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APPLICATION OF THE MODERN PORTFOLIO THEORY IN DIVERSIFICATION OF THE DEBT SECURITIES PORTFOLIO IN EMERGING MARKETS

ПРИМЈЕНА МОДЕРНЕ ПОРТФОЛИО ТЕОРИЈЕ ПРИ ДИВЕРЗИФИКАЦИЈИ ПОРТФОЛИЈА ДУЖНИЧКИХ ХАРТИЈА ОД ВРИЈЕДНОСТИ НА ТРЖИШТИМА У РАЗВОЈУ

Summary: *The term "portfolio analysis", introduced in the economic theory by Harry Markowitz, is not a new term in scientific literature. However, analysis and criticism in the papers of local and foreign authors are mainly based on the examples of developed capital markets. There are very few cases of application of the portfolio analysis in the domestic capital market. The focus of this paper is on implementation of diversification of the bonds on the Banja Luka Stock Exchange. Using Markowitz's portfolio selection, we will prove that diversification, including all limitations, is possible and applicable onto the domestic bonds in the capital market.*

Keywords: *modern portfolio theory, diversification, debt securities, bond market*

JEL classification: *G12, H74, P26*

Резиме: *Термин „портфолио анализа“, који је у економску теорију увео Хари Марковиц није нов у стручној литератури Међутим, у радовима домаћих или страних аутора, анализе и критике се углавном базирају на примјеру развијених тржишта капитала. Ријетки су случајеви примјене портфолио анализе на домаће тржиште капитала. У раду ћемо се фокусирати на примјену диверзификације на обвезнице на Бањалучкој берзи. Користећи Марковицев метод портфолио селекције доказаћемо да је ефекат диверзификације, уз сва ограничења, на обвезнице на домаћем тржишту могућ и примјенљив.*

Кључне ријечи: *Модерна теорија портфолија, диверзификација, дужничке хартије од вриједности, тржиште обвезница*

JEL класификација: *G12, H74, P26*

1. INTRODUCTION

A portfolio, in financial terms, represents a combination of different types of assets, mostly financial instruments - securities and deposits. Under the financial asset we comprise every asset whose value can be exchanged. Financial assets may be: securities, giro money, foreign currency, gold and precious metals, etc.

The two main motives for creating a portfolio are profit and diversification of risk for the investor. Selection of an adequate portfolio depends on the expected return, risk of individual securities, correlations (interconnection of the yields) among individual securities and the preference of investors (preferences or risk aversion).

The concept of diversification as a means to reduce risk is usually explained by following words: "Never put all your eggs in one basket". Creating a portfolio of securities in the financial market needs much more analysis and effort than just doing random selection of various securities.

The modern portfolio theory uses basic statistical categories such as variance, standard deviation, correlation and covariance, followed by categories such as beta and other derived indicators in order to establish and measure the relationship between yield and risk in the portfolio. The main difference between the classical portfolio theory (which deals with diversification of different types of assets by combining their different phases and the rate of return, and introduces individual selection of securities based on analysis of individual actions) and the modern portfolio theory is in fact that the modern portfolio theory introduces mathematical and statistical analysis in a selection of the portfolio, in order to create more optimal portfolio. We will test the scope and limitations of the enhanced

modern portfolio theory in a developing market, which has all the characteristics of an emerging market.

2. PORTFOLIO MANAGEMENT OF SECURITIES BY MEANS OF APPLICATION OF THE MODERN PORTFOLIO THEORY

The founder is Harry Markovitz. He has developed his model in 1952 in his paper “Portfolio Selection” (Markowitz 1952, 77-91). His followers: Sharpe, Treynor, Jensen and others modified and improved the model. Thirty-eight years later, his work on the analysis of the financial portfolio was awarded the Nobel prize in economics. In his work he calculated the expected rate of revenue of the portfolio of financial instruments, showing that the variance of a revenue rate is a significant measure of a portfolio risk. Based on these assumptions he made a formula for calculation of the portfolio variance by calculating the effective portfolio diversification (Jeremic 2012, 298).

Markovic's model is based on several assumptions relating to the behavior of the investors. The most important of them is that investors make a risk assessment of the portfolio based on variability of expected yield. Next assumption says that decisions on investments made by investors are solely based on the expected return and risk. Accordingly, their usefulness curve is a result of the expected yield and its variance (or standard deviation). Third important assumption implies that investors will always prefer the highest revenue for a given level of risk or the lowest risk for a given level of revenue.

While the classic portfolio theory used diversification to reduce the risk, the modern theory instead introduces measurement of return and risk on the basis of risk-adjustment returns, and thus creates an efficient portfolio.

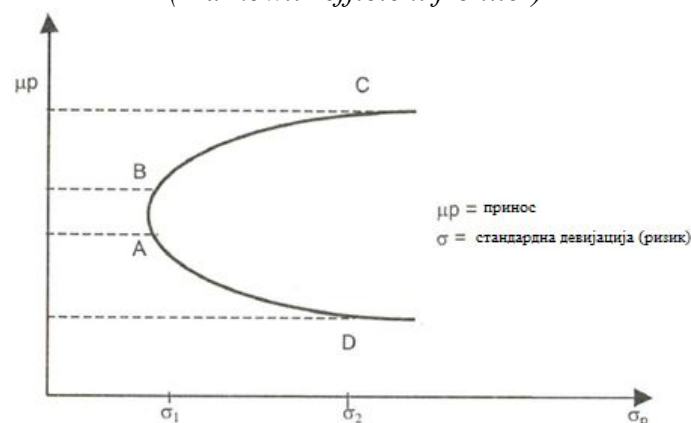
That is possible because the revenues from shares and securities move more often in opposite directions, especially in periods of crises and prosperity. Shares from some sectors can also be negatively correlated, meaning that their price moves in the opposite direction; all of that offers them a possibility to decrease risk when these securities are part of a portfolio.

