SYSTEMATIC RISK ASSESMENT USING OLS METHOD - THE CASE OF THE CAPITAL MARKET OF BOSNIA AND HERZEGOVINA

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ABSTRACT

The Sharpe-Lintner Capital Asset Pricing Model (CAPM) implies a simple linear equation for pricing risky financial assets, individually and in portfolios. CAPM finds that the relevant risk measure of individual financial assets held as a portion of a well-diversified portfolio is not a variance (or a standard deviation) of financial assets, as proposed by the Modern Portfolio Theory, but a contribution of financial assets to the portfolio variance, measured by the financial asset beta. Beta coefficient is the measure of the systematic risk of risky assets.

This paper explores beta coefficients of stocks of the Bosnia and Herzegovina capital market. This capital market is new and underdeveloped, with a modest supply of securities and with a small number of marketable securities. It is interesting to explore whether the beta coefficients of domestic stocks are efficient and whether they could be used in portfolio management.

The paper employs the OLS method to estimate the standard Sharpe-Linter CAPM model. As in most other new markets, this market has a non-synchronous trading problem, which determined the selection of the sample used in the econometric analysis. A representative sample of stocks with satisfactory marketability is analyzed over a five-year period, i.e. 2005–2009. The basic hypothesis of the research is: beta coefficient as a measure of systematic risk is a relevant risk measure for the capital market of Bosnia and Herzegovina. A special aim of the paper is to explore whether estimated models satisfy the presumptions of the linear regression model, which is being examined using a series of diagnostic tests.

The results of this paper can be widely used and have significant implications for business purposes. Special attention is dedicated to estimating efficient beta coefficients that may be considered as reliable in a wide use of the CAPM model in financial practice.

Keywords: CAPM, OLS, beta, Bosnia and Herzegovina

JEL Classification: G12, C32

1. INTRODUCTION

Capital markets of neighbouring transition countries have been attracting significant attention of the wide investment public in the past ten years. These markets were characterized by high return, and in consequence, high volatility of securities' return as compared to developed capital markets. In the reference literature, however, there is no consensus as to which pricing model should be used to estimate the volatility of stocks' returns in these markets.

The Sharpe-Lintner Capital Asset Pricing Model – CAPM (Sharpe, 1964; Lintner, 1965a, b) is the foundation of the Capital Market Theory, and a continuation of the single-

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period return variance model developed by Markowitz (1952) and Tobin (1958), utilizing the Expected Utility Theory from Von Nuemann and Morgensterne (1944). Sharpe and Lintner developed a single-factor CAPM model for pricing financial assets, which assumes that the return of every individual security is linked to a single factor (index). In this model, the number of estimated variables is much lower than in the Markowitz model, which is its basic advantage.

According to the CAPM, the relevant risk measure of individual risky assets is its contribution to the variance of a well-diversified portfolio, measured by beta coefficient. Considering that investors are risk-averse, it is intuitive that a stock with a higher risk (higher beta) should yield a higher return than a stock with a lower beta. The CAPM model suggests that an asset with a zero beta, in equilibrium, will yield an expected return equal to that of a risk-free rate, and that the expected return of all risky assets must be higher than the risk-free rate for a risk premium, that is in direct proportion with the beta. In the rational and competitive market, investors diversify the entire unsystematic risk, thus pricing assets according to the systematic risk.

The theory itself caught a lot of attention of theoreticians and practitioners from around the world. Numerous empiric tests of the CAPM model are available, relating to various markets and testing periods, with no conclusive confirmation or rejection of the model; some tests confirm the model hypotheses, some confirm a number of them, while a number of tests reject them. There are few papers that deal with testing the CAPM model and other factor models in the region; e.g. Latković (2001), Fruk and Huljak (2004) and Kleut (2008) for the Croatian capital market and Zaimović (2010a, 2012) for the capital market of Bosnia and Herzegovina.

Testing the standard CAPM requires the verification of the following three hypotheses:

1. A higher risk (higher beta) should be related to a higher return.
2. The return is linearly correlated with the beta; therefore, for every unit increase of beta, we will have the same increase of return.
3. The capital market rewards only systematic risks, which means that unsystematic risks should not increase the return.

