

Applicability of Capital Assets Pricing Model (CAPM) on Pakistan Stock Markets

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ABSTRACT:

Capital Assets Pricing Model is used as a tool for the estimation of Investments in Capital Markets with the relation of Expected return and Risk on Securities. This study examines the applicability of CAPM on Pakistan Stock Markets and Karachi Stock Exchange being the main capital market of Pakistan is taken for the study. The analysis is done by taking a sample of 10 performing companies of 100 index of KSE for a period of five years from 2006 to 2010. The monthly returns are taken and beta of each security is calculated which is used in the calculation of Expected returns. Microsoft Office (MS Excel) is used for most of the calculations. The empirical findings of this study do not support to the CAPM in Pakistan Stock Markets. In all three types of beta, it gives different results. The results of this study are in line with the previous researches conducted on Pakistan Stock markets but with different time periods and different sample size.

Keywords: CAPM, KSE, β , Market return, Risk free return, Portfolio, Stocks, Expected return.

INTRODUCTION

The Capital Assets Pricing Model (CAPM) is introduced by Sharpe (1965), Lintner (1966) and Black (1972). The CAPM is firstly introduced by William Sharp to provide the basis for the estimation of investment in securities. It is the major systematical tool for explaining the relationship among expected return and risk (Milionis, 2011). To calculate the expected return of the security, the Capital Assets Pricing Model emphasize that the investor should know the two things in mind while investment in a security; one is risk premium of overall portfolio and the other is security beta opposed to the market (Jarlee, 2007).

The purpose of this research is to study systematically, whether the Capital Assets Pricing Model holds true in the capital market or not. (Michailidis et al., 2006). But the study is

conducted only on Karachi Stock Exchange of Pakistan. The CAPM is simple, logic and instinctively satisfying predictions about how to calculate risk and the relationship among expected return and risks in the security markets under the premises that tentative future returns of securities can be explained in terms of moments of their possibility division (Baten, 2006). But unfortunately because of its clearness and purity the previous practical record of the CAPM is poor. The CAPM, in empirical records is poor sufficient to abolish the means it is used in applications. It might be because of true data failing or due to short-comings of the empirical tests (French, 2003). Since the development of the Capital Assets Pricing Model (CAPM), a numbers of studies and efforts have been dedicated to estimate the validity of the CAPM

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by the distinctive breakthrough and important contribution of the financial economics (Jarlee, 2007).

The Capital Assets Pricing Model present with the nominal level of return, it is distinguished by the capital investment and the financial incapability of the investor to find out there turn and risk on investment and take the decision on investment proposal and companies and individual investors invest on the basis of future return and risk on the investment (Sinusi, 2011). The CAPM assert that there is an affirmative (positive) relationship among the expected returns and its systematic risk; beta of the stocks and that beta is an enough variable to clarify stock returns. The developed markets usually show a weak correlation among risk and return. There is a positive correlation among beta and return if the risk premium is positive and there is a negative correlation between the beta and return if the risk premium is negative because in negative realized premium the high beta stocks will be more perceptible and have less return than beta (Wihlborg, 2004).

The Capital Assets Pricing Model affirms that the return in investment to investor has to be equal to:

- ✓ The rate of risk-free
- ✓ Plus a premium for the stock
- ✓ Multiplied by the individual company risk factor

Capital Assets Pricing Model (CAPM) is one of the models which attempt to value the risk. It asserts that if the certain statements or assumptions are accepted as it were given, than from the model we can calculate or estimate the expected return from the assets. (Jarlee, 2007)

Literature Review

Along with William Sharpe many other researchers for the development of asset pricing theory used Markowitz's portfolio theory for financial assets, that theory of price formation is known as Capital Assets Pricing Model (CAPM). Markowitz's portfolio theory is used and helps investor to know how he can excellently invest his wealth in assets with the consideration of risk and expected return and therefore also how the risks can be ignored or reduced. This theory tell the relationship between expected return and risk to investor in

the risky investments or securities it is also used to calculate the cost of capital and assessing the managed portfolio performance (Jarlee, 2007).

It is general that every investor in the riskier investments or securities requires a high expected return. In the Sharpe- Lintner model various studies has been conducted in the past and different examiners have come up with varied results and findings (Bhatti, 2010).