According to the concept of the modern portfolio theory, the investors require:

- the maximum expected return of the portfolio with acceptable level of risk, or alternatively,
- decrease of risk which they will be exposed to, along with a certain assumed level of the expected revenue of the portfolio.

According to this theory, higher revenue does not necessarily imply greater risk (in Figure 1), B combination has greater expected revenue, and the same level of risk as A combination in Figure 2. According to this illustration, only the upper part of the curve marked by points A, B and C satisfies a set of efficient portfolios.

Figure 1: Yield and portfolio risk (yield and standard deviation) on the MEF curve (Markowitz efficient frontier)



Source: Author's own elaboration

Assumptions of the portfolio theory established by Markowitz are:

- the investor takes into account each alternative investment presented in the probability schedule of expected yields in an observed period,
- the investor assesses the portfolio risk based on variability of the expected portfolio yield,
- the investor's decisions are based solely on the expected return and risk, so that utility is the function of the expected yield and the expected variance (or standard deviation) yields,
- for a given level of risk, the investor prefers higher yields compared to lower, and vice versa. For a given level of expected yields, the investor prefers less risk than higher risk.

The return rate can be precisely calculated at the end of the period, once we know the current price of securities and dividends or interest rates. However, at the moment of making a decision on selection of investment alternatives, i.e. the choice of securities (or bonds), we do not know with certainty the amount of profit (dividends and capital gain).

Therefore, in the modern financial theory and analysis of investments in securities it is assumed that the rate of return is a random variable, i.e., variable that could "take" one of a series of values $v_1, v_2, \dots, v_i, \dots, v_n$ wherein $0 \leq v_i \leq 1$ i $v_1 + v_2 + \dots + v_n = 1$

The expected return of the portfolio is a weighted average of the expected yield assets - securities that create the portfolio. The weights are the share of individual securities in the portfolio - totalling to 100 % or 1.00, depending on whether the weights indicate a percentage or a decimal format instead. The expected rate of return for an individual security is the sum of a potential yield multiplied by a corresponding probability of return. The formula for calculating the expected yield for individual risk investment – securities is (Markowitz 1952, 83):

$$E(R_p) = \sum_{i=1}^n w_i R_i$$

wherein:

W = weight (participation of individual securities in the portfolio - total of 1.00, i.e. 100%);

E(R) = the expected rate of return of securities;

P = probability of possible rates of return.

To determine the risk of individual actions it is required to calculate standard deviation or variance, because by doing so it can be measured how certain amounts (in this case - the yield) divert from the average value. The variance is defined as the square deviation from the average, as indicated in the following Formula :

$$\sigma^2 = \sum_{i=1}^n [R_i - E(R_i)]^2 P_i$$

The advantage of squaring is that the value of positive and negative deviations will not be added. However, squaring leads to large numbers that are difficult to interpret accurately, so it is recommended to use the variance root or the so-called standard deviation:

$$\sigma = \sqrt{P_i [R_i - E(R_i)]^2}$$

We emphasise that the correlation between the securities A and B can be calculated by the following Formula¹:

$$p(p_A, p_B) = \frac{\sum_{i=1}^n (p_A - \mu_A)(p_B - \mu_B)}{\sqrt{\sum_{i=1}^n (p_A - \mu_A)^2 * \sum_{i=1}^n (p_B - \mu_B)^2}} =$$

However, for the purpose of our analysis, it is necessary to notice how standard deviation behaves in a portfolio. Therefore, we have to consolidate the correlation coefficient with standard deviations of securities in the portfolio. In this way, the calculation gives the so- called „covariance“, which we will use to further analyse the following Formula:

¹ If correlation is +1, in this case, the data have completely identical development. On the other hand, if the correlation is -1, then data have the opposite development (e.g. increase of A rate leads to a decrease of B course), while the correlation of 0 means that data have developed completely differently.

$$COV_{AB} = \sigma_A \sigma_B \rho_{AB}$$

After defining shares of certain securities in the portfolio, an average yield and standard deviation of the portfolio yield can be calculated. When calculating an average yield of the portfolio, we simply calculate the weighted average of the yield of certain securities (Markowitz 1952, 81).

The expected yield of the portfolio depends on the share of securities in the portfolio. The overall yield of the portfolio will be between the yield securities with the lowest expected return and the yield securities with the highest expected return (Markowitz 1952, 83-84).

The portfolio variance of N securities should be calculated by the following formula:

$$Var(p) = \sum_{i=1}^N \sum_{j=1}^N x_i x_j \sigma_{ij}$$

This formula is one of the most important values of the portfolio theory. It proves that the portfolio risk is contingent on a correlation of securities, that is, a certain type of property. The contribution of the formula is that it suggests that when creating a portfolio it needs to be analysed to what extent the yields of specific types of property are interrelated.

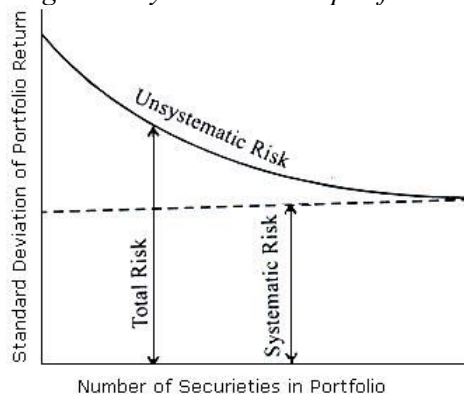
2.1 Diversification of risk

We can decrease the portfolio risk by combining securities in a portfolio, if they are not perfectly positively correlated. Therefore, diversification of a portfolio is the result of combining securities (investments) with yields that are not perfectly positively correlated. Examples of a diversified portfolio show that they (diversified portfolios) will give almost equal yield as the market yield. In case we invest in only one security, then the risk of that „portfolio“ (which consists of a single share) is equal to standard deviation of that share. If the number of randomly selected securities in the portfolio increases, then the overall risk of the portfolio decreases. This risk reduction takes place at a decreasing rate. Accordingly, the overall risk of the portfolio is created from:

- systematic (market) risk and
- non-systematic (specific) risk.

