ТЕМЕ, г. XXXIX, бр. 4, октобар – децембар 2015, стр. 1165–1182

Прегледни рад
Примљено: 13. 10. 2015. UDK 336. 76
Одобрено за штампу: 10. 12. 2015.

CONDITIONAL RELATIONSHIP BETWEEN BETA AND RETURNS: A CASE STUDY OF THE BELGRADE STOCK EXCHANGE

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Abstract

This paper examines the applicability of the CAPM (Capital Asset Pricing Model) and conditional CAPM in the Belgrade Stock Exchange (BSE) in order to determine whether both the CAPM and conditional CAPM can be reliably applied to this emerging market. The returns were collected from the official BSE website for the period from January 2010 to December 2014. Time-series data were then collected for 60 monthly returns of the selected stocks, which is a common practice in model testing. The time-series data were observed for 60 months, which is long enough for all short-term shocks to be neutralized and for beta coefficients to be adjusted to their long-term values. The results of this study indicate that both the CAPM and conditional CAPM cannot be reliably applied in the BSE. The paper suggests that beta cannot be reliably used as a tool for explaining cross-sectional differences in the returns in the BSE and as a measure of market risk.

Key words: CAPM, conditional CAPM, Belgrade Stock Exchange, beta coefficient, market risk

УСЛОВНИ ОДНОС ИЗМЕЂУ БЕТА КОЕФИЦИЈЕНТА И ПРИНОСА: СТУДИЈА СЛУЧАЈА СА БЕОГРАДСКЕ БЕРЗЕ

Апстракт

У овом раду аутори испитују апликативност безусловног и условног модела за вредновање капиталне активе на Београдској берзи, са циљем да се добије одговор на питање да ли се безусловни и условни CAPM може поуздано применити на овом тржишту у настајању. Приноси су прикупљени са званичног сајта Београдске берзе за период од јануара 2010 до децембра 2014. године. На тај начин формиране су временске серије од 60 месечних приноса изабраних акција, што је уобичајено у тестирању модела. Временска серија од 60 месеци довољно је дугачка да се елиминишу сви краткорочни шокови, односно да се бета коефицијенти акција прилагоде својим дугорочним вредностима. Резултати истраживања указују да оба модела не могу поуздано да се примењују на овом тржишту. Резултати истраживања сугеришу да се бета не може поуздано користити за објашњавање упоредних разлика у приносима, односно не може поуздано да се користи као мера тржишног ризика.

Кључне речи: Модел за вредновање капиталне активе, Условни модел вредновања капиталне активе, Београдска берза, бета коефицијент, тржишни ризик

INTRODUCTION

Modern portfolio theory is the most important innovation in the field of investment and portfolio management. The key step in improving modern portfolio theory was the discovery by Sharpe and Lintner that there is a functional relationship between the returns of individual securities and the market return. They found that asset's excess returns are proportional to the regression coefficient of return on individual securities and the market return (market premium). Sharpe (1964) and Lintner (1965) presented these findings in the form of the Capital Asset Pricing Model – CAPM.

CAPM is a linear model, in the market equilibrium, which explains the individual asset's excess returns using covariance of return of the individual investments with the overall market. The appearance of the CAPM has enabled the search for answers to fundamental questions of modern portfolio theory – how to establish equilibrium between the price and the risk of financial assets, i.e. prices of individual securities for a given level of risk. Usage of the CAPM is very simple. CAPM is based on the assumption of a positive return-risk trade-off. However, empirical tests have not confirmed the exceptional applicability of the CAPM. Although early empirical analyses showed that the beta coefficient predicts relatively good returns, especially in a portfolio of stocks, the research of achieved returns has revealed the existence of numerous anomalies. According to Fama and French (2004) the CAPM's empirical problems are a consequence of many simplifying assumptions on which the CAPM is based, but also the consequence caused by difficulties in implementing valid tests of the model.

The main drawback of the CAPM is that it only describes a systematic and positive trade between beta coefficient and expected return. The CAPM does not take into account that there are periods of positive and negative excess market returns. It failed to take into account that the relationship between realized returns and beta is conditional on the relationship between the realized market returns and the risk-free rate (Theriou, Nikolaos et al., 2004, p. 2). The estimation of beta and expected return without differentiating between periods of positive and negative excess market returns produces a flat unconditional relationship between beta and return. Pettengill et al. (1995) found that there is a conditional (segmented) relationship between beta and realized returns, i.e. a positive relation during positive market excess return periods and a negative relationship during negative market excess return periods, and they stated that if realized market returns were seldom lower than the risk-free rate, this conditional relationship would have a trivial impact on the tests of the relationship between beta and returns. However, this relationship occurs frequently. When they are adjusted for the expectations concerning negative market excess returns, Pettengill et al. found that there was a consistent and significant relationship between beta and returns for the entire sample period, for subsample periods, and for a particular date – divided by months in a year. It means that their variant of the CAPM, also known in literature as the conditional CAPM, can be used reliably in developed markets. However, many empirical studies show that the conditional CAPM cannot be used reliably in emerging markets, despite the fact that emerging capital markets have periods of positive and negative risk premium; thus the application of the conditional CAPM is more justifiable exclusively on these markets.

The aim of this paper is to examine how well the conditional CAPM proposed by Pettengill et al. (1995) describes cross-sectional differences in the returns on an emerging stock market, such as the Belgrade Stock Exchange (BSE), and to test the applicability of the conditional CAPM under conditions which are characteristic for the BSE. In addition, in this paper we investigated the applicability of the CAPM in the BSE.

The paper is organized as follows: The first section is the introduction. The second covers literature reviews of the most significant empirical investigation of the applicability of various forms of the CAPM. The paper then provides a brief description of the analysed data and methodology used. The results are discussed in section 4, and the final section summarizes the conclusions.

LITERATURE REVIEW

There is an abundance of studies related to the applicability of the CAPM in literature, and they can be classified into two groups: the first one consists of studies that confirm the validity of the CAPM, and the second one includes studies that provide evidence against the CAPM.

