

Srdarevic, Ivana; Kristek, Ivan

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RISK RANKING OF OPEN-END INVESTMENT FUNDS IN THE REPUBLIC OF CROATIAIvana Srdarević¹, Ivan Kristek²**ABSTRACT**

Risk is an unavoidable situation. Both individuals and business entities are exposed to various types of risk on a daily basis. Since business conducts in contemporary market conditions are characterized by an increasingly higher level of insecurity, business entities have acknowledged the value of risk management. Risk management is a process that entails risk analysis and planning. Risk analysis is a central part of the mentioned process that consists of identification, risk measurement, and assessment of options. Business entities must identify all financial risks that their business conduct is exposed to and quantify them in order to control them. During risk quantification, it is possible to use several methods such as probability analysis, value at risk, and measures of statistical dispersion. After having measured the risk, it is necessary to create a strategy that will efficiently lower exposure to risks and the amount of their influence on business conducts.

Investment funds represent a specific possibility of investing financial resources. These are separate assets controlled by investment fund management companies and investors participate in income return of the overall portfolio fund by purchasing shares in investment funds. These funds invest in various financial instruments such as stocks, bonds, and financial resources, and the risk of investment funds depends primarily on the type of financial instruments in which the fund invests. During the purchase of shares in an investment fund it should be taken into consideration that a possible higher income return brings forth a higher level of risk, as in all other types of investments. The aim of this paper is to quantify risk investment funds that conduct businesses in the Republic of Croatia. For this purpose, the

measures of statistical dispersion and value at risk will be used.

Keywords: open-end investment funds, risk analysis, measuring risk

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1. INTRODUCTION

Every action that is taken by an individual carries certain risk. Risk is a component of life that should be predicted and considered. Danger is usually the first association to risk and risk should therefore be understood as a potential danger or a predicament. Still, this view on risk is not entirely correct. Risk should be viewed as a possibility of predicament appearance for which the probability of appearing can be estimated. In finances, risk is perceived as a possibility to gain a slightly different outcome from a certain decision or investment than expected, therefore the term risk is not equated with the term danger. Even though risk has been the main focus of various research, a generally accepted definition of risk has not yet been created.

Since business entities are continuously exposed to risk, which can have an untoward influence on their business conduct, risk management has been developed as a part of the business organization that is in charge of managing risk. Ever increasing number of business entities understand the importance of risk management and implement it in their organization. Accordingly, the importance and significance of risk management is clearly seen from its standardization trend that resulted in scopes and standards dedicated to risk management. The process of risk management is a dynamic one, the one that is continuously

¹ Josip Juraj Strossmayer University of Osijek Economic faculty in Osijek, srdarevic.ivana@gmail.com

² Josip Juraj Strossmayer University of Osijek Economic faculty in Osijek, ikristek@efos.hr

carried out in order to decrease the influence of risk on business conducts. The mentioned process consists of four phases in which risk is identified and measured, the strategy for risk management is chosen, and the efficiency of the chosen strategy is monitored.

Investment funds are quite noticeable on financial markets and among various financial institutions, which have a role of financial intermediaries. Investment funds attract the attention of individual investors by offering their shares in funds based on which investors can then have a share in the portfolio of various bonds with lower costs. Nevertheless, it should not be forgotten that each investment carries a certain level of risk and investing in investment funds is not an exception. The level of risk will depend on the type of bonds that the fund invests in. According to the type of investment, there are equity funds, bond funds, money market funds, and balanced funds. In this paper, the risk of the mentioned funds will be measured by the measures of statistical dispersion and value at risk.

2. LITERATURE REVIEW

Up until today, the most important discovery in modern financial theory is precisely the ability of modelling risk in a quantitative way. The value of this statement is hidden in the fact that if we know how to measure and decide the price of risk then we can correctly estimate risky assets (Copeland and Weston, 1988). Recent research has proven that funds mostly attract potential investors by emphasizing their success which is substantiated by the accessible historical data. Even though prior success of funds does not guarantee future success, it is presumed that based on prior results initial contact in investment decision making can be realized (Ippolito, 1992). Since the success of funds can be connected to the historical data, the risk of funds can also be connected to the historical data of measures of risk. Therefore, the volatility of an accomplished result of funds measured on the basis of historical data can help investor in decision making and in presuming the expected volatility in the future.

From the work of Markowitz (1952), the standard deviation of returns is one of the most known measures of risk. The model, which was developed

by Markowitz and made mostly for long term portfolios of the capital market in the USA, is based on the assumption that efficiency frontiers of investors are the function of expected returns and the standard deviation of these returns. Since in this paper we are concentrating on the observation of volatility returns as its measure of risk, we can assume that more successful funds should also be riskier funds. Research proved that high levels of risk in the return of investment funds disqualify the variance as an adequate measure of risk. For example, portfolios with nonlinear payments, which have a high Sharpe ratio and high levels of risk (Lucas and Siegmann, 2008), are easily constructed. Even though researchers who investigate this topic have ambiguous views on different measures of risk, in this paper we have opted for a more traditional approach to measuring risk, and the methods that are used are explained in the following section of the paper.

3. METHODOLOGY

The aim of this research is to quantify the risk of investment funds. Considering the fact that risk is a part of everyday life and that both individuals and business entities are exposed to various types of risks, specific attention is demanded. Investment funds are becoming ever more significant participants on financial markets by trying to lower the risk of investments by diversification and offering investments in a wide portfolio of bonds with lower costs to individual investors. Investment funds cannot be adequately observed without the quantification of their risk and the risk of individual types of funds. This research aims at demonstrating the risk of Undertakings for Collective Investment in Transferable Securities (UCITS) funds in the Republic of Croatia by various measures of risk and aims at mutually comparing the mentioned funds. The source of secondary data, which is used for the research purposes, is the Croatian Agency for Supervision of Financial Services (Neto imovina UCITS fondova, 2017). The research includes 23 equity funds, 7 bond funds, 7 balanced funds and 13 money market funds. For the purpose of comparing UCITS funds, in this paper we have chosen the funds that have continuously conducted business during a six-year observation from 2009 until 2014.