The aim of this paper is to examine whether the systematic risk measured by beta coefficient may be used for risk assessment in the capital market of Bosnia and Herzegovina. This market is new and underdeveloped, with low liquidity and a significant problem of non-synchronous trading, which is a characteristic of many other capital markets in transition economies. We have selected a representative sample of stocks with satisfactory marketability over a five-year period, i.e. 2005-2009. We use a traditional two-stage regression procedure to test the CAPM hypotheses. First, by using a series of discrete stock returns we evaluate the CAPM model employing the OLS method. Then, in order to test the CAPM hypotheses we examine the cross-section model employing the OLS method, while using betas as independent variables. We use the indirect test to test the CAPM hypotheses (Lintner, 1965a, b).

The paper consists of six parts, including the introduction. Part two is dedicated to the research methodology, part three contains a description of the sample, part four contains preliminary findings and tests, while part five contains the results of the research. In part six we present the conclusions of the research.

2. METHODOLOGY

Under the strong assumptions, the single factor CAPM implies a linear relation between expected return and expected risk:

$$E(R_i) = r_f + \left(E(R_M) - r_f\right)\beta_i \qquad (1)$$

where $E(R_i)$ is expected return, r_f is the risk-free rate, $E(R_M)$ is the expected return on the market portfolio and β_i is the measure of systematic risk.

In empirical tests *ex-ante* variables in the market model are substituted with *ex-post* variables, which is called the *ex-post* version of the CAPM; expected returns are replaced with historical returns, and beta coefficient is estimated from the regression analysis.

The most empirical tests of the CAPM validity employ the traditional two-stage regression procedure. In the first step, the beta coefficient from CAPM model is estimated for every company from the sample by the first-stage regression, afterward the validity of the CAPM model is tested by the second-stage regression. Thereby we have two different procedures; direct and indirect tests.

In the first-stage time series regression of the systematic risk, beta, is estimated by the OLS method. We estimate the following model specification:

$$r_{i,t} = \hat{\alpha}_i + \hat{\beta}_i r_{M,t} + \varepsilon_{i,t}$$
$$i = 1 \ldots n \, ; t = 1 \ldots T \qquad (2)$$

where

- $r_{i,t}$ is return on security i for the period from t-1 to t,
- $r_{M,r}$ is return on market portfolio analogues $r_{i,,t}$,
- $\hat{\alpha}_i$ is estimated value of the regression line intercept, constant,
- $\hat{\beta}_i$ is estimated beta coefficient represents the expected change in $r_{i,t}$ conditioned with the change in $r_{M,t}$,
- $\varepsilon_{i,t}$ is regression residual,
- T are the periods in days, weeks, months or years.

In this research we employ the indirect tests in order to test the previously mentioned research hypotheses. For indirect testing of the CAPM model we use Lintner methodology (1965a, b), by which the risk-return relation is tested with the following equation.

$$\bar{r}_i = \hat{\gamma}_0 + \hat{\gamma}_1 \beta_i + \hat{\gamma}_2 s_i + u_i \qquad i = 1, \ldots, n \qquad (3)$$

where

- $\bar{r}_i$ is average return on security i (i = *1,...,n*),
- $\hat{\gamma}_j$ are models parameters (j = *0,1*),
- β_i are estimated betas from the first stage regression for the security i,
- s_i is the additional measure of risk for the security i, the residual variance and
- u_i is residual with expected value $E(u_i) = 0$.

The model parameters $\hat{\gamma}_j$ are estimated by OLS method and checked with the theoretical values with the significance tests. By the indirect tests the CAPM hypotheses are tested individually:

$$H_0: \quad \gamma_1 > 0 \qquad (4)$$
$$H_0: \quad \gamma_2 = 0 \qquad (5)$$
$$H_0: \quad \gamma_0 = r_f \qquad (6)$$

The model implication about the systematic risk pricing is tested by the extension of the *ex-post* CAPM equation by the additional risk measure. This risk measure should be independent by beta, and it measures the unsystematic risk of the security.