Early research related to testing the validity of the CAPM, such as Black, Jensen and Schole's or Fama and MacBeth's studies, confirmed the applicability of the CAPM in capital markets. Black, Jensen and Schole (1972) investigated the applicability of the CAPM using the equal-weight portfolio of all stocks traded in the NYSE market as their proxy for the market portfolio between 1926 and 1965. The result of their study shows that beta was able to explain the differences in the monthly returns through securities. Fama and MacBeth (1973) also conducted empirical research of applicability of the CAPM in the NYSE market during the period from 1926 to 1965. They found that the CAPM provided the linear relationship between beta and expected return.

Unlike the previous studies, Lakonishok and Shapiro (1984, 1986) found an insignificant relationship between beta and returns. They concluded that an "individual security's return did not appear to be specifically related to its degree of systematic risk". Lakonishok et al. (1994) showed that the average returns were not positively related to market betas. Similar findings were reported by Fama and French (1992, 2004). Fama and French (1992) pointed out that beta coefficient had little ability to explain the cross-section of average returns on the US stock market. They argued that beta was not positively related to returns.

Reinganum (1981) found that the relationship between beta and cross-sectional returns varied across the sub-periods. Tinic and West (1984) argued that the relationship between beta and returns varied monthly during the year. They found that January had a larger risk premium than the other months. Likewise, they concluded that the significant relationship between risk and expected returns only existed in January. Other studies related to the CAPM were performed by Chan, Chen and Hsieh (1985), Shaken (1985), Bhandari (1985), and Jagannathan and Wand (1996). They also claimed that the CAPM was unable to explain the cross-sectional variation of average returns. On the other hand, Hetson et al. (1999) showed that there is a significant conditional relationship between beta and returns and that beta could explain any of the cross-sectional variations. This result is consistent with Pettengill, Sridhar and Mathur's (1995) statement that one cannot use ex-post data to market inferences about ex-ante expectations and the relationship between betas; in addition, realized returns vary depending on the relationship between beta and expected return. A related study on the conditional CAPM was performed by Hodoshima, Gomes and Kunimura (2000), which investigated the relationship between beta and returns in the Nikkei stock market. The results of their study showed that the conditional CAPM can be applied reliably in this market. Gu (2005) found that betas of value stocks increase significantly during bear market phase.

The most important study is the one conducted by Harvey, who investigated the characteristics of return in the emerging markets in Europe, Asia, and Latin America and who examined the applicability of the conditional CAPM on these markets. He concluded that on average the conditional CAPM failed to price the emerging markets assets correctly and betas were unable to explain any of the cross-sectional variations in the expected returns in emerging markets. Abd and Mohd (2003) also tested the applicability of the conditional CAPM in emerging markets. They focused on investigating the relationship between return and beta for an Islamic unit trust. The result of their study suggests that beta could be used as a tool in explaining cross-sectional differences in the Islamic unit trust's returns and as a measure of market risk in Asian emerging markets. On the other hand, Verma (2011) examined the validity of the conditional CAPM model using international stock returns in 18 countries. His study did not provide evidence in favour of the conditional CAPM model. Conversely, So and Tang (2010) advocated the use of the conditional CAPM and beta as a risk measure. They examined the applicability of the CAPM in the Singapore capital market and found a significantly conditional relationship between risk premium and beta during periods of up (down) markets.

Omran (2007) investigated the validity of applying the conditional CAPM to the emerging stock market of Egypt. He pointed out that the CAPM can be used reliably in the Egyptian emerging stock market. Fruk and Hljak tested the applicability of the CAPM in the Zagreb Stock Exchange (ZSE), analysing 17 most liquid stocks in the ZSE. They concluded that the CAPM cannot reliably be used in an emerging market, such as the Croatian capital market. Similar studies were conducted by Estrada (2001) and Stančić et al., (2010). Estrada (2001) advocated the use of "downside risk" measures, as a tool for explaining the cross-section of returns in emerging markets. In contrast to the above studies, the studies conducted by Ismail and Shakrani (2003), Theriou et al., (2004), Sriyalatha (2010), and Bilgin and Basti, (2014) supported the use of the conditional CAPM model in emerging markets.

THEORETICAL BACKGROUND FOR CAPM

The CAPM is a linear equilibrium model explaining the returns of securities above the risk-free asset using covariance of returns on securities in the overall market. It is based on the positive trade-off between risk and returns, i.e. on the assumption that the sensitivity of a security to general market movements is the only variable that generates systematic differences in returns on different assets. The sensitivity of the securities in the CAPM is measured by beta coefficient – the regression coefficient of the returns on individual securities and the returns of the market portfolio.

The mathematical model can be expressed as follows:

$$E(r_i) = r_f + (E(r_m) - r_f)\beta_i \ , \qquad (1)$$

where $E(r_i)$ – expected return on asset i, r_f – risk-free rate of return, $E(r_m)$ – expected market rate of return; βi – beta coefficient on asset i.

Algebraic equation (1) indicates that the expected return on securities is the sum of the risk-free rate of return and risk premium. The right addend of equation (1) suggests that the risk premium depends on the level of sensitivity of a security to general market movements, which is presented by the market risk premium: $E(r_m)$-r_f). Since, on average, the market risk premium must be higher than the risk-free rate of return (expression $E(r_m)$-r_f) must be positive, because otherwise risk-averse investors would invest only in the risk free securities), the equation implies that the expected return on a risky asset is positive beta function. In other words, the model implies that investors will be rewarded for incurring systematic risk exclusively and not the total risk inherent in selected securities. Equation (1) also implies that investors always choose a linear combination of the market portfolio and the risk-free asset, depending on the level of risk aversion. By holding market portfolios, investors maintain a desired constant level of risk (non-systematic risk is entirely eliminated in the market portfolio), while by including the risk-free assets in the portfolio, they try to increase their returns. The combination of the market portfolio with a risk-free asset always gives a linear relationship between risk and return, so each portfolio based on this combination dominates the set of efficient portfolios, which is obtained by using Markowitz mean-variance model. For investors who prefer a higher level of risk, the model allows them to borrow an additional amount at a risk-free rate and to invest in the portfolio.