Every manager almost who wishes to start a project must validate his decision which is rather based on CAPM. The CAPM establishes simple means for investors and firm managers to estimate their investments. The rational is that the CAPM provides the way for a corporation to estimate the return that it's any investor demands if they are interested to invest in the project. (Michailidis et al., 2006; Jarlee, 2007).

Capital Assets Pricing Model (CAPM) gives return with minimum level, which should be accomplished by the investment tender to reimburse the investor for the risks that cannot be ignored, a risk factor estimated by beta, as shown in the below given equation:

$$E(R_i) = R_f + \beta_j [ER_m - R_f]$$

Where

$E(R_i)$ is the Expected rate of Return on security "i"
 R_f is the Risk free rate of Return
 β_j is the systematic risk or beta of Security "j"
 R_m is the market return is usually estimated as historical market returns for the last years
 $[R_m - R_f]$ is the market premium, it is the expected market return over or above the risk free rate.

The model shows that all the firm managers and all the investors of the investment in a particular asset or security need to do estimation and evaluation among the required return and expected return. If the result of expected return is negative, it is required to end the intentions for possible investment in the specific security (Jarlee, 2007). The CAPM asserts that if the investor of the particular security holds a market portfolio, than the investor should know that how this security or asset will behave in whole market not as individually. For example, if the stock of the investor is exactly varying like the market stock than the expected return of investor and market should be same.

Some studies indicate that the Beta is a non-diversifiable risk measure and also a relative estimation; from this we can estimate the risk relative to the market-portfolio. In other words beta measures the instability and volatility in prices of a share portfolio, and calculates how the expected return on a share portfolio moves relatively in the market portfolio movement. The results concluded that the CAPM is relied on simple assumptions and these several assumptions come out to be unrealistic and cannot hold true in the real world. The assumption of CAPM are that the Investors should have diversified portfolio of securities, Single period transaction horizon, Investors have the option to lend or borrow at the risk-free rate of return and the security market should be perfect (Head, 2008). Some researchers has concluded that CAPM is not true and has some errors and the Arbitrage Pricing Theory (APT) which is developed in 1976 by Ross represent a well description of return than CAPM (Laubscher, 2002).

In the study of (Bhatti, 2010) it has been concluded that the CAPM is not supportive in high risk securities, it is only supportive in low risk securities and CAPM is not valid in Pakistan Stock Market. Because CAPM in most of the years give results of expected return totally different from the actual returns. In this test 60 samples of the different companies were taken and out of 360 only 28 results were supportive and show the accuracy of CAPM. While in the study of Bangladesh the Capital Asset Pricing Model (CAPM) is strongly supportive in Bangladesh stock market (Baten, 2006).

The findings of BurcKayahan, (2007) and Ahmad, (2008) also concluded that the CAPM is not supportive. In BurcKayahan, (2007) study has asserted that in order to check the conditional version of Sharpe Lintner model CAPM by adopting the non-parametric methods of Local Maximum Likelihood the results don't support the CAPM. Where in (Ahmad, 2008) results of Karachi Stock Exchange do not support the CAPM, 49 companies and KSE 100 index data has taken and the findings show that Sharpe model is not useful for Pakistan equity market and CAPM at KSE is credited inefficient in market because a positive tradeoff among market risk and market return, is rejected,

secondly the remaining risk plays some functions in pricing risky assets (Ahmad, 2008).

RESEARCH METHOD

The research question is "Does the Capital Assets Pricing Model (CAPM) assist the investors in evaluating the securities and give the reliable results if applied on Pakistan Stock Markets. Karachi Stock Exchange is the largest stock exchange of Pakistan, so it is selected for this study. The main objective of this research is to evaluate the Capital Assets Pricing Model on Karachi Stock Exchange. The major focus of this research is the calculation of β of 10 companies on monthly basis and on the basis of that β expected rate of return is calculated and later compared with the actual rate of return of the securities in order to establish an opinion about the applicability of CAPM on KSE. The names and symbols of all the companies listed on the Karachi Stock Exchange are available on KSE website. The selection of companies is based on the following rules:

- 1- The companies are selected only from major performing sectors.
- 2- Only one company from one sector is selected.
- 3- The company selected are part of KSE-100 index (KSE, 2011).