Risk can be assessed by the measures of statistical dispersion. These measures include the range of variation, standard deviation, variance, and the coefficient of variation. The simplest measure of statistical dispersion is the range of variation that is calculated by subtracting the lowest value from the highest value (Karić, 2006). Variance, standard deviation and coefficient of variance have a higher informative value. Variance represents a mean square deviation from the arithmetic mean (Vukičević and Odošić, 2012). It is expressed in the same unit of measure in which the values of the results are shown. Furthermore, the standard deviation represents an average deviation from the arithmetic and it is the most commonly used measure of statistical dispersion in practice. It is expressed in the same unit of measure in which the values of the results are shown. The coefficient of variation is also one of the measures of statistical dispersion that is used while measuring risk. Coefficient of variation is a relative measure of statistical dispersion and represents a percentage of the standard deviation in relation to the value of the arithmetic mean (Vukičević and Odošić, 2012).

One of the most acceptable methods for measuring risk is the value at risk (VaR) method. VaR shows the highest possible value of loss, hence, it states the most that can be lost in a certain period. Value at risk is a statistical measure that assesses future risk of certain assets or an entire portfolio and intends to reduce the entire risk of a portfolio to a single figure (Aljinović, Marasović and Šego, 2011). VaR is defined by two parameters, the level of confidence and the defined period. The level of confidence, which is usually used for calculating, is 95% or 99%. VaR can easily be incorporated and interpreted in reports that are presented to management, regulators, investors or wider public (Novak and Sajter, 2007).

4 RESULTS AND DISCUSSION

4.1. Assessing risk by measures of statistical dispersion

There are 50 UCITS funds that are monitored and mutually compared. The annual historical returns of UCITS equity funds for the period

from 2009 until 2014 are demonstrated in **Table 4.1** as well as the risk assessed by the measures of statistical dispersion. The risk of funds has been assessed by the measures of statistical dispersion for 23 observed UCITS equity funds in total. The range of variation for the observed funds is relatively high. The Platinum Blue Chip Fund has the lowest range of variation of annual returns (17%), while the KD Nova Europa Fund has the highest range of variation (69%). KD Nova Europa achieved the highest return of 46.7% during the observed period. The Neta New Europe Fund achieved the highest negative returns of -33.5% during the observed period and it also has the second highest range of variation of 57.8%. Even though initially it might seem that equity funds achieve high returns, average returns are low. The reason therefore is the fact that the observed equity funds have also achieved high negative returns in addition to high positive returns. Furthermore, the calculated standard deviation for UCITS equity funds is within the range of 5.66% to 26.19%. Platinum Blue Chip has the lowest standard deviation while the KD Nova Europa Fund has the highest standard deviation. Seven out of the overall 23 observed UCITS equity funds have the standard deviation that is lower than 10%, while 12 have the standard deviation that is within the range of 10% to 20%. Only four of the observed equity funds have the standard deviation that is higher than 20%, and these funds are Fima Equity, KD Victoria, KD Nova Europa and Neta New Europe. The coefficient of variation for the observed UCITS equity funds is exceptionally high, which means that the mentioned funds have an exceptionally high variability of returns. If the variability of returns is high, then the risk of investment is also higher. Since all the analysed equity funds have a coefficient of variation higher than 70%, the variability of their returns is very high, which also connotes a substantial risk of investment. Thus, the measures of statistical dispersion demonstrate that UCITS equity funds are very risky.

Table 4.2 demonstrates the annual historical returns of UCITS bond funds for the observed period and the risk measured by the measures of statistical dispersion. The risk of funds was calculated for seven observed UCITS bond funds by five measures of statistical dispersion, which

Table 4.1: Benchmark dispersion of UCITS equity funds

Year	2009	2010	2011	2012	2013	2014	Variation range	Average yield	Variance	Standard deviation	Coefficient of variation
A1	18.8	-0.3	-15.2	10.5	-12.3	16.1	34.0	2.9	210.74	14.52	494.89
Adriatic Equity	2.5	-1.2	-17.7	-3.3	5.9	5.0	23.6	-1.5	75.85	8.71	-589.80
Capital Two	7.1	7.8	-18.2	5.0	1.6	27.1	45.3	5.1	210.09	14.49	286.07
Fima Equity	-17.4	-16.1	-11.7	-24.3	13.4	27.5	51.7	-4.8	417.02	20.42	-427.81
HI Growth	13.8	3.5	-8.4	6.4	4.8	15.3	23.7	5.9	72.50	8.51	144.31
HPB Dionički	16.0	-7.6	-5.3	0.3	9.2	9.2	23.6	3.6	86.43	9.30	256.70
Ilirika Azijski tigar	5.2	15.5	-27.6	1.1	-10.5	11.8	43.1	-0.8	255.28	15.98	-2130.31
Ilirika Europa	9.1	4.5	-30.1	3.2	-0.7	5.0	39.2	-1.5	206.26	14.36	-957.45
KD Nova Europa	46.7	16.0	-22.2	17.0	-11.2	-15.5	69.0	5.1	686.16	26.19	510.95
KD Prvi izbor	2.5	12.8	-17.3	10.2	2.1	12.9	30.1	3.9	130.65	11.43	295.48
KD Victoria	-29.9	-8.1	-17.9	12.7	17.2	25.1	55.0	-0.1	472.94	21.75	-15351.00
Neta Frontier	13.8	25.3	-8.2	6.3	3.8	15.2	33.4	9.4	130.94	11.44	122.23
Neta Global Developed	3.0	-0.5	-11.3	3.3	7.6	6.4	18.9	1.4	46.95	6.85	483.08
Neta New Europe	18.6	0.9	-33.5	24.3	-18.6	-12.5	57.8	-3.5	497.79	22.31	-643.28
Neta US Algorithm	3.8	32.3	-18.4	0.3	28.7	11.6	50.7	9.7	357.80	18.92	194.47
OTP Indeksni	11.6	7.2	-16.2	2.7	5.4	1.5	27.8	2.0	92.55	9.62	474.30
OTP Meridijan 20	35.3	3.5	-21.7	9.5	10.3	1.4	57.0	6.4	336.61	18.35	287.42
PBZ Equity	4.4	2.8	-22.0	3.1	1.0	9.3	31.3	-0.2	121.56	11.03	-4469.69
Platinum Blue Chip	13.5	7.1	-3.6	5.3	7.2	2.4	17.0	5.3	32.07	5.66	106.65
Platinum Global Opportunity	17.3	5.5	-22.2	7.2	15.3	12.9	39.5	6.0	211.91	14.56	242.22
ZB Aktiv	8.3	7.0	-15.1	10.3	3.4	5.0	25.4	3.2	85.80	9.26	294.06
ZB Euroaktiv	21.0	2.7	-5.0	15.2	13.3	-1.0	26.0	7.7	10530	10.26	133.26
ZB Trend	24.2	11.6	-7.1	1.3	4.1	-0.4	31.3	5.6	12000	10.95	195.03

