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POSITIONING EQUITY MUTUAL FUNDS PERFORMANCE WITH THE USE OF VARIOUS RISK MEASURES[1]

Summary

Purpose – Verifying the hypothesis that the ranking positions of funds are not repeatable during periods of changing market conditions. The subject of research are equity investment funds operating on the Polish market in the years 2003-2017.

Research method – The research employed various risk measures appearing in investment performance indicators: as measures of variability relative to the average rate of return or market benchmark as well as measures of potential investor losses. Performance comparisons were made in five-year subperiods taking into account the monthly percentage changes in participation units. In each subperiod, a number of rankings based on the following indicators: Sharpe, Information Ratio, Sortino, Martin, Pain, Calmar, RVaR, mRVaR and CS were created.

Results – There are no funds that would occupy high ranking positions created on the basis of various indicators. Positions taken by equity funds change randomly regardless of the situation on the capital market.

Originality /value / implications /recommendations – The study uses a wide range of measures that differ in many important parameters from an investment point of view. In particular, this applies not only to risk measures, but also to benchmarks. The authors tried to increase the value of the study by associating subperiods with periods of changing market conditions. This allows conclusions to be drawn regarding the capital market segment. The presented studies can be extended to funds from other risk classes.

Keywords: risk, rate of return, open-end mutual fund of shares, investment performance, ranking of funds

JEL Classification: C13, C21, G23

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1. Introduction

In the current state of the Polish capital market, entities looking for the possibility of investing their financial surpluses have quite a diversified offer to choose from. It also applies to individuals. And it is this particular group of market participants that is most exposed to making wrong choices. Profit on investment is quite simple and understandable for individuals, but risk is not. A potential client knows that, for example, an equity fund is more risky than a balanced one and a stable growth fund is more risky than bonds. But their knowledge is intuitive, they assume that loss is less likely to occur in less risky funds. On the other hand, by choosing an equity fund investor count on a larger profit than when they decide to invest in a stable growth fund. Every professional investor realizes that such reasoning is basically untrue. Because risk does not only mean a potential loss, but also potential opportunities for greater profit. Moreover, any risk definition must be associated with the expected (or realized) rate of return. Therefore, these two measures of investment are related to each other in the form of performance measures. Unfortunately, when choosing a fund from a given risk group based on intuition, the vast majority of individual investors are not able to select a fund which is "worth" investing in. Portals and financial press publish various types of rankings, but the most common basis for assessment is the rate of return. This does not, in any way, indicate the premises determining the selection of the fund, which is only expected to achieve satisfactory results for the potential client in the future. There is again the problem of ignoring the risk in assessing investment performance. Therefore, the authors of the study set the goal of assessing the investment performance of funds depending on the adopted risk measures. In addition, the answer to the following question will be provided: To what extent is the fund market characterized by the stability of rankings depending on the market situation? The results obtained will provide the investors with information whether they can decide on the choice of the fund based on any measure of investment performance. In addition, the results of the stability of ranking positions in subsequent periods will give information whether the fund stands a chance of maintaining similar results in the future. The research hypothesis states that there are no strong leaders on the open-end mutual funds market. Moreover, good fund performance does not persist in periods of changing market conditions.

In the first aspect of the research, ten performance coefficients were used and divided into three groups. The first one includes measures that use the definition of risk based on the spread of rates of return around the average value. This is a reference to the classical definition of risk, i.e. the standard deviation. The second group includes those values in which the risk is measured by the relative changes in the value of share units. Finally, the third group directly refers to risk as a measure of losses, uses the concept of VaR and its modification. The structure of the rankings was presented in three time periods: the first period covers the years 2003-2007, i.e. before the global financial crisis, the second one encompasses the time of

the crisis itself and the period immediately after it, that is 2008-2012, while the third one can be called a post-crisis period, i.e. the years 2013-2017.

The second aspect of the research is focused on examining the stability of ranking positions depending on the situation prevailing on the capital market. For this purpose, the method based on regression of ranking positions was used. Of course, this is just one of many methods to answer the question. The choice of it was prompted, among others, by a relatively simple computational algorithm and the fact that the use of this method was not commonly mentioned in the literature on the Polish capital market. Moreover, the method examines the stability of the entire market segment, not individual funds, and this was the intention of the authors. This segment is the open-end equity funds operating in the years 2003-2017, i.e. the period of dynamic development of the market of these investment companies. It is worth adding, however, that the stability of the ranking positions of open-end mutual funds was previously examined, also by the authors of this study, but with the use of Spearman's rank correlation coefficient. This is especially true for the first two periods covering the years 2003-2012. Therefore, the use of ranking positions in this study allows one to compare the results of persistence with two different methods.