The sample taken for this research is not covering the whole KSE-100 index as only the 10 companies out of the total listed companies, so the probability sampling technique (systematic Sampling) is applied on the population. The same technique is applied on the above sated rules. The sample size of 10 companies is only the representative of all the listed companies on the KSE which can help to fulfill the research purpose and to solve the research problem. The previous studies took the sample on different basis. The secondary data used for this research is taken from KSE website, ZHV securities website, yahoo finance and also verified from the respective annual reports of the companies. The time period selected for this company is 5 years starting from 2006 to 2010 because up to 2004, Eatjaz and Attiya (2008) and up to 2008 Hanif and Bhatti, (2010) have already conducted the research. The time period in which the stock market was crashed is marked as the abnormal

period. So this period (July 2008 to March 2010) is excluded from the study. In this way this research study tests the CAPM applicability on KSE for a period which is not covered in any study earlier.

The tool used for the analysis of this study is MS Excel. The descriptive and exploratory approaches of research are applied to present the analysis of the data. The formula used to calculate the expected returns of the securities is as under:

$$E(R_i) = R_f + \beta_j [ER_m - R_f]$$

The unit of analysis for this study is the stock prices which are taken from the above mentioned sources. The closing stock market values of each month of above stated period are taken to verify the research objectives. The actual returns of the securities are calculated by using the following formula:

$$\frac{P_t - P_{t-1}}{P_{t-1}}$$

Where

P_t is the price of a security at "t" (month) time
 P_{t-1} is the price of a security at "t-1" (previous month) time

The same formula is applied to stock market index to calculate the market return. The β is calculated by deriving the slope between the market return and the returns of individual security. For this purpose, the return of the securities was kept on y-axis and market returns was kept on x-axis. After calculating the value β for each security on monthly returns basis, expected return or required rate of return (RRR) of each security is calculated by using the equations of CAPM as given above.

The stock prices are used to calculate the actual returns on monthly basis and dividend are not added to the returns because of the non availability of actual amounts of dividends of each security. The risk free rate of return used in this study is taken from the rate of National Savings Certificates on regular income. The closing value of rates of each year is available on the website of National Savings Certificates of Pakistan. The Statistical formula applied to

calculate the means of monthly returns and then multiplied by 12 to get the annual average return of the securities.

RESULTS AND DISCUSSION

The data collected from different sources gone through different statistical tests for the calculation of β of stock index and stock prices as well as the actual and expected rate of returns of the securities. The literature of this research reveals that the Capital Assets Pricing Model does not give the accurate results when it is applied on the Pakistan Stock Exchange (KSE- 100 Index) but in certain years it gives partially correct results for few stocks.

Results with Minute Differences

After the calculations and compilation of data for 5 years, it is observed that the annual expected and actual rate of returns is different from each other. But some results show a very little variation in the actual and required rate of returns. The results having a variation of around 6% are considered as the slightly different and the remaining all as the totally different. This shows the partial applicability of the CAPM on the Pakistan Stock Market. The calculation of 5 companies on which the CAPM is applied is shown in table 1.

Discussion

As the results shown in the table 1 evidenced that the values of expected returns calculated by using CAPM are slightly different from the actual returns in certain years. This is also applied on few companies only. Although the β of these companies at that time is of all types (aggressive, normal and defensive). In all the cases of β the results shows a very slight difference in the actual and expected returns. In this way we are unable to verify the results of Huang, (2000) who stated that the CAPM is a valid model for low risk securities and not applicable on high risk securities. The complete results of the study are shown in the appendix. The acceptance of CAPM in Pakistan Stock Market is how ever applicable only on few results, out of the sample of 10 companies; only 5 companies' results support the validity of CAPM in few years. Only five results are verifying the validity of the model from 51 results. In this way we can say that only 9.8% of