3. DATA

The capital market of Bosnia and Herzegovina dates back to 2002 when two stock exchanges, the Sarajevo Stock Exchange (SASE) and the Banja Luka Stock Exchange (BLSE), were established. General characteristics of this capital market are that it is new and underdeveloped, divided into entities, with a modest supply of market materials and with a small number of liquid securities and generally poor interest of domestic investors.

As in most new markets, the capital market of Bosnia and Herzegovina faces the problem of nonsynchronous trading (for further evidence see Campbell, Lo & MacKinlay, 1997; Latković, 2001; Mateev, 2004), which was a dominant determining factor influencing the size of the sample used in our econometric analysis. Following the best practices of other markets, we choose 50 stocks with highest liquidity from both stock exchanges, 27 from the Sarajevo Stock Exchange (SASE) and 23 from the Banja Luka Stock Exchange (BLSE), to be included in the sample (Table 3.1).

Table 3.1. Sample

Sarajevo Stock Exchange (SASE)		Banja Luka Stock Exchange (BLSE)	
ZIF BIG	BOSNALIJEK	ZIF ZEPTER FOND	RAFINERIJA ULJA
ZIF PROF-PLUS	JP ELEKTROPRIVREDA BIH	KRISTAL INVEST FOND	TRŽNICA
ZIF FORTUNA FOND	ENERGOINVEST	R I TE GACKO AD GACKO	ZIF PRIVREDNIK
SPARKASSE BANK	RMU BANOVIĆI	ZIF INVEST NOVA FOND	BOKSIT AD MILIĆI
ZIF EUROFOND	IK BANKA	EUROINVESTMENT FOND	BIRAČ AD ZVORNIK
ZIF NAPRIJED	JP ELEKTROPRIVREDA HZHB	POLARA INVEST FOND	TELEKOM SRPSKE
ZIF MI-GROUP	ENERGOPETROL	R I TE UGLJEVIK AD UGLJEVIK	ELEKTROKRAJINA
ZIF CROBIH FOND	SOLANA	ZIF BLB-PROFIT	RAFINERIJA NAFTE
ZIF HERBOS FOND	GP ŽGP	BALKAN INVESTMENT FOND	ZIF VIB FOND
ZIF BONUS	SARAJEVO OSIGURANJE	ZIF BORS INVEST FOND	
ZIF BOSFIN	FABRIKA DUHANA SARAJEVO	ZIF AKTIVA INVEST FOND	
ZIF PREVENT INVEST	VRANICA	ZIF JAHORINA KOIN AD PALE	
BH TELECOM	ŠIPAD KOMERC	HIDROELEKTRANE NA DRINI	
HIDROGRADNJA		HIDROELEK. NA TREBIŠNJICI	

Source: Author

Data on individual stocks were obtained from local stock exchanges' official websites (Sarajevo Stock Exchange 2010, Banja Luka Stock Exchange 2010). The sample includes 54% of company stocks, and 46% of closed-end investment fund stocks. The proof that the sample is a balanced representative of the population in the observed period can be seen in the fact that the average share of sample transactions in the population transactions is 87%, the average turnover share is 54%, and the average share of market capitalization is 65%.

Based on the data on stock exchange stock prices we calculated discrete monthly returns from stocks for the period 2005-2009 for all 50 stocks, and used them as a dependent variable in the estimated models (2). Due to the incomplete data, the dividend paid was not taken into consideration. In the event that a stock was not traded in a month, a zero return was recorded. With the aim of presenting an objective return, returns were adjusted for corporate actions, splits and mergers.

This correction is necessary because the named changes in a number of stocks outstanding influence the stock price significantly, sometimes without changing the actual stock returns. We ensured a series of monthly returns for sample stocks, with a minimum of 48, and a maximum of 60 observations.[i] By analyzing the descriptive statistics[ii] we found that 84% stocks have a positive mean, and that the standard deviation, as a measure of distribution dispersion from its mean, is generally high (several times higher than the mean), which indicates the existence of outliers, extreme returns in the distribution.

4. PRELIMINARY ESTIMATES

There are two important estimates that present a challenge to researchers in the CAPM model testing; (1) the choice of the stock market index that will serve as the market portfolio proxy and (2) choice/ estimate of the risk-free rate of return for the market in question.