2. Review of the literature

The starting point of research on investment performance are usually the classical measures, i.e. the Sharpe, Treynor and Jensen ratios. Research using these indicators was carried out, among others, by Shukla and van Inwegen [1995], Kothari and Warner [2001], and Jakšić et al. [2015]. Shukla and van Inwegen [1995] tried to answer the question whether local managers perform better than foreign ones. The results of the local managers turned out to be better than those of the foreign managers. Kothari et al. [2001] focused on mutual funds of the NYSE and AMEX markets. They showed that tests based on classical measures do not give correct results, especially those made on the basis of the CAPM model. For the period 1964-1991, they built portfolios of 50 funds for each month. To assess their performance, they used measures, such as Sharpe, Treynor and Jensen ratios, three-factor Fama-French model and CAPM model. The results of the Fama-French model gave better results than those based on the CAPM model. Jakšić et al. [2015] used the ratings of Sharpe, Treynor and Jensen to assess the mutual funds of the Serbian market in the period 2009-2012. The results obtained were worse than those that were set for the market portfolio. Based on, among others Sharpe ratio, given by W. Sharpe in 1966, began to arise so-called non-classical measures. These included, among others, the Sortino ratio [Sortino, van der Meer, 1991], the Martin ratio [Martin, McCann, 1989], and Calmar ratio [Pedersen, Rudholm-Alfvin, 2003]. The legitimacy of their application resulted from the lack of additional assumptions and the examples of erroneous investment decisions based on classical measures [Wiesinger, 2010]. Analyses of investment performance of funds using both types of measures were conducted, among others, by Eling [2008] or Livanos [2014]. Eling

[2008] examined over 38000 different types of mutual funds. His research concerned the years 1996-2005. The studies have shown a strong correlation between classical and non-classical measures. Livanos [2014] dealt with the British, Greek, Japanese and Indian markets. The results for these markets were compared with the results for the markets of Austria, France and Germany. He used both classical and non-classical measures to assess the results of the funds. In turn, Makrani and Zamanian [2014] used the Sortino ratio to assess 42 funds in 2011-2012 on Tehran Stock Exchange. In recent years, the study of mutual funds on the Polish market was dealt with by, among others, Kompa and Witkowska [2010], Perez [2012], Kopiński [2013], Zamojska [2015], Karpio and Żebrowska-Suchodolska [2014]. Research on the results of investment funds is carried out by means of various methods. In most cases, they are based on classical measures of investment performance. Therefore, the need arose to conduct research based on various groups of measures using different risk definitions and to compare them with each other.

3. Review of selected performance measures

When examining the investment performance of a collective investment institution, a variety of measures may be used, depending on the adopted criteria. Different sizes are taken into account when the emphasis is on the rate of return and still different when risk is emphasized. Of course, both of these characteristics practically always occur simultaneously. In this study, the basis of research are various risk measures that significantly modify the indicators adopted in the analysis. In the science of investing, risk is understood in several different ways. The oldest measure, disseminated by H. Markowitz, is the standard deviation, which for the sample from the distribution of fund A returns is given by the formula:

$$\sigma_A = \sqrt{\frac{1}{N-1}\sum_{t=1}^{N}\left(r_{A,t} - \bar{r}_A\right)^2} \tag{1}$$

Where N is the sample size, if the symbol $c_{A,t}$ denotes the value of fund A in the period t, then to $r_{A,t} = \frac{c_{A,t} - c_{A,t-1}}{c_{A,t-1}}$, $\bar{r}_A$ is the arithmetic mean $r_{A,t} = \frac{1}{N}\sum_{t=1}^{N} r_{A,t}$. This defined risk is a measure of the spread of return rates around the average value. Most often it is equated with the total risk, i.e. the volatility of the rates of return. The classical measure of fund performance using standard deviation is the Sharpe ratio:

$$S_A = \frac{\bar{r}_A - r_f}{\sigma_A} \tag{2}$$

Where r_f is the average risk-free rate. An information ratio that uses a market benchmark has a similar structure. The benchmark will be different for equity funds, and still different for a balanced or money market. The risk is measured by the amount called tracking error, which takes into account the adopted market index, namely:

$$TR_A = \sqrt{\frac{1}{N-1}\sum_{t=1}^{N}\left(r_{A,t} - r_{b,t} - (\bar{r}_A - \bar{r}_b)\right)^2} \tag{3}$$

The b index refers to the adopted benchmark. Thus, $r_{b,t}$ is the percentage change from $t-1$ to t, and $\bar{r}_b$ is the mean change, the other symbols have the same meaning as before. Tracking error is used to calculate the information indicator [Borowski, 2014]:

$$IR_A = \frac{\bar{r}_A - \bar{r}_b}{TR_A} \tag{4}$$

It is easy to notice that the risk measured by tracking error amounts to the standard deviation when we assume that the benchmark is a fixed rate devoid of risk r_f. Thus, an information ratio can be treated as a generalization of the Sharpe coefficient for a variable benchmark case other than a risk-free rate of return. The standard risk is a measure of risk that refers to its colloquial understanding as a measure of loss:

$$\sigma_A^- = \sqrt{\frac{1}{N-1}\sum_{t=1}^{N} d_t\left(r_{A,t} - r_{min}\right)^2} \tag{5}$$

