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Validity of Capital Assets Pricing Model (CAPM)

(Empirical Evidences from Amman Stock Exchange)

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Abstract

The purpose of this study is to test the validity of CAPM in Amman Stock Exchange (ASE) during the period (2010 – 2014), which was divided into three sub periods. We used monthly returns of 60 stocks of Jordanian companies listed in ASE. Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) methods were used to test the CAPM in different study sub-periods. The analysis results showed that higher risk (beta) is not associated with higher levels of return, which violated the CAPM assumption. Results of the study leads to contradict the theory's assumption that beta coefficient is a good toll to predict the relationship between risk and return; hence the beta coefficient of some portfolios in the three sub periods was not significant. In addition, the results of testing SML violated the CAPM assumption in the three sub periods that, the slope should be equal to the average risk premium. Finally, tests of nonlinearity of the relationship between return and betas validated the CAPM hypothesis, that the expected return-beta relationship is linear. Depending on the above results, we couldn't find conclusive evidence in support of CAPM in ASE.

Keywords: CAPM, Beta, Portfolio return, SML, Nonlinearity, Amman Security Exchange (ASE)

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1. Introduction

CAPM (Capital Asset Pricing Model) model is based on the Markowitz modern portfolio theory which was further developed by William F. Sharpe (1963 and 1964) and John Linter (1965). The model used to calculate the return of the financial security depending on three factors: risk free (RF), return of market (Rm) and risk of company measure by beta coefficient (Reily and Brown, 2006). The CAPM assumes that expected rate of return on any asset is related with systematic risk in a positive linear relationship, which means stocks with high returns have high risks (Biligin and Basti, 2011). The model that represents this relation was first proposed independently by John Linter, William F.Sharpe and Mossin, J, as follows:

$$R_{ei} = R_f + \beta i\ (R_m - R_f)$$

Where: R_{ei} is the expected rate of return on company stock i, R_f is the risk free which represents return on treasury bills issued by central bank, βi is Beta coefficient of company i, R_m is expected return on market portfolio. Depending on CAPM the expected return on any stock depends on the value of Beta coefficient of the stock and the positive relationship between value of beta stock and stock return. So, beta coefficient is an indicator for the direction and sensitivity degree of company rate of return to market return. This means that a company with beta equal to (1) has a rate of return moving in the same direction and value with the market return. On the other hand, a company with beta bigger than (1) this means its rate of return moves faster than market return, where as a company with beta less than (1), this means its return moves slowly comparing with market return. Moreover a company with negative beta has a rate of return moves in the opposite direction of the market return, which means when the performance of market increase the performance of the company stock will decrease (Sharpe, 1964). Accordingly, investors use beta coefficient to construct their portfolios and to evaluate the investments opportunities to achieve higher returns on their investments.

Since CAPM was introduced, many researchers conducted several studies to test the validity of CAPM; some of these studies supported the CAPM (Jacob, 1971, Fama & MacBeth, 1973), while others didn't support the model (Tinic & West, 1984, Fama & French 1992 and 1993). Fama and French (1992) provide evidence that CAPM has no ability to predict stock returns depending on beta coefficient; the results of their study showed that, additional factors beside beta effect company return such as, company size, book -to- market ratio. The CAPM faced a lot of critics in the last 60 years, but in spite of these critics we can't eliminate the importance of CAPM in explaining the relationship between risk and return. CAPM still the most important challenge in finance field, because the model was designed to explain the variations in returns of different assets. According to the theory the reasons of variations are due to the differences in risk degrees of the return on these assets.

In general, all previous studies regarding CAPM were aimed to achieve two objectives, firstly: How to test the validity of CAPM using statistical analysis to reach conclusive results in order to accept or refuse the model. Secondly: How to provide information about financial assets or projects in order to help investors take financial decisions, through using the model

to construct portfolios and choose its assets. But there is still a great debate on the empirical validity of CAPM in finance literature; therefore an attempt is made to see if systematic risk beta as independent variable can explain the variation in stock returns in Amman Stock Exchange (ASE). The study outline will be as follows: (1) Introduction; (2) Review of previous studies on empirical evidences on CAPM; (3) Objectives of the study. (4) Data and methodology; (5) Testing CAPM; (6) Empirical results and discussion; (7) Summary and conclusions.

2. Literature Review

The Capital Assets Pricing Model (CAPM) is the most famous asset pricing model in finance literature. It states that the return of a stock is influenced by only one single factor, i.e. the return on the market. The risk of an asset can be measured by its responsiveness to that single factor. If the systematic risk and return relationship implied in this basic model could be validated in real world stock markets that would be a true revolution in finance (Bilgin and Basti, 2014).