is shown in Table 4.2. Bond funds achieved lower annual returns in comparison to equity funds. Nevertheless, their returns were more stable, therefore the range of variation was lower in comparison to equity funds. Among bond funds, the highest annual return of 12.3% was achieved by the Raiffeisen Bond Fund in 2009, while the lowest annual return of -13.8% was achieved by the PBZ Bond Fund in 2012. Out of seven observed bond funds, only one accomplished a positive annual return during the observed years, and that is the Capital One Fund, which has the lowest range of variation of 6.8%.

In contrast, PBZ Bond has the highest range of variation of 22.5%. When taking the average return into consideration, only one bond fund achieved a negative average return of -2.1%, namely the Neta Emerging Bond Fund, while the highest average return of 6.8% in the period from 2009 to 2014 was achieved by the Capital One Fund. The standard deviation of bond funds is within the range of 2.28% to 8.72% and consequently the annual returns of these funds differ slightly from the average annual return. In comparison to the equity funds, bond funds have a significantly lower coefficient of variation. Regardless, the coefficient of variation for 6 out of 7 observed equity funds is higher than 70%, which implies that the variability of returns is very high. Here the Capital One Fund is once more emphasized since it has the coefficient of variation of 45.98% and the variability of its annual returns is moderate.

Table 4.3 demonstrates annual historical returns of the observed UCITS money market funds for the period from 2009 to 2014 and the risk assessed by measures of statistical dispersion. From Table 4.3 it can easily be noticed that the measures of statistical dispersion for money market UCITS funds are outstandingly different from the same measures for equity and bond funds. It must be emphasized that none of the overall 13 observed money market funds accomplished a negative annual return in the period from 2009 to 2014. All money market funds, apart from Agram Euro Cash, achieved the highest return during the observed period in 2009. PBZ Dollar accomplished the lowest annual return of 0.3% in the observed period, while the highest annual return of 9.5% was

accomplished by the Raiffeisen Cash Fund. The range of variation of money market funds is significantly lower than the range of variation of equity and bond funds. The average returns are within the range of 1.7% to 4.5%. Locusta Cash has the highest average return while PBZ Dollar has the lowest. The standard deviation of money market funds is also outstandingly lower than the same measures of equity and bond funds. The standard deviation of money market funds is within the range of 0.46% to 3.13%. All money market funds have a coefficient of variation lower than 100%, unlike equity and bond funds that have exceptionally high coefficients of variation. The Agram Euro Cash Fund has the lowest coefficient of variation of 13.77%, which means that the variability of return of the fund is relatively low. From the observed 13 UCITS money market funds, two funds have the mentioned coefficient within the range of 30% to 50% and the variability of their returns is relatively low, while five other funds have a coefficient of variability within the range of 50% to 70% and relatively high variability of returns. Also, five money market funds from the overall 13 observed funds have a coefficient of variation higher than 70%, which implies that the variability of their returns is very high. The ZB Plus Fund has the highest coefficient of variation of 98.61%.

The annual returns of UCITS balanced funds for the observed period and the risk assessed by the measures of statistical dispersion are demonstrated in Table 4.4, from which the annual returns of the observed seven UCITS balanced funds can be seen as well as the calculated measures of statistical dispersion. The achieved returns of balanced funds are higher than the returns of money market and bond funds, and are similar to the returns of equity funds. Also, what needs to be taken into account is the fact that the returns of equity and balanced funds have had significant oscillation, which is especially true for equity funds. When taking UCITS balanced funds into consideration, the lowest return of -28.7% was achieved by ICF Balanced, while the highest return of 20% was achieved by the OTP Uravnoteženi Fund. When taking the range of variation into consideration, balanced funds have a higher range of variation than bond and money market funds, but a lower range than equity funds.

