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Testing the Capital Asset Pricing Model on Karachi Stock Exchange

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ABSTRACT

The objectives of the paper to evaluate the performance of Capital Asset Pricing Model. applied to company's stocks listed on Karachi stock exchange. The data set contains fifty companies regularly listed in the Karachi Stock Exchange for the period from January 2003 to December 2012.Simple regression model was applied on CAPM. The Results of the Regression indicates that Independent variables market premium, enable us to capture the average returns over the period. CAPM model are correct to serve as proxy for risk.The findings regarding the intercept, as it is signifying-can't different from zero in most periods, weakens the above results and poses a challenge to the applicability of the CAPM. We suggested that researcher should use the another's models such as GARCH and Fama and French Models to make a comparison of results with those based on CAPM.

Key Words: *CAPM, Karachi Stock Exchange, Risk Premium, Beta, Systematic Risk*

INTRODUCTION

Investors invest in stocks whose expected return is high and want to estimate the value of investment. Forecasting of expected return and risk is a financial decision through which an investor decides for investment. In today market there are two main ideas for investment presented by Harry Markowitz and William F. Sharpe. According to Harry Markowitz, high expected return requires high risk exposures. On the other side William F. Sharpe idea is, in the diversified portfolio risks link with individual stocks can cancel each other, the high risk is not link with high expected return. Sharpe's CAPM define that the market beta and stock returns has linear grouping, here compensation given to investors for systematic risk not for unsystematic risk, Un systematic risk can be removed through variation. The CAPM was the first factor model. "While the CAPM recognized risk to a single systematic factor, arbitrage pricing theory (APT), presented by Stephen Ross, constructed a firm theoretical base for the existence of numerous systematic sources of risk and return, and delivers the way for the multi-factor models of today. To calculate the market risk premium and find the factors which can define the prices of risk we have to find the linkage between stocks returns and Beta, in Karachi stock exchange.

The CAPM is used for the forecasting of cost of capital and managed portfolios performance assessment. Actually the CAPM was presented four decades ago by Sharpe (1964) and lintner (1965) but still using in today time for these purposes. Harry Markowitz (1959) developed Capital Asset Pricing Model for portfolio. In this model a portfolio at time *t*-1 is selected that generate a stochastic return at time *t*. the postulation of this model is the investors don't like risk. The investors only think about the average return and risk of one period investment return when the select the portfolio for investment. The outcome is, investors chose 'average return-risk-efficient' portfolios that is the portfolios diminish the difference of portfolio return, assumed predictable return, and enhance predictable return, given variation. Thus, the tactic of Markowitz is also termed 'mean variance model'.

The investigational outcomes that the intersects of CAPM differ statistically from zero have obviously controlled to the tentative analysis of multifactor asset pricing models Aldaarmi*et al* (2015). The fundamental approach has been to introduce supplementary factors in the form of surplus returns on portfolios and then re-test the zero-intercept hypothesis. Fama & French (1993) used this approach and concluded that the estimates of the Capital Asset Pricing Model intercepts deviate from 0 (zero) for portfolios created on the basis of the relationship of book-value to market-value of equity (BE/ME). An approximation for beta is obtained, using a simple regression and this estimate is multiplied by an estimate of the risk premium on the market to obtain an estimate for excess return on given portfolio.

REVIEW OF LITERATURE

Black *et al* (1972) and Fama *et al* (2004) found out the evidence that beta and average return have a linear relationship; for higher beta, the firm will give higher return and there will be high risk involves for higher beta therefore, the firm will give high return.

Basu (1977) exposed "CAPM underestimates the future returns on high earnings to price stocks. They also cited Banz (1981) where there was an appearance of the size effect that demonstrated the inability of the CAPM to capture returns of small stocks. Small size firms have higher average returns than large size firms; small firm's gives better returns on the basis of systematic risk."*Jagannathanet al* (1995) found out that stocks with high book-to-market equity ratios had returns that were not captured by market betas (CAPM).

