Routledge
Taylor & Francis Group

Economic Research-Ekonomska Istraživanja

ISSN: 1331-677X (Print) 1848-9664 (Online) Journal homepage: http://www.tandfonline.com/loi/rero20

Effects of risk aversion on securities portfolio performance in underdeveloped capital markets: the case of the capital market of Bosnia and Herzegovina

Sejfudin Zahirović & Jasmina Okičić

To cite this article: Sejfudin Zahirović & Jasmina Okičić (2016) Effects of risk aversion on securities portfolio performance in underdeveloped capital markets: the case of the capital market of Bosnia and Herzegovina, Economic Research-Ekonomska Istraživanja, 29:1, 343-359, DOI: 10.1080/1331677X.2016.1168042

To link to this article: http://dx.doi.org/10.1080/1331677X.2016.1168042

Published online: 13 May 2016.

ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA, 2016
VOL. 29, NO. 1, 343–359
http://dx.doi.org/10.1080/1331677X.2016.1168042

Routledge
Taylor & Francis Group

Effects of risk aversion on securities portfolio performance in underdeveloped capital markets: the case of the capital market of Bosnia and Herzegovina

Sejfudin Zahirović and Jasmina Okičić

Faculty of Economics, University of Tuzla, Tuzla, Bosnia and Herzegovina

ABSTRACT

The main goal of this article is to examine risk aversion impact on securities portfolio performance in underdeveloped capital markets. For the purpose of this research, portfolio performance was taken as a dependent variable, whereas investors' attitude towards risk was considered as an independent variable. The analysis results have revealed that, *ceteris paribus*, an increase in risk aversion leads to a decrease in expected return and the creation of more superior securities portfolio. The article is expected to produce useful pieces of information which might be helpful for investors in the process of creating their portfolios in underdeveloped capital markets.

ARTICLE HISTORY
Received 18 October 2013
Accepted 25 March 2015

KEYWORDS
Securities portfolio; investor's attitude towards risk; underdeveloped capital market

JEL CLASSIFICATIONS
G11; C58; D81; C61

1. Introduction

As well-known, the trade-off between risk and return is central to the theory of finance, where one of the central tenets is that investors expect higher return for taking risk. Lintner (1965) and Mossin (1966) are one of the first scholars who described a relationship between risk and expected return by developing the Capital Asset Pricing Model (CAPM) which outlines that it is only systematic risk that is rewarded by the market. Fama and MacBeth (1973) demonstrated that, on average, there seems to be a positive trade-off between return and risk, with risk measured from the portfolio viewpoint. They also pointed out that, in making a portfolio decision, an investor should assume linear relationship between a portfolio expected return and risk. Black, Jensen, and Scholes (1972), Fama and MacBath (1974), as well as Friend and Blume (1970) found out that, while there is a positive relationship between beta and average excess return, there are significant deviations from the predicted relationship. Many other scholars, e.g., Bollerslev, Engle, and Wooldridge (1988), Harvey (1989), Baillie and DeGennaro (1990), Campbell and Hentschel (1992), Ghysels, Santa-Clara, and Valkanov (2005), Ludvigson and Ng (2007), etc. have also reported a positive risk-return trade-off relation. In contrast, Breen, Glosten, and Jagannathan (1989), Nelson (1991), Glosten, Jakannatha and Runkle (1993), Brandt and Kang (2004), etc. suggested a

CONTACT Jasmina Okičić jasmina.okicic@untz.ba

strong negative trade-off. In short, estimating expected returns from time series of realised stock return data is very difficult, as summarised by Merton (1980, p. 326) 'to attempt to estimate the expected return on the market is to embark on a fool's errand.'

Expected return determines the risk premium which represents the compensation investors require for taking on the additional risk. As risk premium increases, so does the risk aversion. According to Tobin (1958) and Pratt (1964) the risk premium on the market portfolio was linked to investors' risk aversion. Risk premium has to remain positive because it rewards investors for taking the risk. However, the literature also confirms the evidence of negative risk premium, documented by Boudoukh, Richardson, and Smith (1993), Ostdiek (1998), Arnott and Bernstein (2002), Arnott and Ryan (2001), Bakshi and Kapadia (2003), etc. The literature dealing with the relationship between portfolio selection and risk aversion shows a variety of approaches. Although there has been extensive research into the empirical and theoretical aspects of trade-off between risk and return, most of these studies usually focus on the well-developed capital markets. Taking into account the above-mentioned, the authors decided to select the topic for this article due to the fact that, according to the authors' best knowledge, very few publications dealing with the issue of the trade-off between risk and return in underdeveloped capital markets are found in the existing literature.

The main goal of this article is to examine effects of investor's attitude towards risk on securities portfolio performance in underdeveloped capital markets. But, why should this kind of research be important? First of all, the examination of the effects of investors' attitude towards risk on securities portfolio performance and structure could result in gathering some useful pieces of information which might be beneficial for investors in creating their portfolios in underdeveloped capital markets. Furthermore, due to many specific features of underdeveloped capital markets (such as: low market capitalisation, poor liquidity and turnover, weak legal protection for minority shareholders, low correlation with developed and emerging capital markets, etc.), the results of this research might be recognised as useful guidelines which could assist investors to improve their investment strategies. The starting point of this research study is related to addressing the following question: *How does the investor's risk aversion impact portfolio performance in case of underdeveloped capital market?* With regard to the research question, the central research hypothesis has been defined as follows:

> **Hypothesis:** *Increase in risk aversion leads to decrease in expected return and to creation of more superior securities portfolio as well.*

The main limitations of this study are related to the shorter available financial time series in newly formed capitalistic economy and missing data (due to the lack of collective records on levels of securities offerings issues).

The article is organised as follows. After introduction, the following section gives a brief outline of theoretical background that is relevant to the research. The article moves on describing methodology, after which follows the discussion of the results. In the end a brief summary of the main conclusions is given in accordance with the analysis findings.

2. Theoretical framework

As well-known, investors' risk preferences reflected in asset allocation choices have been widely discussed in literature both theoretically and empirically. It is probably true to say that Friedman and Savage (1948) are one of the first scholars who tried to conceptualise investor's attitude towards risk, i.e., risk aversion by concluding that investors must be paid a premium to induce them to undertake moderate risk, instead of subjecting themselves to either small or larger risks. According to Friedman and Savage (1948), the main factor that gradually changes the investor's attitude towards risk is actually the size of their wealth.