Systematic (systemic) risk which cannot be diversified represents the lowest level of risk that can be achieved by diversifying or combining a large group of securities. Non-systematic risk can be diversified, that is, a well diversified portfolio reduces the overall risk to systematic risk. On the other hand, systematic risk is inevitable, and it represents the result of all risk factors in the financial market. In addition, this risk affects all assets (e.g. all securities in a single country).

Figure 2: Systematic and specific risk

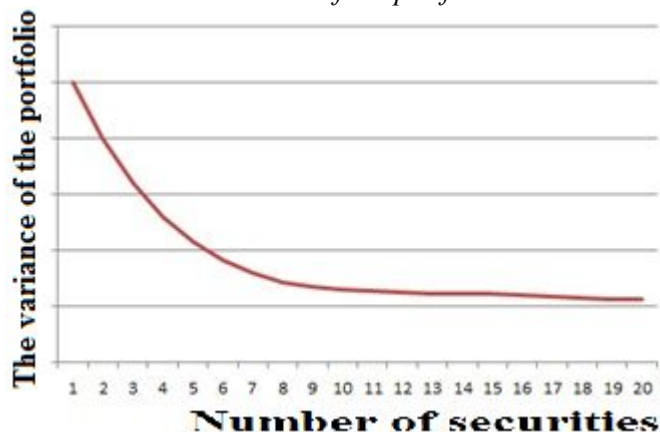


Source: Author's own elaboration

When creating a portfolio that consists of two risky assets, the most important fact is correlation between the movement of the yield of assets. The portfolio risk depends on the correlation between the yield of assets in the portfolio (Zvi et al. 2006, 52). Figure 2 illustrates that the specific risk approaches to zero more with each new share being added to the portfolio. As the number of selected securities included in the portfolio increases, the overall risk decreases; still, regardless of a number of shares in the portfolio, there is a level of risk that is not feasible to eliminate. Efficient

diversification reduces the overall risk of the portfolio to the level where there is only systematic risk.² Unsystematic risk stems from variability of the above average yield of securities, and is not in a functional correlation with movement of the above average yield of the market as a whole (Van Horne, 1993, 72). In relation to the mentioned, we emphasise that the portfolio variability decreases rapidly along with the increase of a number of securities in the portfolio (Figure 3).

Figure 3: Relation between the variance of the portfolio and the number of securities



Source: Author's own elaboration

2.2 Selecting the debt securities in the portfolio

In the capital market of the Republika Srpska, there are all necessary conditions for linking supply and demand for securities. However, most of listed shares are not attractive to investors. On the other hand, the market lacks professional investors. Therefore, we will presume that main characteristics of a market are small number of quality securities and their small level of illiquidity. Without a doubt, the purchase of such shares may not be sufficient to achieve diversification of portfolio risk. There are two dominant reasons for buying these shares:

- concentration of ownership of one or more owners, and
- buying for speculative purposes.

In accordance to the mentioned object of the analysis, securities that we will use are the bonds. However, the subject of our interest are not all bonds listed at the Banja Luka Stock Exchange. By using certain criteria related primarily to the liquidity we will try to extract the best - these with a satisfactory yield, risk management and liquidity. This simplification of analysis goes „in line“ with the advice of a large number of authors who say that the increased number of shares above certain diversification rate reduces the effect of diversification. Accordingly, we will strive not to look only at the riskiness of individual bonds, but also on contribution to the riskiness of the portfolio risk bonds. With the aim to create as better as possible selection of securities, treasury bills will be ignored due to their short maturity, so we observe only bonds in the domestic market (Table 1).

² For typical shares, nonsystematic risk covers about 75% of the total risk, i.e. variance of these shares. This means that the systematic risk explains only 25% of the total variation of individual actions.

Table 1: Turnover in bonds (secondary trading) at the Banja Luka Stock Exchange, per year

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016
Issue of bonds of financial institutions				1,961,318				81,000	
Corporate bonds					6,624,484				
Municipal bonds			1,388,572	361,690					
Bonds of the Republika Srpska					2,000,000	7,111,600	34,668,300		6,373,672
series RSDS					7,616,466	22,051,002	12,167,457	7,527,740	1,968,716
series RSIO	7,893	30,818		45,622	108,414	119,696	61,137	114,358	2,151
series RSOD		15,646	11,593	12,377	37,343	53,006	30,213	11,022	3,054
series RSRS	336,527	20,162,577	16,997,165	21,670,096	29,857,619	47,251,571	46,199,351	39,245,340	16,664,599

Source: Author's own elaboration

By narrowing a selection to securities that were traded with, we notice that with a large number of securities there was almost no secondary trading (Table 2). The exceptions are bonds series of the RSRS. They will be in the focus of our interest and we will create a portfolio with them. Reasons for significant secondary trading will be discussed in the sequel. According to the method of interest payment in the capital market of the Republic of Srpska there are two types of bonds: the bonds amortised in annuities and coupon bonds. Series RSRS are coupon bonds. The first two series have a maturity of 15 years, with a grace period of five years, series C, D and E have a maturity of 14 years, with a grace period of four years, and the other series have a grace period of 3 years.

