version of Sharpe [1964] and Lintner [1965] is still one of a useful method for estimating the cost of equity capital in an emerging market as from the selected sample of forty five companies, the values of beta for thirty seven companies are found significant which proved that beta is still a useful measure of risk in an emerging market like Pakistan.

Introduction

Academic researchers and Investors have paid considerable attention to the emerging markets all over the globe. The focus point of their research was the testing of different pricing models and the estimation of risk-return relationship. For this purpose, they employed different models as well as different methodology for testing these models. The basic aim of all these activities is to find out the equilibrium model for estimating risk and return of equity stocks.

One of the most frequently used model in the Capital Theory is the Capital Asset Pricing Model of Sharpe[1964], Lintner[1965] and Mossin[1966], which examine the relationship between risk and return of an assets. The model requires compensation for the investors as time value of money and risk taken as reflected in the model as a risk free rate and beta respectively. The model has three testable hypothesis i.e.

H_{01}: *"The relationship between risk and expected return is linear"*

H_{02}: *"Beta (β) is a measure of systematic risk of a security"*

H_{03} : *"Higher risk of a security is normally associated with higher return"*

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The theme of this study is to empirically test the CAPM developed by Sharpe[1964] and Lintner[1965] which explains that the expected rate of return of an individual security to a measure of its systematic risk(i.e. beta). For this purpose, we have to test the coefficient of beta in respect of the Karachi Stock Exchange (KSE) 100 index data for a period of 5 years w.e.f 1-07-2005 to 30-06-2009 as the KSE is the largest stock exchange of Pakistan which is an emerging economy of Asia and to test either beta is dead or alive.

As evident from the previous studies that every emerging market has its own unique structure, political and institutional setup, level of integration and local risk free return, consequently the results of testing CAPM may differ from country to country.

The study has its own unique importance because too much ups and downs were noticed in the KSE-100 index for the last few years, the KSE reached to the record of high index of its history as well as to its bottom line in the period of study.

Karachi Stock Exchange established soon after independence in September, 1947, gathered forceful momentum since 2002, during 2002-2007, even with a few episodes of mayhem down the way, however, the beginning of 2008 appeared promising for Pakistan capital markets regardless the sub-prime crises intensifying its grip on financial system all over the globe. The stock markets in Pakistan showed good gains and KSE 100 index gain 11.6 percent by mid April 2008 and reached the highest level of 15676 points on April, 18, 2008 with a gain of 1747 points over the level of index at the start of the year 2008.

Subsequently, "*the KSE however, has seen episodes of precipitous decline and KSE 100 index has fallen by 62 percent. Notwithstanding, equity investors have embarked on a fractional recovery of their fortunes with an upsurge in the KSE 100 index of a fine 22.5 percent since commencement of the year 2009, driven up chiefly by signs of returning economic stability*"[6].

Literature Review

The foundations for the development of asset pricing models were laid by Markowitz (1952) and Tobin (1958), their studies suggest that "*the risk of an individual security is the standard deviation of its return, thus higher the standard deviation of a security return the greater the risk involved in the security*". This model was not considered as an efficient model due to some of the flaws as combining more than two risky security their combine standard deviation be-

come less. The first version of the CAPM was developed by Sharpe [1964], which is a computationally efficient method, the single index model; *"where an individual security is related to the return on a common index"* (Jones, 1991).

In addition to this, Sharp [1964], Lintner [1965] and Mossin [1966] which suggests that high expected returns are coupled with high level of risks. No doubt, CAPM holds a central place in the field of finance but financial researchers have put massive efforts for the testing of CAPM.

Early studies (Lintner, 1965; Douglas, 1969) on CAPM were primarily based on individual security returns. Their empirical results were discouraging. Miller and Scholes (1972) highlighted some statistical problems encountered when using individual securities in testing the validity of the CAPM. Most studies subsequently overcame this problem by using portfolio returns.

The first empirical study which support this model is that of Black, Jenson and Scholes [1972], in their study of all the stocks of the New York Stock Exchange over the period 1931-1965, *"formed portfolios and reported a linear relationship between the average excess portfolio return and the beta, and for beta >1 (<1) the intercept tends to be negative (positive)"*. Therefore, they developed a zero-beta version of the CAPM model where the intercept term is allowed to change in each period (Don U.AGalagedera).

Another study that supports the model is that of Fama and MacBeth [1973]; they examine whether there is a positive linear relation between average return and beta. For this purpose, they first calculated market beta from adjusted risk return and then again including beta as another explanatory variable and again estimated the risk and return of a security.

However, the same model was severely criticized by Roll [1977] due to the employed methodology, as per his opinion the use of market index as proxy of portfolio was unsuitable and the true market portfolio cannot be measured and hence CAPM cannot be tested. Basu(1977) proposes other factor to be considered instead of focusing on beta and argued that price earnings ratio has a great impact over market return. Later on, the studies of Fama and French[1992,96] proposes that book to market value ratio has also affect return of a security and observed that the two non-market risk factors SMB (the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks) and HML (the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to-market stocks) are useful factors when explaining a cross-section of equity returns. He and Ng [1994], Davis [1994], Miles and Timmermann [1996],

and Cambell, Lo and MacKinlay [1997] were also provide weak empirical evidence against the model.