The model also meets the risk-averse investors' requirement that the market returns on average is greater than the risk-free rate of return. Otherwise, risk-averse investors would keep only risk-free securities. Since $E(r_m)$-r_f) must be positive, the result is that the expected return of a risky asset is a positive beta function. In addition to the expectation that market returns are higher on average than risk-free rate, investors must be aware of non-zero probability that market returns will be lower than the risk-free rate of return. According to Pettengill et al. (1995), if investors were confident of market returns exceeding the risk-free rate of return at all times, then no investor would hold risk-free assets. For all portfolios with positive beta coefficient, the expected returns must be greater than the risk-free rate and the return distribution must contain a non-zero probability of returns below the risk-free rate. It should also be borne in mind that there is a certain degree of certainty that high-beta portfolios will earn lower returns if compared to low-beta portfolios. Hence, high-beta portfolios are expected to have higher returns because they are exposed to higher risks. Otherwise, investors would not hold low-beta portfolios. Based on this, one can sublimate the following: high-beta portfolio returns will be lower than low-beta portfolios when the market returns are less than the risk-free rate. This indicates the existence of a segmented relationship between the returns and beta, i.e. there is a positive relationship when the market premium is positive and a negative relationship during negative market premium (rm-rf). These observations were first made by Pettengill et al. (1995) and presented in the form of the conditional CAPM. Since capital markets have periods of positive and negative risk premium, the use of the conditional CAPM is more justifiable in these markets.

The CAPM has several important limitations: 1) It is based on market portfolio, which includes all assets in a financial market (such as securities, real estate, foreign securities, etc.); 2) It operates in the expected and not realized returns; and 3) It ignores the fact that there is a segmented relationship between return and beta.

To construct the market portfolio, it is necessary to know the share of trade value of each individual asset in the total value of market capitalization. Since numerous assets are sometimes not traded at all, it is extremely difficult and almost impossible to constitute (construct) the market portfolio. Another limitation arises from the fact that the model predicts the relationship between the expected return and risk (measured by beta coefficient) in the state of market equilibrium, despite the fact that the analysis is based on historical data on return. Very rarely or almost never do the holding period returns not coincide with the initial expectations. The third constraint stems from the fact that it ignores the inverse relationship between the return and beta. The possibility that the market return is less than the risk-free rate of return implies that high-beta portfolio will earn lower returns than low-beta portfolio when the market risk premium is negative. It suggests that there is not a systemic but a segmented relationship, i.e. there is a positive relationship when the market premium is positive and a negative relationship over the period of negative market premium.

Because of these limitations, the practical implementation of the CAPM is achieved in the form of an index model based on the current returns instead of the expected ones, and the actual stock exchange index rather than the theoretical market portfolio. The index model enables the basic prediction, the relationship between expected return, and systematic risk to be expressed in terms of the observed (realized) variables – the realized return above the risk-free asset returns.

Beginning with the fact that the return rate consists of two components and that return above the risk-free asset return can be expressed as: $r_i - r_f = \alpha_i + (r_m - r_f)\beta_i + \varepsilon_i$ (where: $r_i - r_f$ is the return on security *i* above the risk-free rate of return; α_i is the return on security *i* above the risk-free rate of return when the security is not correlated with market trends; β_i is beta coefficient on *i* security; and ε_i is a component describing the impact of specific risk of the company), and assuming that the positive and negative impacts of the specific company risk cancel each other out, i.e. $\varepsilon_i = 0$, the basic prediction of the CAPM can be expressed as follows:

$$E(r_i) - r_f = \alpha_i + \beta_i (E(r_m) - r_f), \tag{2}$$

where: $E(r_i) - r_f$ is the expected return on i security above the risk-free rate of return; $E(r_m)$ is the expected market rate of return; r_f is risk-free rate of return; and α_i and β_i are regression coefficients.

In other words, the index model enables the prediction of (expected) future returns on assets to be related to the future returns of the market portfolio by means of prediction (analysis) of regression in the observed variables: the realized return on the security above the risk-free assets return $((r_i) - r_f)$ and realized stock index returns $(r_m - r_f)$.

Considering the fact that there is a conditional or segmented relationship between the return and risk, depending on the sign of the market risk premium in particular sub-periods, the main prediction of the conditional CAPM can be expressed as follows:

$$E(r_i) = \gamma_{0t} + \gamma_{1t}\delta\hat{\beta}_i + \gamma_{2t}(1-\delta)\hat{\beta}_i + \varepsilon_{it}), \tag{3}$$

where $\delta = 1$ when $E(r_m) - r_f > 0$, and $\delta = 0$ when $E(r_m) - r_f < 0$.

However, it should be noted that the operationalization of the CAPM as an index model has a number of limitations. The comparison of equations (2) and (1) reveals that the CAPM predicts that alpha should be equal to zero. If alpha is significantly different from zero, then it cannot be concluded whether it is a consequence of an inadequately chosen stock index as an approximation to market portfolio or because the model is unusable. Such is the case with the stocks of the companies with high M/B ratios. Such stocks have a significantly positive alpha value. In addition, the future value of alpha is impossible to predict on the basis of historical data.

DATA AND METHODOLOGY

The applicability of the CAPM and the conditional CAPM in the BSE was tested on a sample of ten stocks. All the data used in this study were collected from the BSE. The study period extends from January 2010 to December 2014. In this way the time-series data of 60 monthly returns of selected stocks were observed. It is long enough to nullify all short-term shocks, for beta coefficients to take long-term values or for beta coefficients to adjust to their long-term values. To reduce the impact of the non-synchronous trading in the process of selecting stocks, special attention was paid to the liquidity of stocks. Therefore, the most liquid stocks were selected from the market during the period 2010 to 2014. Time series of excess returns on the market and on individual stocks were taken over the one-month Serbian Government Bond A2016 rate, as a proxy for the risk-free rate of return.

The daily returns of selected stocks were generated using the logarithmic approximation:

$$R_{i,t} = \log\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \tag{4}$$

where $P_{i,t}$ represents the closing price of asset *i* on the day *t*. Then daily returns were aggregated to compute the monthly returns making the input in our study.

