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TESTING THE CAPM IN BOSNIA AND HERZEGOVINA WITH CONTINUOUSLY COMPOUNDED RETURNS

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Abstract

The capital markets of neighboring transitional Western Balkan countries have attracted a lot of interest from domestic and international investors in the last decade, who view them as an attractive alternative to investing in more developed markets. These markets are characterized by higher returns, and higher volatility of stock returns as compared to those of developed markets. The recent economic and financial crises devastated capital markets worldwide. The new Bosnian capital market faced its hardest times following the withdrawal of international investors.

The aim of this paper is to explore whether there is a standard relation between stock returns and market portfolio returns, as proposed by the Sharpe-Lintner Capital Asset Pricing Model (CAPM), in the stock market of Bosnia and Herzegovina. We tested the model hypotheses with a traditional two-stage regression procedure using the OLS method, using continuously compounded (logarithmic) returns on stocks. Our study indicates that despite the crisis the systematic risk measured by the beta coefficient is priced and that the beta premium is positive. Nevertheless, the Security Market Line (SML) intercepts the ordinate lower than the risk free rate of return. Other factors might also influence stock returns in this market.

Keywords: *CAPM, beta, OLS, Bosnia and Herzegovina*

JEL classification: G12, C32

1. INTRODUCTION

There is no consensus in the literature as to which model should be used to explain the volatility of stock returns and the cost of capital in new capital markets (Morgese Borys, 2007; Morgese Borys, Zemčik, 2008, 2009). The CAPM model is the most often used in developed markets, despite its poor empirical record. Brounen, De Jong and Koedijk (2004) found that 64.2% of US and 57% of European companies use CAPM when assessing the financial feasibility of an investment opportunity. Various factor models have been proposed to overcome CAPM shortcomings (Ross, 1976; Fama, French, 1992, 1993, 1996a, 1996b etc). Since the Bosnian capital market is new and underdeveloped, our analysis focuses on whether one of the most widely used factor models for financial asset pricing, the CAPM, can be used to determine the rates of return in the Bosnian capital market.

Under strong assumptions, the CAPM (Sharpe, 1964; Lintner, 1965a, b) implies a linear equation for pricing risky securities (individually) and/or portfolios of securities. CAPM assumes that the return of every individual security is linked to a single factor (index). According to this model, the relative risk measure of individual financial assets held as a part of a well-diversified portfolio, and of portfolios, is the financial asset beta.

In this research we tested if the regression coefficient, CAPM beta, is a statistically significant risk measure in the new and underdeveloped capital market of BiH. We used a representative sample of 50 actively traded stocks in the five-year period, 2005 to 2010. In this period the average

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share of sample stock transactions in all transactions was 87%, the average turnover share was 54%, and the average share of market capitalization was 65%. We tested the following standard CAPM hypotheses: (1) there is a positive premium on systematic risk; and (2) there are no other factors but the systematic risk that influences stock returns.We used the traditional two-stage regression procedure. First, we estimated the beta coefficients with the OLS method using a time series of countinously compounded (log) returns. Second, we estimated cross-section models with the OLS method using the estimated beta from the first step as the independent variable.

This paper is divided into five sections. Section 2 discusses the theoretical background, literature review and methodology used in our study. Section 3 explains the sample and provides some preliminary estimation. Section 4 presents the study's results, followed by its conclusions.

2. *THEORETICAL BACKGROUND AND METHODOLOGY*

The Sharpe-Lintner CAPM is the basis of Capital Market Theory, representing an extension of the single-period mean-variance model developed by Markowitz (1952) and Tobin (1958) using the Expected Utility Theory formulated by Von Neumann and Morgenstern (1944). The 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 the financial assets to the portfolio variance, measured by the financial asset beta. The beta coefficient is the measure of the systematic risk of the risky assets. In this model, the number of estimated variables (variances, covariances etc.) is much lower than in Markowitz's model, which is its crucial advantage.

