Possibility of Applying Regional Diversification in Capital Markets of Bosnia and Herzegovina and Republic of Serbia

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ABSTRACT – Generally, risk is an uncertainty associated with future outcomes or events. In economic terms, risk is an expected deviation from the planned return of real, financial and intangible assets, of loss or cash flows associated with the uncertain event. The most famous way of reducing the overall risk is diversification of assets. Thus, diversification is a process of investment in a number of unrelated or partially related assets or activities in order to achieve stable business operation, and it shows that portfolios are poor to the extent that they should be avoided in order to increase yields and reduce risk. The portfolio diversification works because prices of different shares do not move in the entirely same direction. Statisticians generally mean the same thing when they say that share price changes are nothing less than perfectly correlated. The main objective of this paper is to discuss the impact of the global financial crisis on the movement tendency of the stock exchange index in the Western Balkans, developed countries and individual EU member states, and determine the feasibility of implementing regional diversification in order to further reduce risk and establish the portfolio of share with the lowest coefficients of correlation

KEYWORDS: absorption capacity of financial assistance, EU pre-accession programs, municipalities, multilevel governance

Introduction

International portfolio investment has long been a tradition in many European countries, but it is a more recent practice in North America. There is now a strong trend toward international diversification in all countries, especially among U.S. institutional investors, such as corporate and public pension funds. In the early 1970 U.S. pension funds basically held no foreign assets, the percentage of foreign assets approached 20 percent of total assets by 2006. British institutional investors hold more than 25 percent of their asset in non - British securities. Some Dutch pension funds have more than half of their assets invested abroad. Indeed, the more size of foreign markets justifies international diversification, even for U.S. investors. At the end of 2006, the world stock market capitalization was around $ 25 trillion. The U.S. stock market accounted for roughly half of the world market. The growth of the world stock market since the early 1970, has been remarkable. In 1974, the New York

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Stock Exchange was the only significant market in the world, representing 60 percent of a world capitalization of less than $1 trillion (Solnik and McLeavey, 2009, pp. 386).

The argument that diversification reduces an investor's exposure to risk is both intuitively and statistically clear, but risk and return models in finance go a step further. The models treat risk from the point of view of investors, which are likely to trade at any time horizon. For the investor who is well diversified, a market risk is the only investment risk. The question is whether this is a realistic assumption. Taking into account the fact that border investors must have many shares that they trade, it is highly likely that they are institutional investors who are generally diversified, although a diversification level varies among different investors. The fact that the border investor is well diversified becomes insignificant if we take into account small companies whose securities are traded less and companies with more than 90 percent ownership in the hands of a small group of shareholders. In the long-run, diversified investors tend to get non-diversified investors out of the market. Thus, the investment risk will always be regarded higher for a non-diversified than for diversified investor, since the diversified investor is not subject to company specific risks as non-diversified (Damodaran, 2010, pp. 31).

This paper will analyse the possibility to implement the regional diversification and find an index with the lowest coefficients of correlation with market indexes on the Sarajevo Stock Exchange (SASX - 10 and SASX - 30), Banja Luka Stock Exchange (BIRS), BSE (BELEX15 and BELEXline) with the aim to further reduce the risk of investment. The main hypothesis tested in this paper is: the inclusion of additional shares of stock indexes in developed countries in an optimal risk portfolio of the Western Balkan countries affects the increase of return and decrease of risk. This hypothesis will be tested in the research section of the paper.

The paper is structured in three parts. The first part describes the theoretical concept and importance of diversification. The second part elaborates a statistical apparatus for measuring return and risk when investing. The last part analyses the possibility of using regional diversification by finding share indexes for the lowest correlation coefficients. Finally, conclusions are given as the results of the study.

Theoretical concept of diversification

The modern portfolio theory is the most important innovation of the twentieth century in the field of investment and portfolio management. Before the modern portfolio theory, it was thought that each share should be analysed through fundamental analysis and include in the portfolio those that have the potential for growth. The modern portfolio theory is the first to provide general access to portfolio management. It has provided a unique platform for the observation and evaluation of investments. The Markowitz portfolio optimization model, also known as (Mean - Variance Model - MV model) is highly valued due to the fact that H.M. Markowitz received the Nobel Prize in 1990 for his achievements in the development of the modern portfolio theory. Markowitz's basic idea was to find a balance between risk and income, and in this regard select a portfolio of shares that would bring maximum profit with minimum risk. Therefore, his idea was to form a mathematical model for the selection of a portfolio that delivers the highest rate of income, but with a certain degree of risk.

According to Markowitz (1952), a much more interesting book is Portfolio Selection: Efficient Diversification of Investments, where Markowitz developed a theory according to which a risk and reward can be brought into balance in a well-selected combination of securities in a portfolio. Therefore, the objective of the modern portfolio management is not maximization of expected revenues, but optimization of expected revenues and associated risks (Aljinović et al., 2011, pp. 136-137).

According to Caso (1992), benefits from international diversification indicate that low diversifications can be overestimated for investors with long-term investment horizons if equity markets move together (Dobardžić, 2013, pp. 124).

Many investors do not truly understand effective diversification, often believing they are fully diversified after spreading their investment across large caps, mid or small caps, energy, financial, healthcare or technology stocks, or even investing in emerging markets. In reality, however, they have merely invested in multiple sectors of the equities asset class and are prone to rise and fall with that market. If we were to look at the Morningstar style indexes or their sector indexes, we would see that despite slightly varying returns, they generally track together. However, when one compares the indexes as a group or individually to the commodities indexes, we do not tend to see this simultaneous directional movement. Therefore, only when positions are held across multiple uncorrelated asset classes is a portfolio genuinely diversified and better able to handle market volatility as the high-performing asset classes can balance out the under performing classes (http://finance.yahoo.com).

It is not always easy to find securities with low mutual correlation coefficients. One way to reduce the overall risk of a portfolio is to increase the number of securities in it, i.e. increase its diversification. The traditional approach is known as a simple diversification and it includes investing in a number of different securities (shares, bonds, etc.). Guided by this approach, at a first glance it may seem that the investment in for example hundreds of different securities had four times lower risk than investments in twenty-five such securities. Banks, pension funds, insurance companies and other financial institutions are even legally obliged to form a diversified portfolio. Individual investors are also guided by diversification. At the national financial market, diversification of risk can be reduced below the level of systematic, i.e. market risk, only with the assistance of the so called Markowitz diversification and finding securities with lower levels of mutual correlation, when the rule is that the lower the correlation coefficient between the yield on the securities in the portfolio, the higher are the effects of diversification. However, very few securities have low levels of mutual correlation and the Markowitz diversification requires a computer database of financial statistics on a large number of securities. The computer application of this method of diversification is called the Markowitz portfolio analysis and it is the foundation of modern portfolio theory.