The inability to identify the true market portfolio brought the highest degree of uncertainty in testing the model. The use of stock index in model testing is a common practice. Therefore, the general (benchmark) index of the BSE – Belexline benchmark was used in the study. Belexline benchmark currently represents the best proxy of the market portfolio, as it contains a large number of liquid stocks, so that it represents a well-diversified portfolio.

The applicability of the CAPM and the conditional CAPM is tested using the Ordinary Least Squares method (OLS). To test the applicability of the unconditional and conditional CAPM, it is necessary to know beta coefficients a priori. Therefore, it is necessary to estimate them. Since the basic prediction of the CAPM can be stated in the category of realized excess returns, which can be expressed mathematically in the equation (1), for estimation of beta coefficients we also used the Ordinary Least Squares method. Mathematically, it can be expressed:

$$r_{it} - r_{ft} = \alpha_i + \beta_i (r_{mt} - r_f) + \varepsilon_{it} \tag{5}$$

where r_i is return on asset *i*, and α_i and β_i are the intercept and slope of the line that relates asset *i*'s achieved excess return to the achieved excess return of the index. The index return is denoted by r_m to emphasize that the index portfolio is a proxy for the market portfolio. The ε_i is the deviation of security *i*'s realized return from the regression line, which were assumed to be normally distributed.

The acceptance of this assumption allows us to use a one-sided t-test and the following hypotheses:

$$H_o : E\left[\hat{\alpha}_i\right] = 0; \quad H_1 : E\left[\hat{\alpha}_i\right] \neq 0$$

$$H_0 : E\left[\hat{\beta}_i\right] = 0 \quad H_1 : E\left[\hat{\beta}_i\right] > 0$$

The key condition necessary for the Ordinary Least Squares method to consistently estimate the beta is that the error has the mean of zero and is uncorrelated with each of the regressors.

Assuming there is an unbiased estimation of beta coefficients to test the CAPM, the following equation is used:

$$\overline{r_i - r_f} = \gamma_0 + \gamma_1 \hat{\beta}_i + \varepsilon_{it} \tag{6}$$

where $\overline{r_i - r_f}$ is the average monthly excess return on asset *i*, $\hat{\beta}_i$ is estimated the beta coefficient, γ_0, γ_1 are the regression coefficients of equation (5), and ε_{it} – is a random error term. Hence, the following hypotheses were tested using the simple T-test:

$$H_0 : \gamma_0 = 0 \quad H_1 : \gamma_0 \neq 0$$
$$H_0 : \gamma_1 = 0 \quad H_1 : \gamma_1 > 0$$

According to the CAPM, γ_0 should be equal to zero and γ_1 should be greater than zero. To test the applicability of the conditional CAPM the following equation was used:

$$E(r_i) = \gamma_{0t} + \gamma_{1t}\delta\hat{\beta}_i + \gamma_{2t}(1-\delta)\hat{\beta}_i + \varepsilon_{it}) \tag{7}$$

where $E(r_i)$ is expected monthly excess return on asset *i* and δ denotes a dummy variable that takes value 1, when market excess returns are positive and 0 when market excess returns are negative.

The equation (7) enabled testing the conditional relationship between beta and returns. In other words, the equation (7) enabled us to find out whether positive and negative linear relationships between returns and estimated beta existed in up- and down markets. For this reason, the total sample period was divided into two periods when the market excess returns were positive and negative. For each of these periods betas were re-estimated by taking the monthly excess returns and both the positive market and the negative market excess returns. In up market months, the monthly excess returns were regressed on the positive market excess returns. In down market months the monthly excess returns were regressed on the negative market excess returns. Since γ_1 was estimated in periods with positive market excess returns, its expected sign was positive. γ_2 was represented in periods with negative market excess returns, and its expected sign was negative (Pettengill, et al. (1994)). The slope coefficients γ_1 and γ_2 capture the conditional relationship between beta and return, in up- and down markets, respectively. The following joint hypotheses were tested using the simple T-test:

$$H_0 : \gamma_1 = 0 \quad H_1 : \gamma_1 > 0$$
$$H_0 : \gamma_2 = 0 \quad H_1 : \gamma_2 < 0$$

The validity of the conditional CAPM will be accepted if both of the null hypotheses are rejected in favour of the alternatives.

EMPIRICAL RESULTS

The results of estimation of the parameters of equation (5) for each of the stocks are given in Table 1.

Table 1. The results of estimation of the parameters of equation (5)