Table 4.2: Benchmark dispersion of UCITS bond funds

Year	2009	2010	2011	2012	2013	2014	Variation range	Average yield	Variance	Standard deviation	Coefficient of variation
Capital One	8.4	9.1	2.3	7.5	3.1	6.4	6.8	6.1	7.95	2.82	45.98
HPB Obveznički	6.5	4.3	0.4	10.2	-1.1	8.3	11.3	4.8	19.56	4.42	92.92
HI Conservative	0.3	5.8	-0.6	5.5	5.9	7.3	7.9	4.0	10.97	3.31	82.11
Neta Emerging Bond	-5.9	5.5	-10.4	0.9	-11.9	9.5	21.4	-2.1	76.08	8.72	-425.48
PBZ Bond	5.6	7.7	0.7	-13.8	-2.0	8.7	22.5	1.1	70.61	8.40	738.16
Raiffeisen Bonds	12.3	8.4	0.8	-6.9	-4.4	5.9	19.2	2.7	56.21	7.50	279.41
ZB Bond	11.1	4.8	2.1	7.5	-3.6	7.2	14.7	4.9	26.12	5.11	105.37

Table 4.3: Benchmark dispersion of UCITS cash funds

Year	2009	2010	2011	2012	2013	2014	Variation range	Average yield	Variance	Standard deviation	Coefficient of variation
Agram Euro Cash	3.2	3.5	3.1	4.1	3.5	2.7	1.4	3.4	0.21	0.46	13.77
Erste Money	7.0	3.7	2.4	3.1	1.4	1.0	6.0	3.1	4.65	2.16	70.05
HPB Novčani	8.4	3.9	2.5	2.8	1.3	0.8	7.6	3.3	7.53	2.74	83.55
HI Cash	6.5	2.5	2.8	2.3	1.8	1.4	5.1	2.9	3.39	1.84	63.85
Locusta Cash	9.3	4.6	3.9	4.0	2.6	2.3	7.0	4.5	6.47	2.54	57.06
Money One	6.7	3.4	1.6	3.2	2.3	1.8	5.1	3.2	3.52	1.88	59.27
OTP Novčani	6.1	2.8	2.5	3.0	1.0	1.1	5.1	2.8	3.43	1.85	67.32
PBZ Novčani	8.6	2.9	2.1	3.1	1.2	0.8	7.8	3.1	8.06	2.84	91.46
PBZ Euronovčani	5.0	3.8	2.5	3.5	2.0	1.5	3.5	3.1	1.70	1.30	42.70
PBZ Dollar	3.6	2.6	1.2	1.2	0.3	1.4	3.3	1.7	1.40	1.18	69.90
Raiffeisen Cash	9.5	3.9	2.7	2.6	1.1	1.1	8.4	3.5	9.83	3.13	89.99
ZB Plus	8.8	2.3	2.5	2.7	1.0	0.7	8.1	3.0	8.75	2.96	98.61
ZB Europlus	3.9	2.5	2.0	2.5	1.2	1.0	2.9	2.2	1.11	1.05	48.25

Table 4.4: Benchmark dispersion of UCITS balanced funds

Year	2009	2010	2011	2012	2013	2014	Variation range	Average yield	Variance	Standard deviation	Coefficient of variation
HPB Global	11.8	-8.2	-7.9	-12.6	-3.6	12.5	25.1	-1.3	116.80	10.81	-816.69
HI Balanced	11.2	4.8	-5.5	5.5	3.7	12.6	18.1	5.4	41.51	6.44	119.68
KD Balanced	11.9	1.5	-11.1	5.1	4.3	6.9	23.0	3.1	60.14	7.75	250.43
ICF Balanced	-28.7	-11.9	-3.8	3.7	-11.3	12.1	40.8	-6.6	199.97	14.14	-212.81
OTP Uravnoteženi	20.0	-5.7	-16.5	3.9	9.8	4.4	36.5	2.7	158.64	12.60	475.30
PBZ Global	9.6	4.0	-9.8	-2.2	0.6	12.2	22.0	2.4	64.50	8.03	336.04
ZB Global	13.9	7.6	-14.2	7.4	0.1	7.0	28.1	3.6	95.43	9.77	268.87

Table 4.5: The ranges of scale dispersions by the types of UCITS funds

Measure	The ranges of movement (%)		
	Equity fund	Balanced funds	Bond funds
Variation range	17.0 – 69.0	18.1 – 40.8	6.8 – 22.5
Variance	32.1 – 686.2	41.5 – 200.0	8.0 – 76.1
Standard deviation	5.7 – 26.2	6.4 – 14.1	2.8 – 8.7
Coefficient of variation	-15,351.0 – 510.9	-816.7 – 475.3	-425.5 – 738.2
			Cash funds
			1.4 – 8.4
			0.2 – 9.8
			0.5 – 3.1
			13.8 – 98.6

The HI Balanced Fund has the lowest range of variation of 18.1% in balanced funds but also has the highest average return of 5.4%. The ICF Balanced Fund has the highest range of variation of 40.8% but also the lowest average return of -6.6%. Out of seven observed balanced funds, two funds have a negative average return. The standard deviation of balanced funds is within the range of 6.44% to 14.14%. These funds have a higher standard deviation than bond funds and money market funds, but a lower standard deviation than equity funds. The situation is similar with the coefficient of variation. The mentioned coefficient of all seven mentioned balanced funds is higher than 70%, which implies that the variability of returns of UCITS balanced funds is quite high.

Table 4.5 demonstrates the range of calculated measures of statistical dispersion for all

observed types of UCITS funds. The range of variation is highest in equity funds and the lowest in money market funds. The same can be determined for variance, standard deviation and the coefficient of variation. Therefore, according to the measures of statistical dispersion, equity funds are the riskiest, followed by balanced funds. In contrast, bond funds are less risky, while the least risky are money market funds.

4.2. Value at Risk

The following measure of risk used for comparing the chosen funds is value at risk (VaR). Based on the data of annual historical returns for the analysed period, a six-year VaR of equity funds with a 95% or 99% level of confidence is calculated and shown in Table 4.6.