Considering that rational 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, the investors diversify the entire unsystematic risk, thus pricing assets according to the systematic risk.

The theory itself caught a lot of attention from theoreticians and practitioners from around the world. Numerous empirical tests of the CAPM model are available, relating to various markets and testing periods, with no conclusive confirmation or rejection of the model. There is wide international evidence of CAPM application possibilities (e. g. Lintner, 1965a, b; Black et al., 1972; Fama and MacBeth, 1973; Strambaugh, 1982; Ulschmid, 1994; Mateev, 2004; Michailidis et al., 2006; Omran, 2007; Guersoy and Rejepova, 2007 etc.). The most prominent early tests of CAPM were proposed by Lintner (1965a, b), Black et al. (1972) and Fama and MacBeth (1973). In all of these studies a combination of time-series regressions and cross-section regression was used.

Taking into account the characteristics of BiH's capital market, we reviewed what some of the newer tests in the region and in some new capital markets are revealing. Experiences from the Croatian capital market suggest that unsystematic risk explains better stock returns than systematic risk (Fruk and Huljak, 2004). A test of the three-factor Fama-French model on 6 portfolios shows that this three-factor model is successful in the explanation of stock return variations in the Croatian market (Kleut, 2008). Atanasovska (2008) analyzed the Macedonian stock market in the period 2002 – 2006, using the methodology of Fama-MacBeth (1973) and Pettengill et al. (1995). The research rejects the hypothesis of a linear risk-return relationship for individual stocks, but its results are in line with the findings of Pettengill et al. (1995), suggesting a conditional risk-return relation.

Mateev (2004) finds that CAPM beta coefficient, size, book and market leverage are priced in the Bulgarian market. Michailidis et al. (2006) show that the risk return relationship is linear and residual risk does not influence portfolio returns in the Greek capital market. On the other hand, this test does not support the intercept hypothesis; in addition, the coefficient of the betas in cross-section regressions is negative, implying an inverse relationship between beta and return. A negative linear relationship between beta and stock returns was also found in the Egyptian capital market (Omran, 2007).

In the Turkish market, Guersoy and Rejepova (2007) used the direct test (Black et al., 1972) and found systematic risk measured by beta to be statistically significant (although negative) as well as the intercept to be significantly different from zero (except in one sub-period). The systematic risk was priced in this market. In addition, they use the methodology of Pettengill et al. (1995) for CAPM tests and got the expected results; the beta was positive in up-markets and negative in down-markets. The intercept test was rejected in both markets (except in two cases) bringing the authors to the conclusion that beta was not the only variable that explains realized returns.

Experiences from the Visegrad Group countries (Czech Republic, Hungary, Poland and Slovakia) are also controversial. The standard CAPM has been confirmed in Hungary and Slovakia, while the four-factor model (besides market portfolio, the factors are industrial production, inflation and term structure) has had some significance in Poland and Hungary (Morgese Borys, 2007).

There is limited evidence from BiH's capital market about the factor pricing models. Earlier studies (Zaimović, 2011, 2012a, 2012b) have shown a positive beta premium, linear risk and return relationship, while the intercept hypothesis has been rejected. These studies detected the violation of the normality assumption of discrete returns employed in regression analysis due to trends at that time in the capital market in the observed period (a bull market in 2006 and the first half of 2007, followed by a bear market). In this paper we aim to test whether continuously compounded returns better satisfy the normality assumption. Finally, we investigate how this shift in inputs affects CAPM test results.