Risk can be defined as a difference between realised and expected return. Therefore, the risk averse investor is the one who dislikes risk and requires a higher rate of return as a reward to buy riskier securities. On the other hand, risk neutral investor is indifferent between investing in risk-free and risky investment, under the presumption of the same expected return. Risk-lovers, however, acquire investments of higher risk with a lower expected return. The first notable efforts in understanding the factors that influence the degree of risk aversion were made by Pratt (1964) and Arrow (1965). They pointed out that, for the certain amount of risk, an investor with high risk aversion demands much larger risk premium compared to the one required by the risk-lovers. How will an investor behave depends on how he interprets a risk–return trade-off. This 'interpretation' is measured by investor's utility curve. Risk aversion, which has been defined by absolute risk aversion coefficient, is also known as Arrow–Pratt absolute risk aversion. This coefficient at point x is defined as:

$$\lambda_A(x) = -\frac{U''(x)}{U'(x)}, \tag{1}$$

where $U'(x)$ and $U''(x)$ denotes the first and second derivative of utility function, respectively. Utility functions with constant absolute risk aversion coefficient are called CARA utility functions. However, it is often assumed that most investors have constant relative risk aversion. Utility functions with constant relative risk aversion coefficient are called CRRA utility functions. Arrow (1971) defines a measure of relative risk aversion which is invariant to positive linear transformations and involves only the first two derivatives of the utility function:

$$\lambda_R(x) = -x\frac{U''(x)}{U'(x)}. \tag{2}$$

Arrow (1971) hypothesises that $\lambda_R(x)$ is an increasing function of wealth (Graves 1979, p. 205)

Basically, utility functions give us a way to measure investor's preferences for wealth, as well as the amount of risk they are willing to undertake in order to attain greater wealth. This makes it possible to develop a theory of portfolio optimisation, which implies that utility theory lies at the heart of modern portfolio theory (MPT). According to Markowitz (1959) rational risk averse investors expect either a maximum return for a given level of risk, or a given return for minimum risk. In line with it, 'the most important aspect of Markowitz's work was to show that it is not a security's own risk that is important to an investor, but rather the contribution the security makes to the variance on his entire portfolio' (Rubinstein 2002, p. 1042).

Since this research deals with the effects of the investor's risk aversion on portfolio performance in case of underdeveloped capital market, the research is expected to show that an increase in risk aversion leads to decrease in expected return and to creation of more superior securities portfolio. Figure 1 illustrates this theoretical concept.

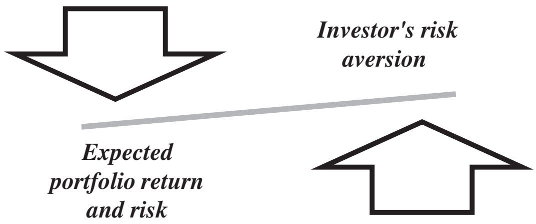

Figure 1. Illustration of the theoretical concept. Source: Created by the authors.

The main premise behind our theoretical concept is that there is a negative trade-off between risk aversion and expected portfolio return and risk. Canner, Mankiw, and Weil (1997) used similar approach in their attempt to describe the influence of an investor's attitude toward risk on the composition of his portfolio.

3. Methodology

3.1. Research site

This research is conducted focusing on the analysis of the capital market of Bosnia and Herzegovina. This capital market is characterised by territorial division, the incompatibility of entity institutions and legal regulations which negatively affect the investment climate and the liquidity of securities. MSCI Inc. (2013) provides an evaluation of the four market accessibility criteria, as follows: (1) openness to foreign ownership; (2) ease of capital inflows/outflows; (3) efficiency of the operational framework; and (4) stability of the institutional framework. In case of capital market of Bosnia and Herzegovina, improvements are needed especially in case of the third criteria, i.e., information flow, clearing and settlement, trading, transferability[1] and short selling (see Appendix A). According to these criteria, the capital market of Bosnia and Herzegovina is characterised as the so called *standalone market*, which 'includes potential candidates for the MSCI Frontier Markets Indices that currently do not meet the minimum liquidity requirements as well as markets that are currently partially or fully closed to foreign investor. Furthermore, stocks lending and short selling are activities that are either not developed or completely prohibited in all standalone market countries and the summary does not highlight these issues on a country – by country basis' (MSCI Inc. 2013, p. 36). The capital market of Bosnia and Herzegovina consists of two independent territorial regions that have separate stock exchanges, i.e., the Sarajevo Stock Exchange (SASE) which operates in the Federation of Bosnia and Herzegovina and the Banja Luka Stock Exchange (BLSE) which operates in the Republika Srpska.

3.2. Variables

The investor's attitude towards risk measured by previously explained relative risk aversion coefficient$\left(\lambda_R(x)\right)$ is considered as an *independent* variable. A *dependent* variable is portfolio performance measured by: (1) average return measures; (2) risk measures; and (3) information ratio (according to Modern Investment Technologies (2006–2008), pp. 11–52).

Excess Mu and expected excess growth rate are used as an *indicator* for an average return measures. Excess Mu (μ_p^e) is defined as:

$$\mu_p^e = \mu_p - r_f + d_p, \tag{3}$$

where μ_p refers to portfolio Mu, r_f denotes risk-free rate and d_p is called portfolio dividend yield. Expected excess growth rate (ρ_p^e) is defined as:

$$\rho_p^e = \mu_p^e - \frac{\sigma_p^2}{2}, \tag{4}$$

where σ_p^2 refers to portfolio volatility. Information ratio (I) is taken as an indicator of portfolio performance, and is defined by the following expression:

$$I = \frac{\rho_p^e - R_{min}^e}{\sigma}, \tag{5}$$

where R_{min}^e is minimum acceptance excess rate. Sharpe ratio is a particular case of information ratio corresponding to $R_{min}^e = 0$. Volatility, value at risk (VaR) and conditional value at risk (CVaR) are used as risk *indicators.* Portfolio VaR is defined as a maximum portfolio loss over a given time interval at a given level of statistical confidence. This measure of portfolio risk is defined by following expression (Modern Investment Technologies 2006–2008, p. 44):

$$P\left(r_{[0,T]}^e < -VaR_\alpha^T\right) = 1 - \alpha, \tag{6}$$

where $r_{[0,T]}^e$ is portfolio excess simple return over [0,T] period. On the other hand, portfolio CVaR is conditional expectation of losses beyond VaR. Therefore, it is basically an average value of $(1 - \alpha)100\%$ of highest losses.