A step further in the analysis of diversification is international diversification. It offers investors an even better opportunity to increase yield and reduce risk at the same time. On the other hand, the international diversification implies an exposure to foreign currency risk and country risk. The international diversification provides a special opportunity. Investors have traditionally invested primarily in their national financial markets. In order to diversify their investments, they turned to investing in different economic sectors and various

securities. Today, primarily due to the development of telecommunications, the prevailing commitment is to attempt and increase diversification of investments by investing in the international financial markets and the globalization of financial markets has become a worldwide trend. A systematic or market risk is the lowest limit to which a portfolio risk can be reduced by diversification in the domestic financial market. By investing in a number of shares, the impact of specific factors is reduced and portfolio volatility should be reduced as well. If there is a large number of risky securities in the portfolio, risk cannot be avoided, because in principle all securities are subject to the impact of general macroeconomic factors. The risk which can be eliminated by diversification is called unique, specific or unsystematic risk (Bodie et al., 2009, pp. 162 - 163). Additional diversification can have effects in terms of further reduction of portfolio risk, below the level of market risk, only if it is aimed at foreign financial markets (Zivkovic et al., 2005, pp. 427).

There are two motivations for global investment. All else being equal, a low international correlation allows reduction of the volatility, or total risk, of a global portfolio. A low international correlation also provides profit opportunities for an active investor: Because market do not move up or down together, an expert investor can hope to adjust the international asset allocation of the global portfolio toward market with superior expected returns. This should lead to a superior risk adjusted performance. On the other hand, barriers to international investments also exist (Solnik and McLeavey, 2009, pp. 388).

According to some traditional estimates, internationally diversified portfolio should have half the risk of a diversified portfolio in the national U.S. financial market (Figure 1). Although globalization of the financial system in the world contributes to higher mutual dependence of national financial markets, there is no perfect correlation among them and this allows for a further risk decrease of internationally diversified portfolios. However, this has limits too. The limits are so called global factors, i.e. circumstances affecting the volatility of global financial markets as a whole and can be regarded a global systematic or market risk (lower interrupted line in the Figure). A global market risk, according to some new estimates is 56% of the national market risk (Hunter and Coggin, 1990, pp. 303). An additional factor in minimizing risk through international portfolio diversification can be obtained also by hedging transactions, although their effectiveness may be under significant impact of foreign currency exchange rates (Madura and Tucker, 1992, pp. 2-3). The expansion of potential international investment opportunities with shares to bonds further contributes to raising the performance of so constructed portfolios. Although further risk reduction through international diversification is limited, it does provide significant benefits to investors.

A risk reduction is only one side of the international diversification of portfolio. Other, often more important side, is potentially higher yields. The potentially higher yields can result from two factors. First, the global financial market provides a greater choice of investment, i.e. it allows investors to invest in companies which are not available through the national financial markets.

Figure 1. Risk of internationally diversified portfolio and diversified portfolio in U.S. national market
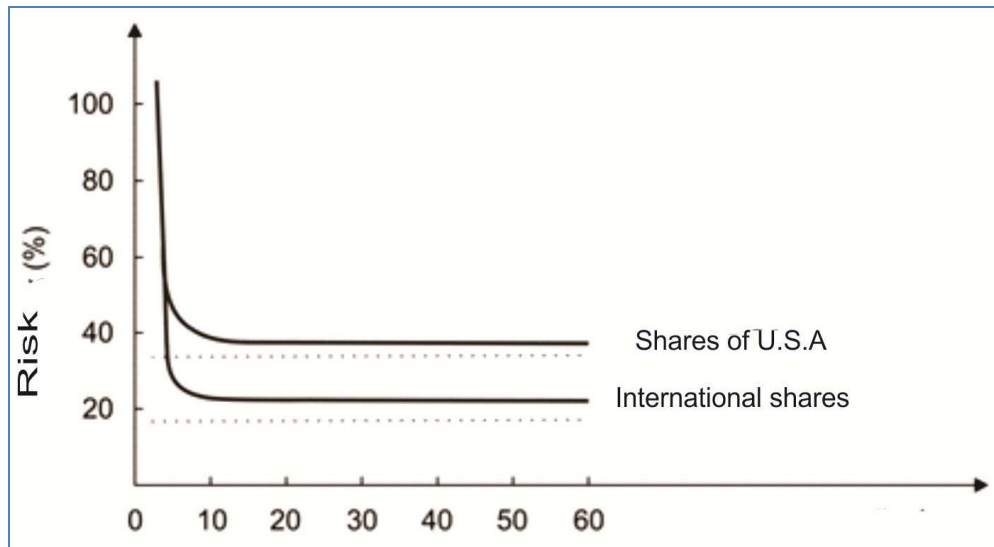
Source: Solnik, B. (1974) Why Not Diversity Internationally Rather than Domestically?, Financial Analysts Journal, pp. 119 – 138.

Second, it allows for speculative gains relying on fluctuations in exchange rates, which can significantly increase yield on investments abroad if investors' domestic currency depreciates against the currency in which it is invested, and it can reduce if the domestic currency appreciates. The choice of countries in which to invest is based on the stability of national currency, capital appreciation of their financial markets and achievable average of dividend yield.

Market return and risk measurement

From the point of view of investors, it is not that important whether prices of some securities rise or fall. What is important is the contribution of their portfolio and the portfolio risk. Thus, the yield and risk of specific securities should not be analysed under conditions in which they affect the yield and risk of the portfolio in which they are.

An investor's portfolio may hold shares of company that is not well known, whose shares are not liquid, whose earnings fluctuated in the past and which did not pay dividends. All of this indicates shares with high risk, which should correspond to high yield. However, in practice such shares may have a low yield. This means that investors regarded the company as low-risk, despite the low earnings.

The reason for this lies in diversification and its impact on the risk. The earnings of the company and the price of securities grow during the recession, while the prices of most other shares fall. Therefore, keeping these securities in the portfolio yield stabilizes the entire portfolio. The level of diversification depends on: (1) the scope of securities offer in the market, (2) volume of investments, (3) access to markets, and (4) investors being informed.