In order to test the CAPM hypotheses with stock returns from BiH's capital market we adopted the most widely used two-stage regression methodology. In empirical tests *ex-ante* variables are substituted with *ex-post* variables; expected returns are replaced with historical returns, and the beta coefficient is estimated from the regression analysis. The basic CAPM equation (Sharpe, 1970) with expected returns, where $E(R_i)$ represents the expected return on security *i*, $E(R_M)$ the expected return on market portfolio, r_f the risk free rate and β_i the security's beta

$$E(R_i) = r_f + \left(E(R_M) - r_f\right)\beta_i \tag{1}$$

is being transformed into the *ex-post* equation (Ulschmid, 1994)

$$r_{i,t} = r_{f,t} + \beta_i\left(r_{M,t} - r_{f,t}\right) + \varepsilon_{i,t} \quad i = 1 \ldots n\,; t = 1 \ldots T \tag{2}$$

where $r_{i,t}$ is return on security *i* for the period from t-1 to t, $r_{f,t}$ is risk free rate in the period from t-1 to t, $r_{M,t}$ is return on market portfolio analogues $r_{i,t}$, estimated beta coefficient represents the expected change in $r_{i,t}$ conditioned with the change in $r_{M,t}$, $\varepsilon_{i,t}$ is the regression residual and *T* are the periods in days, weeks, months or years. In order to test the CAPM model we employ the most common time series regression analysis using the OLS method. We estimated the following model:

$$r_{i,t} = \hat{\alpha}_i + \hat{\beta}_i r_{M,t} + \varepsilon_{i,t} \quad i = 1 \ldots n\,; t = 1 \ldots T \tag{3}$$

where variables with hat are estimated from regression; estimated beta is a measure for systematic risk, and estimated alpha is a regression constant. The second stage regression enables us to test the CAPM hypothesis. We used both the direct (Black et al., 1972) and the indirect test (Lintner 1965 a, b). The first one is specified as:

$$\bar{r}_i = \hat{\gamma}_0 + \hat{\gamma}_1\beta_i + u_i \qquad i = 1,\ldots,n \tag{4}$$

and the second one is specified as:

$$\bar{r}_i = \hat{\gamma}_0 + \hat{\gamma}_1\beta_i + \hat{\gamma}_2 s_i + u_i \qquad i = 1,\ldots,n \tag{5}$$

where $\bar{r}_i$ is average return on security *i* (*i = 1,...,n*), $\hat{\gamma}_j$ are models parameters (*j = 0,1,2*), 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.

In contrast to the methodology of Black et al. (1972) where in equations (3) and (4) excess returns were used, we estimate regressions with full returns. This adoption affects the hypotheses testing, as we suggest. The intercept in the cross-section regressions does not represent the CAPM alpha coefficient, therefore the intercept is not expected to be equal to zero, but to equal the risk-free rate. If we compare equations (4) and (5) with the *ex-ante* CAPM equation (1) we conclude that for the CAPM validity three conditions must hold

$$\gamma_0 = r_f \ (6), \qquad \gamma_1 > 0 \ (7), \qquad \gamma_2 = 0 \ (8).$$

If we cannot reject the null hypothesis of an expected value for $\hat{\gamma}_1$, than the systematic risk is positively priced. Other risk factors that might influence stock returns are accounted for in the indirect test by the expected value of $\hat{\gamma}_2$. The intercept hypothesis says that assets not correlated with the market portfolio should earn a risk-free rate.

3. DATA AND PRELIMINARY ESTIMATES

The capital market of Bosnia and Herzegovina was established in 2002, when two stock exchanges, the Sarajevo Stock Exchange (SASE) and the Banja Luka Stock Exchange (BLSE), started working. This market is new and underdeveloped, with a relatively small number of traded securities. As in most new and less liquid markets, the Bosnian capital market faces the problem of nonsynchronous trading, where prices are followed in regular periods (daily, weekly, monthly) while trading has happened in irregular periods (Campbell, Lo and MacKinlay, 1997; Latković, 2001; Mateev, 2004), which was a dominant determining factor influencing the size of the sample and the return interval used in our econometric analysis.