Since CAPM was developed half a century ago, many researchers in finance field tries to test its validity in order to evaluate its ability in explaining risk-return relationship in stock markets. Some of these studies results supported the model while others contradicted the supportive results. One of the earliest studies supported this model is the one developed by Black, Jensen and scholes (1972). In their study, they formed portfolios of all stocks of the New York Stock Exchange over the period 1931-1965, instead of individual stock return, to eliminate or reduce the company unsystematic risk in order to deal with effect of systematic risk on returns, which can measure by beta coefficient. This method will reduce the statistical errors that may appear when estimating beta coefficient. Their findings showed a linear relationship between average excess portfolio return and the beta, and portfolios with high beta have higher returns, while portfolios with lower beta have lower returns. Fama and MacBeth (1973) extended the work of Black et.al (1972) and reached the same results.

However, succeeding research contradicted the supportive results of initial studies (Banz, 1981; Fama and French, 1992). Some studies has been conducted in the early eighteen gave evidences that CAPM validity is weak in explaining the relationship between risk and return, and proved that this relation is not linear. Hence there are other factors that affect the relation which CAPM didn't take in consideration.

Banz (1981), tested the CAPM to measure the effect of company size in explaining the rest of return which beta couldn't explain. He concluded that company size explained the return for some stocks better than beta coefficient, and he found that return of stock of small companies is higher than return of large companies. After that, more researchers (Fama and French, 1992, Davis, 1994) tested others factors which may influence the relationship between risk and return, such as; EPS, financial leverage, book-to-market ratio. Their results supported Banz findings.

In 1992 Fama and French adopted Banz findings in their study; they found that results of Banz study could be very important in explaining the relationship between risk and return, in

spite of the fact, that they used the same methodology used in Fama and MacBeth study (1973), which supported the CAPM. They reached contradictory results that proved that there is no relationship between beta coefficient and stock return. But later, Fama and French study (1992) faced more critics, the most of which was regarding the data used in their study.

Kothari et al (1995) said that Fama and French results depend basically on explaining the statistical results only, but Amihudm et al (1992) and Black (1993) supported the concept that the distorted data couldn't be reliable to deny CAPM. They confirmed that when using efficient statistical method, the expected results regarding the relationship between risk and return will be significant and positive. In addition to that, Black (1993) mentioned in his study that the effect of firm size in Banz study may appear in some periods and disappear on others.

In spite of critics against Fama and French study (1992), more studies call for new models beside CAPM to evaluate stock. Jagannathan and Wang (1996) said that results of Fama and French (1992) are not important, they assumed that lack of practical evidence on validity of CAPM may refer to the basic assumptions which were adopted to test CAPM for example, most of studies which tested CAPM assumed that indexes return in financial markets are the best measures of assets returns in macroeconomics, but this assumption is not accurate. Depending on the inconclusive results of validity of CAPM, many studies in developing and emerging markets has been made to test the validity of this model, in order to adopt or deny it, in explaining the relationship between risk and return. Hence many investors adopted this model to predict the expected return of any stock, and here are some of these studies:

Ocampo (2004) tested the validity of CAPM in Philippine equity market by using monthly returns of stocks during 1992 – 2002. He used traditional and conditional approach; the results showed that validity of CAPM through traditional approach is not applicable in explaining the relationship between beta and return, while using conditional approach, the results proved significant effect of beta in explaining stock return.

Grigris et al. (2006) tested the validity of CAPM in Athen's securities market, by using weekly return of 100 companies. They constructed 10 portfolios, each portfolio contains 10 companies in order to calculate beta for each portfolio, they tested the relationship between beta and portfolios returns, their results showed that portfolios with high beta didn't earn high returns, and the intercept (α) of the model is not equal to zero, which means that CAPM is not valid in explaining the relationship between risk and return in Athen's security market.

Yang and Donghui (2006) tested CAPM in the Shanghai stock exchange during 2000 – 2005. They used weekly stock returns from 100 companies, methods of time-series test and cross-sectional test were used, and they found linear relation between expected returns and betas, which implies a strong support of the CAPM hypothesis. But in testing the intercept and the slope, the results proved that CAPM is not valid in Chinese stock market.

Loukeris (2009) tested the validity of CAPM in London stock market for the period 1980 – 1998 by using two step regression procedures of 39 stocks, the results showed that the cross section of average excess security return is positively related to beta. But when using the two

step regression procedure into CAPM, the result showed that the slope of the security market line is different from the slope of SML indicated by CAPM, which means that CAPM hasn't a statistical significance in portfolio selection.