Ferson and Harvay (1991) concluded from US stocks and bonds returns that the variation in market risk premium for beta is more important. But Fama & French (1992) observed that single-factor model is inadequate to explain stock's returns. It doesn't fit in the real world, because there are several other factors affecting the stock return for example size, B/M ratios, P/E ratios, leverage ratios. Moreover, according to them, the market portfolio in CAPM doesn't take into consideration the real world assets. Therefore, it cannot explain true risk and the expected return of an investment.

Iqbal and Brooks (2007) observed that the systematic risk varies according to market conditions i.e. the systematic risk for bullish-market is different from systematic risk in bearish-market.

Pettengil, *et al*(1995) observed that the inconsistent results of studies testing relationship between risk and return is due to the conditional nature of the relationship between the beta and realized returns. According to them, when the realized returns are used, the relationship between beta and expected returns is conditional on the excessive market returns. They concluded that positive relationship exists between beta and returns during up-market and negative relationship exists during down-market. Crombez and Vennet analyzed the conditional relationship between stocks return and beta at Brussels Stock Exchange during period 1990 to 1996. They found that beta is significant variable in both upward potentials in bullish market and downward risk in bearish market.

Fama & French (1992) found that beta has little or no ability in explaining variation in stock returns that is why they use variables such as size of the firm and the book-to-market value of equity to make variation in stock returns more reliable.

Fama & French (1993, 1995, 1996 & 1998) Of note is the paper by Fama & French (1998) which documents international evidence of their model in a set of thirteen major developed markets (including the US and Australia) and sixteen emerging markets (including Brazil, Greece and India). Further, Chui and Wei (1998) confirm the obvious deficiency of a relationship between return and beta in five Pacific Basin rising markets.

Pedro and Ocampo, (2003) tested the three factor model developed by Fama and MacBeth to found risk return relationship. They tested both unconditional as well as conditional CAPM. The results strongly supported conditional CAPM relationship between risk and returns but found weak relationship between risk and returns for unconditional CAPM.

Tang and Shum (2004) conducted a study to test CAPM validity at Singapore stock market over the period 1986 through 1998. The sample included 144 listed stocks at Singapore Stock Exchange. The unconditional test showed weak positive relationship between risk and returns while the conditional test found significant relationship between risk and realized returns.

Gharghori*et al* (2012) compared the explanatory power of the single index model with the multifactor asset pricing model of Fama and French (1993) for Hong Kong, Korea, Malaysia and Philippines. They found that the size effect and book to market effect are present in these markets and that the FF three-factor model explained the variation in returns better than the single index model. They suggested that the premium is a compensation for risk that is not captured by the CAPM."

DATA AND METHODOLOGY

The objectives of the paper to evaluate the performance of Capital Asset Pricing Model. applied to company's stocks listed on Karachi stock exchange All of the data has taken from the websites of KSE (Karachi Stock Exchange), business recorder, yahoo finance and State Bank of Pakistan website. The data set contains fifty companies regularly listed in the Karachi Stock Exchange for the period from January 2003 to December 2012. The share prices and market index data have been obtained from Karachi Stock Exchange and annual reports of the companies obtained from their websites. Financial firms which on average have higher leverage like banks, insurance companies are excluded from the analysis because it might change our test result significantly.

This study focuses on individual stock and not considered portfolios. As Berk (1995) argued that ignoring the factors of economy, portfolios creation based on value and size show high expected returns. Another reasons are emerging equity markets where investor lack capital and mostly give priority to invest in individual stock rather than portfolios. In order to conduct study this research base on cross sectional data which sample regression is applied on CAPM. We follow Capital Asset Pricing Model (CAPM). For these accounting variables, we match the accounting data for all fiscal year-ends in calendar year (January 2003–

December 2012). Capital Asset Pricing Model (CAPM) is based on the idea that the returns of individual assets are subjective by the market itself.