Comp. Name	$\overline{r_i - r_f}$	$\hat{\alpha}_i$	Stand. error	t_α - test	p_α-value	β_i	Stand. error	t_β - test	p_β-value	$\hat{\sigma}_{\varepsilon i}$
AIKB	0.0385	0.0027	0.0151	0.1819	0.8569	1.1326	0.3760	3.0125	0.0054	0.0512
ALBS	0.0215	0.0358	0.0465	0.7695	0.4483	-0.4061	1.1391	-0.3565	0.7242	0.1530
ALFA	0.0368	0.0451	0.0212	2.1265	0.0424	-0.2610	0.5277	-0.4945	0.6248	0.0718
AMSO	-0.0103	0.0319	0.0308	1.0377	0.3083	-1.3378	0.7665	-1.7454	0.0919	0.1043
BCKA	0.0903	0.0805	0.0853	0.9445	0.3530	0.3104	2.1231	0.1462	0.8848	0.2890
BDNS	-0.0046	-0.0120	0.0046	-2.5860	0.0152	0.2326	0.1151	2.0206	0.0530	0.0157
BMBI	0.0374	0.0250	0.0230	1.0848	0.2873	0.3932	0.5734	0.6857	0.4986	0.0780
BNNI	-0.0261	-0.1118	0.0862	-1.2965	0.2054	2.7165	2.1472	1.2651	0.2163	0.2922
CCNB	-0.0068	-0.0370	0.0541	-0.6838	0.4997	0.9560	1.3466	0.7099	0.4836	0.1833
DJMN	0.0447	0.0376	0.0643	0.5851	0.5632	0.2241	1.6008	0.1400	0.8897	0.2179
DNAP	-0.0031	-0.0081	0.0042	-1.9249	0.0645	0.1586	0.1050	1.5108	0.1420	0.0143
DNOS	-0.0113	-0.0567	0.0483	-1.1736	0.2505	1.4368	1.2022	1.1951	0.2421	0.1636
DNRM	-0.0503	-0.0059	0.0379	-0.1566	0.8766	-1.4049	0.9433	-1.4894	0.1476	0.1284
ELKR	-0.0031	-0.0081	0.0042	-1.9249	0.0645	0.1586	0.1050	1.5108	0.1420	0.0143
ENHL	-0.0113	-0.0567	0.0483	-1.1736	0.2505	1.4368	1.2022	1.1951	0.2421	0.1636
FITO	-0.0503	-0.0059	0.0379	-0.1566	0.8766	-1.4049	0.9433	-1.4894	0.1476	0.1284
GFOM	-0.0197	0.0110	0.0315	0.3507	0.7285	-0.9732	0.7836	-1.2420	0.2246	0.1066
GLOS	-0.0194	-0.0374	0.0407	-0.9187	0.3661	0.5694	1.0135	0.5618	0.5787	0.1379
GRPE	0.0238	0.0727	0.0471	1.5445	0.1337	-1.5521	1.1726	-1.3237	0.1963	0.1596
HBLA	-0.0161	-0.0348	0.0151	-2.3067	0.0287	0.5939	0.3756	1.5811	0.1251	0.0511
HBLK	-0.0031	-0.0081	0.0042	-1.9249	0.0645	0.1586	0.1050	1.5108	0.1420	0.0143
IMLK	0.0267	0.0055	0.0170	0.3247	0.7478	0.6717	0.4224	1.5904	0.1230	0.0575
JESV	0.0271	0.0245	0.0151	1.6226	0.1159	0.0836	0.3757	0.2224	0.8256	0.0511
JMBN	0.0028	0.0099	0.0425	0.2339	0.8168	-0.2266	1.0585	-0.2140	0.8321	0.1441
KMBN	0.0506	-0.0005	0.0217	-0.0245	0.9806	1.6205	0.5391	3.0058	0.0055	0.0734
MTLC	0.0207	-0.0227	0.0129	-1.7654	0.0884	1.3746	0.3202	4.2932	0.0002	0.0436
PRGS	0.0005	-0.0299	0.0433	-0.6904	0.4956	0.9627	1.0791	0.8922	0.3799	0.1469
PTLK	0.0001	-0.0109	0.0682	-0.1601	0.8739	0.3487	1.6979	0.2054	0.8388	0.2311
PUUE	-0.0016	-0.0060	0.0566	-0.1059	0.9164	0.1384	1.4084	0.0983	0.9224	0.1917
RDJZ	0.0152	-0.0093	0.0386	-0.2416	0.8108	0.7772	0.9603	0.8094	0.4251	0.1307
RMBG	-0.0715	-0.0966	0.0791	-1.2213	0.2321	0.7953	1.9684	0.4041	0.6892	0.2679
SJPT	0.0511	-0.0158	0.0259	-0.6116	0.5457	2.1213	0.6437	3.2956	0.0027	0.0876
SNCE	-0.0123	-0.0491	0.0236	-2.0778	0.0470	1.1641	0.5881	1.9792	0.0500	0.0800
TGAS	0.0369	0.0007	0.0201	0.0353	0.9721	1.1468	0.5011	2.2888	0.0298	0.0682
TIGR	-0.0034	-0.0379	0.0540	-0.7022	0.4884	1.0934	1.3439	0.8136	0.4227	0.1829
TLKB	-0.0659	-0.1232	0.0487	-2.5326	0.0172	1.8163	1.2114	1.4992	0.1450	0.1649
VETZ	-0.0089	0.0252	0.0314	0.8010	0.4299	-1.0809	0.7821	-1.3819	0.1779	0.1064
VITL	-0.0365	-0.0551	0.0348	-1.5822	0.1248	0.5882	0.8664	0.6789	0.5028	0.1179
VZAS	0.0514	0.0508	0.0346	1.4688	0.1530	0.0167	0.8616	0.0194	0.9846	0.1173
ZISR	-0.0326	-0.0116	0.0476	-0.2429	0.8098	-0.6666	1.1861	-0.5620	0.5786	0.1614

Source: Author's calculations

Note: Significant at the 5% level

The critical value of the two-sided T-test with 58 degrees of freedom at the 5% level of significance was 2.00. This means that the null hypothesis can be accepted, i.e. the expected value of the intercept was equal to zero in all cases, except in ALFA. The critical value of one-sided T-test with 58 degrees of freedom at 5% level of confidence for the beta coefficient was 1.67. The results of the one-sided T-test indicated the rejection of the null hypothesis and the acceptance of the alternative hypothesis that the expected values of beta coefficients were greater than zero, in cases of AIKB, BDNS, KMBN, MTLC, SJPT, SNCE, and TGAS. In cases of these seven stocks beta coefficients were significant at 5% level of significance.

The results of regression equation (7) for the unconditional relationships are presented in Table 2.

Table 2. The results of estimation of the parameters of regression equation (7) for the unconditional relationships

Coefficient		Standard error	*t*-test	*p*- value
γ_0	-0.01348	0.003546	-3.80133	0.000507
γ_1	0.000665	0.004758	0.139853	0.889515
R^2	0.000514	-	-	-

Source: Author's calculations
Note: Significant at the 5% level

As previously stated, γ_0 should be equal to zero and γ_1 should be greater than zero. According to the results of the unconditional test, coefficient γ_0 was not significantly different from zero at 5% level of significance, but coefficient γ_1 was not significantly greater than zero. This means that application of the CAPM is not reliable in the BSE. This finding is consistent with Fama and French's research (1992) and many other studies documenting no statistical significant unconditional relation between beta and return in emerging markets. The value of the coefficient of determination is 0.000514. The relatively low coefficient of determination indicates that unsystematic risk factors have a significant role to play in explaining stock returns in the BSE.