We will assume that the information on the payment coupon are and will be included in the price movement of these bonds. To make this example more realistic in our calculation we took into account the payment of coupons: Series A coupon payment was on 30 June 2015 in the amount of BAM 0,1120, series B on 15 December 2015 in the amount of BAM 0.1135, series C was a payment coupon on 30 October 2015 in the amount of BAM 0.1135 BAM, etc. It is important to bear in mind that the decision to invest only in a single series of bonds does not reduce specific risk.

Table 2: Number of trading days

Mark	Bonds	2008	2009	2010	2011	2012	2013	2014	2015	2016
BLKB-O-B	Banka Srpske ad Banja Luka	-	-	-	1	-	-	-	-	-
BNIF-O-A	Municipality of Bijeljina	-	-	3	1	-	-	-	-	-
KLPL-O-A	Kaldera Company doo Laktaši	-	-	-	-	3	-	-	-	-
OLKI-O-A	Municipality of Lopare - the first issue	-	-	1	2	-	-	-	-	-
PPMK-O-C	First senior citizen microcredit company d.o.o Banja Luka	-	-	-	-	-	-	-	4	-
RSBD-O-A	Republika Srpska 5% 18/11/18	-	-	-	-	-	1	-	-	-
RSBD-O-B	Republika Srpska 6% 4/26/19	-	-	-	-	1	-	1	-	-
RSBD-O-D	Republika Srpska 4.5% 4/11/18	-	-	-	-	-	-	1	-	-
RSBD-O-E	Republika Srpska 6% 6/18/19	-	-	-	-	-	-	3	-	-

RSBD-O-F	Republika Srpska 6% 9/24/18	-	-	-	-	-	-	1	-	-
RSBD-O-G	Republika Srpska 5.5% 3/12/19	-	-	-	-	-	-	1	-	-
RSBD-O-L	Republika Srpska 3.5% 12/30/20	-	-	-	-	-	-	-	-	2
RSBD-O-N	Republika Srpska 4.5% 03/03/23	-	-	-	-	-	-	-	-	3
RSDS-O-D	Republika Srpska - frozen savings 4	-	-	-	-	477	564	73	64	17
RSDS-O-E	Republika Srpska- frozen savings 5	-	-	-	-	-	1,104	387	81	67
RSDS-O-F	Republika Srpska - frozen savings 6	-	-	-	-	-	-	477	539	112
RSIO-O-A	Republika Srpska - general obligations	1	8	-	23	17	28	12	19	2
RSOD-O-A	Republika Srpska - obligations to suppliers 1	-	-	1	3	8	12	4	9	2
RSOD-O-B	Republika Srpska - obligations to suppliers 2	-	13	2	2	1	11	5	4	-
RSRS-O-A	Republika Srpska - war damage 1	298	2,013	1,174	987	1,023	845	575	352	69
RSRS-O-B	Republika Srpska - war damage 2	5	1,476	888	710	624	653	477	330	88
RSRS-O-C	Republika Srpska - war damage 3	-	2,319	3,264	1,861	1,231	1,184	964	722	122
RSRS-O-D	Republika Srpska - war damage 4	-	-	2,980	1,527	757	710	548	323	126
RSRS-O-E	Republika Srpska - war damage 5	-	-	-	3,624	1,219	757	412	456	140
RSRS-O-F	Republika Srpska - war damage 6	-	-	-	-	6,018	2,363	1,049	964	188
RSRS-O-G	Republika Srpska - war damage 7	-	-	-	-	-	3,410	623	392	86
RSRS-O-H	Republika Srpska - war damage 8	-	-	-	-	-	2,504	1,452	572	164
RSRS-O-I	Republika Srpska - war damage 9	-	-	-	-	-	-	3,849	1,826	179
RSRS-O-J	Republika Srpska - war damage 10	-	-	-	-	-	-	-	-	2,966
SMFO-O-A	Municipality of Šamac	-	-	1	-	-	-	-	-	-

Source: Author's own elaboration

We note that the market value of all RSRS bonds is more than BAM 260 millions (Table 3).

Table 3: Market value of RS war damage bonds

Mark	Bond	Nominal value	Market price ³	The remaining part of the nominal value	Market value
RSRS-O-A	Republika Srpska - war damage 1	40,764,772	82.40	0.80	26,872,138
RSRS-O-B	Republika Srpska - war damage 2	27,868,713	80.50	0.80	17,947,451
RSRS-O-C	Republika Srpska - war damage 3	80,545,470	81.00	0.80	52,193,465
RSRS-O-D	Republika Srpska - war damage 4	35,996,199	80.00	0.90	25,917,263
RSRS-O-E	Republika Srpska - war damage 5	29,103,835	78.49	1.00	22,843,600
RSRS-O-F	Republika Srpska - war damage 6	55,449,667	74.50	1.00	41,310,002
RSRS-O-G	Republika Srpska - war damage 7	21,818,286	79.00	1.00	17,236,446
RSRS-O-H	Republika Srpska - war damage 8	27,301,604	72.00	1.00	19,657,155
RSRS-O-I	Republika Srpska - war damage 9	32,185,097	69.68	1.00	22,426,576
RSRS-O-J	Republika Srpska - war damage 10	23,795,791	64.40	1.00	15,324,489
		374,829,434			261,728,585

Source: Author's own elaboration based on data from the website of Banja Luka Stock Exchange

2.3. The results of diversification of the debt securities portfolio according to the modern portfolio theory

For each observed bond, we calculated the expected return on an annual basis and the matrix of variance and covariance, also on an annual basis, with other securities in the portfolio.

We took the following limitations:

- that the sum of the share of securities in the portfolio is expressed in percentage of 100%,
- quantities of some securities in the portfolio can not be negative value, i.e. we eliminated the so-called short sale, and
- for each specific yield a special calculation is needed.