Table 4.6: VaR for UCITS equity funds

Equity Fund	VaR (95%)	VaR (99%)
A1	-21.02	-30.89
Adriatic Equity	-15.85	-21.77
Capital Two	-18.85	-28.71
Fima Equity	-38.47	-52.35
HI Growth	-8.15	-13.94
HPB Dionički	-11.72	-18.04
IlirikaAzijskitiger	-27.11	-37.98
Ilirika Europa	-25.20	-34.96
KD Nova Europa	-38.09	-55.91
KD Prviizbor	-14.99	-22.76
KD Victoria	-36.02	-50.81
Neta Frontier	-9.52	-17.30
Neta Global Developed	-9.89	-14.55
Neta US Algorithm	-21.48	-34.35
OTP Indeksni	-13.85	-20.39
OTP Meridijan 20	-23.89	-36.37
PBZ Equity	-18.44	-25.94
Platinum Blue Chip	-4.03	-7.88
Platinum Global Opportunity	-18.01	-27.91
ZB Aktiv	-12.13	-18.43
ZB Euroaktiv	-9.23	-16.21
ZB Trend	-12.46	-19.91

When taking a 95% level of confidence into consideration, out of 23 observed equity funds, only five equity funds have VaR lower than 10%. The Platinum Blue Chip Fund has the lowest VaR of 4.03% with a 95% level of confidence. Nine equity funds have VaR within the range of 10% to 20%, while five funds have VaR within the range of 20% to 30%. Only three equity funds have VaR within the range of 30% to 40%. The only observed equity fund that has VaR higher than 40% is the Neta New Europe Fund, its VaR is 40.28% with a 95% level of confidence. When taking a 99% level of confidence into account, only one equity fund has VaR lower than 10% and that is the Platinum Blue Chip Fund. Its VaR is 7.88%. The KD Nova Europa Fund has the highest VaR of 55.91% with a 99% level of confidence.

Table 4.7 demonstrates VaR of UCITS bond funds. Clearly, VaR of bond funds is significantly

lower than the VaR of the previously observed equity funds. With a 95% level of confidence, from the overall seven observed bond funds only two funds have VaR that is higher than 10%, while the rest have VaR lower than 10%. The lowest VaR with the mentioned level of confidence was registered for the Capital One Fund (1.48%) and HI Conservative (1.43%), while the highest VaR of 16.44% belongs to the Neta Emerging Bond Fund. When taking a 99% level of confidence into consideration, out of all seven observed bond funds only four have VaR lower than 10%, and three funds have VaR higher than 10%, leaving only one fund (Neta Emerging Bond) with VaR higher than 20%.

Table 4.8. demonstrates the VaR of UCITS money market funds and it is clear that the VaR of the observed funds is very low. With a 95% level of confidence, none of the observed

Table 4.7: VaR for UCITS bond funds

Bond fund	VaR (95%)	VaR (99%)
Capital One	1.48	-0.44
HPB Obveznički	-2.54	-5.55
HI Conservative	-1.43	-3.68
Neta Emerging Bond	-16.44	-22.37
PBZ Bond	-12.73	-18.44
Raiffeisen Bonds	-9.69	-14.79
ZB Bond	-3.58	-7.06

Table 4.8: VaR for UCITS cash funds

Cash fund	VaR (95%)	VaR (99%)
Agram Euro Cash	2.59	2.28
Erste Money	-0.48	-1.95
HPB Novčani	-1.24	-3.11
HI Cash	-0.15	-1.41
Locusta Cash	0.26	-1.47
Money One	0.07	-1.21
OTP Novčani	-0.30	-1.56
PBZ Novčani	-1.58	-3.51
PBZ Euronovčani	0.90	0.02
PBZ Dollar	-0.26	-1.06
Raiffeisen Cash	-1.69	-3.82
ZB Plus	-1.88	-3.89
ZB Europlus	0.45	-0.27

Table 4.9: VaR for UCITS balanced funds

Balanced fund	VaR (95%)	VaR (99%)
HPB Global	-19.16	-26.50
HI Balanced	-5.25	-9.63
KD Balanced	-9.70	-14.97
ICF Balanced	-29.98	-39.59
OTP Uravnoteženi	-18.13	-26.70
PBZ Global	-10.86	-16.32
ZB Global	-12.49	-19.13

money market funds have VaR higher than 3%, and with a 99% level of confidence, none of the funds have VaR higher than 4%. When taking a 95% level of confidence into account, out of 13 money market funds eight have VaR lower than 1%, however with a 99% level of confidence, only five funds have VaR higher than 2%.

Table 4.9 demonstrates the VaR of UCITS balanced funds. The same funds have higher VaR than money market and bond funds, but lower VaR than equity funds. With a 95% level of confidence out of seven observed balanced funds, only two funds have VaR lower than 10%, while four of them have VaR within the range of 10% to 20%. Only one balanced fund has VaR higher than 20%, and that is the ICF Balanced

Fund. Its VaR is 29.98%. The HI Balanced Fund has the lowest VaR of 5.25% with a 95% level of confidence. With the level of confidence being 99%, out of seven observed balanced funds, only one fund has VaR lower than 10%, and that is the HI Balanced fund. Its VaR is 9.63%. Three balanced funds have VaR within the range of 10% to 20%, and two balanced funds have VaR within the range of 20% to 30%. ICF Balanced has the highest VaR of 39.59% with a 99% level of confidence.

Figure 4.1 shows the average VaR for a 95% and 99% level of confidence according to the type of UCITS funds. Clearly, the highest VaR on average belongs to UCITS equity funds. They are followed by mixed funds that on average have