Choudhary and Choudhary (2010) tested the validity of CAPM in India equity market during the period 1996 – 2009 through 278 companies listed on the Bombay stock exchange, they used Black et al (1972) methodology through constructing portfolios and conducting time series test of the CAPM, which based on the time series regressions of excess portfolio return on excess market return, their results showed that; (1) higher risk (beta) is not associated with a higher level of return and this result don't support the CAPM theory. (2) The CAPM's prediction for the intercept and the slope of the equation is contradictory with the CAPM hypothesis. (3) The relationship between beta and expected return is linear.

Bilgin and Basti (2011) tested the validity of CAPM in Istanbul stock exchange during 2006 – 2010 for 42 company stock, they adopted Fama and McBeth's (1973) unconditional testing approach, and they used monthly returns of stock. Their results indicated that there is no meaningful relationship between betas and risk premiums, which means CAPM is not valid in (ISE).

Khan et al. (2012) tested the CAPM in Pakistan stock exchange during the period 2006 - 2010 by using ten companies stock, they calculated beta of each company and its expected return, then they compared the expected return with the actual return, their results indicated that CAPM is not applicable to Pakistanian stock exchange.

Bilgin and Basti (2014) gave further evidence on the validity of CAPM in Istanbul stock exchange by testing both the unconditional and conditional versions of CAPM during the period 2003-2011, through dividing the test period into four sub-periods, their results indicated that unconditional CAPM is rejected for the sample period, while the test of conditional CAPM indicated a statistically significant conditional relationship during some sub-periods. But since the relationship between risk and return in up and down markets is not symmetric, this conditional relationship doesn't indicate a positive relation between risk and return, according to these results, CAPM may not be a useful tool to measure the relationship between risk and return in ISE.

Depending on the previous studies mentioned above, we can conclude that some of these studies supported the CAPM while others don't. As we noticed, all studies used different methods in testing the validity of the model, some used unconditional CAPM while others used conditional CAPM, and thus the results are inconclusive.

Jordan stock market is consider as one of the emerging markets in the Middle East, and for the knowledge of the researchers, it has not been subject to any study conducted in this market to test the validity of CAPM. Therefore this study aims to make a contribution to CAPM literature by testing the validity of the model in its unconditional form and if the risk-returns relationship proposed by CAPM exists in Amman Stock Exchange (ASE).

3. Objectives of the study

The objective of this study is to examine whether the CAPM holds true in Amman Stock Exchange. More specifically, the study aims to:

- Examine whether a higher/lower risk stocks yields higher/lower expected rate of return.
- Examine whether the slope of security market line equal to the average risk premium.
- Examine whether the expected rate of return is linearly related with the stock beta, i.e. its systematic risk.

4. Data Selection and Methodology

This study will cover the period 1st January 2010 to 31 December 2014. We intentionally started from 2010 to avoid the effects of the world economic crises on stock market which occurred in 2008 and 2009. (221) companies were listed in ASE in year 2010 (ASE website). (98) Company has been chosen, according to the following conditions that match our requirements: (1) Company must not be exposed to the merger during the study period. (2) Company didn't pay stock dividends. (3) Company didn't reduce its capital. (4) Company didn't have new opening price for its stock as a consequence of private underwriting. To test the validity of CAPM only (60) Companies were randomly selected from the (98). The study used the monthly closing stock prices to calculate the rate of return of each stock, and the monthly closing values of Amman Stock Market index as proxy for the market return (source of data from ASE website). Furthermore the returns on 6 months treasury bills of government of Jordan central bank were incorporated as risk free for the years (2010-2012). Since data for the years 2013 and 2014 were not available, thus the researchers adopted the risk free return for the two years depending on the risk free return of years (2010-2012) after being converted to monthly return.

5. Testing CAPM

In order to test the prediction of CAPM, we used the same method as Black et al (1972) introduced a time series test; they conducted their study through grouping stocks into portfolios. Justification for grouping stocks into portfolios are (Cochrane, 2005): (1) Using individual stock betas will create a problem of error measurement which will lower regression coefficients. (2) Individual betas vary over the time as the size, leverage and risk of business change. (3) The individual stock return is so volatile that we can't reject the hypothesis that all average returns are the same. (4) Portfolio betas are better measured because the portfolio has lower residual variance. Our study will also use Fama and MacBeth (1973) methodology to test the Non-Linearity. The test of CAPM with portfolios can be conducted in three steps: first step starts with estimating beta coefficient for individual stock using monthly return through regressing each stock's monthly return against the market return according to the following equation:

$$Rit - Rft = \alpha i + \beta i\,(Rmt - Rft) + eit \qquad (1)$$

Where, Rit: is the rate of return on asset i at time t, = (Pt – Pt-1)*100/ Pt-1

Where: P_t = closing price of stock i for month t. P_{t-1} = closing price of stock i for month t-1.