On the basis of the variance and covariance matrices, i.e. based on the expected return and risk of stocks we determine shares of bonds in the portfolio for which the required yield is achieved with minimum risk, and with the lowest variance portfolio.⁴

$$\sigma_p^2 = w^T * \sum w$$

When developing this equation, we have:

$$\sigma_p^2 = [w_1 \quad w_2 \quad \dots \quad w_i \quad \dots \quad w_n] \begin{bmatrix} \sigma_{11} & \sigma_{12} & \dots & \sigma_{1j} & \dots & \sigma_{1n} \\ \sigma_{21} & \sigma_{22} & \dots & \sigma_{2j} & \dots & \sigma_{2n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ \sigma_{i1} & \sigma_{i2} & \dots & \sigma_{ij} & \dots & \sigma_{in} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ \sigma_{n1} & \sigma_{n2} & \dots & \sigma_{nj} & \dots & \sigma_{nn} \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \\ \dots \\ w_i \\ \dots \\ w_n \end{bmatrix}$$

The expected yield on the obtained curve MEF (Markowitz efficient frontier) varies from the maximum expected return per bond (if we invest 100% of the amount only in the bond with the

³ If accrued interest is included in the price of the bonds in the market we are talking about the total price (dirty price) paid by the buyer to the seller of the bonds.

⁴ With the aim of faster and more accurate calculation of the portfolio, optimisation was performed using the Solver subprogramme. This is a free add-in software package of Microsoft Excel.

highest yield) to the lowest expected return per bond (if we invest 100% of the amount invested only in the bond that gives the lowest yield).

At the end, for each desired yield we calculated the relations between securities.

Table 4: Return of RSRS in the period from 1 January to 31 December 2015

Bond	Return
RSRS-O-A	8.36%
RSRS-O-B	13.98%
RSRS-O-C	16.84%
RSRS-O-D	9.75%
RSRS-O-E	12.35%
RSRS-O-F	13.80%
RSRS-O-G	19.38%
RSRS-O-H	17.39%
RSRS-O-I	27.77%

Source: Author's own elaboration based on data from the website of Banja Luka Stock Exchange

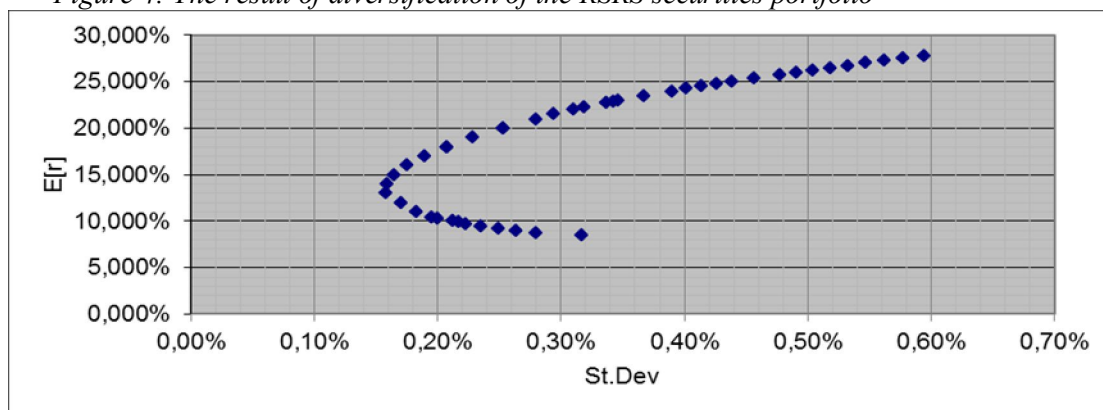
Without calculating we can say that if we invest all in bonds with the highest yield in our portfolio we would achieve a yield of 27.77% (Table 4). The same applies to bonds with the lowest yield. The lowest yield is 8.36% (Figure 4). These are two end points on the chart - the highest and the lowest. For the other points we need previously described model. We will show a table for each individual case in the range 8.36% - 27.77% with the relations between securities in the portfolio, with every increase of a desired yield of 0.25%. Every offered relation expressed in percentage multiplied with the expected yield gives the expected yield for that particular security (Table 5).

Table 5: The matrix of variance and covariance for RSRS bonds for a period from 1 January to 31 December 2015

Expected return	RSRS-O-A	RSRS-O-B	RSRS-O-C	RSRS-O-D	RSRS-O-E	RSRS-O-F	RSRS-O-G	RSRS-O-H	RSRS-O-I
	8,0%	11,0%	10,0%	11,0%	14,0%	14,0%	15,0%	5,0%	15,0%
RSRS-O-A	0.00001208	-0.00000011	0.00000076	0.00000066	0.00000234	0.00000038	0.00000083	0.00000210	0.00000110
RSRS-O-B	-0.00000011	0.00001257	0.00000095	-0.00000298	-0.00000047	0.00000096	-0.00000098	0.00000231	0.00000192
RSRS-O-C	0.00000076	0.00000095	0.00001492	0.00000150	0.00000148	0.00000276	0.00000331	0.00000099	-0.00000045
RSRS-O-D	0.00000066	-0.00000298	0.00000150	0.00001646	0.00000053	-0.00000150	0.00000103	0.00000049	-0.00000229
RSRS-O-E	0.00000234	-0.00000047	0.00000148	0.00000053	0.00001276	0.00000190	0.00000125	0.00000161	0.00000111
RSRS-O-F	0.00000038	0.00000096	0.00000276	-0.00000150	0.00000190	0.00001692	0.00000290	0.00000044	0.00000412
RSRS-O-G	0.00000083	-0.00000098	0.00000331	0.00000103	0.00000125	0.00000290	0.00003369	0.00000133	0.00000286
RSRS-O-H	0.00000210	0.00000231	0.00000099	0.00000049	0.00000161	0.00000044	0.00000133	0.00003461	-0.00000167
RSRS-O-I	0.00000110	0.00000192	-0.00000045	-0.00000229	0.00000111	0.00000412	0.00000286	-0.00000167	0.00003535