Chung, Johnson and Schill (2001) observed that as higher-order systematic co-moments are included in the cross-sectional regressions for portfolio returns, the SMB and HML generally become insignificant. Therefore, they argued that SMB and HML are good proxies for higher-order co-moments.

As suggested by the literature, CAPM as the benchmark Asset Pricing Model generally perform poorly in both developed and emerging markets, like in the UK stock market which is a developed market the empirical results of Talib Zahor et.al[2007] show that the relevance of CAPM is none, as well as the study of Grigorios Michilidis et.al[2006] of emerging Greek security market presented not supportive but in the emerging market of Pakistan the findings of Javed Iqbal et.al(2008) found that Fama and French model perform best among the competing models as well as Elahi Mirza Nawazish[2008] also found the results of Fama and French for KSE-100 index as supportive.

The rest of the paper is organized as follows: Section II will discuss the selection of data. Section III will discuss the methodology adopted. Section IV presents the empirical results and finally Section V concludes the paper.

Selection of Data:

The sample data selected for this study is of 45 companies share prices listed at the Karachi Stock Exchange which is the biggest equity market of Pakistan for a period of five years w.e.f. 1-07-2005 to 30-06-2009(excluding holidays and no-trading days) as during this period the Karachi Stock Exchange experienced historical ups and downs. Randomly fifteen sectors were selected and from each sector at least 3 companies were selected. The data were downloaded from the business recorder website i.e. "www.brecorder.com" on monthly basis for each company.

The daily closing returns were calculated from the daily closing prices of forty five randomly selected companies. The KSE 100 Index return is used as proxy for market return while three months Treasury Bill Rate issued by State bank of Pakistan is selected to be used as proxy for the risk free return as required in the testing of CAPM model.

Necessary calculation for the adjustment of risk return and market return for capital changes that is dividend, bonus shares and rights, are also carried out in the Excel sheet for testing of beta on daily basis and arranged in a separate excel sheet for data analysis.

Methodology

The methodology of our research for testing of CAPM on KSE 100 index is almost the same as employed initially by Sharpe[1964] and Lintner[1965] and we are going to test the Sharp and Lintner version of CAPM . For this purpose, a sample of 45 companies listed on Karachi Stock Exchange-100 Index of different sectors are selected for a period of five years w.e.f 01/07/2005 to 30/06/2009.

The secondary data has been gathered from business recorder website, monthly closing prices for 45 stocks of the Karachi Stock Exchange (KSE) 100 index are collected and then stock return i.e. (current price-previous price)/ previous price are calculated for all the forty five companies besides this KSE 100 index (using as proxy for return on market portfolio) is also calculated as needed in the testing of CAPM in the same manner.

The main formula is Sharpe – Lintner CAPM version for each of the 50 selected stocks of KSE-100 Index is:

$$E(R_i) = R_f + \beta_i \left\{ E(R_m) - R_f \right\} \qquad \text{....... (1)}$$

Equation (1) is estimated as:

$$R_{it} - R_{ft} = \eta i + b_i \left(R_{mt} - R_{ft} \right) + \varepsilon_{it} \qquad \text{....... (2)}$$

Where:

R_{it} is the return on stock i (i=1...45),

R_{ft} is the rate of return on a risk-free asset,

R_{mt} is the rate of return on the market index,

b_i is the estimate of beta for the stock i , and

ε

ε_{it} *is the corresponding random disturbance term in the regression equation.*

First of all, the data is downloaded from the business recorder website then we carried some necessary calculation as needed in the testing of CAPM in Microsoft Excel Sheet. After, calculation adjusted risk returns for stock as well as adjusted market return from the historical data were obtained and used as a proxy for expected stock return and expected market return respectively by using stock return as proxy for expected return, KSE 100 index return as proxy for market return and treasury bills rate as proxy for risk free rate i.e.

Stock Return – Risk Free Rate = Market Return –Risk Free Rate

The first part that is Stock Return – Risk Free Rate is used as dependent variable and the second part i.e. Market Return –Risk Free Rate as independent variable, then the regression was run using SPSS forty five times separately and compute the value of beta , standard error and t-statistic and p-value for testing purposes.