CAPM Model Specification:

The CAPM cross-sectional regression on monthly returns against the variables in the following equation:

$$\mathbf{R_i - R_f = \alpha + \beta_1 (R_m - R_f)} \qquad \mathbf{(1)}$$

$\mathbf{R_i}$ **=** Security returns = (previous price – current price)/ previous price or $(p_1 - p_o)/ p_0$

$\mathbf{R_m}$ **=** Return on Market Portfolio = $(Index_1 - Index_o)/ Index_o$

$\mathbf{R_f}$ =Risk free rate = T-bill rates.

$\mathbf{R_m - R_f}$**= The** excess return on an individual selected stocks.

$\mathbf{R_m - R_f}$ **=** The excess return on a broad market portfolio.

We have selected fifty firms, for this study, the excess the returns of these companies are our dependent variable (Ri–Rf) and independent variable is Market premium(Rm–Rf). we have taken monthly stock prices in order to obtained monthly returns for the specified period. The exposures for each stock must be estimated with a regression of the stock's returns for a nine year. The regression model is a conventional one, resulting in an alpha, Beta, R-square, adjusted R-square, F-values and T-values, and an error term for each stock. The error term is a normally distributed variable with a zero mean.

ANALYSIS AND RESULTS

The result of the regression analysis is given in the table 1. Individual excess security returns are dependent and market excess returns is our independent variable (Khan *et al*, 2016). From these result the following relationship can be established.

Security Risk Premium = α + β (Market Risk premium)

Table 1: **Analysis of CAPM**

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.791340538					
R Square	0.626219847					
Adjusted R Square	0.619662301					
Standard Error	0.051344491					
Observations	59					
ANOVA						
	Df	***SS***	***MS***	***F***	***Significance F***	
Regression	1	0.251752	0.251752	95.49606	8.69E-14	
Residual	57	0.150267	0.002636			
Total	58	0.402019				

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	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.011511356	0.007067	1.628914	0.108846	-0.00264	0.025663
X Variable 1	0.911531205	0.093278	9.772208	8.69E-14	0.724745	1.098317

SRP = α + β (MRP)
SPR = 0.011+ 0. 0.911 MRP
From the result of regression investigation, we can say that a 100% change in market returns leads to 91.1% positive change in our security returns.

R^2 is the coefficient of determination and is defined as the proportion of the total variation in dependent variable explained by the variation in independent variable. If $R^2$was closed to 1 this would mean perfect correlation, whereas, if it was closed to 0, it would mean that the independent variables would not have any explanatory power on the dependant variable. The actual value determined for R^2 is 0.626 (i.e. 62.6 %) which suggests that the model is good in explaining the size effect.

In ANOVA value of regression sum of squares are greater than their residual sum of squares value signifying that the dependency between variables has a good fit.

Table 2: **Probability Value**

A	t(α)	P-value	B	t(β)	P-Value	F-value	R-Square	Adjusted R-Square
0.01151	1.6289	0.1088	0.9115	9.7722	8.6897E-14	95.4960	0.6262	0.6196

In the given table 2, P-value for α (alpha) is 0.108 we can say that parameter **α** (alpha) is insignificant. This value demonstrates that the model is a good model for stock valuation.

Regression outcome

Appendix-A, given at the last page, shows regression result for fifty companies, which are listed in Karachi stock exchange. First we calculate average monthly returns from stock price. Using CAPM approach calculating parameters, R-square and P-values through simple regression, we are tracing the significance and insignificance of parameters through P-value, in aapendix-A , out of fifty regression results there are five companies alphas (α) are insignificant and the rest are significant. CAPM approach strongly relies on alpha (α), but here out of fifty companies forty becomes significant and the rest is insignificant.
R-square = 0.62, means that 62.6 % variation in stock returns are due to explain variable and the rest are unknown.