3.3. Sample

Given the large number of available but not actively traded securities, a subset of the most actively and highest capitalised stocks traded on SASE and BLSE[2] was used for the purpose of this research. These securities must have sufficiently large daily trading volumes to qualify for inclusion in a portfolio.

The Bosnian Traded Index (BATX) [3] incorporates the most liquid securities from the capital market of Bosnia and Herzegovina, i.e., BH Telecom – BHTSR, Bosnalijek – BSNLR, Fabrika duhana Sarajevo – FDSSR, JP Elektroprivreda BiH – JPESR, Nova banka ad Banja Luka – NOVB-R-E, Telekom Srpske – TLKM-R-A (Wiener Börse AG, 2012), we used them as a sample as well as some of the top 10 issuers in 2012, i.e.: Tvornica cementa Kakanj d.d. Kakanj – TCMKR, Elektro grupa d.d. Jajce – ELGJR, ZIF BIG Investiciona grupa d.d. Sarajevo – BIGFRK3, ZIF Bosfin d.d. Sarajevo – BSNFRK2, ZIF MI Group d.d. Sarajevo – MIGFRK2, IK Banka d.d. Zenica – IBZRK2, ZIF Zepter fond ad Banja Luka – ZPTP-R-A, ZIF Jahorina Koin ad Pale – JHKP-R-A.[4] This sample represents blue chips stocks from the underdeveloped capital market of Bosnia and Herzegovina.

3.4. Risk free rate of return

Due to overall complex political and economic situation[5], the government of Bosnia and Herzegovina still hasn't issued treasury bills. There have been some more or less successful attempts of treasury bills issue on SASE and BLSE separately, but the 'real' risk-free securities are still missing. As Mossin (1966) pointed out, to identify riskless asset as cash may be quite suggestive. Lintner (1965, p. 15) also assumed that 'each individual investor can invest any part of his capital in certain risk free asset, i.e., deposits in insured savings accounts all of which pay interest at a common positive rate'. In his reflections on the meaning of risk free Fisher (2013, p. 68) claims that 'returns on cash and cash equivalents are quite a handsome rate of return for something that is our best proxy for risk free'. This is also in accordance with the Society of Actuaries Committee on Finance Research (2009, p. 78) where 'the only safe harbour for assets in periods of crisis may be cash, short-term government bonds, and gold'. For the purpose of this study, and due to lack of treasury bills issue, fixed term deposit interest rate has been equalled with a proxy of risk-free rate of return. Based on the passive deposit money banks interest rate, given at the annual level $\left(i_y\right)$, this rate at the monthly level $\left(i_m\right)$ is recalculated as follows:

$$i_m = 100\left[\sqrt[12]{\left(1+\frac{i_y}{100}\right)}-1\right]. \tag{7}$$

3.5. Models for portfolio optimisation

If we assume that utility function of the investor belongs to the CRRA class and that the relative risk aversion coefficient value is known and equal to $\lambda_R(x)$, then the portfolio, that is optimal relative to a CRRA utility function, is obtained by the maximisation (over the set of all admissible portfolios) of one of the following utility function (Modern Investment Technologies 2006–2008, p. 21):

$$Q_{\frac{\lambda_{R(x)}}{2}}\left(\vec{\pi}\right) = \vec{\mu}^e\vec{\pi}^* - \frac{\lambda_{R(x)}}{2}\vec{\pi}^*\Omega\vec{\pi}, \tag{8}$$

where $\vec{\mu}^e$ denotes excess Mu vector, Ω stands for covariance matrix and $\vec{\pi}$ denotes the vector of constant portfolio weights, corresponding to risky securities. Upper asterisk (*) denotes trasposition operation. According to our optimality criterion and different portfolio structure, where $\pi_i, i=\overline{1,n}$ and π_0 denotes weights in risky and riskless asset, respectively, the following four models have been defined and presented in Table 1.

M_1 and M_2 models imply that the investor doesn't want to invest in riskless asset, whereas models M_3 and M_4 illustrate the possibility for investing in riskless asset. Although the original model given by Markowitz (1952) excludes short sales, in this article all the models were analysed with a possibility of short selling included (models M_2 and M_4).

3.6 Research design

The research is organised in three phases. The first phase brings an analysis of some basic parameters of descriptive statistics and coefficients of correlation. These results have been considered of immense importance in terms of proper understanding of specificities of the observed financial time series. In the second phase, previously defined mathematical

Table 1. Mathematical models used in portfolio optimisation.

Optimality criterion:		$Q_{\frac{\lambda_{R(x)}}{2}}(\vec{\pi}) = \vec{\mu}^e \vec{\pi}^* - \frac{\lambda_{R(x)}}{2} \vec{\pi}^* \Omega \vec{\pi} \to max$
Portfolio weights structure (for each model)	M_1	$\sum_{i=1}^{n} \pi_i = 1$ $\pi_i \geq 0, i = \overline{1,n}$ $\pi_0 = 0$
	M_2	$\sum_{i=1}^{n} \pi_i = 1$ $\pi_i \geq\leq 0, i = \overline{1,n}$ $\pi_0 = 0$
	M_3	$\sum_{i=1}^{n} \pi_i = 1$ $\pi_i \geq 0, i = \overline{1,n}$ $\pi_0 \geq 0$
	M_4	$\sum_{i=1}^{n} \pi_i = 1$ $\pi_i \geq\leq 0, i = \overline{1,n}$ $\pi_0 \geq\leq 0$

Source: Created by the authors in accordance with Modern Investment Technologies (2006–2008).

models were used for the purpose of conducting a comparative analysis of the portfolio performance and developing structure for each model respectively at a certain value of relative risk aversion coefficient. In the last phase, the empirical results of the research have been presented.