Source: Author's own elaboration based on data from the website of Banja Luka Stock Exchange

Figure 4: The result of diversification of the RSRS securities portfolio



Source: Author's own elaboration

We note that diversification based on the model established by Markowitz is possible and applicable to bonds in the capital market of the Republika Srpska. Figure 4 shows a pronounced curve

of the expected return and risk - from the minimum portfolio towards the increasing yields and risks. Each point of the curve represents a combination of yield and risk bonds that make up the portfolio. In other words, each point represents a certain percentage of participation of various securities in the portfolio. Specific selection depends on the attitude of investors to risk.

3. FACTORS AFFECTING THE MARKET OF DEBT SECURITIES IN THE REPUBLIKA SRPSKA

From the position of the issuer of these bonds - Republika Srpska's issuance of the war damage bond was the only possible and rational solution. In addition, the Republika Srpska also had significant liabilities based on old foreign currency savings. In order to identify factors that may affect the fluctuation of price of debt instruments, we will discuss the most important factors that influence the debt instruments in the market in the Republika Srpska.

3.1. Verdict of the Constitutional Court and the European Court of Human Rights

Payment of claims by means of settling debts was recognized as constitutional. The verdict of the European Court of Human Rights in Strasbourg in the case Suljagić against Bosnia and Herzegovina in November 2009 confirmed that the settlement of the old foreign currency savings bonds is fair (Mijović 2014, 146-185). However, there is a huge number of bondholders who believe that they have been harmed by this way of settling the debt and launched an appeal to the Constitutional Court. For example, case No. AP 244/08 „appelation Rajko Milešević and others“, based on which the Constitutional Court issued a decision by which it determined a violation of the right to a fair trial, points to the obligation of the Government of the Republika Srpska to „perform constitutional duties“, and emphasised that the RS Government is to ensure „respecting human rights by taking appropriate legal measures“ to ensure that the appellants and other creditors who have own executive decisions on the budget of the RS can „settle their claims as soon as possible“ (Official Gazette of the RS 2011, 23).

3.2. Paying taxes with the war damage bonds

Demand for the war damage securities has grown also due to a regulation of the RS Ministry of Finance to enable their owners settlement of tax liabilities incurred until 31 December 2007 (Official Gazette of the RS 2014, 52). In particular, tax debt for tax until 31 December 2007 in the amount of, for example, BAM 10.000 was possible to settle with the purchase of 10.000 bonds. This benefit was realized by a large number of companies that had tax debts, which in fact resulted in the increase of turnover of bonds of RSOD, RSRS and RSIO series.

According to the Ministry of Finance, data from brokerage houses and from the website of the Banja Luka Stock Exchange, clearly show that for tax clearing was spent 101,346,442 of bonds, of which 99,296,102 or 97.98% were RSRS bonds. This amount represents 28.29 percent of the total amount of this series (Table 6). Thus, more than 70% of securities by which it is possible to settle reprogrammed tax and non-tax liabilities is in free float (Table 6).

Table 6 Bonds deposited for paying taxes

Ticker	The amount of the issue	Number Of bonds	In percent	The rest (in free float)	In percent (in free float)	2009	2010	2011	2012	2013	2014	2015	2016
RSOD-O-A	1,735,962	131,816	7.59%	1,604,146	92.41%	56,808	-	48,402	23,099	3,507	-	-	-
RSRS-O-A	40,764,772	9,142,449	22.43%	31,622,323	77.57%	8,515,598	561,346	47,446	8,059	-	10,000	-	-
RSRS-O-B	27,868,713	6,882,850	24.70%	20,985,863	75.30%	5,130,347	827,264	865,196	24,872	5,018	25,407	4,746	-
RSOD-O-B	542,293	79,515	14.66%	462,778	85.34%	35,367	-	-	44,148	-	-	-	-
RSIO-O-A	2,908,047	1,880,620	64.67%	1,027,427	35.33%	1,834,582	-	2,481	41,611	1,946	-	-	-
RSRS-O-C	80,545,470	25,141,862	31.21%	55,403,608	68.79%	17,546,372	5,894,575	1,697,964	129,368	-174,430	-29,629	63,952	13,690
RSRS-O-D	35,996,199	13,718,762	38.11%	22,277,437	61.89%	-	5,698,319	5,998,187	1,654,581	183,519	36,506	147,650	-
RSRS-O-E	29,103,835	9,982,993	34.30%	19,120,842	65.70%	-	-	3,304,188	4,834,905	665,275	1,094,090	84,535	-
RSRS-O-F	55,449,667	12,020,857	21.68%	43,428,810	78.32%	-	-	-	4,312,546	4,095,771	3,024,440	575,711	12,389
RSRS-O-G	21,818,286	5,339,915	24.47%	16,478,371	75.53%	-	-	-	-	2,153,283	3,052,710	133,922	-
RSRS-O-H	27,301,604	7,032,440	25.76%	20,269,164	74.24%	-	-	-	-	326,956	6,377,424	328,060	-
RSRS-O-I	32,185,097	11,978,594	37.22%	20,206,503	62.78%	-	-	-	-	-	547,239	11,431,355	-
RSRS-O-J	32,185,098	0	0.00%	32,185,098	100.00%	-	-	-	-	-	-	-	-
Total	356,219,945	101,346,442	28.45%	254,873,503	71.55%	33,119,074	12,981,504	11,963,864	11,073,189	7,260,845	14,138,187	12,769,931	26,079

Source: Author's own elaboration based on data from the website of the Banja Luka Stock Exchange

Looking at the mentioned regulation from current perspective, it seems that those who did not pay tax until the end of 2007 made the most rational choice because they had a chance to settle their obligations for a little more than a third of the amount of debt and without any interest. In fact, most of these „settlements“ of taxes related to the period until the end of 2010, when the value of the bonds was around 40 percent of nominal value.