Ten indices monitor the changes in the stock prices in the capital market of Bosnia and Herzegovina: three are calculated and published by SASE, six by BLSE and one by the Vienna Stock Exchange, for various time spans. Previous research of the capital market in Bosnia and Herzegovina shows that there is a low to moderate correlation of 0.24 to 0.59 between returns on the four major indices in Bosnia and Herzegovina, SASX, BIFX, BIRS and FIRS (Zaimović & Delalić, 2010). This means that none of the indices represent the market in a comprehensive and representative manner; it is evident that the indices are insufficiently diversified as portfolios, which implies that the four major indices are a poor substitute for a market portfolio, since the betas calculated would be considerably different if we used the returns on FIRS instead of the returns on BIFX, as an independent variable, etc.

Another research (Arnaut-Berilo & Zaimović, 2012) tested the efficiency of BIFX and FIRS indices in the context of the mean-variance efficiency.[iii] The results of the research proved that the observed indices showed no mean-variance efficiency in any period of observation, which confirms our opinion that the indices BIFX and FIRS are not a good replacement for a market portfolio.

In a large number of empirical CAPM tests, specially designed indices are used (e.g. Fama & Macbeth, 1973; Winkelmann, 1981; Pasquariello 1999; Fruk & Huljak 2004), which is the approach employed in this paper. We constructed an equally weighted portfolio of all sample stocks that served as a proxy of a market portfolio for this market. This is a well-diversified portfolio composed of stocks from 10 sectors, and stocks of closed-end investment funds from throughout Bosnia and Herzegovina.

Since no official statistics on monitoring and calculating the risk-free rate of return is available in Bosnia and Herzegovina, we estimated the missing economic indicator using the methodology advocated by Damodaran (2008). We took into consideration the available research on the risk-free rate in our region (Zaimović & Mrkonja, 2010, 2011). The real rate of return, that was extrapolated from the return on US government securities with the maturity of one month (Board of Governors of the Federal Reserve System 2010, Inflation Data 2010), was increased by the monthly inflation rate in Bosnia and Herzegovina (Agency for Statistics of Bosnia and Herzegovina 2010), which gave us the average monthly nominal risk-free rate in Bosnia and Herzegovina, for the period of 2005-2009, amounting to 0.337%, calculated for the annual level 4.12%.

Prior to estimating the model, we examined whether the returns on stocks in the capital market of Bosnia and Herzegovina have a normal distribution. In order to test the distribution of stock returns and the proxy index, we used the Skewness-Kurtosis test. The zero hypothesis of this test is that the random variable has a normal distribution. The SK test employs χ^2 statistics, which renders it suitable for series with 9 or more observations. The SK test results indicate that the zero hypothesis of normal distribution cannot be rejected in six cases with the conventional level of statistical significance of 5%. We believe that this is due to the existence of extreme returns, or the outliers, in the distribution.

A positive asymmetry is present in the distribution of our sample and in the market in general, in the observed period, which suggests the dominance of the bear market during the observed period. These results are no surprise, since our market has been affected by the global economic and financial crisis since 2008, which especially afflicted the capital market.

The empiric researches of time series assume that the time series is stationary. We used the Augmented Dickey-Fuller test (Dickey & Fuller, 1979) for a unit root in a time series. We got the expected results; time series of stock prices are integrated of the order 1, I(1). The returns on stocks are stationary time series.

5. RESULTS

In order to estimate beta coefficients of the standard single-factor CAPM model, we use equation (2), in which the independent variable is the return on the previously estimated proxy index of 50 stocks from the capital market of Bosnia and Herzegovina, which we use as the market portfolio proxy, and the dependent variable are discrete returns on stocks 1 to 50. The period of return calculation is one month, and the time series contain between 48 and 60 observations.