4. Results and discussion

4.1. Descriptive statistics and correlation analysis

In order to create a better insight into a specificity of observed financial time series first some basic parameters of descriptive statistics were analysed (see Appendix B). In accordance with the result findings, only BSNLR, JHKP-R-A, JPESR, TCMKR, TLKM-R-A and ZPTP-R-A appeared to have positive average return.

By applying the Jarque-Bera test the null hypothesis has been rejected (H_0: *the data are from a normal distribution*) at the 5% significance level for the following variables: BHTSR (p = .013), BIGFRK3 (p = .0,022), BSNFRK2 (p = .000), BSNLR (p = .000), ELGJR (p = .000), FDSSR (p = .000), JPESR (p = .000), MIGFRK2 (p = .000) and TCMKR (p = .000).

By applying Augmented Dickey-Fuller test of unit roots, and taking into account that statistics of the test in its absolute form is lower than theoretically critical values for all three significance levels (1%, 5% and 10%), null hypothesis H_0: the series contains a *unit root* has also been rejected.

According to Grigoletto and Lisi (2009), and from a financial perspective, skewness is crucial since it may be considered as a measure of risk. Positive skewness means that the distribution has a long right tail, whilst negative skewness implies that the distribution has a long left tail.

In line with it, Kim and White (2004) highlight that, if investors prefer right-skewed portfolios then, for equal variance, one should expect a 'skew premium' to reward investors willing to invest in left-skewed portfolios. In a large number of analysed variables (BIGFRK3, BSNFRK2, ELGJR, FDSSR, JHKP-R-A, MIGFRK2, NOVB-R-E, TLKM-R-A) negative skewness indicates that there was a substantial probability of a big negative return.

On the other hand, kurtosis measures the degree to which extreme outcomes in the 'tails' of a distribution are likely. The normal distribution has a kurtosis of 3 (mesokurtic). Kurtosis, except for JHKP-R-A and TLKM-R-A, points out leptokurtosis for all selected variables. Furthermore, excess kurtosis is a measure of the fatness of the tails of kurtosis where there is higher likelihood of large gains or large losses on an investment. Excess kurtosis indicates that the volatility of the investment is highly volatile. Excess kurtosis has been in particular detected in case of ELGJR and FDSSR, meaning that investors may face higher likelihood of large gains or large losses when in investing in these stocks (See Appendix C).

Knowing the correlations between the returns of securities is important for the process of allocating investments among them. Therefore, the examination between selected securities seems to be the next logical step. Correlation between two variables indicates the level to which those variables move together. The sample correlation coefficient r is an estimate of the population correlation coefficient ρ.

In case of statistical significance of correlation coefficient, the following hypotheses are tested (Doane & Seward, 2009, p. 501): $H_0{:}\rho = 0; H_1 \neq 0$.

The analysis results have revealed statistically significant correlation[6] between the following variables: BATX – BHTSR (p = .000), BATX –BIGFRK3 (p = .000), BHTSR – BSNFRK2 (p = .017), BIGFRK3 – IBZRK2 (p = .041), BIGFRK3 – ZPTP-R-A (p = .002), BSNLR – FDSSR (p = .000), BSNLR – JPESR (p = .000), FDSSR – JPESR (p = .000), JHKP – R-A – ZPTP-R-A (p = .000) and MIGFRK2 – NOVB-R-E (p = .047) (see Appendix D).

4.2. Model performance analysis

Prior to discussing the analysis of the optimisation models results, it is important to outline that, taking into account previously-mentioned complex characteristics of the capital market of Bosnia and Herzegovina fixed term deposit interest rate were used as a proxy of risk-free rate of return.

Passive deposit money banks interest rate, on an annual basis, for December 2012, was 2.97% (CBBH Governing Board, 2012). Accordingly, equivalent monthly interest rate is: $i_m = 100\left[\sqrt[12]{\left(1 + \frac{2.97}{100}\right)} - 1\right] = 0.244193481\%$. In line with the main goal of this research we analysed the sensitivity of the model to the various values of $\lambda_R(x)$. Among many others factors, Schooley and Drecnik (1996) have shown that investment in risky assets is significantly related to attitude toward risk taking. Since larger $\lambda_R(x)$ implies more risk aversion, we arbitrarily chose its values (2, 4, 6, 8 and 10) and incorporated it into the CRRA utility function that was our optimality criteria.

By applying previously defined mathematical models, 20 portfolios have been detected as a result of the optimisation process. Moreover, in the further process of portfolio optimisation and performance analysis, the sample was downsized only to those issuers that had positive average return (see Appendix B). General model performance analysis for all 20 portfolios is given in Table 2. Estimations were carried out by using Smartfolio (Version 3.0.88) software.

The results presented in Table 2 clearly lent some support to our hypothesis that, *ceteris paribus*, an increase in risk aversion leads to decrease in expected return and the creation of more superior securities portfolio. In case of all analysed models, average return measured by excess Mu and expected excess growth rate decreases as investor becomes more averse. In examining investor attitudes towards risk uncertainty as well as their reactions

Table 2. General model performance analysis.

MODEL PERFORMANCE CHARACTERISTICS		$\lambda_R(x)$ 2	4	6	8	10
M_1						
Average Return Measures	Excess Mu	154.16%	78.98%	53.92%	40.58%	32.42%
	Expected Excess Growth Rate	116.25%	69.26%	49.42%	38.02%	30.78%
Risk Measures	Volatility	87.07%	44.08%	29.98%	22.59%	18.08%
	Value-at-Risk	27.15%	14.07%	9.63%	7.28%	5.84%
	Conditional Value-at-Risk	34.42%	18.52%	12.84%	9.78%	7.88%
Performance Measures	Sharpe Ratio	1.34	1.57	1.65	1.68	1.70
M_2						
Average Return Measures	Excess Mu	426.92%	212.87%	141.52%	105.84%	84.44%
	Expected Excess Growth Rate	319.90%	186.11%	129.62%	99.15%	80.15%
Risk Measures	Volatility	146.31%	73.16%	48.77%	36.58%	29.27%
	Value-at-Risk	34.83%	17.49%	11.62%	8.71%	6.96%
	Conditional Value-at-Risk	45.38%	24.47%	16.68%	12.65%	10.19%
Performance Measures	Sharpe Ratio	2.19	2.54	2.66	2.71	2.74
M_3						
Average Return Measures	Excess Mu	161.72%	80.86%	53.91%	40.43%	32.34%
	Expected Excess Growth Rate	121.29%	70.75%	49.42%	37.90%	30.73%
Risk Measures	Volatility	89.92%	44.96%	29.97%	22.48%	17.98%
	Value-at-Risk	27.82%	14.32%	9.62%	7.24%	5.81%
	Conditional Value-at-Risk	35.25%	18.85%	12.84%	9.73%	7.83%
Performance Measures	Sharpe Ratio	1.35	1.57	1.65	1.69	1.71
M_4						
Average Return Measures	Excess Mu	604.67%	302.33%	201.56%	151.17%	120.93%
	Expected Excess Growth Rate	453.50%	264.54%	184.76%	141.72%	114.89%
Risk Measures	Volatility	173.88%	86.94%	57.96%	43.47%	34.78%
	Value-at-Risk	36.09%	17.50%	11.42%	8.45%	6.70%
	Conditional Value-at-Risk	48.19%	25.72%	17.40%	13.13%	10.54%
Performance Measures	Sharpe Ratio	2.61	3.04	3.19	3.26	3.30