Rft: is the risk-free rate at time t. αi: is the intercept. βi: is the beta of stock i. Rmt: is the rate of return on the market portfolio at time t,

$$= (It - It\text{-}1)*100/\ It\text{-}1$$

Where: It = the index value in the end of month t. It-1 = the index value in the end of month t-1. eit: is the random disturbance term in the regression equation at time t.

The equation can be also express as follows:

$$rit = \alpha\, i + \beta i\ rmt + eit \quad (2)$$

Where:

ri_t: is the excess return of stock i, $=Ri_t - Rf_t$. rm_t: is the risk premium, $=Rm_t - Rf_t$. αi: is the intercept, and the βi: is the beta of stock i.

The study will use the percentage monthly return of company stock and the monthly market return in addition to the risk free return. Then we will regress the company stock return as dependent variable against the market return as the independent variable.

In the second step we will construct the portfolios by using the calculated beta through arranging the individual beta for each stock in the sample on ascending order, and then stocks will be grouped into portfolios with 10 stocks each according to their beta. As we mentioned earlier our sample included 60 companies, so the number of portfolios will be 6. The first portfolio will include 10 stocks with the lowest beta, and the second portfolio will include the next 10 stocks with the second highest beta, and so for the other portfolios until we reached portfolio number (6) with the highest beta. Also, we divided the sample period for three sub periods. The first portfolio formation period begin from 1st January 2010 to 31st December 2011 (24 observations). In initial estimation period we calculate the monthly returns of each portfolio in year (2012) for portfolios estimated. The same procedure is adopted for next formation period (see table 1 below).

Table 1. Portfolio Formation, Estimation and Testing Period

Beta estimation period	**2010 - 2011**	**2011 - 2012**	**2012 - 2013**
Portfolio formation period	2011	2012	2013
Testing period	2012	2013	2014
No. of stock	60	60	60

In this step the portfolios betas were calculated by using the following model:

$$r_{pt} = \alpha_p + \quad \beta_p r_{mt} + e_{pt} \quad (3)$$

Where:

r_{pt} : is the average excess portfolio return on time t, = Σ Rs / 10.

where:

Rs: is the average monthly return for stock s (s = 1,2,…,10), thus we will have for each portfolio 12 observation multiple 6 portfolios equal 72 observation. β_p : is the estimated portfolio beta, rm_t : is the risk premium and e_{pt} : is the error term in the regression equation at time t.

In the third step following calculating the portfolios beta we will estimate the ex post security market line for each testing period by regressing the portfolio return against portfolio betas as follows:

$$r_p = \lambda 0 + \lambda 1 \beta_p + e_p \quad (4)$$

Where:

r_p: is the average excess return of portfolio p. β_p: is the beta of the portfolio P, e_p: is the error term in the regression equation. The theory says that if the CAPM is true, the intercept (λ0) should be equal to zero and the slope SML (λ1) is the average risk premium of the market portfolio.

The study will also test the Non-Linearity between the total portfolio returns and its beta by using the following equation:

$$r_p = \lambda 0 + \lambda 1 \beta_p + \lambda 2 \beta^2_p + e_p \quad (5)$$

According to the theory, if the CAPM is true, the portfolio returns and its beta are linearly related with each other and (λ2) will be equal to zero.

6. Empirical results and discussions

6.1 Calculating the individual stock beta for the sample study

The first step in our study for testing the CAPM started with estimating betas for individual sample stocks by using monthly returns for each period, the results of estimated beta for sub period (1) 2010 – 2011 showed that beta ranged from (1.36 – 3.32). In the second sub period 2011 – 2012 beta ranged from (- 0.02) to (3.25), while in the third sub period 2012 - 2013 beta ranged from (- 0.19) to (2.98). As a result we can conclude that beta is varying during the study sub periods.