When investing in a particular security, the portfolio risk is a possibility that planned yields will not be achieved, and that funds invested make less profit than expected or even a

loss. Value deviations around its expected mean value can be measured by the variance and standard deviation. The variance is a sum of weighted squared deviations of possible returns around the expected mean (Soskic and Serdar, 1994, pp. 61). The weights are the probability of appearance of each contribution. The higher the possible deviation around the expected means value and the higher the probability, the higher is the variance. The standard deviation is expressed by the same units in which the arithmetic mean is expressed, so the standard deviation is an absolute measure of dispersion. For the calculation of the variance σ^2, the following formula is used:

$$\sigma^2 = \sum_{i=1}^{N}(R_i - \bar{R})^2 \times p_i \tag{1}$$

where: σ^2- variance, R_i - possible variations (oscillations) around the mean value, $\bar{R}$ - expected mean value, p_i probability of performing a certain value. The standard deviation σ is the square root of the variance:

$$\sigma = \sqrt{\sum_{i=1}^{N}(R_i - \bar{R})^2 \times p_i} \tag{2}$$

The standard deviation as an absolute measure of dispersion is not appropriate for the comparison of the dispersion size of two distributions with two different numerical evaluative features. A relative measure of dispersion should be used for such a comparison, eliminating the impact of various numerical values of the first and second sample units. The relative dispersion measure based on the standard deviation is the coefficient of variation:

$$V = \frac{\sigma}{\bar{R}} \times 100 \tag{3}$$

The expected yield of portfolio is calculated as the weighted sum of returns of individual securities that make up the portfolio. The share of individual securities in a portfolio serves as a weight:

$$E(R_{port}) = \sum_{i=1}^{N} X_i E(R_i) \tag{4}$$

Where: $E(R_{port})$ - expected return on portfolio, X_i − percentage share of securities (i) in the portfolio, $E(R_i)$- expected yield securities (i). The variance of the portfolio is calculated as follows:

$$\sigma^2 = \sum_{i=1}^{N} X_i^2 \sigma_i^2 + \sum_{i=1}^{N}\sum_{j=1}^{N} X_i X_j \sigma_i \sigma_j \rho_{ij} \tag{5}$$

Where: σ_i^2- variance of the i-th securities, σ_i - standard deviation of the i-th securities, ρ_{ij} − the correlation coefficient between yield securities (i) and (j). The last part of the equation (5) $(\sigma_i \sigma_j \rho_{ij})$ can be replaced by the statistical term $Cov_{i,j}$ (covariance) in order to simplify the equation, since it is:

$$\rho_{ij} = \frac{Cov_{i,j}}{\sigma_i \sigma_j} \tag{6}$$

Covariance is obtained from the following formula (Berenson and Levine, 1996, pp. 733):

$$Cov_{i,j} = \frac{1}{N-1} \sum_{i=1}^{N} [(x_i - \bar{x})(y_i - \bar{y})] \tag{7}$$

A measure expressing a joint motion of two series is called the correlation coefficient, indicated by the Greek letter ρ. The correlation coefficient always takes a value between -1 (perfect negative correlation) and +1 (perfect positive correlation), indicating the accuracy of the description of the mutual movement between two sets of returns. The correlation coefficient between -1 and +1 describes that two sets of returns vary together in an imperfect way. The correlation coefficient is expressed as follows:

$$correlation\left(r_{YY}, r_{ABC}\right) = \rho_{YY,\ ABC} = \frac{Cov\left(r_{YY}, r_{ABC}\right)}{\sigma_{YY} \cdot \sigma_{ABC}} \tag{8}$$

The higher the correlation coefficient, the more two series are moving together, so that if the correlation coefficient was -1 or +1, then the two series would be in no correlation or in perfect correlation. Thus, the positive correlation coefficient indicates the proportionality of variables, i.e. that the increase of one variable causes the growth of the other and vice versa. The negative ρ indicates an inverse variable proportionality, i.e. that the increase of one variable causes the decrease of the other variable and vice versa. If ρ is closer to zero, the correlation is weaker, and the closer it is to one, the relationship is stronger (Vukicevic et al., 2010, pp. 294).

Table 1. Correlation between variables depending on absolute values of correlation coefficients

Absolute value of correlation coefficient	Strength of association between variables
$\|\rho\|$	Complete correlation
$0{,}8 \le \|\rho\| < 1$	Strong correlation
$0{,}5 \le \|\rho\| < 0{,}8$	Medium correlation
$0{,}2 \le \|\rho\| < 0{,}5$	Relatively weak correlation
$0 < \|\rho\| < 0{,}2$	Insignificant correlation
$\|\rho\| = 0$	Complete absence of correlation

Source: Vukičević, M., Gregurek, M., Odobašić, S., Grgić, J. (2010). Financial management in MS Excel, Golden Marketing - Technical Books, Zagreb, pp. 294

The table above describes a rough interpretation of correlation coefficient values. The significance of correlation coefficients primarily depends on particular characteristics of observed variables determined by additional statistical methods. Generally, the Pearson's

linear correlation coefficient is used as a measure of association between two variables (X and Y) in a risk analysis. It is indicated by r and expressed as follows:[2]

$$r = \frac{\sum_{i=1}^{N} X_i Y_i - N \cdot \overline{X} \cdot \overline{Y}}{\sqrt{\left(\sum_{i=1}^{N} X_i^2 - N\overline{X^2}\right)\left(\sum_{i=1}^{N} y_i^2 - N\overline{Y^2}\right)}} \qquad (9)$$

An investor who diversified an investment does not take into account the individual risk of an asset, but its effect on the risk of the overall portfolio (Bawa et al., 1979, pp. 1042). As the standard deviation and variance measure the risk of an asset when it is viewed in isolation, it is necessary to use measures that bind one property to another when assessing a corporate risk. The determination of an expected return and standard deviation of return allows the formation of a yield probability distribution curve. By the yield probability distribution curve, a probability of deviations from the expected return is observed. Thereby, the most widely used is the Gaussian curve - normal distribution curve (Figure 2).

Figure 2. Gaussian curve - normal distribution curve
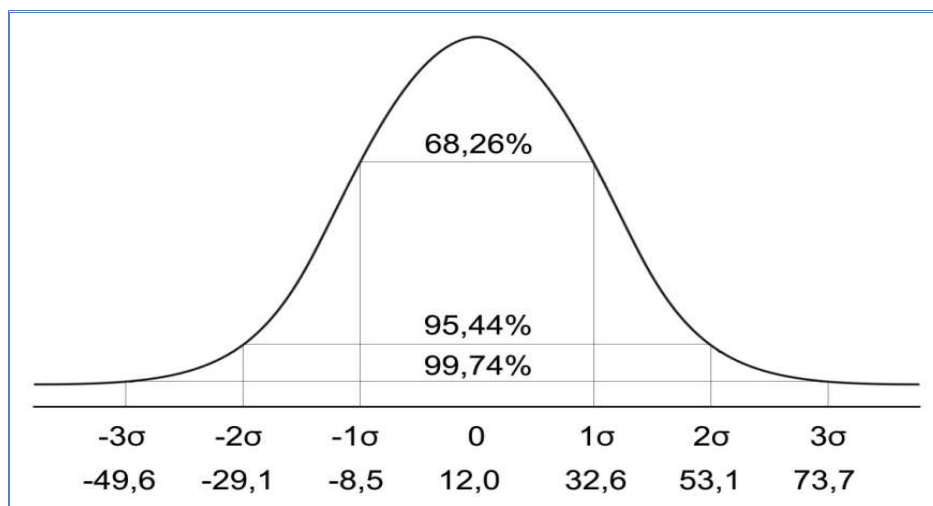
Source: Brigham, E., Daves, P., Gapenski, L. (2004) Intermediate Financial Management, Mason OH: Thomson South–Western, *pp. 35.*

The Gaussian curve takes into account positive and negative deviations from the expected size. The yield is interpreted by the Rule 3σ, i.e. 68% of the yield is in the range R ± 1σ, 95% of the yield is in the range R ± 2σ and 99.7% of the yield is in the range R ± 3σ. By the comparison of the curves of normal distribution, the investor chooses among possible investment alternatives. If the range of possible yields is higher, the curve will be flatter in shape and such investment will be riskier than investments with a lower range of possible

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[2] The assessment of significance of the correlation coefficients is very important in the application of the correlation analysis. The analysis of the importance of the correlation coefficients on the basis of their value often leads to erroneous conclusions, so that in examples of small samples the correlation analysis may be questionable.

yields. By the optimisation of the portfolio structure and risk reduction, investors can increase positive deviations from the expected return or reduce negative bias.