We included all stocks with sufficient liquidity, based on trading volume and number of transactions, from BiH's capital market in the sample. Namely, only 50 stocks from both stock exchanges, 27 from the Sarajevo Stock Exchange (SASE) and 23 from the Banja Luka Stock Exchange (BLSE), were traded on a regular basis in the five-year period, 2005-2010. Data on individual stocks were obtained from the local stock exchanges' official websites. The sample is made of companies' stocks from 9 industries (54%) and of closed-end investment fund stocks (46%).[1] The average share of transactions of sample stocks in the transactions of all registered stocks in both stock exchanges in the observed period is 87%, the average turnover share is 54%, and the average share of market capitalization is 65%. We calculated the monthly log returns on stocks for the five year period from January 2005 to January 2010 for all 50 stocks, which were used as a dependent variable in the estimated model (4).[2] Dividend yields are not taken into account due to missing data. If there were no transactions with particular stocks during a month, a null return was notified. Returns are adjusted for stock splits and reverse stock splits.

In order to test the normality assumption of log returns the Skewness - Kurtosis (SK) test was used. The results of the SK test for log returns of sample stocks (P values) are presented in Table 1. Based on these results we suggest that the null hypothesis regarding the normal distribution of returns cannot be rejected in 21 cases at the 5% significance level.

Stock	P value	Stock	P value	Stock	P value	Stock	P value	Stock	P value
1	0.4495	11	0.0029	21	0.0108	31	0.7778	41	0.0323
2	0.0000	12	0.0004	22	0.0201	32	0.0406	42	0.6015
3	0.0000	13	0.2057	23	0.0344	33	0.0024	43	0.4226
4	0.0222	14	0.0014	24	0.0112	34	0.0139	44	0.7495
5	0.0474	15	0.0836	25	0.0153	35	0.1076	45	0.0356
6	0.5050	16	0.2148	26	0.0005	36	0.0136	46	0.0286
7	0.0635	17	0.2136	27	0.4473	37	0.3602	47	0.0180
8	0.0633	18	0.0029	28	0.9369	38	0.0000	48	0.0049
9	0.8928	19	0.0443	29	0.0054	39	0.0000	49	0.2921
10	0.0603	20	0.0136	30	0.0000	40	0.4203	50	0.3924

Source: Author's calculations
Table 1: Results of SK test for returns' normal distribution

We find, in general, the normality assumption more satisfactory for log than for discrete returns, compared to the results of earlier studies when only 6 stock returns were normally distributed (Zaimović 2011, 2012a). In the observed period there were ongoing extreme trends in Bosnian capital market; a bull market from the beginning of the period was followed by a bear market that was deepened by the global financial and economic crisis. Most returns' distributions are positively skewed, which is understandable due to the global trends in the observed period.

The unit root test, ADF test (Dickey and Fuller, 1979) is used to test whether a time series of log returns is stationary. Considering that the time series of stock prices is not stationary, we tested the first difference of prices, log returns, for stationarity. The results of the ADF test for monthly returns for all sample stocks show that the time series of log returns is stationary. By using graphical analysis, we excluded time trend and drift. The null hypothesis regarding the time series of discrete returns with the unit root is rejected in all cases at the 1% significance level. As expected, our results indicate that stock prices series are integrated to the order 1, I (1).

Some studies have shown that there is a low to moderate positive correlation between pairs of indices returns for the most important stock indices in BiH's market (Zaimović and Delalić, 2010). Furthermore, BIFX and FIRS indices are not mean-variance efficient (Arnaut-Berilo and Zaimović, 2012a). These indices are not suitable proxies for a market portfolio because the calculated betas would significantly differ if instead of one index returns another index returns were used. Indices that are a substitute for each other and a good proxy for a market portfolio at the same time cannot result in different beta estimates. We can conclude that none of these indices represents the entire Bosnian stock market.[3] Instead of using the existing stock market indices, we created an equally weighted portfolio of all sample stocks that serves as proxy for a market portfolio for this market.

This is a well-diversified portfolio composed of stocks from 9 sectors, and the stocks of investment funds from the entire Bosnian market. This methodology has been widely used since the first CAPM tests (e. g. Fama and MacBeth, 1973; Winkelmann, 1981; Pasquariello 1999).