CONCLUSION

The objectives of the paper to evaluate the performance of Capital Asset Pricing Model. applied to company's stocks listed on Karachi stock exchange. The data set contains fifty companies regularly listed in the Karachi Stock Exchange for the period from January 2003 to December 2012. The method adopted is similar to Fama and Macbeth (1973) approach of cross-sectional regression of estimated betas on excess returns. Financial firms which on average have higher leverage like banks, insurance companies are excluded from the analysis because it might change our test result significantly. Simple regression model was applied on CAPM. Using CAPM approach calculating parameters, R-square and P-values through simple regression, we are tracing the significance and insignificance of parameters through P-value. CAPM approach strongly relies on Alpha and our regression result indicates that out of fifty company'salpha, there are only five company's alpha were insignificant and the remaining were significant which indicates, as most Intercept are significant different from zero in most periods, weakens the above results and poses a challenge to the applicability of the CAPM. The Results of the Regression indicates that Independent variables market premium, enable us to capture the average returns over the period. CAPM model are correct to serve as proxy for risk. The findings regarding the intercept, as it is signifying-can't different from zero in most periods, weakens the above results and poses a challenge to the applicability of the CAPM. We suggested that researcher should use the another's models such as GARCH and Fama and French Modelsto make a comparison of results with those based on CAPM.

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Appendix -A

Firms	**A**	**t(α)**	**P-value**	**B**	**t(β)**	**P-Value**	**F-value**	**R-Square**	**Adj. R-Square**
GADT	(0.0132)	(0.9368)	0.3529	0.8769	4.7116	0.0000	22.1990	0.2839	0.2711
BNWM	(0.0012)	(0.0687)	0.9455	0.4891	2.1378	0.0369	4.5702	0.0755	0.0589
IBFL	0.0043	0.2240	0.8235	0.8704	3.4820	0.0010	12.1243	0.1780	0.1633
ACPL	0.0155	1.0082	0.3176	0.5653	2.7794	0.0074	7.7251	0.1194	0.1039
BWCL	(0.0011)	(0.0621)	0.9507	0.9824	4.2281	0.0001	17.8772	0.2388	0.2254
CHCC	(0.0037)	(0.1554)	0.8771	0.7393	2.3795	0.0207	5.6618	0.0904	0.0744
DGKC	(0.0033)	(0.2695)	0.7885	1.1812	7.3606	0.0000	54.1782	0.4873	0.4783
FCCL	(0.0135)	(0.6292)	0.5317	1.1780	4.1478	0.0001	17.2038	0.2318	0.2184
LUCK	0.0365	1.1748	0.2450	1.7337	4.2266	0.0001	17.8638	0.2386	0.2253
MLCF	(0.0122)	(0.7332)	0.4664	1.0638	4.8387	0.0000	23.4128	0.2912	0.2787