As an alternative option, the entity could have frozen the accounts of all debtors. With this move many enterprises would be brought in a position to declare bankruptcy, release workers and make even greater problem to the Republika Srpska.

By the mentioned regulation the owners of securities encashed the securities, the tax debtors „cleaned“ their balances and eased conditions for doing business or new indebtedness in the future, liquidity at the stock exchange was increased and a base was created for future more quality investing of institutional investors in securities.

However, the regulation can also bring negative effects. Economic associations can again make debts consciously, expecting the RS Government again to allow this means of settling obligations or to plan to cover the existing obligations by means of emission of their own securities.

3.3. Legalisation of building constructions with RSRS bonds

The regulation of the RS Government on means of the method of calculation and payment of a fee for legalisation of objects defines conditions, means of calculation and payment for legalisation of objects that is calculated pursuant to the Law on Spatial Planning and Construction (Official Gazette of the RS 2013, 97). That means that a fee for legalisation of objects under construction can even be paid by means of the war damage securities, whereat the value of securities is calculated according to nominal value. From this stems that the value of a security is calculated as BAM 1, if grace period is not over. In case it is over, that is, that some other coupon is payed out, the value of unpaid part of the equity is taken.

The mentioned regulation regulates that local communities need to elaborate these procedures more in detail. In practise this request has caused a number of interpretations by those who are employed in local communities. More concretely, interested persons were given information that legalisation of a particular object can be paid by securities, but only if it is about the initial winners. Hence, only the first owner of securities would have the right to legalise the object in this way.

Allowing payment of taxes or repurchase of garages by securities have had an impact on trade of securities to a great extent. In the coming period it is possible to expect similar innovations; for example, that owners of entity securities have privileges when paying seasonal parking tickets, registration of vehicles and similar.

3.4. Influence of PREF

The Pension Reserve Fund of the RS (PREF), each year since its establishment, was making profit. Profit was achieved thanks to the decision to invest in bonds, particularly in old foreign currency savings and war damages. Dividend of PREF represents a regular income of the PIO Fund⁵ (Fund for Pensions and Insurance of Persons with Disabilities). The biggest result of the process of restructuring is that PREF's portfolio today has more than BAM 60 millions in bonds and deposits in banks, and it generated the revenue from interest rates in the amount of BAM 3.7 million (Grujić 2014, 31-40).

By a careful insight into the PREF's transactions it is possible to note the selling of treasury bills and securities each spring with the objective of converting this property into money for the purpose of payment of dividends to the PIO Fund. Namely, pursuant to a decision of the Supervisory Board of the Reserve Fund, a dividend can be disbursed to the founder exclusively for the purpose of financing current pensions for beneficiaries, under the condition that the amount of disbursed net revenue is not larger than 50% of the value of dividends and interest rates the Reserves Fund has received in money (Official Gazette of the RS 2010, 20).

Aiming to secure sufficient money for disbursement of pensions, the PREF was selling treasury bills and securities in the secondary market prior to their maturity, and in that way, thanks to money obtained from dividends, interest rates and securities auctions, it managed to secure money for disbursement to the PIO Fund. Namely, we notice that a significant number of secondary trades with treasury bills occurred immediately before the disbursement of the PREF's dividends.

4. DISADVANTAGES AND LIMITATIONS OF THE MODERN PORTFOLIO THEORY TO THE DOMESTIC CAPITAL MARKET

The main advantage of the portfolio theory is that this theory analyses individual securities by means of correlation. The correlation or degree of integration of individual securities is one of the key factors that determine the success of a portfolio (Balvers 2001, 22). However, a more detailed analysis of the portfolio theory and its assumptions in every capital market suggests that it significantly simplifies the complex world of trading with securities.

The first problem, often ignored in numerous economic models is ignoring the transaction costs. In addition, models ignore transaction costs and institutional restrictions to trade. How this assumption would limit practical validity of the theory depends on how transaction costs and institutional constraints will affect preparing of the portfolio and trading in general (Bailey 2005, 115). For illustration, these costs are negligible in the initial creation of the portfolio, but they are significant in the case a portfolio should be adjusted to the results obtained by applying Markowitz's model. According to the classical economic theory, it is assumed that investors are only thinking how to maximize profit. Such behavior of investors encourages managers to falsify financial statements (e.g. Enron or Worldcom scandals) to show the greatest possible profit or cover losses. Also, consequences for the environment are not taken into account for this behavior, because the investor behaves only in line with his/her interest. In reality, investors not necessarily seek to achieve profit in the short-term, but they buy shares of certain companies with the aim to take over the ownership package.

Also, it is necessary to examine the assumption of the portfolio theory according to which all investors possess the same information. In fact, it is generally accepted that there exists something as asymmetric information, i.e. that one party has more information than the other. This leads to problems of adverse selection and moral hazard. Usually, small investors have questions and problems regarding information. On the other hand, the asymmetry of information can be reduced with help of intermediaries (e.g. brokers) who have more information than individual investors. However, it is clear that their level of information is different. Broker's information depends on the possibility of obtaining additional information from issuers and from knowledge and skills to interpret publicly available information (the impact of macro-economic indicators or amendments of the regulations).

The results of modelling depend on which data will be used in the model. Depending on the data in the model, each investor may have different information that may lead to different decisions on investing.