Table 1: Minute difference in expected and actual returns

S. No	Company Name	Year	Beta	Expected Returns (CAPM)	Actual Returns (P2-P1/P1)	Difference
1	DG Khan Cement	2007	1.24728	0.432943	0.481570	-0.04863
2	MCB Bank Limited	2008/09	1.33787	-0.310910	-0.227639	-0.06327
3	Pakistan Petroleum	2010	0.73214	0.229240	0.174213	0.05503
4	Indus Motors Limited	2008/09	0.85705	-0.150294	-0.141546	-0.00875
5	Abbot Laboratories	2007	0.87804	0.332980	0.371188	-0.03821

Table 2: Over Valued results

S. No	Company Name	Year	Beta	Expected Returns (CAPM)	Actual Returns (P2-P1/P1)	Difference	Over Valued
1	D. G Khan Cement	2006	1.29321	-0.06047	-0.64515	0.58468	Over Valued
		2008/09	1.49310	-0.36276	-0.41137	0.04861	Over Valued
		2010	1.86116	0.39215	0.00682	0.38532	Over Valued
2	MCB Bank Limited	2010	1.37281	0.32168	0.08006	0.24162	Over Valued
3	Pakistan Petroleum Limited	2007	0.92142	0.34472	0.08079	0.26393	Over Valued
		2008/09	0.64792	-0.08043	-0.13534	0.05491	Over Valued
		2010	0.73214	0.22924	0.17421	0.05503	Over Valued
4	Dawood Hercules	2006	0.59717	0.02181	-0.41228	0.43409	Over Valued
		2010	1.50579	0.34087	0.17885	0.16202	Over Valued
5	Indus Motors Limited	2006	-0.51095	0.15280	-0.74397	0.89677	Over Valued
6	Pakistan Tobacco Company	2006	0.69224	0.01057	-0.32652	0.33710	Over Valued
		2007	1.43842	0.48461	0.01312	0.47149	Over Valued
		2008/09	1.13029	-0.24157	-0.45919	0.21762	Over Valued
		2010	0.76175	0.23351	0.14089	0.09262	Over Valued
7	Abbot Laboratories	2006	0.57668	0.02423	-0.34062	0.36485	Over Valued
		2010	1.24544	0.30330	-0.00735	0.31066	Over Valued
8	Murree Brewery	2006	-0.74242	0.18016	-0.11254	0.29270	Over Valued
		2008/09	-0.23229	0.21359	-0.35610	0.56969	Over Valued
9	Adamjee Insurance	2010	1.80985	0.38474	-0.24854	0.63329	Over Valued
10	NishatChunia Limited	2006	0.47774	0.03593	-0.86396	0.89989	Over Valued
		2007	1.46884	0.49284	0.04029	0.45255	Over Valued
		2008/09	1.56629	0.65921	0.06602	0.59319	Over Valued
		2010	2.39347	0.46895	0.22038	0.24857	Over Valued

the results are supporting the validity of the model. In view of the above, the results of Eatzaz and Attiya (2008), Hanif and Bhatti (2010) are proved. The results shown by them are approximately the same as shown in the table 1 above but with a larger data. They concluded that the CAMP is not fully applicable on the Pakistan Stock Markets but in few cases and for a certain time period, it gives slightly different results. Our study also some extent verify the results of Lau and quay (1974) who put forth that the Capital Assets Pricing Model is applicable on the Tokyo Stock Exchange where the actual returns of were slightly different from the expected returns in most of the years.

Results with Huge Differences

Capital Assets Pricing Model gives a slightly different results in few cases and for certain years only as shown in Table 1 but in most of the cases it gives the accurate results. Table 2 has reported highly over valued results as compared with the table 1 for the same companies but with different years. The values of expected returns are very high in comparison with the values of the actual returns for all the companies of the sample.

Table 3 below also present totally different results but here the results are undervalued. The expected returns calculated with the help of CAPM are less than the actual results obtained from the data with a huge intensity. Out of the total of 10 companies 8 are showing the undervalued results of expected returns.