Tendency of movement in capital markets of the Western Balkans and data analysis

An uneven movement of share exchange indexes in the world and the region, as the result of global economic factors in the previous period, continued in 2012. Main indexes experienced a decline in value in the world markets during the mid-year and in the third quarter there was growth, which continued until the end of the year as a sign of recovery of the world economy.

Chart 1. Movement of share indexes in developed markets for the period: 23 December 2011 to 23 December 2012
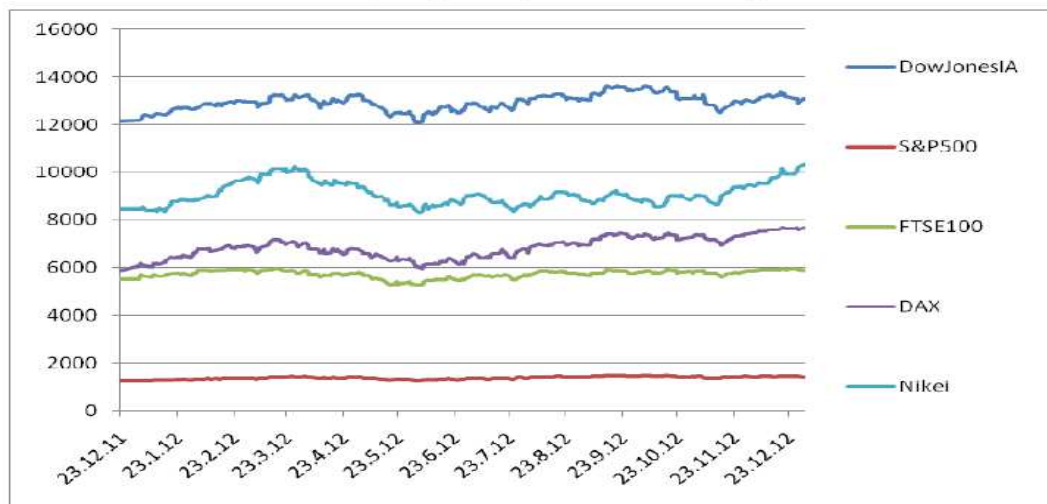
Source: www.dep.gov.ba, Annual Report 2012, Economic Trends, pp. 36

In 2012, the neighbouring countries, as well as the Sarajevo and Banja Luka Stock Exchange, registered a slight decline in market capitalization, and by the end of the year they began making gradual growth. The total market capitalization[3] of Sarajevo and Banja Luka Stock Exchange (SASE and BLSE) at the end 2012 amounted to EUR 4.26 billion, which is a relative increase by approximately 1.52% in comparison to the same period the year before. Unlike the market capitalization, indexes in BH capital market recorded a decline in value. In the period from 30 December 2011 to 29 December 2012, the value of the SASX - 10 share indexes decreased by 31 index points, which is a relative decline by 3.86%. Also, the index of Banja Luka Stock Exchange - (BIRS) in the same period declined by 69 index points, i.e. in the relative value of 7.9% (DEP, 2012). On the final day of 2012, on the Belgrade Stock Exchange a regulated market capitalization of the share market amounted to 2.8 billion EUR, whereby the Prime Listing capitalization was EUR 1.34 billion and the Standard Listing around EUR 131 million. After two consecutive years of negative returns, in 2012 the BSE indexes had

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[3] Market capitalization is the sum of share price and volume of shares traded on the stock exchanges.

positive values. The index of the most liquid shares (BELEX15) ended the year with a growth by 523.89 index points, i.e. with a relative increase by 4.98%, while the other general index (BELEXline) reported somewhat lower growth by 2.9% (BSE, 2012).

In this paper, we analyse the possibility of broader diversification using data on the movement of share indexes divided into three groups, namely: (1) indexes of developed countries, such as the indexes of USA (S&P 500 and DJIA), France (CAC 40), Great Britain (the FTSE All share), Germany (DAX), (2) indexes of the Western Balkans: Bosnia and Herzegovina (SASX - 10 and SASX - 30 and BIRS), Serbia (BELEX15 and BELEXline), (3) Indexes of EU countries: Blue chip index Eurozone (Euro Stoxx 50), Hungary (BUX and BUMIX), Slovenia (SBITOP) and Croatia (CROBEX).

We will observe the correlation coefficients in two different time intervals and for the period from 31 March 2009 to 28 December 2012 and from 31 March 2009 to 28 March 2013.[4] The table below illustrates a correlation matrix between the share indexes in developed countries, Western Balkan countries and individual EU member states for the first period observed.

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[4] Correlation coefficients were calculated based on monthly price movements of the observed indexes in the mathematical program Matlab 7.1.

Table 2. Correlation coefficient matrix for indexes of developed countries of Western Balkans and some EU member states for the period: 31 March 2009 – 28 December 2012