Since there is no official statistical data on monitoring and calculating the risk-free rate of return in Bosnia and Herzegovina, we had to estimate this missing economic indicator for the purpose of this research. Damodaran (2008) suggests that the real rate of return is equal worldwide and that it can be extracted from the return on government securities of some mature markets, such as the American. Applying this methodology, we used the monthly inflation rates in BiH and the US, and the monthly data for US government securities yields, with one month constant maturity.[4] Data was obtained from Agency for Statistics of BiH Releases, the Historical Consumer Price Index website and Federal Reserve Statistical Releases.[5] The average BiH monthly inflation rate in the observed period was 0.297%, while average monthly inflation in the US was 0.211%. We estimated the average risk-free rate in BiH in the period of January 2005 to January 2010 at 0.337% monthly, or 4.12% annualized.[6,7]

4. RESULTS

We used monthly returns on sample stocks as the dependent variable, and monthly returns on the proxy of the market portfolio as the independent variable in order to estimate the first stage regression, model (3), during the period January 2005 to January 2010. We performed the estimation with full returns, not excess returns, as explained earlier. The Ramsey Regression Equation Specification Error Test (RESET) test (Ramsey, 1969) was used to test the classical linear models for correct specification. Estimated time-series regressions are summarized in Table 2.

Model	**1**	**2**	**3**	**4**	**5**
Constant $\hat{\alpha}_i$	-0.003	-0.024	0.002	0.012	0.010
Market portfolio return $\hat{\beta}_i$	0.584***	0.864***	0.582***	0.759***	1.304***
R^2	0.16	0.15	0.32	0.31	0.38
Ramsey RESET test (P value)	0.164	0.984	0.902	0.144	0.219
Model	**6**	**7**	**8**	**9**	**10**
Constant $\hat{\alpha}_i$	-0.015	-0.007	-0.021	-0.014	0.001
Market portfolio return $\hat{\beta}_i$	1.150***	1.174***	1.287***	0.800***	1.162***
R^2	0.24	0.46	0.24	0.24	0.52
Ramsey RESET test (P value)	0.988	0.08	0.370	0.497	0.084
Model	**11**	**12**	**13**	**14**	**15**
Constant $\hat{\alpha}_i$	0.004	0.009	-0.001	-0.009	0.004
Market portfolio return $\hat{\beta}_i$	1.104	1.463	1.210	0.895	1.174
R^2	0.37	0.59	0.63	0.39	0.69
Ramsey RESET test (P value)	0.824	0.052	0.765	0.147	0.137
Model	**16**	**17**	**18**	**19**	**20**
Constant $\hat{\alpha}_i$	0.002	0.008	0.007	0.002	0.001
Market portfolio return $\hat{\beta}_i$	1.330***	1.009***	1.397***	1.499***	0.559***
R^2	0.69	0.42	0.58	0.52	0.28
Ramsey RESET test (P value)	0.718	0.779	0.656	0.608	0.342
Model	**21**	**22**	**23**	**24**	**25**
Constant $\hat{\alpha}_i$	0.002	-0.004	0.000	0.002	0.005
Market portfolio return $\hat{\beta}_i$	0.898***	0.756***	1.370***	0.786***	1.015***
R^2	0.49	0.34	0.69	0.45	0.61
Ramsey RESET test (P value)	0.127	0.665	0.336	0.147	0.673
Model	**26**	**27**	**28**	**29**	**30**
Constant $\hat{\alpha}_i$	-0.007	0.009	-0.015	0.010	0.002
Market portfolio return $\hat{\beta}_i$	1.101***	1.097***	0.647***	0.897***	1.247***
R^2	0.588	0.351	0.338	0.399	0.522
Ramsey RESET test (P value)	0.017	0.616	0.647	0.355	0.450
Model	**31**	**32**	**33**	**34**	**35**
Constant $\hat{\alpha}_i$	0.011	0.015	0.002	0.033	0.012
Market portfolio return $\hat{\beta}_i$	0.658***	1.359***	1.265***	1.201***	0.722***
R^2	0.27	0.63	0.57	0.30	0.33
Ramsey RESET test (P value)	0.449	0.379	0.321	0.046	0.978
Model	**36**	**37**	**38**	**39**	**40**
Constant $\hat{\alpha}_i$	0.008	-0.002	0.021	0.012	-0.007
Market portfolio return $\hat{\beta}_i$	0.994***	1.038***	0.155***	1.397***	1.011***
R^2	0.35	0.53	0.37	0.33	0.65
Ramsey RESET test (P value)	0.646	0.246	0.001	0.180	0.967
Model	**41**	**42**	**43**	**44**	**45**
Constant $\hat{\alpha}_i$	-0.012	-0.010	-0.002	-0.019	-0.004
Market portfolio return $\hat{\beta}_i$	0.656***	0.795***	1.167***	0.499***	0.743***
R^2	0.37	0.39	0.44	0.23	0.48
Ramsey RESET test (P value)	0.657	0.694	0.428	0.532	0.525