To test the applicability of the conditional CAPM in the BSE, the total sample period was divided into up market months and down market months. The number of up_market months was equal to the number of down market months. The average market excess return was 0.0027 in up market periods and -0.0279 in down market periods. The results of re-estimation of beta coefficients for all stocks are given in Table 3.

Table 3. The results of estimation of beta coefficients in up market and down market months

Company Name	Up Market Months				Down Market Months			
	β_i	*Standard error*	t_β *- test*	p_β *- value*	β_i	*Standard error*	t_β *- test*	p_β *- value*
AIKB	1.1326	0.3760	3.0125	0.0054	1.6221	0.2945	5.5083	0.0000
ALBS	-0.4061	1.1391	-0.3565	0.7242	-0.3789	1.0420	-0.3636	0.7190
ALFA	-0.2610	0.5277	-0.4945	0.6248	0.4314	0.3587	1.2027	0.2392
AMSO	-1.3378	0.7665	-1.7454	0.0919	-1.4434	0.9566	-1.5089	0.1425
BCKA	0.3104	2.1231	0.1462	0.8848	-0.3686	0.8806	-0.4186	0.6787
BDNS	0.2326	0.1151	2.0206	0.0530	0.0671	0.0589	1.1387	0.2645
BMBI	0.3932	0.5734	0.6857	0.4986	0.2652	0.4597	0.5770	0.5686
BNNI	2.7165	2.1472	1.2651	0.2163	0.1068	0.6788	0.1574	0.8761
CCNB	0.9560	1.3466	0.7099	0.4836	1.3477	0.6598	2.0425	0.0500
DJMN	0.2241	1.6008	0.1400	0.8897	0.5913	0.3488	1.6953	0.1011
DNAP	0.1586	0.1050	1.5108	0.1420	0.0671	0.0589	1.1387	0.2645
DNOS	1.4368	1.2022	1.1951	0.2421	0.3265	0.6859	0.4760	0.6378
DNRM	-1.4049	0.9433	-1.4894	0.1476	-0.6176	0.5568	-1.1092	0.2768
ELKR	0.1586	0.1050	1.5108	0.1420	0.0671	0.0589	1.1387	0.2645
ENHL	1.4368	1.2022	1.1951	0.2421	0.3265	0.6859	0.4760	0.6378
FITO	-1.4049	0.9433	-1.4894	0.1476	-0.6176	0.5568	-1.1092	0.2768
GFOM	-0.9732	0.7836	-1.2420	0.2246	-1.2542	0.7526	-1.6665	0.1068
GLOS	0.5694	1.0135	0.5618	0.5787	1.0734	0.9568	1.1219	0.2715
GRPE	-1.5521	1.1726	-1.3237	0.1963	-0.4974	0.2292	-2.1699	0.0387
HBLA	0.5939	0.3756	1.5811	0.1251	0.0567	0.0593	0.9557	0.3474
HBLK	0.1586	0.1050	1.5108	0.1420	0.0671	0.0589	1.1387	0.2645
IMLK	0.6717	0.4224	1.5904	0.1230	1.2147	0.4552	2.6684	0.0125
JESV	0.0836	0.3757	0.2224	0.8256	0.4349	0.1984	2.1922	0.0368
JMBN	-0.2266	1.0585	-0.2140	0.8321	0.6813	0.6084	1.1199	0.2723
KMBN	1.6205	0.5391	3.0058	0.0055	1.0978	0.3458	3.1745	0.0036
MTLC	1.3746	0.3202	4.2932	0.0002	0.8807	0.2388	3.6885	0.0010
PRGS	0.9627	1.0791	0.8922	0.3799	-0.4734	0.9057	-0.5227	0.6053
PTLK	0.3487	1.6979	0.2054	0.8388	0.6351	1.2523	0.5071	0.6160
PUUE	0.1384	1.4084	0.0983	0.9224	1.5711	0.6812	2.3065	0.0287
RDJZ	0.7772	0.9603	0.8094	0.4251	1.8954	0.5946	3.1876	0.0035
RMBG	0.7953	1.9684	0.4041	0.6892	0.5736	0.5512	1.0406	0.3070
SJPT	2.1213	0.6437	3.2956	0.0027	1.2762	0.3911	3.2635	0.0029
SNCE	1.1641	0.5881	1.9792	0.0577	0.2844	0.3485	0.8160	0.4214
TGAS	1.1468	0.5011	2.2888	0.0298	0.9287	0.4085	2.2734	0.0309
TIGR	1.0934	1.3439	0.8136	0.4227	1.3455	0.6006	2.2403	0.0332
TLKB	1.8163	1.2114	1.4992	0.1450	0.8434	0.4992	1.6894	0.1023
VETZ	-1.0809	0.7821	-1.3819	0.1779	0.4693	0.2759	1.7013	0.1000
VITL	0.5882	0.8664	0.6789	0.5028	0.7404	0.4799	1.5429	0.1341
VZAS	0.0167	0.8616	0.0194	0.9846	0.4413	0.4010	1.1003	0.2806
ZIRS	-0.6666	1.1861	-0.5620	0.5786	-0.2508	0.5155	-0.4866	0.6303

Source: Author's calculations
Note: Significant at the 5% level

As can be seen from Table 3, all of the estimated beta coefficients are insignificant at 5% level of significance in up markets months. The exceptions are AIKB, BDNS, KMBN, MTLC, SJPT, SNCE, and TGAS stocks. The estimated beta coefficients are insignificant at 5% level of significance in down markets months, except in the cases of AIKB CCNB, GRPE IMLK, JESV, KMBN, MTLC PUUE, RDJZ, SJPT, TIGR, and TGAS stocks.

Table 4 shows the results of estimation of the regression parameters in equation (7) for conditional relationships.