6.2 Testing CAPM through portfolios

6.2.1 Sub period 2010-2011

In this step we tested the portfolios for the year 2012, which we constructed during the first sub period 2010 – 2011, by using equation number (3), to calculate the portfolio beta. The results shown in Table (2), (portfolios were arranged in a descending order regarding beta value). From the table, it is clear that portfolio (P1) with highest beta (1.19) attained the highest return at (0.0960), and portfolio (P6) with the lowest beta (0.23) attained a return of (-0.0709), therefore, we conclude that this result support the CAPM hypothesis, i.e., higher risk beta is associated with higher rate of return, but if we look at portfolio (P2) its beta is (1.16) and its return is (0.31), which means that its beta is lower than beta of (P1) but its return nearly was three times more than (P1). Also if we go through the other portfolios (P3, P4, P5)

we will see that Portfolios P3 and P4 have beta of (1.12 and 0.88) respectively with negative returns (- 0.1720, - 0.1212), but portfolio P5 has lower beta than those portfolios with positive return. Accordingly, this result is inconsistent with the argument of CAPM, i.e., that higher risk beta is associated with higher rate of return. Also table (2) shows that all constants of all portfolios are not statistically significant, except portfolio (P2). The constant of portfolios (P1, P2, P5) have positive values, while portfolios (P3, P4, P6) have negative values. This means that alpha coefficient is significantly not different from zero; thereby we accept the null hypothesis. Also if we have a look at the estimated beta of portfolios, we can see that they are statistically significant in (P2, P3, P4) only, and this lead to reject the null hypothesis in three Portfolios and accept it in the others. Accordingly, we can say that, these results are inconclusive and contradictory; hence the beta coefficient can't be used for predicting the relationship between risk and return in ASE for the sub period 2010-2011.

Table 2. Results of Regression between Average Excess Portfolio Return and Portfolio Betas for First Sub Period 2010-2011

Portfolio	Portfolio Return (rp)	Constant	Beta	P - Value of beta	Standard Error	R^2
P1	**0.0960**	0.013 (0.322)	**1.19**	0.062	0.0435	0.306
P2	**0.3100**	0.031 **(0.021)***	**1.16**	**0.043***	0.0387	0.348
P3	**-0.1720**	- 0.009 (0.170)	**1.12**	**0.002****	0.0209	0.648
P4	**-0.1212**	- 0.006 (0.202)	**0.88**	**0.001****	0.0153	0.661
P5	**0.0388**	0.007 (0.525)	**0.79**	0.112	0.0351	0.233
P6	**-0.0709**	- 0.005 (0.338)	**0.23**	0.317	0.0165	0.102

*, ** significant at 5%, 1% respectively

Estimation of the Security Market Line (SML) for first sub period (2010-2011):

In order to estimate the SML, we used equation number (4); $r_p = \lambda 0 + \lambda 1 \beta_{p+} e_p$. Table (3) shows the results of the estimation of the SML. Depending on t-test we accept the null hypothesis concerning the intercept (λ0), because the absolute t –value (0.671) is smaller than 1.96 and the p-value of t-test (0.539) is greater than (α=0.05). This means that λ0 is statistically not significant and it is equal to zero. This result is consistent with CAPM hypothesis. The t-test of the slope (λ1) accepts the null hypothesis because the absolute t-value (0.782) is smaller than 1.96 and the p-value of t-test (0.478) is greater than (α=0.05), which means that λ1 is not significantly different from zero. The CAPM assumed that λ1 should be equal to the average risk premium, which should be greater than zero. We can conclude that, this result is inconsistent with the CAPM hypothesis and therefore the CAPM is rejected for the first sub period.

Table 3. The Result of The Test of SML for First Sub Period (2010-2011)

	Coefficients	Std error	**t- value**	**p-value**	F	Sig
λ0	- 0.144	0.215	- 0.671	0.539	0.612	0.478
λ1	0.176	0.225	0.782	0.478		

Testing Non-linearity for first sub period:

To test for non-linearity between the portfolios return and its betas, we used equation number (5) $r_p = \lambda 0 + \lambda 1 \beta p + \lambda 2 \beta^2_p + e_p$. Table (4) shows the results, test of intercept indicate that the absolute t-value (0.066) is smaller than 1.96 and the p-value of t.test (0.952) is greater than (α=0.05), this means that we don't reject the null hypothesis which assumed that λ0 equal to zero, therefore this result is consistent with the CAPM hypothesis. Also concerning λ1, the t-test shows that we don't reject the null hypothesis because the absolute t-value (0.375) is smaller than 1.96, and the p-value of t-test (0.732) is greater than (α=0.05), this means that λ1 is significantly not different from zero and this result is inconsistent with CAPM hypothesis, which assumed that λ1 should be equal to the average risk premium. Furthermore, the results shows that the value of λ2 is not significantly different from zero since the absolute t-value (0.520) is smaller than 1.96 and the p-value of T.test (0.639) is greater than (α=0.05), which means that this result is consistent with CAPM hypothesis. Accordingly, this result indicates that the expected rate of return of portfolios and betas are linearly related with each other. Therefore, we can't clearly reject the CAPM.