	SASX-10	SASX-30	BIRS	BELEX15	BELEXLine	CROBEX	BUX	BUMIX	SBITOP	DAX	EuroStoxx 50	FTSE All share	CAC 40	S&P 500	DJIA
SASX - 10	1,000	0,836	0,463	0,659	0,656	0,633	0,331	0,393	0,544	0,211	0,272	0,208	0,269	0,188	0,126
SASX - 30	0,836	1,000	0,463	0,573	0,571	0,626	0,369	0,404	0,466	0,222	0,335	0,224	0,310	0,209	0,155
BIRS	0,463	0,463	1,000	0,423	0,466	0,465	0,263	0,325	0,333	0,204	0,241	0,301	0,261	0,341	0,298
BELEX 15	0,659	0,573	0,423	1,000	0,987	0,739	0,537	0,581	0,452	0,312	0,383	0,422	0,440	0,382	0,296
BELEXLine	0,656	0,571	0,446	0,987	1,000	0,717	0,501	0,569	0,497	0,267	0,337	0,374	0,391	0,342	0,252
CROBEX	0,633	0,626	0,465	0,739	0,717	1,000	0,569	0,558	0,481	0,288	0,379	0,460	0,429	0,448	0,386
BUX	0.331	0.369	0.263	0.537	0.501	0.569	1.000	0.879	0.495	0.735	0.795	0.797	0.784	0.764	0.762
BUMIX	0.393	0.404	0.325	0.581	0.569	0.558	0.879	1.000	0.499	0.612	0.700	0.725	0.678	0.683	0.656
SBITOP	0.544	0.466	0.333	0.452	0.497	0.481	0.495	0.499	1.000	0.334	0.281	0.270	0.243	0.351	0.296
DAX	0.211	0.222	0.204	0.312	0.267	0.288	0.735	0.612	0.334	1.000	0.899	0.819	0.866	0.799	0.754
EuroStock 50	0.272	0.335	0.241	0.383	0.337	0.379	0.795	0.700	0.281	0.899	1.000	0.897	0.978	0.835	0.804
FTSE All share	0.208	0.224	0.301	0.422	0.374	0.460	0.797	0.725	0.270	0.819	0.897	1.000	0.914	0.910	0.887
CAC 40	0.269	0.310	0.261	0.440	0.391	0.429	0.784	0.678	0.243	0.866	0.978	0.914	1.000	0.852	0.813
S&P 500	0.188	0.209	0.341	0.382	0.342	0.448	0.764	0.683	0.351	0.799	0.835	0.910	0.852	1.000	0.975
DJIA	0.126	0.155	0.298	0.296	0.252	0.386	0.762	0.656	0.296	0.754	0.804	0.887	0.813	0.975	1.000

Source: Calculation by Author

It is clear from the above table that most of the observed share indexes are positively correlated, while certain indexes have a correlation coefficient below one. If we observe indexes of the Western Balkan countries, what we first notice is that they have the highest positive correlation with indexes of some EU member states as well as between themselves, while they correlate the least with indexes of developed countries. If we take a look at the SASX – 10 index, it is evident that the strongest positive relationship is expressed with the other Sarajevo Stock Exchange - SASX – 30 index (0.836), which is logical given that they belong to the same segment of the financial market, then with the Belex15 (0,659), BELEXline (0.656) and the Zagreb stock exchange index CROBEX (0,633). The strongest negative correlation is present with the market indexes DJIA (0,126), S&P 500 (0,188) and DAX (0,211). Likewise, almost the same tendencies in the movement of correlation coefficients is between the Banja Luka Stock Exchange and Belgrade Stock Exchange indexes. Thus, the strongest positive relationship between the share indexes of Banja Luka Stock Exchange index was observed with indexes of the Belgrade Stock Exchange BELEXLine (0.466) and Zagreb Stock Exchange (0,739). On the other hand, the strongest negative correlation was achieved with market indexes of developed countries, such as the DAX (0,204), DJIA (0,298) and S&P 500 (0,341). A similar trend of movement is also with other indexes of the Western Balkan countries. To test the hypothesis about the variability of correlation coefficients between the observed share indexes, the correlation coefficient matrix is calculated below for the period from 31 March 2009 to 28 March 2013.

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Table 3. Correlation coefficient matrix for indexes of developed countries, Western Balkans countries and some EU member states for the period: 31 March 2009 – 28 March 2013

	SASX-10	SASX-30	BIRS	BELEX15	BELEXLine	CROBEX	BUX	BUMIX	SBITOP	DAX	EuroStoxx 50	FTSE All share	CAC 40	S&P 500	DJIA
SASX - 10	1.000	0.826	0.442	0.662	0.657	0.636	0.337	0.389	0.541	0.209	0.273	0.223	0.273	0.195	0.143
SASX - 30	0.826	1.000	0.464	0.558	0.552	0.612	0.355	0.393	0.457	0.214	0.319	0.221	0.303	0.196	0.142
BIRS	0.442	0.464	1.000	0.396	0.417	0.436	0.237	0.316	0.320	0.196	0.223	0.274	0.247	0.315	0.258
BELEX 15	0.662	0.558	0.396	1.000	0.986	0.742	0.539	0.575	0.449	0.312	0.387	0.434	0.445	0.391	0.314
BELEXLine	0.657	0.552	0.417	0.986	1.000	0.721	0.498	0.561	0.488	0.266	0.341	0.385	0.395	0.354	0.273
CROBEX	0.636	0.612	0.436	0.742	0.721	1.000	0.557	0.542	0.466	0.282	0.375	0.473	0.430	0.459	0.407
BUX	0.337	0.355	0.237	0.539	0.498	0.557	1.000	0.874	0.505	0.730	0.794	0.788	0.780	0.748	0.740
BUMIX	0.389	0.393	0.316	0.575	0.561	0.542	0.874	1.000	0.503	0.613	0.701	0.711	0.677	0.670	0.631
SBITOP	0.541	0.457	0.320	0.449	0.488	0.466	0.505	0.503	1.000	0.336	0.286	0.268	0.245	0.340	0.280
DAX	0.209	0.214	0.196	0.312	0.266	0.282	0.730	0.613	0.336	1.000	0.898	0.807	0.865	0.791	0.734
EuroStock 50	0.273	0.319	0.223	0.387	0.341	0.375	0.794	0.701	0.286	0.898	1.000	0.887	0.976	0.829	0.788
FTSE All share	0.223	0.221	0.274	0.434	0.385	0.473	0.788	0.711	0.268	0.807	0.887	1.000	0.909	0.907	0.886
CAC 40	0.273	0.303	0.247	0.445	0.395	0.430	0.780	0.677	0.245	0.865	0.976	0.909	1.000	0.848	0.802
S&P 500	0.195	0.196	0.315	0.391	0.354	0.459	0.748	0.670	0.340	0.791	0.829	0.907	0.848	1.000	0.972
DJIA	0.143	0.142	0.258	0.314	0.273	0.407	0.740	0.631	0.280	0.734	0.788	0.886	0.802	0.972	1.000

Source: Calculation by Author

Table 3 shows that the correlation coefficients in the second analysed period for the share market indexes in the Western Balkans and the EU countries slightly changed the intensity and direction with respect to the increase of values with respect to the first analysed period, while the correlation coefficient of indexes of developed countries recorded a tendency of a slight decrease in value. The strongest positive correlation with the index of the Sarajevo Stock SASX – 10 index was made by the following indexes: SASX - 30 (0.826) BELEX 15 (0.662), BELEXline (0.657) and CROBEX (0.636). As in the first analysed period, the strongest negative relationship with the share index of SASX - 10 was made by the following indexes of developed countries: DJIA (0,143), S&P 500 (0,195) and DAX (0,209), which provides a good opportunity for diversification.