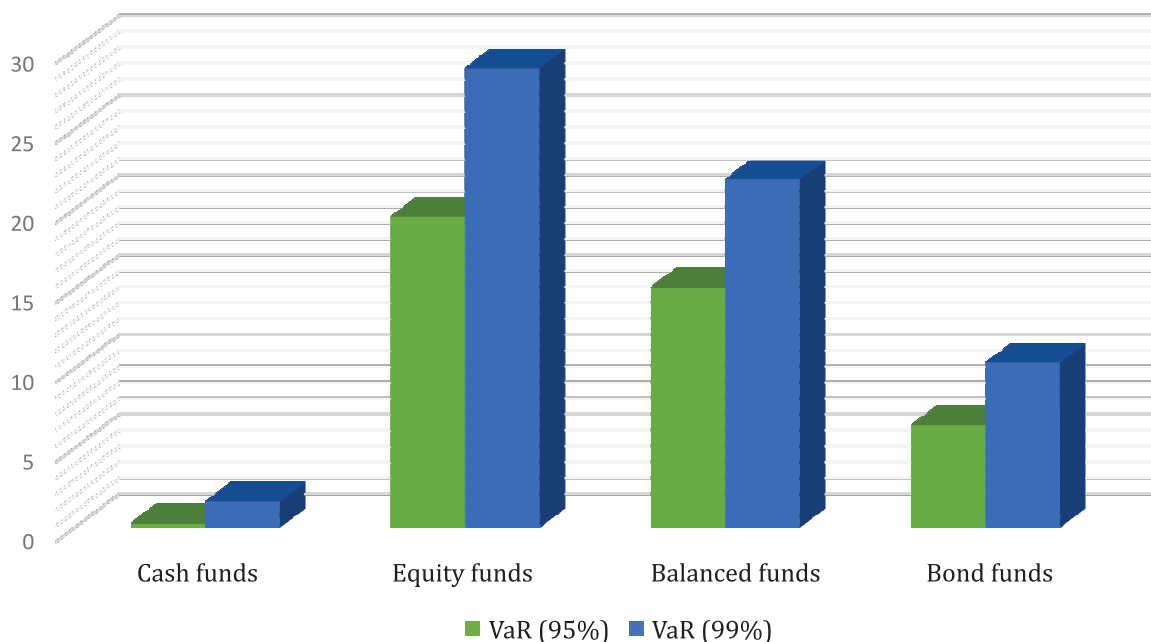


Figure 4.1: Average VaR by type of UCITS fund

VaR of 15.08% for a 95% level of confidence and 21.84% for a 99% level of confidence. Bond funds have the average VaR of 6.42%. UCITS money market funds have the lowest average VaR. Thus, according to the VaR as a measure of risk, equity funds are the riskiest, followed by balanced funds, then bond funds and finally money market funds, which are the least risky.

4.3. Variance-covariance matrix

Covariance is used as a measure of the relationship between variables. Covariance is a measure of degree that shows the extent of two variables varying together over time (Vukičević and Odošajić, 2012). If the covariance is positive, the variables tend to vary together in the same direction, if it is negative, the variables vary in the opposite direction. The covariance can also be zero, which means that there is no relationship between the two variables. Variance-covariance matrix will be used in order to demonstrate the relationship between investment funds. The matrix was combined in such a way that the values of fund variances have been put diagonally while the rest of the fields in the matrix have been fulfilled with the values of covariance between investment funds.

Table 4.10 demonstrates the variance-covariance matrix for the observed UCITS equity funds. The positive covariance is prevalent, which implies that the returns of each of the equity funds have a tendency of varying together in the same direction. Clearly, it is not a common rule for all observed funds since certain funds have a negative covariance. Fima Equity has the most negative values in covariance, which means that the returns of the mentioned fund are varying in the opposite direction from the returns of the funds with a negative covariance (for example KD Nova Europa, Neta New Europe, ZB Euroaktiv, ZB Trend, etc.). When taking the size of value of covariance between equity funds into consideration, the values range up to 100%, but certain funds have outstandingly higher covariance. Such examples are the funds KD Nova Europa, Neta New Europe and Platinum Global Opportunity. Their values of covariance exceed 100%. Among the observed equity funds, the lowest positive covariance of 1.09% exists between the funds A1 and Neta US Algorithm, while the highest positive covariance of 424.98% exists between the funds KD Nova Europa and Neta New Europe. The funds KD Nova

Europa and Fima Equity have the highest negative covariance of -275.74%.

Table 4.11 demonstrates the variance-covariance matrix for the observed UCITS bond funds. The variance-covariance matrix of UCITS bond funds shows that among the observed funds positive values of covariance prevail. Nevertheless, when compared to equity funds, the values of covariance with bond funds are considerably lower. PBZ Bond and Raiffeisen Bonds have the highest positive value of covariance of 45.12%.

HI Conservative and Raiffeisen Bonds have the highest negative value of covariance of -5.64%. The Neta Emerging Bond Fund is emphasized in the variance-covariance matrix due to being the only out of all seven observed bond funds that has a double-digit covariance towards all other funds within the range of 13.74% to 23.33%. In the group of bond funds HI Conservative has the most negative values of covariance, the returns of this fund are varying in opposite direction from the returns of PBZ Bond, Raiffeisen Bonds and ZB Bond funds.

Table 4.12 demonstrates the variance-covariance matrix for the observed UCITS money market funds. It can clearly be seen that the values of their covariance are lower in comparison to the covariance of equity and bond funds. The value of covariance of money market funds is within the range of -0.06% to 7.59%. Therefore, a negative covariance, which is considerably low, exists only in two cases, between the covariance of the funds Agram Euro Cash and HI Cash of -0.03%, and between the funds Agram Euro Cash and PBZ Dollar of -0.06%.

Unlike the first two matrices for equity and bond investment funds, the variance-covariance matrix for money market funds entails positive values of covariance, which means that the returns of bond funds have a tendency of varying together in the same direction. However, since the values are relatively small, the mentioned tendency is very low. The funds Raiffeisen Cash and ZB Plus have the highest positive covariance of 7.59%.