Table 4. Testing for Non – Linearity for First Sub Period (2010-2011)

	Coefficients	Std error	**t- value**	**p-value**	F	Sig
λ0	0.027	0.406	0.066	0.952	0.385	0.710
λ1	- 0.490	0.305	- 0.375	0.732		
λ 2	0.467	0.897	0.520	0.639		

6.2.2 Second sub period 2011-2012:

In this step we tested the portfolios in year (2013) by using equation number (3) to calculate the portfolio beta; the results are shown in the Table (5). From the table, it is clear that portfolio (P1) with highest beta (1.23) earned the return of (0.2654), and portfolio (P6) with the lowest beta (0.51) earned the return of (- 0.0735). Therefore we conclude, that this result supports the CAPM hypothesis, i.e, higher risk beta is associated with higher rate of return. On the other hand, if we look at portfolio (P2) its beta is (1.07) and its return is (0.0546), which means that its beta is lower than beta of (P1) and earned return nearly four times less than (P1). Also if we go through the other portfolios we will see that portfolio (P4), where its beta is (0.87) and its return is (0.3053), as compared with return of portfolios (P1, P2, P3), where its earned the highest rate of return, though its beta is the lowest. Hence this result is inconsistent with the argument of CAPM, that higher risk beta is associated with higher rate of return.

Furthermore, table (5) shows that all constants of all portfolios are not statistically significant except portfolio (P4). The constant of portfolios (P1, P2, P3, P4, P5) have positive values

while portfolio (P6) have negative value, which means that alpha coefficient is significantly not different from zero except constant of (P4), thereby we accept the null hypothesis for all constants except (P4). Also if we have a look at the estimated beta of portfolios, we can see that they are statistically significant in (P2, P3, P4, P5, P6) except (P1), and this leads to reject the null hypothesis in the five Portfolios and accept it in (P1). Accordingly, we can say that, these results do not fully support CAPM; hence the beta coefficient can be used for predicting the relationship between risk and return in ASE for the sub period 2011-2012.

Table 5. Results of Regression between Average Excess Portfolio Return and Portfolio Betas for Second Sub Period 2011-2012

Portfolio	Portfolio Return (rp)	Constant	Beta	P- Value of beta	Standard Error	R^2	F value
P1	**0.2654**	0.002 (0.457)	**1.23**	0.160	0.0911	0.187	2.306
P2	**0.0546**	0.003 (0.823)	**1.07**	**0.026***	0.0458	0.407	6.858
P3	**0.0967**	0.007 **(0.524)**	**0.99**	**0.009****	0.0349	0.507	10.280
P4	**0.3053**	0.024 **(0.021)***	**0.87**	**0.009****	0.0306	0.507	10.296
P5	**0.0676**	0.005 (0.620)	**0.67**	**0.038***	0.0317	0.363	5.704
P6	**-0.0735**	- 0.007 (0.329)	**0.51**	**0.032***	0.0231	0.384	6.236

*, ** significant at 5%, 1% respectively

Estimation of Security Market Line (SML) for second sub period (2011-2012):

The results for the second sub period are shown in table (6). Depending on t-test we accept the null hypothesis that, λ0 is not significantly different from zero, the calculated value of the intercept is (- 0.006) and the absolute value of t.test is (0.912) which is smaller than 1.96. This means that λ0 is significantly not different from zero and this result is consistent with CAPM hypothesis. Furthermore, from table (6) the t-test of the slope λ1 accepts the null hypothesis because the absolute t-value (0.582) is smaller than 1.96, which means that λ1 is not significantly different from zero. As CAPM assumes, that λ1 should be greater than zero, hence the result is inconsistent with the CAPM hypothesis and the CAPM is rejected during this period.