Table 4. The results of estimation of the regression parameters in equation (7) for conditional relationships

	Up Market Months					Down Market Months			
	Coefficient	Standard error	t- test	p- value		Coefficient	Standard error	t- test	p- value
γ_0	0.0012	0.0059	0.1999	0.8426	γ_0	-0.0242	0.0053	-4.5829	0.0001
γ_1	0.0038	0.0055	0.6912	0.4937	γ_2	-0.0093	0.0063	-1.4909	0.1443
R^2	0.0124				R^2	0.0553			

Source: Author's calculations
Note: Significant at the 5% level

As can be seen in Table 5, coefficients γ_1 and γ_2 have the expected signs (γ_1=0,0038, γ_2 = 0,0063), but the results of the conditional test show that coefficient γ_1 is not significantly greater than zero at 5% level of significance and coefficient γ_2 is not significantly less than zero at 5% level of significance. In conclusion, the validity of the conditional CAPM in the BSE during the test period is rejected. This finding indicates that the Conditional CAMP cannot be reliably applied in the BSE.

The analysis of the estimated regression coefficients γ_1 and γ_2 indicates that there is no statistically significant conditional relationship between beta and returns in the BSE. This conclusion is confirmed by the values of the coefficients of determination. The values of the coefficients of determination are 0.0124 and 0.0553 in up market months and down market months, respectively.

CONCLUSION

In this study, we tested the applicability of the CAPM and conditional CAPM in the BSE between January 2010 and December 2014. To test the applicability of the CAPM, we applied the unconditional test procedure. The results of the unconditional test indicate that the CAPM cannot be reliably applied in the BSE. Since the conditional CAPM recognizes the existence of conditional relationship, which means that in most periods the market risk premium in the capital market is negative, it was expected that the model can be reliably applied in the BSE.

To test the applicability of the conditional CAPM, we applied the conditional test procedure proposed by Pettengill et al. (1995). The results of this test have shown that conditional CAPM cannot be reliably applied in the BSE. Further, the analyses of obtained results show that there is no a significant positive relationship in an up market and a significant negative relationship in a down market. The results suggest that beta cannot be used as a tool in explaining cross-sectional differences in the returns in the BSE and as a measure of market risk. Also, this study cannot confirm that during up markets high-beta stocks earned positive returns, and during down markets high-beta stocks incur lower returns. Furthermore, it does not show that as expected, high beta stocks incur lower returns during down markets than those of low beta stocks.

The test results obtained from the application of the conditional CAPM are inconsistent with the previous studies conducted in the emerging markets in Europe, which use the same methodology. The main reason may be in the small number of stocks involved. The small number of selected stocks does not give us much confidence in estimating beta coefficients, because of a possible error in variable problem. Moreover, accepting the findings of this study, we should take into account the possible errors in the estimation of the regression coefficients of equation (5) and (7), since the regression is conducted on the assumption that estimation of beta coefficients is unbiased and reliable. Increased uncertainty about the accuracy of the estimates of parameters means a greater probability that regression coefficients are asymptomatically biased. In up market months, beta coefficient estimates were statistically significant at the confidence level of 5% in the case of only 7 stocks, and in down market months it was the case with 12 actions. Such a small number of statistically significant results certainly raised much doubt on the validity of the research.

An explanation for this phenomenon can be found in the fact that a large number of securities in the BSE are not traded or are traded occasionally, thus they are exposed to the effect of non-synchronous trading. Even 32 stocks out of 40 under consideration had not been traded for three or more consecutive days. The existence of non-synchronous trading leads to a spurious correlation among the stocks and between the stocks and the market. In fact, this phenomenon leads to the difference between the actual and observed (spurious) covariance. It is higher for rarely traded stocks, and especially if an individual stock is rarely traded and the other is traded very often. Differences in covariance are such that the observed covariance is less by the absolute value than the actual covariance. In this way, non-synchronous trading causes the spurious non-correlation between the low-liquid stocks and the market, and thus directly affects the validity of estimation of beta coefficient and the results of the research as well.

REFERENCES

Abd, G. and Shakran, M. S. (2003). The conditional CAPM and cross-sectional evidence of return and beta for Islamic unit trusts in Malaysia. *Journal of Economics and Management,* 11(1), 2-30.

Black, F., Jensen, M. C., Scholes, and Myron, S. (1972). The Capital Asset Pricing Model: Some Empirical Tests, in Jensen Michael (Ed.), *Studies in the Theory of Capital Markets* (pp. 79-121). New York: Praeger.

Bilgin, R. and Basti, E. (2014). Further Evidence on the Validity of CAPM: the Istanbul Stock Exchange Application. *Inzinerine Ekonomika-Engineering Economics,* 25(1), 5–12.

Bhandari, L. C. (1988). Debt/Equity Ratio and Expected Common Stock Returns: Empirical Evidence. *Journal of Finance*, 43(2), 507-528.

Chan, K. C., Chen Nai-fu, Hsieh David (1985). An Explanatory Investigation of the Firm Size Effect. *Journal of Financial Economics*, 14(3), 451-471.

Estrada, Javier, (2001). The Cost of Equity in Emerging Markets: A Downside Risk Approach. *Emerging Markets Quarterly,* 5(1), 63-72.

Fama, E. F. and MacBeth, J. D. (1973). Risk, Return, and Equilibrium: Empirical Tests. *Journal of Political Economy,* 81(3), 607-36.

Fama, E. F. and French, K. R. (1992). The Cross-Section Stock Returns. *Journal of Finance*, 47(2), 427-465.

Fama, E. F. and French, K. R. (2004). The Capital Asset Pricing Model: Theory and Evidence. *Journal of Economic Perspectives*, 18(3), 25-46.

Lakonishok, J. and Shapiro, A. C. (1986). Systematic Risk, Total Risk, and Size as Determinants of Stock Market Returns. *Journal of Banking and Finance*, 10(1), 115-32.

Lakonishok, J. et al. (1994). Contrarian Investment, Extrapolation and Risk. *Journal of Finance*, 49(5), 1541-578.

Fruk, M. and Huljak, I. (2004). Testiranje Šarp-Lintnerovog modela na Zagrebačkoj burzi [Testing the Sharpe-Lintner Model in the Zagreb Stock Exchange]. *Financijska teorija i praksa*, 28 (1), 77-91.