Source: Created by the authors.

to market turmoil, Corter (2010) came up with the similar conclusion, i.e., higher levels of risk tolerance lead to riskier portfolios, and thus to higher exposure to losses. Liu and Xu (2010) have also revealed that in the absence of complicated constraints or objective terms, the return, risk, and utility of the optimal mean-variance portfolio decrease as the risk aversion increases.

Also, as Canner et al. (1997) pointed out, since the set of investment opportunities is not constant over time, investors should attempt to hedge their portfolios against adverse shifts in the asset-return distribution. Although the goal of this article was to examine the effects of investor's attitude towards risk on securities portfolio performance, it would also be necessary to shed some light on these 'abnormal' expected average returns (in case of models M_2 and M_4) presented in Table 2. Put simply, these returns may be explained by the fact that the securities listed on the SASE and BLSE are basically very risky and, consequently, generate high expected return. Under the assumptions of M_2 and M_4 models, short selling is not prohibited, but in reality, capital market of Bosnia and Herzegovina still doesn't have sufficiently developed infrastructure for short selling in the first place (see Appendix A). That is why it is probably wise not to include short selling in models when analysing portfolio performance on underdeveloped markets. However, this question of 'abnormal' expected average returns still remains open for some other research.

Also, based on the Sharpe ratio for each portfolio, it can be concluded that, *ceteris paribus*, an increase in risk aversion leads to creation of more superior securities portfolios. Range for Sharpe ratio, for selected relative risk aversion coefficient, varies from 1.34 to 1.70 for model M_1, from 2.19 to 2.74 for model M_2, from 1.35 to 3.71 for model M_3 and from 2.61 to 3.30 for model M_4 (Table 2).

Furthermore, if all issuers are ranked based on the excess kurtosis, it can be concluded that, as relative risk aversion increases proportion of highly risky investments in portfolio decreases (see Appendix C). Portfolio structure definitely supports this statement (see Appendix E). For example, excess kurtosis is particularly noticed in case of BSNLR, JPESR and TCMKR (see Appendix C), meaning that investors may face higher likelihood of large gains or large losses when in investing in these stocks. In addition, the portfolio structure also confirms that as relative risk aversion increases proportion of these highly risky securities decreases.

This conclusion is valid in case of all models analysed. On the assumption of the M_2 model, as risk aversion increases, the proportion of BSNLR goes from – 62.68 for $\lambda_R(x) = 2$ to – 12.37 for $\lambda_R(x) = 10$. JPESR and TCMKR are also classified as a highly risky investment. On the assumption of the same model (M_2), their portfolio proportion changes from 6.42 for $\lambda_R(x) = 2$ to 2.74 for $\lambda_R(x) = 10$ (JPESR) and from 1.15 for $\lambda_R(x) = 2$ to 0.22 for $\lambda_R(x) = 10$ (TCMKR) (see Appendix E).

The analysis results have also confirmed that the more risk averse investor is, the proportion of highly risked securities in its portfolio is smaller. In general, and as mentioned by Ameur and Prigent (2010), the optimal solution depends on the risk aversion of the investor. The main practical consequence of these results is that risk averse investors should rebalance their portfolios more frequently than risk-loving investors. This is in accordance with some previous research, such as that conducted by Jones and Stine (2005). Similarly, we also suggest that more risk-averse individuals should lower their allocation to risky assets. Dorn and Huberman (2010) have also concluded that the more risk averse investors will buy less volatile securities. Although further work is required to gain a more complete understanding of the effects of investor's attitude towards risk on securities portfolio performance, the results presented in this article may be a solid platform for creating portfolios especially on underdeveloped capital markets.

5. Conclusion

To sum up, the analysis results have revealed that an increase in risk aversion leads to a decrease in expected return and the creation of more superior securities portfolio. The main practical consequence of the obtained results is that risk averse investors should rebalance their portfolios more frequently than risk-loving investors. The main limitations of this study are related to the shorter available financial time series in newly formed capitalistic economy and missing data due to the lack of collective records on levels of securities offerings issues. The real implications of this research can be seen in the shaping of investment strategies of potential investors looking to diversify their portfolios. Further research should shed more light on measuring investor 'risk appetite' in the underdeveloped capital markets.

Notes

1. See MSCI Inc. (2013, p. 37).
2. Historical prices for these stocks are publicly available at the SASE and BLSE websites.

3. BATX represents stocks traded both at SASE and BLSE. It is a capitalisation-weighted price index made up of the most actively traded and highest capitalised stocks traded at the SASE and BLSE. The index is calculated and disseminated on a real-time basis in EUR, USD and BAM (Wiener Börse AG, 2012). Real historical values for BATX are available at (Yahoo! Finance, 2012).
4. For more information see: (Banja Luka Stock Exchange, 2012) and (The Sarajevo Stock Exchange, 2012).
5. 'The Dayton/Paris Peace Agreement put an end to the 1992–1995 war and brought peace to Bosnia and Herzegovina. However, Bosnia and Herzegovina's Constitution, which is Annex 4 to the Agreement, established a complex institutional architecture, which remains inefficient and is subject to different interpretations. The complicated decision-making process has contributed to delay structural reforms and reduce the country's capacity to make progress towards the EU' (European Commission, 2011, p. 7).
6. At the 1% and 5% significance level.