The variance-covariance matrix of UCITS observed balanced funds can be seen in table 4.13. The values of covariance for balanced funds are higher than the values of covariance for money market and bond funds. Even though initially the variance-

Table 4.10: The matrix of variance and covariance of the observed equity funds

Fund	A1	Adriatic Equity	Capital 2	Fima Equity	HI Growth	HPB Dion.	Ilirika A.T.	Ilirika E.	KD N.E.	KD Pl.	KD Victoria	Neta Frontier	Neta G.D.	Neta N.E.	Neta US	OTP Ind.	OTP M20	PBZ Equity	Plat B.C.	Plat G.O.	ZB Aktiv	ZB Euro.	ZB Trend
A1	210.74	52.69	131.29	-6.30	89.45	59.49	142.75	129.39	197.99	87.3	6.80	79.10	41.39	200.31	1.09	68.68	145.95	98.23	36.30	108.48	79.14	52.40	69.55
Adriatic Equity	52.69	75.85	84.16	72.95	52.49	45.69	78.52	91.31	55.86	62.52	72.99	51.53	47.78	59.42	101.45	59.21	93.31	72.97	28.62	102.28	53.14	38.02	39.82
Capital 2	131.29	84.16	210.09	125.51	92.19	50.93	165.24	140.59	58.61	119.60	137.69	101.22	63.79	101.37	113.23	72.28	96.79	121.52	26.22	132.85	80.84	16.21	37.17
Fima Equity	-6.30	72.95	125.51	417.02	49.92	63.02	19.62	21.32	-275.74	32.81	244.84	5.04	54.34	-204.43	100.01	-3.98	-48.29	53.58	-20.27	70.63	-9.65	-58.17	-58.79
HI Growth	89.45	52.49	92.19	49.92	72.50	49.47	86.93	90.15	87.26	59.96	43.78	51.09	40.03	89.86	48.79	52.54	97.89	71.67	26.29	91.51	52.19	35.75	42.88
HPB Dion.	59.49	45.69	50.93	63.02	49.47	86.43	23.40	57.43	65.30	15.12	12.42	7.46	35.13	44.09	12.20	39.52	104.22	44.34	25.84	80.74	28.60	48.72	41.54
Ilirika A.T.	142.75	78.52	165.24	19.62	86.93	23.40	255.28	168.49	180.09	141.20	56.96	146.16	54.28	182.58	151.28	98.63	130.71	129.13	43.42	135.75	102.87	31.50	80.09
Ilirika E.	129.39	91.31	140.59	21.32	90.15	57.43	168.49	206.26	199.51	121.82	63.79	110.40	69.20	196.62	143.29	109.34	179.63	128.06	55.58	163.61	107.58	76.23	89.33
KD N.E.	197.99	55.86	58.61	-275.74	87.26	65.30	180.09	199.51	686.16	89.57	-248.38	128.68	35.09	424.98	51.29	152.89	335.95	107.19	105.07	159.70	133.00	170.62	213.90
KD Pl.	87.63	62.52	119.60	32.81	59.96	15.12	141.20	121.82	89.57	130.65	103.59	91.58	49.30	127.66	121.53	68.70	82.79	97.67	27.17	104.96	79.13	27.47	36.46
KD Victoria	6.80	72.99	137.69	244.84	43.78	12.42	56.96	63.79	-248.38	103.59	472.94	10.19	75.45	-48.51	125.04	8.45	-59.43	88.40	-23.24	86.33	47.10	-26.16	-101.33
Neta Frontier	79.10	51.53	101.22	5.04	51.09	7.46	146.16	130.94	130.94	10.19	130.94	31.26	46.95	106.78	126.71	70.04	85.78	81.33	32.07	86.82	65.17	16.20	64.67
Neta G.D.	41.39	47.78	63.79	54.34	40.03	35.13	54.28	69.20	35.09	49.30	75.45	31.26	46.95	53.90	68.76	42.67	68.84	56.68	19.88	78.58	42.87	32.88	21.89
Neta N.E.	200.31	59.42	101.37	-204.43	89.86	44.09	182.58	196.62	424.98	127.66	-48.51	106.78	53.90	497.79	41.58	125.76	256.85	126.36	75.40	154.48	142.87	142.49	129.25
Neta US	1.09	101.45	113.23	100.01	48.79	12.20	151.28	143.29	51.29	121.53	125.04	126.71	68.76	41.58	357.80	104.88	98.13	110.57	45.19	148.74	85.05	30.78	63.92
OTP Ind.	68.68	59.21	72.28	-3.98	52.54	39.52	98.63	109.34	152.89	68.70	8.45	70.04	42.67	125.76	92.55	131.98	76.31	76.31	42.82	108.07	67.75	60.29	72.66
OTP M20	145.95	93.31	96.79	-48.29	97.89	104.22	130.71	179.63	335.95	82.79	-59.43	85.78	68.84	256.85	131.98	336.61	117.27	117.27	83.65	187.88	110.73	140.72	147.97
PBZ E.	98.23	72.97	121.52	53.58	71.67	44.34	129.13	128.06	107.19	97.67	88.40	81.33	56.68	126.36	110.57	76.31	121.56	35.15	35.15	124.31	79.12	45.33	51.15
Plat. B.C.	36.30	28.62	26.22	-20.27	26.29	25.84	43.42	55.58	105.07	27.17	-23.24	32.07	19.88	75.40	45.19	42.82	83.65	35.15	32.07	56.58	34.32	41.39	48.24
Plat.G.O.	108.48	102.28	132.85	70.63	91.51	80.74	135.75	163.61	159.70	104.96	86.33	86.82	78.58	154.48	148.74	108.07	187.88	124.31	56.58	211.91	99.16	85.47	84.27
ZB Ak.	79.14	53.14	80.84	-9.65	52.19	28.60	102.87	107.58	133.00	79.13	47.10	65.17	42.87	142.87	85.05	67.75	110.73	79.12	34.32	99.16	85.80	53.33	51.41
ZB Euro.	52.40	38.02	16.21	-58.17	35.75	48.72	31.50	76.23	170.62	27.47	-26.16	16.20	32.88	142.49	30.78	60.29	140.72	45.33	41.39	85.47	53.33	105.30	65.04
ZB Trend	69.55	39.82	37.17	-58.79	42.88	41.54	80.09	89.33	213.90	36.46	-101.33	64.67	21.89	129.25	63.92	72.66	147.97	51.15	48.24	84.27	51.41	65.04	120.00