Gu, L. (2005). *Asymmetric Risk Loadings in the Cross Section of Stock Returns.* Unpublished manuscript.

Harvey, C. R., (1995). Predictable Risk and Returns in Emerging Markets. *Review of Financial Studies*, 8(3), 773-816.

Heston, S. L., et al. (1999). The Role of Beta and Size in the Cross-Section of European Stock Returns. *European Journal of Financial Management*, 5(1), 9-27.

Hodoshima, J., Garza–Gomez X. and Kunimura, M. (2000). Cross-Sectional Regression Analysis of Return and Beta in Japan. *Journal of Economics and Business,* 52(6), 515-533.

Jagannathan, R. and Wang, Z. (1996). The conditional CAPM and the Cross-Section of Expected Returns. *Journal of Finance,* 51(1), 3-53.

Lintner, J. (1965). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *Review of Economics and Statistics*, 47(1), 13–37.

Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions. *Journal of Finance*, 19(3), 425-442.

Omran, M. F. (2007). An analysis of the capital asset pricing model in the Egyptian stock market. *The Quarterly Review of Economics and Finance*, 46, 801-81.

Pettengill, G. N., Sundaram, S. and Mathur, I. (1995). The Conditional Relation between Beta and Returns. *Journal of Financial and Quantitative Analysis*, (30)1, 101-116.

Reinganum, M. R. (1981). A New Empirical Perspective on the CAPM. *Journal of Financial and Quantitative Analysis*, 16(4), 439–462.

Shaken, J. (1985). Multivariate Tests of the Zero-Beta CAPM. *Journal of Financial Economics*, 14, 327-48.

Stancic, P. et al., (2010). Testing the applicability of the CAPM in the Serbian Stock Market. *GSTF Business Review*, 1(3), 24-30.

Sriyalatha, M. K. (2010). The Conditional Relation between Risk and Return in the Colombo Stock Market. *名城論*, 3, 171-186.

Tinic, S. and West R. R. (1984). Risk and Return: January vs. the Rest of the Year. *Journal of Financial Economics*, 13(4), 561-574.

Theriou, N. et al., (2004, April). *Testing the Relation between Beta and Returns in the Athens Stock Exchange*. 2nd International Conference on Accounting and Finance in Transition (ICAFT), Athens, 1-17.

So, M. S. and Tang, G. Y. N. (2010). An Examination of Conditional Effect on Cross-Sectional Returns: Singapore Evidence. *Applied Economics*, 42(6), 777-795.

Verma, R. (2011). Testing the Forecasting Power of the Conditional Relationship between Beta and Return. *Journal of Risk Finance*, 12(1), 69–77.

УСЛОВНИ ОДНОС ИЗМЕЂУ БЕТА КОЕФИЦИЈЕНТА И ПРИНОСА: СТУДИЈА СЛУЧАЈА СА БЕОГРАДСКЕ БЕРЗА

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Резиме

Модел за вредновање капиталне активе (CAPM) представља трагање за одговорима на фундаменталне дилеме модерне портфолио теорије – равнотежног односа између цене и ризика финансијских средстава, односно цена појединачних хартија од вредности за дати ниво ризика. Бројна касније спроведена емпиријска истраживања открила су да на овом плану CAPM није савршен модел. Главни проблем овог приступа је што се CAPM фокусира на систематску и позитивну релацију између бета и очекиваног приноса, односно да не респектује чињеницу да је однос између остварених приноса и коефицијента бета детерминисан односом између остварених приноса на тржишту и безризичне стопе. Накнадна истраживања су открила да процена бета коефицијента и очекиваног приноса без дистинкције између периода позитивних и негативних вишкова приноса на тржишту ствара раван безусловни однос између бете и приноса. То је био сигнал да постоји и условни (сегментирани) однос између коефицијента бета и оствареног приноса, односно позитиван однос током периода позитивних вишкова приноса на тржишту и негативан однос током периода негативног вишка приноса на тржишту. Произлази да, уколико су остварени тржишни приноси углавном виши од безризичне стопе приноса, да ће условни однос имати мали утицај на тестовима односа између коефицијента бета и приноса. Међутим, тај однос постаје сигнификантан ако су тржишни приноси често нижи од безри-

зичне стопе, што је реалност савремених финансијских тржишта. Пошто је неспорно да се варијанта условног CAPM може поуздано користити на развијеним тржиштима, главни циљ рада је да тестира његову употребљивост на берзанском тржишту у развоју, односно да истражи могућности примене на Београдској берзи.

Спроведено истраживање је базирано на подацима о трговању на узорку од 40 акција са Београдске берзе, у периоду између јануара 2010. године и децембра 2014. године. У првом кораку истраживања примењено је безусловно тестирање, чији резултати показују да CAPM модел није поуздано примењив на Београдској берзи. Резултати условног тестирања су показали практично исте резултате, односно да не постоји значајна позитивна веза на тржишту виших цена нити значајна негативна повезаност на тржишту нижих цена. Објашњење за ове релативно неочекиване резултате треба тражити у чињеници уског тржишта Београдске берзе. Мали број акција не даје довољно поверења у процену бета коефицијената, због инхерентних грешака у варијаблама. Томе треба додати и евентуалне грешке у процени регресионих коефицијената у једначинама, које се базирају на претпоставци да је процена бета коефицијената објективна и поуздана. Већа непоузданост у тачност процене параметара значи и већу вероватноћу да су регресиони коефицијенти асимптоматски необјективни. У периоду виших цена на тржишту оцене бета коефицијента су статистички значајне за ниво поверења од 5% само у случају 7 акција, а у периоду нижих тржишних цена – у случају 12 акција. Овако мали број статистички значајних оцена свакако доводи у питање валидност истраживања. Додатни проблем представља и чињеница да на Београдској берзи постоји велики број хартија од вредности којима се не тргује или се повремено тргује (ефекат несинхроног трговања). Од 40 акција које су разматране, чак у случају 32 акције забележено је да се њима није трговало три или више узастопних дана, што доводи до привидне корелисаности између акција и акција са тржиштем (разлика између стварне и опажане коваријансе).