ORCID

Jasmina Okičić http://orcid.org/0000-0002-3440-413X

References

Ameur, H. B., & Prigent, J. L. (2010). Behaviour towards risk in structured portfolio management. *International Journal of Economics and Finance, 2*, 91–102.

Arnott, R. D., & Bernstein, P. L. (2002). What risk premium is "normal"? *Financial Analysts Journal, 58*, 64–85.

Arnott, R. D., & Ryan, R. J. (2001). The death of the risk premium. *The Journal of Portfolio Management, 27*, 61–74.

Arrow, K. (1965). *Aspects of the theory of risk-bearing*. Helsinki: Yrjš Jahnsson Foundation.

Arrow, K. J. (1971). *Essays in the theory of risk – bearing*. Chicago, IL: Markham Publishing Company.

Baillie, R. T., & DeGennaro, R. P. (1990). Stock returns and volatility. *The Journal of Financial and Quantitative Analysis, 25*, 203–214.

Bakshi, G., & Kapadia, N. (2003). Delta-hedged gains and the negative market volatility risk premium. *Review of Financial Studies, 16*, 527–566.

Banja Luka Stock Exchange. (2012). Retrieved December 13, 2012, from https://www.blberza.com/Pages/Default.aspx

Black, F., Jensen, M. C., & Scholes, M. (1972). The capital asset pricing model: Some empirical tests. *Studies in the Theory of Capital Markets* (pp. 79–121). New York, NY: Praeger.

Bollerslev, T., Engle, R., & Wooldridge, J. (1988). A capital asset pricing model with time-varying covariances. *Journal of Political Economy, 96*, 116–131.

Boudoukh, J., Richardson, M., & Smith, T. (1993). Is the ex ante risk premium always positive?: A new approach to testing conditional asset pricing models. *Journal of Financial Economics, 34*, 387–408.

Brandt, M. W., & Kang, Q. (2004). On the relationship between the conditional mean and volatility of stock returns: A latent VAR approach. *Journal of Financial Economics, 72*, 217–257.

Breen, W., Glosten, L., & Jagannathan, R. (1989). Economic significance of predictable variations in stock index returns. *The Journal of Finance, 44*, 1177–1189.

Campbell, J. Y., & Hentschel, L. (1992). No news is good news: An asymmetric model of changing volatility in stock returns. *Journal of Financial Economics, 31*, 281–318.

Canner, N., Mankiw, N. G., & Weil, D. N. (1997). An asset allocation puzzle. *American Economic Review, 87*, 181–191.

CBBH Governing Board. (2012). Retrieved December 31, 2012, from BH Financial Sector: http://www.cbbh.ba/index.php?id=33&lang=bs&sub=mon&table=pasivne_kamatne_stope_komercijalnih_banaka

Corter, J. E. (2010). Investor attitudes towards risk and uncertainty and reactions to market turmoi. *Paper presented at the behavioural finance working group conference: Fairness, trust and emotions in finance*. London: Cass Business School.
Doane, D. P., & Seward, L. E. (2009). *Applied statistics for business & economics*. New York, NY: The McGraw – Hill Companies, Inc.
Dorn, D., & Huberman, G. (2010). Preferred risk habitat of individual investors. *Journal of Financial Economics, 97*, 155–173.
European Commission. (2011). *Bosnia and Herzegovina progress report*. Brussels: European Commission.
Fama, E. F., & MacBath, J. D. (1973). Risk, return, and equilibrium: empirical tests. *Journal of Political Economy, 81*, 607–636.
Fama, E. F., & MacBeth, J. D. (1974). Tests of the multiperiod two-parameter model. *Journal of Financial Economics, 1*, 43–66.
Fisher, P. R. (2013). *Bank for International Settlements (BIS)*. Retrieved December 1, 2013, from Reflections on the meaning of "risk free" http://www.bis.org/publ/bppdf/bispap72l.pdf
Friedman, M., & Savage, L. J. (1948). The utility analysis of choices involving risk. *Journal of Political Economy, 56*, 279–304.
Friend, I., & Blume, M. (1970). Measurement of portfolio performance under uncertainty. *American Economic Review, 60*, 607–636.
Ghysels, E., Santa-Clara, P., & Valkanov, R. (2005). There is a risk-return trade-off after all. *Journal of Financial Economics, 76*, 509–548.
Glosten, L., Jakannathan, R., & Runkle, D. (1993). On the relation between the expected value and the volatility of nominal excess return on stocks. *The Journal of Finance, 48*, 1779–1801.
Graves, P. E. (1979). Relative risk aversion: Increasing or decreasing. *The Journal of Financial and Quantitative Analysis, 14*, 205–214.
Grigoletto, M., & Lisi, F. (2009). Looking for skewness in financial time series. *Econometrics Journal, 12*, 310–323.
Harvey, C. R. (1989). Time-varying conditional covariances in tests of asset pricing models. *Journal of Financial Economics, 24*, 289–317.
Jones, S. K., & Stine, J. B. (2005). Constant mix portfolios and risk aversion. *Financial Counseling and Planning, 16*, 1–8.
Kim, T. H., & White, A. (2004). On more robust estimation of skewness and kurtosis: Simulation and application to the S&P500 index. *Finance Research Letters, 1*, 56–73.
Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The Review of Economics and Statistics, 47*, 13–37.
Liu, S., & Xu, R. (2010). *MSCI Barra research*. Retrieved January 20, 2013, from The Effects of Risk Aversion on Optimization: Demystifying Risk Aversion Parameters in the Barra Optimizer http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1601412
Ludvigson, S. C., & Ng, S. (2007). The empirical risk-return relation: A factor analysis approach. *Journal of Financial Economics, 83*, 171–222.
Markowitz, H. (1952). Portfolio selection. *The Journal of Finance, 7*, 77–91.
Markowitz, H. (1959). *Portfolio selection: Efficient diversification of investments*. New York, NY: John Wiley & Sons, Inc.
Merton, R. C. (1980). On estimating the expected return on the market - An exploratory investigation. *Journal of Financial Economics, 8*, 323–361.
Modern Investment Technologies. (2006-2008). *Multi-period asset allocation: SmartFolio theoretical background*. Moscow: Modern Investment Technologies Ltd.
Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica, 34*, 768–783.
MSCI Inc. (2013). Retrieved April 15, 2013, from MSCI Global Market Accessibility: MSCI Global Market Accessibility
Nelson, D. B. (1991). Conditional heteroskedasticity in asset returns: A new approach. *Econometrica, 59*, 347–370.
Ostdiek, B. (1998). The world ex ante risk premium: An empirical investigation. *Journal of International Money and Finance, 17*, 967–999.