Table 3: Under Valued results

S. No	Company Name	Year	Beta	Expected Returns (CAPM)	Actual Returns (P2-P1/P1)	Difference	Under Valued
1	DG Khan Cement	2007	1.24728	0.43294	0.48157	-0.04863	Under Valued
		2006	1.60009	-0.09674	0.26208	-0.35882	Under Valued
2	MCB Bank Limited	2007	1.01175	0.36916	0.54143	-0.17227	Under Valued
		2008/09	1.33787	-0.31091	-0.22764	-0.08327	Under Valued
3	Pakistan Petroleum Limited	2006	1.78937	-0.11912	0.17796	-0.29708	Under Valued
4	Dawood Hercules	2007	0.61197	0.26099	0.34193	-0.08094	Under Valued
		2008/09	1.36667	-0.32053	-0.18968	-0.13085	Under Valued
		2007	-0.08700	0.07186	0.64857	-0.57671	Under Valued
5	Indus Motors Limited	2008/09	0.85705	-0.15029	-0.14155	-0.00875	Under Valued
		2010	3.38151	0.61152	7.22101	-6.60950	Under Valued
6	Abbot Laboratories	2007	0.87804	0.33298	0.37119	-0.03821	Under Valued
		2008/09	1.14738	-0.24728	-0.18737	-0.05991	Under Valued
7	Murree Brevery	2007	0.12685	0.12972	0.72776	-0.59803	Under Valued
		2010	-0.90271	-0.00665	0.80871	-0.81536	Under Valued
		2006	1.17546	-0.04655	0.06300	-0.10955	Under Valued
8	Adamjee Insurance	2007	1.35021	0.46074	1.11128	-0.65054	Under Valued
		2008/09	1.57933	-0.39157	-0.26951	-0.12206	Under Valued

Discussion

Unlike table 1 which gives the slightly different results, table 2 and 3 gives altogether different results. The outcomes are either over valued or undervalued with a massive variation. The intensity of difference in results verifies from few percent to many times. The findings showing huge difference in actual and expected returns comprise over 90% of the sample. The findings seen in literature are in line with the findings of this research. Hui and Chistopher (2008) gives the same results. Our findings are also confirmed with the Groenewold and Fraser (1997), Fraser and Hamelink (2004) stated that the CAPM is not applicable to most of the stocks. So by comparing the results with previous researches and on the basis of our own findings, we conclude that the CAPM is not an applicable model for the calculation of expected returns of the stocks and it might mislead the investors in pricing the underlying securities in most of the cases.

CONCLUSION

This research study is conducted to find the applicability of Capital Assets Pricing Model on Pakistan stock exchanges and Karachi Stock Exchange being the largest and oldest stock exchange of the country is taken as the case study. For this study a sample of 10 companies are taken from the KSE-100 Index and cover a total period of 5 years (2006-2010). The abnormal period of the stock exchange index is excluded from the study. The results of this study show that the CAPM does not give the accurate results when applied to the Pakistan Stock Markets. Out of the total 51 observations, only five gives the slightly different results which may cause the acceptance of this Model. The remaining 46 observations give totally different results in the form of highly over valued or highly undervalued returns. The findings showing great variation in the values comprises over 90% of the sample. The intensity of difference varies from few percent to many times. On the basis of these findings we suggest that the CAPM is not applicable on the Pakistan Stock Markets (KSE) in full extent. The rate of returns calculated by using CAPM cannot be used in decision making by the investors as these are not the reliable ones. The findings of this research is also in sequence with the previous

findings of Eatzaz and Attiya (2008), Hanif and Bhatti (2010) on Pakistan Stock markets, Hui and Christopher (2008) on Japanese stock markets, Groenewold and Fraser (1997), Fama and French (1992) on the US Stocks.

To wind up, the CAPM is not a reliable Model to measure the risk and return on the stock prices of Pakistan Stocks traded on KSE. In future the CAPM may be tested on different markets with different stocks by using the dividends on the stocks in addition to the capital gains. Furthermore the same study can also be conducted by using more sophisticated and reliable tools like Autoregressive Conditional Heteroscedasticity (GARCH) Model or Arbitrage Pricing Theory (APT) which are considered the multifactor Models as compared with the CAPM.

Appendix
Complete Result of the Sample

S. No	Company Name	Year	Beta	Expected Returns (CAPM)	Actual Returns (P2-P1/P1)	Difference	Under/Over Valued
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		2008/09	1.49310	-0.36276	-0.41137	0.04861	Over Valued
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		2008/09	1.57933	-0.39157	-0.26951	-0.12206	Under Valued
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