Model	**46**	**47**	**48**	**49**	**50**
Constant $\hat{\alpha}_i$	-0.001	-0.011	-0.012	0.001	-0.013
Market portfolio return $\hat{\beta}_i$	1.054***	0.613***	0.677***	1.185***	0.709***
R^2	0.60	0.28	0.27	0.59	0.41
Ramsey RESET test (P value)	0.744	0.175	0.550	0.592	0.685

Source: Author's calculations
Notes: *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; * denotes statistical significance at the 10% level; number of observations varies from 48 to 60.

Table 2: Results of estimated OLS regressions

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 2) were statistically significant at 1% and positive, with variability of estimated betas present. The constant was insignificant in all models; we cannot reject the null hypothesis that the constant is equal to zero. The variability of betas ranged from 0.499 to 1.499. There are no negative betas, typical in other markets as well. The average coefficient of determination in all 50 regressions was 42.6%. 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 was on average 42.6% due to systematic risks and 57.4% due to unsystematic risks. Based on Ramsey's RESET test in three cases (models 26, 34 and 38) we have indications that the relationship between variables can be better explained by non-linear models. These are highly speculative stocks indicating a large portion of unsystematic risk in their variance.

The models have been tested for structural stability because of the financial and economic crises in the analyzed period. The structural breaks were to be looked for in October/November 2008, when the global crises appeared in this market. The Chow test was not an adequate method, because of the quite short length of one sub-period (only 16 observations). Therefore, we used regression with dummy variables as an alternative to the Chow test (Gujarati, 2006) and CUSUM - CUSUMSQ techniques and found betas to be unstable in 2 cases systematically, while in other (45) cases stable.[8]

In order to test the CAPM hypotheses, expressions (6), (7) and (8), we estimated with the second stage regressions (4) and (5). Estimated betas from the first stage regressions (Table 2) were used as the independent variable, while average log returns on sample stocks were used as the dependent variable. Betas from misspecified models are excluded from the sample in the cross-section regressions. The models were checked with diagnostic tests.

Coefficients with betas were significant at 1% and were positive. This means that systematic risk measured by beta is priced in this market and beta premium is positive; we cannot reject the hypothesis (7) in either of the models. The basic CAPM statement that stocks with higher risks bring higher returns applies in this market. The indirect test shows that the unsystematic risk measured by residual variance is also priced in the Bosnian market, thus hypothesis (8), above, must be rejected. The Ramsey-RESET test indicates that the estimated cross-section models were well-specified, which allows us to conclude that the relationship between risk and return is linear in this market. In estimated

	Direct test	Indirect test
Constant $\hat{\gamma}_0$	-0.018*** (0.005)	-0.017*** (0.005)
Betas $\hat{\gamma}_1$	0.030*** (0.005)	0.026*** (0.005)
Residual variance $\hat{\gamma}_2$		0.167*** (0.065)
R^2 (No. of observations)	0.46 (47)	0.52 (47)
Ramsey RESET test (P value)	0.445	0.201
Heteroscedasticity test based on the regression of squared residuals on squared fitted values (P value)	0.757	0.948

Source: Author's calculations
Notes: Standard errors are given in brackets; *** denotes statistical significance at 1% level; ** denotes statistical significance at 5% level; * denotes statistical significance at 10% level.