Equation (2) clearly shows that the estimate is made employing full returns, i.e. with no correction in this step of estimating the model for the risk free rate of return. Therefore, the estimated alpha coefficients from the equation (2) are not the measure of undervaluation/overvaluation; it is an intercept of the regression line on the *y* axis, therefore a constant. On the other hand, the estimated beta coefficients are CAPM betas, therefore measures of the systematic risk, since the beta represents the regression line slope that remains the same whether the estimate is performed with an excess return over the risk-free rate or with full returns.

Using specific notation, we estimate model (2) with discrete returns using the following equation:

$$D_{i,t} = \hat{C}_i + \hat{\beta}_i TP_t + \varepsilon_{i,t} \qquad (7)$$

where D_i is the discrete return on stock i where i=1,...50, t is the observation period expressed in months, where t=1... up to 48 or 60, TP is the discrete return on the proxy index used as the market portfolio proxy, C_i a constant, β_i the beta coefficient, and $\varepsilon_{i,t}$ the residual.

Table 5.1. Results of the estimated CAPM models

Model	1	2	3	4	5
C (constant) (P value)	0.000 (0.995)	-0.007 (0.842)	0.000 (0.988)	0.012 (0.484)	0.017 (0.550)
Beta coefficient (P value)	0.547 (0.002)	0.983 (0.003)	0.586 (0.000)	0.739 (0.000)	1.332 (0.000)
Model	6	7	8	9	10
C (constant) (P value)	-0.002 (0.955)	-0.007 (0.698)	0.000 (0.999)	-0.010 (0.659)	-0.001 (0.937)
Beta coefficient (P value)	1.163 (0.000)	1.123 (0.000)	1.233 (0.000)	0.703 (0.001)	1.123 (0.000)
Model	11	12	13	14	15
C (constant) (P value)	0.008 (0.754)	0.009 (0.694)	-0.006 (0.684)	-0.011 (0.502)	-0.002 (0.839)
Beta coefficient (P value)	1.166 (0.000)	1.499 (0.000)	1.151 (0.000)	0.919 (0.000)	1.151 (0.000)
Model	16	17	18	19	20
C (constant) (P value)	-0.003 (0.832)	0.007 (0.676)	0.005 (0.779)	0.005 (0.836)	0.000 (0.981)
Beta coefficient (P value)	1.288 (0.000)	0.962 (0.000)	1.452 (0.000)	1.532 (0.000)	0.532 (0.000)
Model	21	22	23	24	25
C (constant) (P value)	-0.002 (0.875)	-0.005 (0.734)	-0.005 (0.715)	-0.002 (0.882)	0.000 (0.991)
Beta coefficient (P value)	0.876 (0.000)	0.707 (0.000)	1.377 (0.000)	0.755 (0.000)	0.979 (0.000)
Model	26	27	28	29	30
C (constant)	-0.012	0.012	-0.017	0.008	0.000

(P value)	(0.388)	(0.576)	(0.242)	(0.647)	(0.986)
Beta coefficient (P value)	1.149 (0.000)	1.067 (0.000)	0.577 (0.000)	0.907 (0.000)	1.378 (0.000)
Model	31	32	33	34	35
C (constant) (P value)	0.010 (0.505)	0.011 (0.468)	0.000 (0.978)	0.044 (0.158)	0.011 (0.466)
Beta coefficient (P value)	0.602 (0.000)	1.342 (0.000)	1.285 (0.000)	1.126 (0.000)	0.700 (0.000)
Model	36	37	38	39	40
C (constant) (P value)	0.009 (0.659)	-0.005 (0.696)	0.024 (0.374)	0.025 (0.532)	-0.013 (0.225)
Beta coefficient (P value)	0.993 (0.000)	0.996 (0.000)	1.402 (0.000)	1.873 (0.000)	0.966 (0.000)
Model	41	42	43	44	45
C (constant) (P value)	-0.015 (0.233)	-0.013 (0.363)	-0.002 (0.926)	-0.020 (0.127)	-0.008 (0.460)
Beta coefficient (P value)	0.629 (0.000)	0.744 (0.000)	1.131 (0.000)	0.440 (0.000)	0.733 (0.000)
Model	46	47	48	49	50
C (constant) (P value)	-0.006 (0.666)	-0.012 (0.411)	-0.013 (0.415)	-0.003 (0.825)	-0.016 (0.177)
Beta coefficient (P value)	1.030 (0.000)	0.590 (0.000)	0.619 (0.000)	1.160 (0.000)	0.678 (0.000)