Based on the data on the movement of share indexes in the Western Balkans and on the theoretical basis elaborated in the second part of the paper, we will initially make the selection of shares from Sarajevo, Banja Luka and Belgrade Stock Exchange, which we will combine into a certain optimal risk portfolio. The second step of the analysis is to include a certain number of shares from the New York Stock Exchange and Germany Stock Exchange in our initial portfolio in order to further reduce investment risks because the correlation coefficients between the share indexes of Western Balkan countries and the developed countries are with the lowest correlation coefficients (Table 3). Based on the collected data on monthly price changes of selected securities share indexes of the Western Balkans for the period from 31 August 2010 to 28 March 2013, which amount to the total of 944 days or 677 working days, by the calculation by a software used for the optimisation, we came up with the following values of return and risk, as illustrated by the table below.

Table 4. Average yield and standard deviation of individual shares within the share market indexes: SASX – 10, BIRS and BELEX15 for the period from 31 August 2010 to 28 March 2013

Share Symbols	BHTSR	BSNLR	HTKMR	JPEMR	JPESR	BOKS-R-A	HEDR-R-A	NOVB-R-E	RNAF-R-A	TLKM-R-A	AIKB	ENHL	KMBN	NIIS
Average Yield	0,19	0,06	-0,54	-0,58	-0,18	2,59	0,90	-0,35	1,24	1,13	-1,36	-0,28	-1,22	2,57
Standard Deviation	5,50	7,48	7,44	9,70	8,07	11,43	7,92	8,50	24,48	5,14	9,04	9,65	10,66	12,79

Source: Calculation by Author

The table above clearly shows that the highest average (monthly) rate of return was achieved by the shares of the company of Boksit, Milici by 2.59%, and the risk is expressed by a standard deviation of 11.43%, whereby it could be concluded that the yield and risk are positively correlated. The second highest average positive yield is achieved by the shares of the Serbian Oil Company[1] of 2.57% and a standard deviation of 12.79%. The highest prices of the Oil Industry of Serbia shares in 52 weeks of trading amounted to RSD 1.020, while the lowest price was RSD 585 (www.belex.rs). Unlike the positive values of average (monthly)

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[1] The Public Joint Stock Company of Oil Industries of Serbia is an enterprise for research, processing, distribution and sale of oil and exploration and production of natural gas.

yields, the lowest negative value during the observed period was recorded by the shares of the Agro-Industrial Commercial Bank, Nis (-1.36%), and a standard deviation of 9.04%, followed by the shares of the Belgrade Commercial Bank with a negative average yield of 1.22% and a standard deviation of 10.66%, and the shares of JP EP HZHB Mostar are in the third place with an average yield (-0.58%) and a standard deviation (9.70%). By the comparison of the average rate of return of the observed share indexes of the Western Balkan countries it can be noted that there is a slight deviation from the value of zero, except for the shares of the Oil industries of Serbia, Telekom of Srpska, Boksit company Milici and Oil Refinery - Brod, which is consistent with the theoretical assumption of many approaches and models for measuring market risks, which include the premise that a long-term average (monthly) return equals zero. Likewise, along with the data collected on the monthly price movements of selected shares, a process of the optimisation of initial venture portfolio of 14 shares observed was carried out, as illustrated in the table below.

Table 5. Features of first nine optimal portfolios of shares observed in the composition of the share indexes: SASX – 10, BIRS and BELEX15 on 28 March 2013

	PORTFOLIO								
	1.	2.	3.	**4.**	5.	6.	7.	8.	9.
Yield (%)	0.50	**0.76**	1.02	1.29	1.55	1.81	2.07	2.33	2.60
Risk – σ (%)	3.36	**3.42**	3.60	3.87	4.23	4.74	5.47	6.38	11.43
									SHARE (%)
BHTSR	0.136	**0.140**	0.130	0.113	0.052	-0.000	-0.000	-0.000	-0.000
BSNLR	0.107	**0.077**	0.037	0.001	-0.000	-0.000	-0.000	-0.000	-0.000
HTKMR	0.065	**0.011**	-0.000	-0.000	-0.000	0.000	0.000	-0.000	0.000
JPEMR	0.017	**0.027**	0.016	0.001	0.000	0.000	-0.000	-0.000	0.000
JPESR	0.000	**-0.000**	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
BOKS –R-A	0.000	**0.015**	0.064	0.116	0.164	0.244	0.345	0.447	1.000
HEDR-R-A	0.132	**0.141**	0.141	0.141	0.143	0.105	0.040	-0.000	-0.000
NOVB-R-E	0.130	**0.101**	0.073	0.043	-0.000	0.000	-0.000	-0.000	0.000
RNAF-R-A	0.009	**0.015**	0.017	0.018	0.019	0.019	0.019	0.013	-0.000
TLKM-R-A	0.381	**0.424**	0.431	0.434	0.444	0.393	0.288	0.160	-0.000
AIKB-2	-0.000	**-0.000**	-0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000
ENHL	-0.000	**0.000**	0.000	0.000	0.000	0.000	-0.000	-0.000	0.000
KMBN	0.015	**-0.000**	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NIIS - 4	0.008	**0.049**	0.048	0.133	0.178	0.239	0.308	0.380	-0.000

Source: Calculation by Author

As it can be seen, the second out of nine portfolios has a slightly higher risk measured by standard deviation compared to the first, but a significantly higher rate of return, so we opted for the second portfolio as the optimal solution. The selected initial (risk) optimal portfolio has an overall yield of 0.76%, the variance of 11.70% and standard deviation of 3.42%. The yield of the second selected optimal portfolio presents a relative increase by 52% compared to the yield of the first portfolio. Since the selected shares present a structural share of the stock indexes of SASX-10, BIRS and BELEX15, if we compare the yield and risk of share index with the optimal portfolio we come to the following data. The benchmark

index of the Sarajevo Stock Exchange SASX - 10[2] in the period from 31 September 2009 to 28 March 2013 reached a negative average (monthly) return of 0.08%, the variance of 29.05 and a standard deviation of 5.39%. In the same period observed, the index of Banja Luka Stock Exchange - BIRS also generated negative average (monthly) return of 0.22% , the variance of 13.76% and a standard deviation of 3.71%.