Table 4.11: The matrix of variance and covariance of the observed bond funds

Fund	Capital One	HPB Obveznički	HI Conservative	Neta Emerging Bond	PBZ Bond	Raiffeisen Bonds	ZB Bond
Capital One	7.95	7.52	1.96	13.74	3.69	9.20	9.07
HPB Obveznički	7.52	19.56	3.57	23.33	-4.92	3.83	15.78
HI Conservative	1.96	3.57	10.97	15.03	-1.05	-5.64	-2.48
Neta Emerging Bond	13.74	23.33	15.03	76.08	18.31	16.78	19.37
PBZ Bond	3.69	-4.92	-1.05	18.31	70.61	45.12	5.52
Raiffeisen Bonds	9.20	3.83	-5.64	16.78	45.12	56.21	17.84
ZB Bond	9.07	15.78	-2.48	19.37	5.52	17.84	26.12

Table 4.12: The matrix of variance and covariance of the observed cash funds

Fund	Agram Euro Cash	Erste Money	HPB Novčani	HI Cash	Locusta Cash	Money One	OTP Novčani	PBZ Novčani	PBZ Euronovčani	PBZ Dollar	Raiffeisen Cash	ZB Plus	ZB Europlus
Agram Euro Cash	0.21	0.14	0.09	-0.03	0.04	0.12	0.10	0.11	0.20	-0.06	0.00	0.03	0.12
Erste Money	0.14	4.65	4.90	3.15	4.52	3.22	3.28	5.01	2.25	1.86	5.55	5.13	1.86
HPB Novčani	0.09	4.90	7.53	4.09	5.79	4.11	4.14	6.40	2.77	2.38	7.14	6.59	2.31
HI Cash	-0.03	3.15	4.09	3.39	3.84	2.63	2.72	4.27	1.67	1.45	4.72	4.51	1.46
Locusta Cash	0.04	4.52	5.79	3.84	6.47	3.78	3.86	5.97	2.51	2.17	6.63	6.20	2.12
Money One	0.12	3.22	4.11	2.63	3.78	3.52	2.67	4.29	1.84	1.54	4.65	4.33	1.48
OTP Novčani	0.10	3.28	4.14	2.72	3.86	2.67	3.43	4.30	1.89	1.54	4.71	4.46	1.59
PBZ Novčani	0.11	5.01	6.40	4.27	5.97	4.29	4.30	8.06	2.80	2.32	7.31	6.95	2.36
PBZ Euronovčani	0.20	2.25	2.77	1.67	2.51	1.84	1.89	2.80	1.70	1.06	3.06	2.78	1.12
PBZ Dollar	-0.06	1.86	2.38	1.45	2.17	1.54	1.54	2.32	1.06	1.40	2.76	2.35	0.86
Raiffeisen Cash	0.00	5.55	7.14	4.72	6.63	4.65	4.71	7.31	3.06	2.76	9.83	7.59	2.58
ZB Plus	0.03	5.13	6.59	4.51	6.20	4.33	4.46	6.95	2.78	2.35	7.59	8.75	2.40
ZB Europlus	0.12	1.86	2.31	1.46	2.12	1.48	1.59	2.36	1.12	0.86	2.58	2.40	1.11

Table 4.13: The matrix of variance and covariance of the observed balanced funds

Fund	HPB Global	HI Balanced	KD Balanced	ICF Balanced	OTP Uravnoteženi	PBZ Global	ZB Global
HPB Global	116.80	42.40	41.16	-19.65	67.44	59.10	39.57
HI Balanced	42.40	41.51	38.63	-2.02	52.49	41.10	47.03
KD Balanced	41.16	38.63	60.14	-23.33	75.94	43.08	58.74
ICF Balanced	-19.65	-2.02	-23.33	199.97	-63.46	-9.36	-29.92
OTP Uravnoteženi	67.44	52.49	75.94	-63.46	158.64	57.09	78.64
PBZ Global	59.10	41.10	43.08	-9.36	57.09	64.50	53.21
ZB Global	39.57	47.03	58.74	-29.92	78.64	53.21	95.43

covariance matrices for equity and balanced funds do seem alike, the values of covariance of balanced funds are lower in comparison to equity funds. Unlike equity funds, none of the values of balanced funds are higher than 79%. The funds ZB Global and OTP Uravnoteženi have the highest positive value of covariance of 78.64%. The funds OTP Uravnoteženi and ICF Balanced have the highest negative value of the mentioned measure of -63.46%.

5. CONCLUSION

Risk implies a situation in which possible outcomes and the probability of its appearance are known, yet the final outcome is unknown. Individuals often perceive risk as a danger of a possible loss; however in the world of finance risk does not solely denote the possibility of loss but also the probability of profit. In finance, risk can be labelled as a possibility of making the final outcome different than the one which is wanted, hence, it can be both better or worse in relation to the expected outcome. Risk cannot be equated with uncertainty since in a situation of uncertainty neither the outcome nor the probability of its appearance are known.

For measuring risk and comparing it based on the measures of statistical dispersion and value at risk, 50 UCITS funds, which have continuously conducted business in the period from 2009 until 2014, have been chosen. In the selected sample, equity funds have prevailed. Measures of statistical dispersion have shown that the riskiest funds are equity funds, followed by

balanced funds. According to the level of risk, after balanced funds the bond funds follow, while money market funds are the least risky. The same ranking of funds based on the level of risk was shown from value at risk (VaR). Thus, based on all measures of risk, volatility of fund return is highest in equity funds.

Further research should connect volatility with the performance of investment funds. In public and scientific circles, there is a common remark that risk is a function of return. Investment funds can serve as an excellent sample for testing this hypothesis. The fact of the matter is that these two variables are closely connected, but the question remains whether higher volatility actually results in higher returns on funds.

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