Table 3: Results of estimated cross-section regression

cross-section models, the constant is significant and negative, i.e. lower than 0.337%, the estimated risk-free rate of return. According to our results, assets not correlated to the market portfolio had a return that is lower than the risk-free rate of return. We reject the hypothesis about the expected value of the SML intercept, expression (6). These results indicate that other factors influence the returns' dynamics in the capital market of Bosnia and Herzegovina as well, and investors were risk-loving rather than risk-averse in the analyzed period.

5. CONCLUSIONS

We tested the Sharpe-Linter version of the CAPM with log monthly stock returns from the capital market in Bosnia and Herzegovina. The usage of continuously compounded returns in CAPM estimations has improved satisfaction of the normality assumption as compared to the usage of discrete returns. However, due to the extreme returns, outliers, and return distribution, it would be necessary to model outliers in such an analysis, which could be done in further research.

All beta coefficients were positive and significant at the 1% level. There are no negative betas, typical in other markets as well. In the long run, and especially in bull and bear markets, stock prices tend to move together, not necessarily as a result of issuers' better or worst performances, but due to the herding effect, the irrational and emotion-driven behavior of investors. This causes betas to be positive in the market most of the time, as it is in our study. We also found three of the fifty models were misspecified. One possible explanation is that these securities stock prices were driven by some speculative attacks.

Based on direct and indirect tests using cross-section regressions, we found that systematic risk measured by the regression coefficient beta is priced and beta premium is positive in this market. The empirical regression line has a lower intercept in both cross-section models, as one would expect under the CAPM, implying that other factors, like size, book to market value etc., influence the stock returns in this market as well. In addition, the indirect test suggested that the unsystematic risk measured by residual variance is also priced in this market, in contrast to the earlier CAPM test with discrete returns (Zaimović, 2011). Other indirect tests could help explain additional factors that are priced in this market, which could be addressed in further research. Multi-factor models like the Fama –French three factor model are a natural extension of our work, as well as other methods for beta estimation such as ARCH and GARCH.

Although beta, as a CAPM measure of systematic risk, is found to be statistically significant and positively priced in BiH's capital market, we must conclude that as in other, much more developed capital markets in the world, most CAPM assumptions do not hold in this market. Namely, investors were not able to lend and borrow at a risk-free rate in this market because prior to 2011 there were no treasuries in this market at all. Since 2011, there are quasi-government treasuries, issued by the two entity-level governments.

Not all investors have homogeneous expectations, and not all information is available at the same time to all investors. The fact that the SML line intercepts the y axis lower than the risk-free rate indicates that the market was not in equilibrium in the analyzed period, i.e. forces other than the market itself, like speculative attacks, have driven the realized returns. Investors in that time had substantially different expectations about the return and risk of stocks in this market, which in turn explains the extreme trends in the BiH's capital market in the analyzed period.

(Notes)

1 List of companies included in the sample available with the author.

2 Some stocks were introduced to the market a few months later. Therefore the number of observation varies from 48 to 60.

3 In contrast to our research, Winkelmann (1981) finds the contrary when he analyzes four German stock market indices. Based on the high correlation coefficients he concludes that the analyzed indices are a good substitute for each other.

4 A similar methodology for risk-free rate estimation was used by Guersoy and Rejepova (2007) for the Turkish market.

5 www.bhas.ba, www.federalreserve.gov and www.inflationdata.com

6 For detailed methodology and data see Zaimović (2010) and Zaimović and Mrkonja (2010).

7 Average risk-free rates are used in other studies also, e. g. Omran (2007) and Učkar and Nikolić (2008).

8 Models with non-linear risk-return relation were not tested for stability.

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