Pratt, J. W. (1964). Risk aversion in the small and in the large. *Econometrica, 32*, 122–136.
Rubinstein, M. (2002). Markowitz's "portfolio selection": A fifty-year retrospective. LVII(3). *The Journal of Finance,* 1041–1045.
The Sarajevo Stock Exchange. (2012). Retrieved December 31, 2012, from http://www.sase.ba/v1/en-us/
Schooley, D. K., & Drecnik, Worden D. (1996). Risk aversion measures: Comparing attitudes and asset allocation. *Financial Services Review, 5*, 87–99.
Society of Actuaries Committee on Finance Research. (2009). *The financial crisis and lessons for insurers*. Schaumburg: The Society of Actuaries.
Tobin, J. (1958). Liquidity preference as behavior towards risk. *The Review of Economic Studies, 25*, 65–86.
Wiener Börse AG. (2012). Retrieved December 31, 2012, from BATX - Bosnian Traded Index: http://en.indices.cc/indices/cee/profiles/batx.html
Yahoo! Finance. (2012). Retrieved December 31, 2012, from Market Data: http://finance.yahoo.com/market-overview/

Appendix A

Table A1. Assessment results for the capital market of Bosnia and Herzegovina.

Criteria	Evaluation
Openness to foreign ownership	
Investor qualification requirement	++
Foreign ownership limit (FOL) level	++
Foreign room level	++
Equal rights to foreign investors	++
Ease of capital inflows / outflows	
Capital flow restriction level	++
Foreign exchange market liberalisation level[a]	+
Efficiency of the operational framework	
Market entry	
Investor registration & account set up	++
Market organisation	
Market regulations[b]	+
Competitive landscape	
Information flow	-/?
Market infrastructure	
Clearing and Settlement	-/?
Custody[c]	++
Registry / Depository[d]	++
Trading	-/?
Transferability	-/?
Stock lending	-/?
Short selling	-/?
Stability of institutional framework	+

++: no issues
+: no major issues, improvements possible
-/?: improvements needed / extent to be assessed
[a]There is no offshore currency market.
[b]Not all regulations can be found in English.
[c]According to additional information, it has been learned that there are several active custodians available for foreign investors.
[d]There are two central depositories, each of them acting as central registry.
Source: (MSCI Inc. 2013, p. 49).

Appendix B

Table B1. Basic descriptive statistics.

Variables:															
Paremeters:	BATX	BHTSR	BIGFRK3	BSNFRK2	BSNLR	ELGJR	FDSSR	IBZRK2	JHKP	JPESR	MIGFRK2	NOVB	TCMKR	TLKM	ZPTP
Mean	−0.0006	−0.0007	−0.00071	−0.0056	0.0080	−0.0076	−0.0652	−0.0005	0.0001	0.1525	−0.00328	−0.0011	0.0036	1.59E−05	0.0002
Median	−0.00053	−0.00124	−0.000488	0.000000	−3.20E-05	0.000000	−0.00197	−7.00E-05	−0.00023	−1.43E-17	−0.000118	−0.00037	1.93E-18	1.76E-18	−0.00052
Max	0.00486	0.008479	0.017360	0.081488	0.099162	0.019053	0.006402	0.017098	0.01093	1.66051	0.051293	0.00808	0.076961	0.00544	0.00856
Min	−0.00433	−0.00434	−0.022398	−0.110395	−0.01113	−0.13068	−0.73620	−0.01482	−0.01174	−0.01992	−0.053069	−0.01201	−0.04721	−0.00552	−0.00851
Std. Dev.	0.00178	0.002844	0.007164	0.031369	0.024359	0.027735	0.173159	0.006972	0.00507	0.41507	0.017961	0.00453	0.024036	0.00240	0.00411
Skewness	0.272735	1.041191	−0.856298	−0.406899	2.627860	−3.27656	−2.83694	0.466639	−0.01510	2.664181	−0.490007	−0.23236	1.364079	−0.29985	0.12488
Kurtosis	4.47014	4.191558	5.286723	6.285706	9.001441	13.58116	9.983538	3.631116	2.950997	8.78173	6.100412	3.28348	6.115168	2.94786	2.78733
Jarque-Bera	3.68828	8.634188	12.24314	17.18719	95.45983	232.3565	121.4439	1.903971	0.004969	92.72970	15.85947	0.444494	25.72067	0.543539	0.161417
Probability	0.15816	0.013339	0.002195	0.000185	0.000000	0.000000	0.000000	0.385974	0.99752	0.00000	0.000360	0.80072	0.000003	0.76203	0.92246
Sum	−0.02158	−0.02359	−0.025376	−0.20007	0.28580	−0.27401	−2.34705	−0.01929	0.003779	5.488825	−0.118226	−0.03859	0.129085	0.000573	0.00704
Sum Sq. Dev.	0.00011	0.000283	0.001796	0.034439	0.020768	0.026923	1.049436	0.001701	0.00090	6.03003	0.011291	0.00072	0.020221	0.00020	0.00059

Source: Created by the authors.

Appendix C

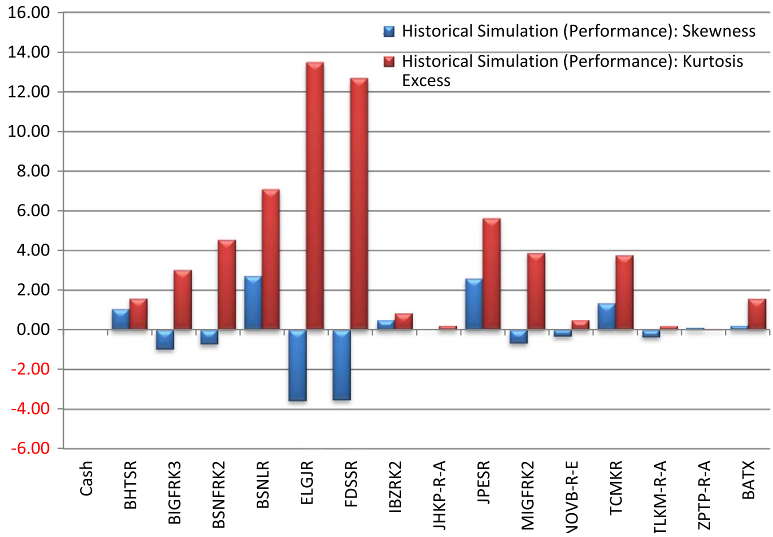

Figure C1. Skewness and kurtosis excess. Source: Created by the authors.