Unlike the index of Sarajevo and Banja Luka stock exchanges, the share index of the Belgrade stock exchange - BELEX15 in the same period registered a positive average (monthly) return of 1.25%, variance of 81,90% and standard deviation of 9.05%. If a potential investor is in a dilemma whether to invest in shares of initially formed optimal portfolio or the shares of SASX - 10 and BIRS share indexes, they should certainly give advantage to the optimal portfolio for the simple reason that the average return is positive (0.76%) compared to the yield of the share index SASX – 10, which is negative (-0.08%) and the yield of BIRS share index (-0.22). Also, in terms of risk measured by a standard deviation, the advantage is with the optimal portfolio, which achieved a standard deviation of 3.42%. Unlike the optimal portfolios, the SASX-10 share index achieved a standard deviation of 5.39% over the observed period, which represents a relative increase compared to the optimal portfolio by approximately 58%. Similarly, the index of Banja Luka stock exchange - BIRS in this period was riskier than the optimal portfolio, where it achieved a standard deviation of 3.71%, which represents a relative increase by 8%. On the other hand, if a potential investor has the option to invest in shares of the Belgrade stock exchange index - BELEX15 or in shares of initial optimal portfolio, then in terms of return they should invest in the BELEX15 share index because it yielded by 1.25%, which is a relative increase by 64%. If we look at the risk, then priority should certainly be given to the optimal portfolio which had a standard deviation by 3.42% in this period, which is a relative decrease compared to the share index of BELEX15 by approximately 63%. If certain shares from the structure of the German Stock Exchange index (DAX) and New York Stock Exchange indexes (S & P 500 and DJIA) are included into the initially formed (risk) portfolio, we come to the newly formed optimal portfolio, as illustrated by following table.

Table 6. Features of the first nine optimal portfolios of observed shares in composition of share indexes: SASX – 10, BIRS and BELEX15, DAX, S&P 500 i DJIA on 28 March 2013

	PORTFOLIO								
	1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**
Yield (%)	0.88	**1.09**	1.31	1.52	1.74	1.95	2.17	2.38	2.60
Risk – σ (%)	2.12	**2.14**	2.24	2.42	2.67	2.99	3.36	3.78	11.43
	SHARE (%)								
BHTSR	0.015	**0.025**	0.038	0.031	0.000	0.000	0.000	-0.000	-0.000
BSNLR	0.000	**-0.000**	-0.000	-0.000	-0.000	-0.000	0.000	0.000	-0.000
HTKMR	0.103	**0.101**	0.089	0.073	0.058	0.027	0.000	-0.000	0.000
JPEMR	-0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
JPESR	0.089	**0.059**	0.021	0.000	0.000	-0.000	-0.000	0.000	-0.000

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[2] Index of SASX - 10 follows price movements among top ten companies on the market, excluding investment funds as measured by market capitalization of trading.

BOKS –R-A	0.052	**0.074**	0.094	0.117	0.142	0.165	0.188	0.000	1.000
HEDR-R-A	-0.000	**0.002**	0.013	0.015	0.011	0.003	0.000	0.216	-0.000
NOVB-R-E	0.011	**0.000**	-0.000	-0.000	0.000	0.000	0.000	-0.000	0.000
RNAF-R-A	-0.000	**0.000**	0.000	-0.000	-0.000	-0.000	-0.000	0.000	0.000
TLKM-R-A	0.000	**-0.000**	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	-0.000
AIKB	-0.000	**-0.000**	0.000	-0.000	0.000	-0.000	-0.000	-0.000	0.000
ENHL	-0.000	**0.000**	-0.000	-0.000	0.000	0.000	0.000	-0.000	-0.000
KMBN	0.004	**-0.000**	-0.000	-0.000	0.000	0.000	0.000	-0.000	0.000
NIIS	0.007	**0.018**	0.029	0.043	0.058	0.074	0.090	0.103	0.000
ADS	0.032	**0.074**	0.124	0.177	0.235	0.297	0.352	0.430	-0.000
BAYN	0.063	**0.057**	0.051	0.039	0.022	-0.000	-0.000	-0.000	-0.000
DAI	0.000	**-0.000**	0.000	0.000	-0.000	-0.000	-0.000	0.000	0.000
AAPL	0.117	**0.108**	0.098	0.091	0.088	0.084	0.079	0.066	-0.000
GOOG	0.006	**0.030**	0.054	0.077	0.098	0.118	0.131	0.149	0.000
PEP	0.456	**0.437**	0.390	0.337	0.288	0.231	0.159	0.036	-0.000
CHRW	0.045	**0.016**	-0.000	-0.000	0.000	0.000	0.000	-0.000	-0.000
PHH	-0.000	**0.000**	-0.000	-0.000	0.000	0.000	0.000	-0.000	-0.000

Source: Calculation by Author

From the table above, it is clear that the rates of return of almost all of the nine observed portfolios were increased and risks measured by the standard deviation were reduced by including shares of companies from different sectors in Germany and the New York Stock Exchange, which confirms the main hypothesis tested in the paper, that further inclusion of shares stock indexes in developed countries in the optimal risk portfolio of the Western Balkan countries directly affects the increase of return and decrease of risk. Since here the second portfolio from the efficient threshold (Table 6) also has a slightly higher risk than the safest portfolio and a higher rate of return, it presents an optimal solution. The selected optimal portfolio in the period observed has a total average yield of 1.09%, variance of 4.58 and a standard deviation of 2.14%. Since we compared the initial (risk) optimal portfolio to the market indexes in the Western Balkans, i.e. the market performance of their business, we will compare the market performance of the second obtained optimal portfolio to the performances of the share index DAX, S& P 500 and DJIA. The index of German stock exchange - DAX in this period achieved an average (monthly yield) of 1.52%, the variance of 31,92 and standard deviation of 5.65%. If a potential investor considers whether to invest in the shares of the German stock exchange index - DAX or the shares of another optimal portfolio, from the point of view of return they should invest into the share index DAX because it yielded 1.52%, which represents a relative increase by 39% compared to other established optimal portfolio. If we analyse the risks, then a priority should definitely be given to the optimal portfolio, which in this period had a standard deviation of 2.14%, which is a relative decrease compared to the DAX share index by approximately 63%.

Unlike the German stock market index, the index of New York Stock Exchange S&P 500 achieved an average (monthly) return of 1.69%, variance of 18,40% and standard deviation of 4.29% over the observed period. In this case, a potential investor from the yield point should invest in the S&P 500 share exchange index because they guarantee higher profit compared to the other established optimal portfolio, while in terms of risks the advantage is once again given to the optimal portfolio. The other analysed index on the New York Stock Exchange

DJIA in this period also made a positive average (monthly) return of 1.44%, variance of 15.44% and standard deviation of 3.93%. It is safe to conclude that in this case priority is given to investments in shares of the DJIA share index because they guarantee the yield of 1.44%, which in comparison with the optimal portfolio yield represents a relative increase of 32%. On the other hand, in terms of a risk measured by the standard deviation, advantage is given to the optimal portfolio because for the period observed it has a standard deviation of 2.14% and, as opposed to the DJIA share market index, it is a relative reduction by approximately 46%.

Conclusion

The basic argument in favor of international diversification is that foreign investments allow investors to reduce the total risk of the portfolio, while offering additional profit potential. By expanding the investment opportunity set, international diversification helps to improve the risk - adjusted performance of a portfolio. Domestic securities tend to move up and down together because they are similarly affected by domestic conditions, such as monetary announcements, movements in interes rates, budget deficits, and national growth.