Source: Author's own research and calculations

According to the CAPM, beta coefficients should statistically differ from zero, should be positive and should vary across stocks. All beta coefficients in our analysis (Table 5.1) are statistically significant at 1% and positive, with variability of estimated betas present. The variability of betas ranges from 0.44 to 1.87. There are no negative betas, which is rare in other markets also. Seven stocks (14% of the sample) have a beta of approximately 1, ranging from 0.96 to 1.05. These stocks have systematic risks as the market itself. We can characterize 20 stocks, or 40% of the sample as defensive stocks. *On* the other hand, 23 stocks belong to the aggressive investments, which makes 46% of the sample. Constant is insignificant in all models (Table 5.1); we cannot reject the null hypothesis that the constant is equal to zero. The average coefficient of determination in all 50 regressions is 42%. In our case, this measure has its economic interpretation, showing the relative significance of systematic risk for each stock. The variance of the sample stocks is on average 42% due to systematic risks and 58% due to unsystematic risks.

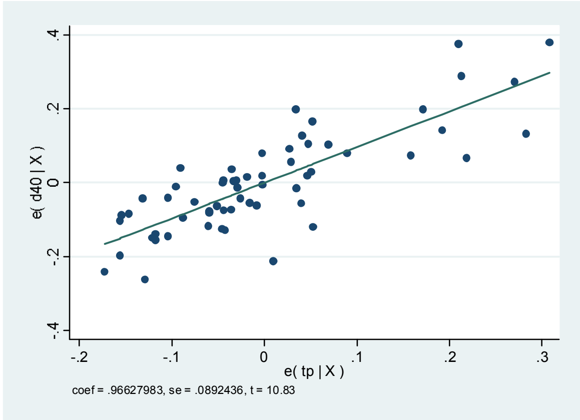

Figure 5.1. The funcional relation between return on the market portfolio and the return on stock 40
Source: Author's own calculations (generated by Stata 10)

As an illustration, we present the estimated regression line for one of the stocks, e.g. stock 40 (Figure 5.1). The estimated beta coefficient for stock 40 is 0.966 which means that the increase in the return on the market portfolio of 1% results in an increase in return on stock 40 for 0.966%, on average. The same applies for the decrease in return: a decrease in the returns on the market portfolio of 1% leads to a decrease in the return on stock 40 for the 0.966%, on average. The regression line passes though the origin, i.e. the constant equals zero.

The Ramsey Regression Equation Specification Error Test (RESET) test (Ramsey, 1969) was used to test the classical linear models for correct specification. It tests whether non-linear combinations of the estimated values help explain the dependent variable. If non-linear combinations of the explanatory variables have any power in explaining the dependent variable, then we have an indication that model is mis-specified.

The null hypothesis of Ramsey's RESET test about the correct specification of the model cannot be rejected in 46 cases at 5% significance level. In four cases, or 8% of the sample (models that include returns on stocks 26, 34, 38 and 39), we have indications that the relationship between variables can be better explained by non-linear models.

By estimating the CAPM model applying the OLS method, we got a series of beta coefficients (Table 2). We used betas and average returns of well-specified models; the cross-section model, therefore, now has 46 observations. The risk-free rate of return was estimated earlier at 0.339% per month. This value will be compared to the value of coefficient γ_0, expression (3). Testing model hypotheses using the indirect method requires the estimation of the unsystematic risk. The unsystematic risk is estimated as the residual variance using the following formula:

$$\sigma_{\varepsilon_i}^2 = \sigma_i^2 - \beta_i^2 \sigma_M^2 \qquad (8)$$

The estimated model (3) was verified using a series of diagnostic tests, in accordance with the assumptions of the linear regression model. In addition to the functional form of the model, based on the Ramsey RESET test, we also test: (1) the hypothesis of serial non-correlation based on the Lagrange multiplier test, (2) the hypothesis of normal distribution of residuals based on the test of asymmetry and kurtosis of residuals, and (3) the hypothesis of homoscedasticity on the basis of regression of squared residuals and squared fitted values.