Appendix D

Table D1. Correlation matrix.

		BATX	BHTSR	BIGFRK3	BSNFRK2	BSNLR	ELGJR	FDSSR	IBZRK2	JPESR	JHKP-R-A	MIGFRK2	NOVB-R-E	TCMKR	TLKM-R-A	ZPTP-R-A
BATX	Pearson Correlation	1	0.683**	0.568**	−0.115	0.119	−0.008	0.022	0.407*	0.002	0.048	0.133	0.161	−0.100	0.295	0.200
	Sig, (2-tailed)		0.000	0.000	0.496	0.484	0.961	0.899	0.012	0.990	0.778	0.433	0.342	0.558	0.076	0.236
BHTSR	Pearson Correlation		1	0.324	−0.392*	−0.043	0.056	0.117	0.311	−0.108	0.039	−0.079	−0.136	−0.282	−0.034	−0.065
	Sig, (2-tailed)			0.051	0.017	0.799	0.748	0.491	0.061	0.526	0.817	0.641	0.423	0.091	0.843	0.702
BIGFRK3	Pearson Correlation			1	0.071	0.115	−0.077	−0.046	0.337*	0.053	0.294	0.298	0.176	−0.060	0.223	0.488**
	Sig, (2-tailed)				0.675	0.498	0.655	0.788	0.041	0.755	0.077	0.073	0.299	0.725	0.184	0.002
BSNFRK2	Pearson Correlation				1	0.200	−0.088	−0.201	−0.184	0.246	0.149	0.254	0.074	−0.145	0.196	0.145
	Sig, (2-tailed)					0.236	0.611	0.232	0.274	0.143	0.377	0.129	0.663	0.390	0.245	0.392
BSNLR	Pearson Correlation					1	0.018	−0.981**	0.105	0.985**	0.257	0.158	0.060	0.077	−0.055	0.230
	Sig, (2-tailed)						0.915	0.000	0.535	0.000	0.125	0.350	0.722	0.650	0.746	0.172
ELGJR	Pearson Correlation						1	−0.036	−0.026	0.018	0.312	−0.020	0.184	0.152	0.222	−0.029
	Sig, (2-tailed)							0.836	0.882	0.917	0.064	0.906	0.282	0.376	0.192	0.867
FDSSR	Pearson Correlation							1	−0.078	−0.996**	−0.285	−0.133	−0.018	−0.132	0.056	−0.200
	Sig, (2-tailed)								0.647	0.000	0.087	0.433	0.914	0.437	0.742	0.234
IBZRK2	Pearson Correlation								1	0.081	0.114	0.173	−0.005	0.208	0.236	0.178
	Sig, (2-tailed)									0.632	0.502	0.307	0.976	0.217	0.160	0.291
JPESR	Pearson Correlation									1	0.276	0.133	0.018	0.101	−0.038	0.207
	Sig, (2-tailed)										0.098	0.431	0.916	0.551	0.824	0.218
JHKP-R-A	Pearson Correlation										1	0.201	0.034	0.081	0.084	0.660**
	Sig, (2-tailed)											0.232	0.843	0.634	0.621	0.000
MIGFRK2	Pearson Correlation											1	0.329*	0.008	−0.038	0.066
	Sig, (2-tailed)												0.047	0.963	0.824	0.698
NOVB-R-E	Pearson Correlation												1	−0.144	0.179	0.159
	Sig, (2-tailed)													0.396	0.290	0.349
TCMKR	Pearson Correlation													1	0.289	0.042
	Sig, (2-tailed)														0.082	0.807
TLKM-R-A	Pearson Correlation														1	0.262
	Sig, (2-tailed)															0.117
ZPTP-R-A	Pearson Correlation															1
	Sig, (2-tailed)															

**Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).
Source: Created by the authors.

Appendix E

Table E1. Portfolio structure.

Model:			M_1					M_2					M_3					M_4		
$\lambda_A(x)$ →	2	4	6	8	10	2	4	6	8	10	2	4	6	8	10	2	4	6	8	10
Portfolio structure ↓										Portfolio weights ↓										
Cash	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−1.99	−0.50	0.00	0.25	0.40	149.96	75.48	50.65	38.24	30.79
BSNLR	0.00	0.00	0.00	0.00	0.00	−62.68	−31.23	−20.75	−15.51	−12.37	0.00	0.00	0.00	0.00	0.00	−94.29	−47.15	−31.43	−23.57	−18.86
JHKP-R-A	0.00	0.00	0.00	0.00	0.00	−19.54	−9.70	−6.41	−4.77	−3.79	0.00	0.00	0.00	0.00	0.00	−41.79	−20.90	−13.93	−10.45	−8.36
JPESR	0.98	0.49	0.33	0.25	0.20	6.42	3.20	2.13	1.59	1.27	0.98	0.49	0.33	0.25	0.20	9.22	4.61	3.07	2.31	1.84
TCMKR	0.02	0.51	0.67	0.55	0.43	1.15	0.57	0.37	0.28	0.22	2.01	1.00	0.67	0.50	0.40	3.26	1.63	1.09	0.82	0.65
TLKM-R-A	0.00	0.00	0.00	0.21	0.37	34.69	17.71	12.05	9.22	7.52	0.00	0.00	0.00	0.00	0.00	−74.94	−37.47	−24.98	−18.74	−14.99
ZPTP-R-A	0.00	0.00	0.00	0.00	0.00	40.96	20.45	13.61	10.20	8.15	0.00	0.00	0.00	0.00	0.00	49.58	24.79	16.53	12.39	9.92
Σ	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Source: Created by the authors.