A portfolio diversification works because prices of different shares do not move in a completely same direction. Statisticians generally mean the same thing when they say that share price changes are nothing less than perfectly correlated. Correlation coefficients between securities in the capital markets in the Western Balkans should be taken with some reserve because of their proven variability, since in financial crises correlation coefficients converge to the unit, benefits of diversification disappear and portfolio risk becomes simply equal to the weighted sum of individual risks of securities of which it is composed. The logic of diversification has very solid theoretical assumptions and it is well known in the popular proverb: „Do not put all your eggs in one basket". It is equally easy to demonstrate logical benefits of inclusion of securities from different industries and markets into the portfolio, which is reflected in lower risk and stable returns. Reasons for positive effects of international diversification can be found in the fact that economic cycles of countries do not move synchronously.

The above analysis clearly shows that the investment of available funds for a given optimization model and active management of a portfolio can provide significant rates of return because, as it can be observed from the second formed optimal portfolio, yield rate of about 30% increased compared to the risk portfolio formed first. Also, the risk of almost all of the nine formed portfolios decreased owing to the inclusion of shares from different share markets and different sectors of activity.

A chronic lack of large institutional investors, whose participation in the capital markets, in addition to providing liquidity also reduce volatility, again brings to the forefront the issue of establishing cooperation and finding adequate forms of association of market organisers. Connection in the capital market is a very topical issue, because it brings forth all the positive effects, such as the formation of an optimal portfolio, increase of the attractiveness of a market and a wider range of market materials for potential investors. Also, the trend of connectivity brings with it the possibility of a direct trade to a broker over the stock market, which is a model that should meet the highest standards of broker - share

market business. Observed on the other hand, it is true that smaller share markets face problems of economic self-sufficiency, which is particularly evident in times of recession to be successfully overcome, where the connectivity between stock markets and capital markets becomes inevitable.

References

Alihodžić, A., and Plakalović, N. 2013. *Savremeno upravljanje finansijama sa primjenom u MS Excel-u*. Beograd: Institut ekonomskih nauka.

Bawa, S. V., Elton, J. E. and Gruber, J. M. 1979. „Simple rules for Optimal Portfolio Selection in stable Paretion Market". *The Journal of Finance*, (34):4.

Bodie, Z., Kane, A., and Marcus, J. A. 2009. *Osnovi investicija*. Beograd: DATASTATUS.

Belgrade stock exchange (BSE). 2012. Godišnji izveštaj o poslovanju u 2012. godini. *http://www.belex.rs/files/proizvodi_i_usluge/GI_2012.pdf*.

Berenson, M. L., and Levine, D. M. 1996. *Basic Business Statistics – Concepts and Applications*. New Jersey: Prentice Hall.

Brigham, E., Daves, P., and Gapenski, L. 2004. *Intermediate Financial Management*. Mason OH: Thomson South–Western.

Damodaran, A. 2010. *Analiza vrijednosnica za investicijske i korporativne financije*. Drugo izdanje. Zagreb: MATE.

Dobardžić, E. 2013. „Dinamičke interakcije međunarodnih tržišta kapitala: perspektiva Srbije". *Ekonomske teme,* 51 (1): 123 -137.

DeFusco, R.A., McLeavey, D. W., Runkle, D. E. 2004. *Quantitative methods for investment analysis*. Second Edition. Virginia: CFA Institute.

Directorate for economic planning (DEP) 2012. **"**Godišnji izvještaj, 2012.*"* *Ekonomski trendovi,* http://www.dep.gov.ba/default.aspx?langTag=bs-BA&template_id=139&pageIndex=1.

Erić, D., and Đukić, M. 2012. *Finansijska tržišta u uslovima krize. Beograd:* Institut ekonomskih nauka i Beogradska bankarska akademija - Fakultet za bankarstvo, osiguranje i finansije.

Finance. 2013. Yahoo Finance Diversification. http://finance.yahoo.com (Accessed, October 30, 2013).

Hunter, J. R., and Coggin, T. D. 1990. „An Analysis of the Diversification Benefit from International Equity Investment". *The Journal of Portfolio Management*, 17(1).

Madura, J., and Tucker, A. L. 1992. „Hedging International Stock Portfolios: Lessons from the 1987 Crash". *The Journal of Portfolio Management*, 18(3).

Richard, A. B., Myers, S., and Marcus, J. A. 2007. *Osnovi korporativnih finansija*. Beograd: MATE.

Solnik, B., McLeavey, D. 2009. *Global Investments*. Sixth Edition. Boston: Pearson International Edition.

Solnik, B. 1974. „Why Not Diversity Internationally Rather than Domestically"?. *Financial Analysts Journal*.

Šoškić, I., and Serdar, V. 1994. *Uvod u statistiku*. Zagreb: Školska knjiga.

Vukičević, M., Gregurek, M., Odobašić, S., and Grgić, J. 2010. *Finansijski menadžment u MS Excelu,* Zagreb: Golden marketing - Tehnička knjiga.

http://www.belex.rs

http://www.sase.ba

http://www.blberza.com

http://www.zse.hr

http://www.bse.hu

http:// deutsche-boerse.com

http://www.londonstockexchange.com

http://www. nyse.com

http://www.investing.com/equities/apple-computer-inc-historical-data

Mogućnost primene regionalne diversifikacije na tržištima kapitala Bosne i Hercegovine i R. Srbije

REZIME – *Generalno rizik predstavlja nesigurnost povezanu s budućim ishodom ili događajem. U ekonomskom smislu rizik predstavlja očekivano odstupanje od planiranih prinosa realne, finansijske i neopipljive imovine, ostvarivanje gubitka, ili novčanih tokova povezanih s nesigurnim događajem. Najpoznatiji način umanjivanja ukupnog rizika je diversifikacija imovine. Dakle, diversifikacija je proces investiranja u brojne nepovezane ili djelimično povezane imovine ili aktivnosti u cilju postizanja stabilnog poslovanja, odnosno ona pokazuje koji su portfoliji u toj mjeri loši da ih treba izbjegavati kako bi se uticalo na povećanje prinosa i smanjenje rizika. Diversifikacija portfolija funkcioniše jer se cene različitih akcija ne kreću u potpunosti u istom smeru. Statističari u principu misle na istu stvar kada kažu da promene cena akcija nisu ništa manje nego u savršenoj korelaciji. Osnovni cilj u ovom radu je razmatranje uticaja globalne finansijske krize na tendenciju kretanja berzanskih indeksa zemalja zapadnog Balkana, razvijenih zemalja i pojedinih zemalja članica EU, te utvrđivanje mogućnosti sprovođenja regionalne diversifikacije u cilju dodatnog smanjivanja rizika, odnosno formirnja portfolija akcija s najnižim koeficijentima korelacije.*

KLJUČNE REČI: *sistematski rizik, nesistematski rizik, gausova kriva, efikasna granica, optimalni portfolio*