⁵ Pension and Disability Insurance

One consequence of the presumption of possession of the same information would be to compile the same portfolio for all investors or to reduce to a minimum the portfolio of possible combinations. The reason for this is that all investors (according to theory) have access to the information which contains the same rate of return on all securities from the past (Bailey 2005, 116-117). Another consequence of this assumption is creating a similar portfolio („imitation“), which can reduce unsystematic risk, or increase market risk (systemic risk), because it will increase the demand for certain securities. In this way, the investor or investment manager will analyze the basic information of the issuer. This will lead to an artificial increase in demand for certain securities, although their individual value is much lower. In this way it can easily happen that the expected returns are not realized, though, it is perhaps the standard deviation of the portfolio. This can happen to those investors who do not follow the theory of portfolio and do not behave according to certain norms and who can have a higher yield than those that follow the portfolio theory.

The portfolio theory assumes that all players at the stock exchange behave in a rational way and would not invest in a single portfolio if there is another portfolio with better combination of revenue and standard deviation. So, the investors would not invest in a portfolio with higher standard deviation and equal revenue (i.e. investors are always strongly suspicious towards risk) if there is another one with the same revenue and lesser standard deviation. However, main revenue at the stock exchange is achieved via identification of companies that are currently evaluated less than their real value; for example due to the fact that a company has higher development costs, so that it will make use of new products only in the future (as was the case, for instance, with “Apple” company). So, at the American stock exchanges there are firms such as Snapchat and Pinterest without revenues and with large expenses, but still with market capitalization of a few billion dollars. The portfolio theory does not accept this practical case, meaning that all investors should behave rationally and possess same information. Earlier studies, primarily in the field of behavioral economics, had shown that investors do not behave rationally (Kahmenan and Tversky 1979, 263-292).

The portfolio theory assumes that the courses at the stock exchange are arranged according to normal distribution. However, in practice courses have a high standard deviation, so that normal distribution would not be able to predict changes. Classical economists tend to eliminate maximum deviation as an anomaly with the aim to get a normal distribution of data for their analysis. However, for a correct analysis it is necessary to include all periods of extreme price changes, because ignoring these periods would lead to normal distribution (Mandelbrot 1963, 394-419). In relation to that, if the stock exchange courses had behaved in accordance to normal distribution, the stock exchange crash from 1987 with more than twenty standard deviations would have had a probability measured one in a billion (Taleb 2007, 270).

5. CONCLUDING REMARKS AND RECOMMENDATIONS

A detailed analysis of the modern portfolio theory and its assumptions in every capital market indicates that this theory simplifies trading with securities.

One of the biggest problems of this theory is ignoring transaction costs. Also, this theory assumes that all investors are rational and that they only think of how to maximise profit. In addition, it is necessary to examine the assumption that all investors have the same information. Taking into account all the limitations, the results of diversification will depend on data to be used for creating a model - whether there would be used longer or shorter series of data or future expectations will be installed in modelling.

The portfolio theory, in addition to the lack of presumption of rationality of investors, has a disadvantage that does not take into account individual utility function of investors and individual attitude to risk. Therefore, there are always investors who are willing to take greater risk. The best example of this are the „venture capital“ companies.

Using certain criteria related primarily to liquidity, we have tried to extricate the best bonds - those with a satisfactory yield, risk and liquidity. We noticed that the criterium is met only with bonds of RSRS series. Thus, we have shown that the use of Markovitz method of the portfolio selection of bonds in the domestic market, with all the limitations, is possible and applicable. But, however, the results still suggest that diversification reduces the overall risk of the portfolio, i.e. the sum of systematic (market) risk and unsystematic (specific) risk, so that the investor would be very exposed to risk of a single issuer.

REFERENCES

-
- Bailey, Roy E. 2005. *The economics of financial markets*. Cambridge: University Press
- Balvers, Ronald J. 2001. "Foundations of asset pricing." *Lecture Notes, West Virginia University*
- Bodie, Zvi, Alex Kane, Alan J. Marcus, Blaženka Eror-Matić and Zlatko Šantak. 2006. *Počela ulaganja*. Zagreb: Mate
- Grujić, Miloš. 2015. „Razvoj sekundarnog tržišta trezorskih zapisa - Stanje i perspektive na tržištu Republike Srpske.“ *Banja Luka: Financing 2*
- Jeremić, Zoran. 2012. *Finansijska tržišta i finansijski posrednici*. Beograd: Univerzitet Singidunum
- Kahneman, Daniel, and Amos Tversky. 1979. "Prospect theory: An analysis of decision under risk." *Econometrica: Journal of the econometric society* 263-291.
- Mandelbrot, Benoit B. 1997. "The variation of certain speculative prices." *In Fractals and Scaling in Finance*, pp. 371-418
- Markowitz, Harry. 1952. "Portfolio selection." *The journal of finance* 7, no. 1 77-91.
- Mijović, Ljiljana. 2014. *Bosna i Hercegovina pred Evropskim sudom za ljudska prava*. Banja Luka: Comesgrafika
- Taleb, Nassim Nicholas. 1998. *The black swan: the impact of the highly improbable*. New York: Penguin Random House
- Van Horne, James C. *Financijsko upravljanje i politika*. Zagreb: Mate
- Official Gazette of RS. 2013 The Law on Pension Reserve Fund of the Republika Srpska. No. 50. Banja Luka.
- Official Gazette of RS. 2013 No. 97. Law on Spatial Planning and Construction. Banja Luka.
- Official Gazette of RS. 2011 Number of 23rd Banja Luka.
- Official Gazette of RS. 2014 No. 52. Law on special ways of settling tax debt. Banja Luka.
- BL Berza. 2015. <http://www.blberza.com>
- PREF RS. 2015. <http://www.pref.rs.ba/>