Data Analysis and Results

In this section the data is analyzed using SPSS. For this purpose, the data has been entered in SPSS sheet which is already compiled in Excel sheet then regression was run one by one for forty five companies separately, taking the

Results of Beta for forty five companies Listed at KSE-100 Index and its respective Descriptive Statistics on Daily Basis w.e.f 1-07-2005 to 30-06-2009

S. No.	Name of Company	β	Std Error	t-value	p-value
1	Cass Pak Ltd	-1.744	0.326	-5.356	.000
2	Singer Pak	0.298	0.056	5.341	.000
3	Jenson Pak	0.185	0.067	2.742	.006
4	Seimens Eng	0.140	0.044	3.192	.000
5	Pak Petrlm	0.193	0.045	4.331	.000
6	Mari Gas	0.438	0.051	8.519	.000
7	Climax Eng	0.113	0.042	2.700	.007
8	Pak Tel Cabl	0.300	0.108	2.764	.006
9	Oil&Gas Dev Corp	0.286	0.041	6.989	.000
10	Ados Pak Ltd	0.200	0.056	3.557	.000
11	Bolan castg Ltd	0.103	0.038	2.681	.007
12	Crescent Steels and Allied	0.099	0.052	1.906	.057
13	Dadex Extnit Ltd	0.108	0.038	2.835	.005
14	Al Abbas cemt	0.136	0.077	1.774	.076
15	Attock Cement	0.116	0.049	2.374	.018
16	Bestway cement	0.122	0.044	2.804	.005
17	Lafrage cement	0.304	0.079	3.839	.000
18	Cherat cement	0.119	0.051	2.341	.019
19	DG Khan cement	0.160	0.54	2.943	.003

S. No.	Name of Company	β	Std Error	t-value	p-value
20	Dewan cement	0.021	0.079	.268	.789
21	Ghandhara Ind ltd	0.205	0.055	3.729	.000
22	Ghandhar Nissan Ltd	0.296	0.060	4.902	.000
23	Ghani Auto Ltd	0.365	0.071	5.115	.000
24	Al Ghazi Tractor Ltd	0.113	0.036	3.133	.002
25	Abbot	0.295	0.038	7.704	.000
26	Callmate tellips	0.208	0.071	2.91	.004
27	Eye TV Network	0.322	0.059	5.467	.000
28	Pak Telecom Ltd	0.278	0.044	6.264	.000
29	Khyber Tobacco Ltd	0.132	0.050	2.629	.009
30	Lakson Tobacco Ltd	0.152	0.038	3.961	.000
31	Pak Tobacco	0.290	0.044	6.510	.000
32	Pak National Shipping	0.222	0.051	4.313	.000
33	Glaxosmith Kline	0.264	0.036	7.404	.000
34	Aventis	0.148	0.043	3.421	.001
35	Ferozsons(Lab) Ltd	0.155	0.038	4.130	.000
36	Highnoons(Lab) ltd	0.047	0.043	1.098	.273
37	Askari Commercial Bank	0.156	0.046	3.351	.001
38	Arif habib Ltd	0.495	0.059	8.313	.000
39	Jehangir Siddique	0.665	0.058	11.556	.000
40	Islamic Investment	0.127	0.078	1.636	.102
41	IGI Invest Bank Ltd	0.125	0.085	1.47	1.42
42	Bank of Punjab Ltd	0.196	0.058	3.394	.001
43	Adam Jee Ins Ltd	0.136	0.059	2.311	.021
44	Askari Gen Ins	0.080	0.056	1.441	.150
45	Pak Ins Ltd	0.130	0 .104	1.247	.213

(Source: KSE-2009, 45 companies betas)

Adjusted Risk Return of each company as dependent variable and Adjusted Market Return as independent variable and record the required results in the following table which represent the value of beta for each company as well as standard error, *t*-statistic and p-value which are normally used for testing purposes of a coefficient of a parameter (i.e. beta) which explains either estimated parameter is significant or insignificant.

In light of the aforementioned results which are obtained from the forty five companies daily price share return and its corresponding KSE-100 Index daily return for a period of five years, it shows that the values of beta for 37 companies out of forty five found significant and for 8 companies found insignificant i.e. 74% results are supportive and just 26% results are against beta.

Conclusion

In this study efforts has been made to investigate the issue of how risky assets are priced and how cost of equity capital is estimated in the emerging markets and to examine that whether beta is still a useful measure of a market risk or not. For this purpose a case of KSE-100 index was used and the monthly panel data of forty five companies for a period of five years were analyzed.

The results of our study indicate that for overall sample on the average the values of beta are positive and hence there is a positive relationship between beta and return. As beta has ben tested for forty five companies and out of forty five companies we obtained significant values of beta for thirty seven companies and insignificant for just eight companies which show that beta is a useful measure for investors and portfolio managers when making investment decisions in emerging markets. Thus, we can say that CAPM version of Sharpe [1964] and Lintner[1965] is still one of a useful method for estimating the cost of equity capital in an emerging market.

However, after testing the hypothesis i.e. as to whether beta is still alive or dead by using data for daily basis which is proved as supportive we can further test the data on weekly and monthly basis and can comprehensively analyze the assets pricing for emerging markets, besides this one can test the validity of the model by using different methodologies like Fama and MacBeth [1973] as well as Fama and French[1992,1996].

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