Table 6. The Result of The Test of SML for Second Sub Period (2011-2012)

	Coefficients	Std error	**t- value**	**p-value**	F	Sig
λ0	- 0.006	0.193	- 0.912	0.413	2.513	0.188
λ1	0.002	0.010	0.585	0.688		

Testing Non-linearity for second sub period (2011-2012):

Table (7) summarizes the results of the test of non-linearity for second sub period as follows: (1) the results show that the intercept λ0 (- 0.048) is not significantly different from zero. The t- value is (-.0746) and P- value (0.210) is greater than (α=0.05), thereby it is consistent with the argument of CAPM. (2) In the case of λ1, the t-value is (0.711) and the P- value is (0.528) is greater than (α=0.05) which means that, it is not significantly different from zero. As CAPM assumes that λ1 should be equal to the average risk premium, hence the result here inconsistent with CAPM hypothesis. (3) Concerning λ 2, the value of coefficient is (- 0.580) and the t- value is (- 0.538) with P- value (0.728) greater than (α=0.05), we can say that λ 2 is consistent with the CAPM hypothesis, and betas are linearly related with return, thereby CAPM is be accepted during the second sub period, but still the results show weakness to fully explain the model.

Table 7. Testing for Non – Linearity for Second Sub Period (2011-2012)

	Coefficients	Std error	**t- value**	**p-value**	F	Sig
λ0	- 0.048	0.768	- 0.746	0.210	1.178	0.419
λ1	0.383	0.857	0.711	0.528		
λ 2	- 0.580	0.079	- 0.538	0.728		

6.2.3 Third sub period (2012-2013):

In this step we tested the portfolios in the year (2014), by using equation number (3) to calculate the portfolio beta. The results are shown in the Table (8). From the table, it is clear that portfolio (P1) with highest beta (2.66) earned rate of return of (0.1145), and portfolio (P6) with the lowest beta (0.34) earned rate of return of (- 0.0240), therefore we can say that this result supports the CAPM hypothesis, i.e., higher risk beta is associated with higher rate of return. But if we look at portfolio (P4) it's beta is (1.10) and its return is (0.14), which means it's beta is lower than beta of portfolios (P1, P2, P3) and in spite of that it earned the highest return. Thus, this result is inconsistent with CAPM hypothesis, that higher risk beta is associated with higher rate of return.

Furthermore, from table (8), it is clear that all constants of all portfolios are not statistically significant. The constant of portfolios (P1, P2, P4) have positive values while portfolios (P3, P5, P6) have negative values, which means that alpha coefficient is significantly not different from zero. Thereby, we accept the null hypothesis for all constants. Also if we have a look at the estimated beta of portfolios, we can see that they are statistically significant in (P1, P2, P3, P5), except (P4 and P6), and this leads to reject the null hypothesis in four Portfolios and accept it in portfolios (P4 and P6). Accordingly, we conclude that, these results are not fully

supporting CAPM; hence the beta coefficient can be used for predicting the relationship between risk and return in (ASE) for the sub period 2012-2013.

Table 8. Results of Regression between Average Excess Portfolio Return and Portfolio Betas for Third Sub Period 2012-2013

Portfolio	Portfolio Return (rp)	Constant	Beta	P- Value of beta	Standard Error	R2	F value
P1	**0.1145**	0.008 (0.527)	**2.66**	**0.001****	0.0414	0.698	23.106
P2	**0.0390**	0.002 (0.838)	**1.55**	**0.011***	0.0374	0.492	9.680
P3	**-0.0394**	- 0.004 (0.492)	**1.26**	**0.001****	0.0198	0.694	22.634
P4	**0.1400**	0.011 (0.074)	**1.10**	0.372	0.0407	0.293	4.147
P5	**-0.1049**	- 0.009 (0.085)	**1.01**	**0.001****	0.0170	0.666	19.906
P6	**-0.0240**	- 0.002 (0.754)	**0.34**	0.316	0.0238	0.100	1.112

*, ** significant at 5%, 1% respectively

Estimation of Security Market Line (SML) for third sub period (2012-2013):

The results for the third sub period are shown in table (9). Regarding t-test we accept the null hypothesis that, λ0 is not significantly different from zero. The calculated value of the intercept is (- 0.064) and the absolute value of t.test is (-0.815) which is smaller than 1.96. This means that λ0 is significantly not different from zero and this result is consistent with CAPM hypothesis. Further from table (9), the t-test of the slope λ1 accepts the null hypothesis because the absolute t-value (1.225) is smaller than 1.96, which means that λ1 is not significantly different from zero. As CAPM assumes that λ1 should be greater than zero, thereby, the result is inconsistent with the CAPM hypothesis and the CAPM is rejected during this period.