PHMP	0.0706	1.0524	0.2971	1.7654	1.9932	0.0510	3.9728	0.0652	0.0488
PAKT	0.0073	0.2899	0.7730	0.9642	2.8979	0.0053	8.3976	0.1284	0.1131
ATRL	0.0256	0.6296	0.5314	1.5114	2.8160	0.0067	7.9300	0.1221	0.1067
NRL	0.0050	0.1782	0.8592	1.2962	3.5124	0.0009	12.3372	0.1779	0.1635
PRL	(0.0029)	(0.1328)	0.8948	1.1524	4.0678	0.0001	16.5469	0.2250	0.2114
KESC	(0.0374)	(1.2986)	0.1993	1.0265	2.7035	0.0090	7.3088	0.1137	0.0981
PSO	(0.0122)	(1.5478)	0.1272	0.8555	8.2128	0.0000	67.4504	0.5420	0.5340
SHELL	(0.0063)	(0.4596)	0.6475	0.7160	3.9666	0.0002	15.7343	0.2163	0.2026
SNGP	(0.0357)	(1.7096)	0.0928	0.9678	3.5126	0.0009	12.3385	0.1779	0.1635
SSGC	(0.0224)	(1.7910)	0.0786	0.9806	5.9503	0.0000	35.4056	0.3832	0.3723
MARI	0.0294	0.7889	0.4334	1.5628	3.1721	0.0024	10.0623	0.1500	0.1351
OGDC	(0.0121)	(0.9783)	0.3320	1.1414	6.9870	0.0000	48.8185	0.4613	0.4519
POL	(0.0166)	(1.0980)	0.2768	1.2797	6.4208	0.0000	41.2264	0.4197	0.4095
INIL	0.0021	0.0983	0.9220	0.6645	2.3335	0.0232	5.4450	0.0872	0.0712
AGTL	0.0061	0.4900	0.6260	0.6897	4.1874	0.0001	17.5344	0.2353	0.2218
ATLH	0.0126	0.6783	0.5004	0.5582	2.2786	0.0265	5.1921	0.0835	0.0674
HCAR	(0.0256)	(1.2029)	0.2340	1.4541	5.1777	0.0000	26.8081	0.3199	0.3079
INDU	0.0050	0.3860	0.7009	1.0219	5.9912	0.0000	35.8945	0.3864	0.3756
MTL	0.0010	0.0810	0.9358	0.4009	2.4932	0.0156	6.2161	0.0983	0.0825
PSMC	0.0086	0.5372	0.5932	0.8492	4.0044	0.0002	16.0349	0.2196	0.2059
ENGRO	(0.0018)	(0.2305)	0.8185	0.6512	6.2928	0.0000	39.5991	0.4099	0.3996
FFBL	(0.0009)	(0.0781)	0.9381	0.8881	5.9969	0.0000	35.9630	0.3869	0.3761
FFC	(0.0084)	(0.9780)	0.3322	0.4615	4.0548	0.0002	16.4417	0.2239	0.2103
PKGS	0.0064	0.5771	0.5661	0.5798	3.9336	0.0002	15.4735	0.2135	0.1997
BATA	0.0597	1.0882	0.2811	0.8630	1.1915	0.2384	1.4196	0.0243	0.0072
NESTLE	0.0993	0.6786	0.5001	2.2801	1.1802	0.2428	1.3929	0.0239	0.0067
ULEVER	(0.0025)	(0.4358)	0.6647	0.3124	4.0530	0.0002	16.4271	0.2237	0.2101
GHGL	0.0007	0.0501	0.9602	0.3908	2.1885	0.0327	4.7895	0.0775	0.0613

ABOT	(0.0001)	(0.0051)	0.9960	0.5750	3.1269	0.0028	9.7774	0.1464	0.1314
ICI	(0.0044)	(0.3747)	0.7093	1.0469	6.7370	0.0000	45.3877	0.4433	0.4335
SIEM	0.0168	1.0934	0.2788	0.5431	2.6744	0.0098	7.1523	0.1115	0.0959
THAL	0.0237	1.2325	0.2228	0.6396	2.5239	0.0144	6.3702	0.1005	0.0847
NML	(0.0019)	(0.1283)	0.8983	1.5866	7.9490	0.0000	63.1868	0.5257	0.5174
COLG	0.0464	1.6660	0.1012	0.1830	0.4976	0.6207	0.2476	0.0043	(0.0131)
PSEL	0.0341	1.4767	0.1453	0.7291	2.3935	0.0200	5.7289	0.0913	0.0754
LOTPTA	(0.0329)	(2.7178)	0.0087	1.0551	6.5988	0.0000	43.5441	0.4331	0.4231
KOHE	(0.0268)	(1.5267)	0.1324	0.4445	1.9180	0.0601	3.6788	0.0606	0.0441
HUBC	(0.0217)	(2.5080)	0.0150	0.6147	5.3825	0.0000	28.9711	0.3370	0.3254
GATI	0.0036	0.1484	0.8826	0.4630	1.4654	0.1483	2.1475	0.0363	0.0194
DREL	0.0309	0.8563	0.3954	0.8412	1.7643	0.0830	3.1128	0.0518	0.0351
PNSC	0.0123	0.5272	0.6001	1.6017	5.1842	0.0000	26.8761	0.3204	0.3085