Table 5.2. Results of estimated cross-section regression, indirect test

Indirect test	
$\hat{\gamma}_0$ (P value)	-0.014 (0.002)*
SE	0.004*
$\hat{\gamma}_1$ (P value)	0.026 (0.000)*
SE	0.004*
$\hat{\gamma}_2$ (P value)	0.015 (0.779)*
SE	0.054
R^2	0.472
Ramsey RESET test (P value)	(0.935)
Lagrange multiplier test of residual serial correlation (P value)	(0.253)
Normality test (P value)	(0.210)
Heteroscedasticity test (P value)	(0.009)

* P value after standard error corrections by the Newey-West method due to heteroscedasticity (Gujarati, 2005)

Source: Author's own research and calculations (Data analysis performed in Mfit 4.0)

The estimated model has a satisfactory test for the functional form, which means that the model is well-specified and that the relationship between variables is linear. Furthermore, the zero hypotheses of normal residual distribution and serial non-correlation cannot be rejected for the conventional level of statistical significance. Due to the occurrence of homoscedasticity, we applied the White method of correcting standard errors (Gujarati, 2005). Table 5.2 contains the probability after the corrections; there have been no changes to the significance of model parameters following the application of the White method.

The coefficient with betas, $\hat{\gamma}_1$, in the cross-section regression is positive and significant at 1%; the risk premium is priced in the capital market of Bosnia and Herzegovina. Our results show that the systematic risk is priced indeed, i.e. the beta premium is positive in this market. By comparing the empirical *t* value of this coefficient with its theoretical values and appropriate levels of freedom, we conclude that we cannot reject the hypothesis (4) in our model.

Using the indirect tests, we examined whether an additional factor, the unsystematic risk, could describe the average return on stocks. Since the coefficient $\hat{\gamma}_2$ is not significant, we can conclude that the unsystematic risk is not priced, which means that the hypothesis (5) cannot be rejected.

The coefficient representing a constant is significant at 5%, with a negative value. Since the estimated average monthly risk-free rate of return for the observed period is 0.3%, we conclude that the constant is not equal to the risk-free rate. In other words, the SML line intercepts the y axis lower than expected. The hypothesis (6) is therefore rejected, and an alternative hypothesis is accepted according to which the intercept is different than the risk-free rate of return, $\gamma_0 \neq \mathrm{r_f}$.

6. CONCLUSION

Testing the hypotheses of the CAPM model by using an indirect test in the capital market of Bosnia and Herzegovina speaks in favour of using this model in our market. We used a sample of 50 stocks from both stock exchanges of Bosnia and Herzegovina, for the period of 2005-2009. Our research has shown that a higher risk is linked to a higher return; the parameter with beta coefficients in a cross-section regression is significant and positive, and therefore we accept the first hypothesis of our research.

Based on the Ramsey's RESET test of the functional form of estimated cross-section model, we reach the conclusion that the model is well-specified, i.e. the relationship between variables is linear. Based on the above, we accept the second hypothesis of our research. We also accept the third hypothesis since the unsystematic risk parameter is highly non-significant; we have not found any proof that the unsystematic risk is priced in the analyzed market during the observed period.

The results of our research can be widely used and have significant implications for business purposes. The systematic risk measured by stock beta is a statistically significant variable and it may be used in a wide range of applications of the CAPM model. We suggest the most important use of the betas in the context of Bosnia and Herzegovina: (1) to estimate the required rate of return on securities, (2) to estimate the discount rate used to discount cash flow, (3) in calculating cost of debt, cost of capital and weighted average cost of capital in companies, (4) in capital budgeting in companies, and (5) in measuring the performance of portfolio management.

Our research does not exclude the possibility that other sources of risk could affect the dynamics of return, since the constant in the cross-section models remained significant and negative. Multi-factor models are natural extension of our work.

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[i] Some stocks that became highly marketable were introduced to the market in 2005.
[ii] Due to the limited space, the data were not presented in the paper, but are available in author's possession.
[iii] Mean-Variance Efficiency.