Table 9. The Result of the Test of SML for the Third Sub Period (2012-2013)

	Coefficients	Std error	**t- value**	**p-value**	F	Sig
λ0	- 0.064	0.078	- 0.815	0.461	1.501	0.288
λ1	0.064	0.052	1.225	0.288		

Testing Non-linearity for the third sub period (2012-2013):

Table (10) below summarizes the results of the test of non-linearity for sub period 3 as follows: **(1)** the results shows that the intercept λ0 (- 0.038) is not significantly different from zero. The t- value is (-0.232) and P- value (0.831) is greater than (α=0.05), thereby, it is consistent with the argument of CAPM. **(2)** In the case of λ1, the t-value is (0.093) and the P-value (0.932) is greater than (α=0.05), which means it is not significantly different from zero.

As CAPM assumes that λ1 should be equal to the average risk premium, hence the result here is inconsistent with CAPM hypothesis. **(3)** Concerning λ 2, the value of coefficient is (0.014) and the t- value is (0.185) with P- value (0.865) greater than (α=0.05), we can conclude that, λ 2 is consistent with the CAPM hypothesis, and betas are linearly related with return, and hence, CAPM is be Accepted during the third sub period, but still the results show weakness to fully explain the model.

Table 10. Testing for Non – Linearity for Third Sub Period (2012-2013)

	Coefficients	Std error	**t- value**	**p-value**	F	Sig
λ0	- 0.038	0.165	- 0.232	0.831	0.586	0.61
λ1	0.022	0.236	0.093	0.932		
λ 2	0.014	0.073	0.185	0.865		

7. Summary and Conclusion

The purpose of this study was to investigate the validity of CAPM in Amman Stock Exchange (ASE) for the period (2010 – 2014), by using monthly rate of return of 60 stocks of Jordanian companies listed in ASE. The researchers tested the CAPM for different study sub-periods by using 6 portfolios each have 10 stocks. The findings of the study led to the following **conclusions**:

- The test for the CAPM hypothesis that higher risk beta is associated with higher rate of return is violated in the three sub periods. This result is in line with studies results of (Grigris et al. 2006; Choudhary and Choudhary, 2010).
- The test for the CAPM hypothesis that alpha coefficient is significantly not different from zero is accepted in the three sub periods, thereby we accept the null hypothesis for all constants. This result is not in line with studies results of (Grigris et al. 2006; Yang and Donghui, 2006; Choudhary and Choudhary, 2010).
- The test for the CAPM hypothesis that beta coefficient is a good toll to predict the relationship between risk and return did not fully support the CAPM, hence the beta coefficient of some portfolios in the three sub periods was not significant, which means it is not different from zero, and this violated the CAPM assumption. This result is in line with studies results of (Yang and Donghui, 2006; Choudhary and Choudhary, 2010; Bilgin and Basti, 2011)
- Test for SML, the intercept λ0 was significantly not different from zero in all sub periods which is consistent with CAPM hypothesis, but regarding the slope λ1, it was not significantly different from zero in all sub periods. As CAPM assumes that, λ1 should be equal to the average risk premium, which should be greater than zero, thereby the result is inconsistent with the CAPM hypothesis, and accordingly, the CAPM is rejected in the three sub periods. This result is in line with studies results of (Yang and Donghui, 2006; Loukeris, 2009; Choudhary and Choudhary, 2010; Bilgin and Basti, 2011)
- Test for Non linearity, the intercept λ0 is not significantly different from zero in the three sub periods; thereby, it is consistent with the argument of CAPM. In the case of λ1, the test results show that the λ1 is not significantly different from zero in the three sub periods, as

CAPM assumes that λ1 should be equal to the average risk premium, the results here are inconsistent with CAPM hypothesis. But concerning the coefficient λ 2, the results show that coefficient λ 2 is not significantly different from zero in the three sub periods, which means that these results are consistent with the CAPM hypothesis and betas are linearly related with rate of return. This result is in line with studies results of (Black, et. al, 1972; Fama and MacBeth, 1973; Yang and Donghui, 2006; Choudhary and Choudhary, 2010). On the other hand results of other studies contradicted our results (Fama and French, 1992; Bilgin and Basti, 2011), thus, CAPM can be accepted in the three sub periods, but still the results show weakness to fully explain the model.

Depending on the above results, the researchers reached the final conclusion, that we cannot find conclusive evidence in support of validity of CAPM in Amman Stock Exchange (ASE) for the period (2010 – 2014).

Recommendations

The researchers recommends further future studies as follows:

- It is necessary when studying CAPM to take in consideration the impact of the following variables; EPS, P/E, MV/BV, Dividend Yield of stock, Company Size and other financial and marketing indicators, thus many studies proved that these variables have significant impact on stock return.
- Expand the study period for at least 10 years to cover more data and companies.

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