Where r_{min} is the minimum required rate of return in the period in which the average $\bar{r}_A$ is calculated. It is often assumed that $r_{min} = 0$, i.e. any profit is required, which is undoubtedly excessive caution. The coefficient d_t takes the value zero, when $r_{A,t} > r_{min}$ and is equal to one in the opposite case. The measure of the investment's performance is then the Sortino coefficient [Sortino, van der Meer, 1991]:

$$ST_A = \frac{\bar{r}_A - r_{min}}{\sigma_A^-} \tag{6}$$

It is an analog of the Sharpe coefficient, in which the r_{min} is the benchmark. Standard semi-deviation is not the only option for linking risk to losses, another is the Ulcer index:

$$UI_A = \sqrt{\frac{1}{N}\sum_{t=1}^{N} D_{A,t}^2} \tag{7}$$

Where $D_{A,t}$ is the relative decrease in the value of fund shares A in the period t calculated on the formula:

$$D_{A,t} = \frac{c_t - \max\limits_{u\in\{1,2,\dots,N\}} c_u}{\max\limits_{u\in\{1,2,\dots,N\}} c_u} \tag{8}$$

Where c_u are share values in periods $u = 1,2,\dots,N$. Consequently, the Ulcer index leads to the Martin ratio [Martin, McCann, 1989]:

$$M_A = \frac{\bar{r}_A - r_f}{UI_A} \tag{9}$$

The Ulcer index, and consequently the Martin ratio, refer to the definition of risk described by the standard deviation. Their modification uses the measure of the dispersion described by the average deviation defining the Pain index: [Bacon, 2008]:

$$PI_A = \frac{1}{N}\sum_{t=1}^{N} \left|D_{A,t}\right| \tag{10}$$

And we get the Pain indicator:

$$P_A = \frac{\bar{r}_A - r_f}{PI_A} \tag{11}$$

The last two indicators use the risk, taking into account the value of share units c_t, comparing them with their highest value $\max_{t\in\{1,2,\dots,N\}} c_t$. The definition of $D_{A,t}$ is the relative change in the value of share units related to the largest value. In addition, both measures refer to the Sharpe ratio, because the counter compares the average change with the value of the risk-free rate. Formula (8) is also used to define the Calmar coefficient. For this purpose, the minimum value of relative decreases $D_{A,t}$ is selected, resulting in a maximum drop in the rate of return:

$$MDD_A = \min_{t\in\{1,2,\ldots,N\}} \frac{c_t - \max\limits_{u\in\{1,2,\ldots,N\}} c_u}{\max\limits_{u\in\{1,2,\ldots,N\}} c_u} \tag{12}$$

The Calmar ratio is defined by the formula [Pedersen, Rudholm-Alfvin, 2003]:

$$C_A = \frac{\bar{r}_A}{MDD_A} \tag{13}$$

The performance indicators discussed so far were based on risk definitions, which measure the rate of return (standard deviation σ_A, standard semi-deviation σ_A^-) or share value (indexes of Ulcer, Pain and maximum return rate drop). The first ones did not refer to the actual loss that the investor may incur, but only to the potential resulting from the volatility of share units. The second group of performance indicators uses the VaR and its modification. Therefore, they are based on investor's losses expressed in terms of amounts. However, the rates of return and standard deviation have an indirect meaning as the characteristics of the distribution of return rates. If X is the value of the investment portfolio and α is the level of confidence, the value at risk is defined by the condition:

$$VaR_\alpha(X) = inf\{x \in \mathbb{R}: F_X(x) > \alpha\} \tag{14}$$

Where F_X is a distributor of random variable X (portfolio value). Consequently, $VaR_\alpha(X)$ is the smallest y value of the random variable Y (investment portfolio losses) such that the probability that $Y = -X$ will not exceed y with the probability of at least $1 - \alpha$. If we assume that the percentage changes in fund A shares have a normal distribution, then the unit values will have a log-normal distribution. Then $VaR_\alpha(X)$ is expressed by the formula [Jorion, 2006]:

$$VaR_\alpha(X) = -(\bar{r}_A + q_\alpha \sigma_A) \tag{15}$$

Where q_α is a quantile of a standardized normal distribution. The performance indicator using Value at Risk was introduced in [Dowd, 2000] and is called reward to VaR:

$$RVaR_A = \frac{\bar{r}_A - r_f}{VaR_\alpha} \tag{16}$$

Because there is a loss measure in the denominator, a proposal is made to add a risk-free rate to it. Consequently, we obtain a modified RVaR indicator [Alexander, Baptista, 2003], namely:

$$mRVaR_A = \frac{\bar{r}_A - r_f}{VaR_\alpha + r_f} \tag{17}$$

However, the value at risk is not a coherent measure, which means that the risk does not decrease as the portfolio value increases (more diversification). This deficiency has no conditional Value at Risk $CVaR_\alpha(X)$. Apart from the accounting details, we get the definition [Albrecht, Koryciorz, 2003]:

$$CVaR_A(X) = \bar{r}_A + \frac{\varphi(N_{1-\alpha})}{\alpha}\sigma_A \tag{18}$$

$\varphi(N_{1-\alpha})$ is 1-α quantile of a standardized normal distribution, and φ is a function of the density of this distribution. A conditional Sharpe indicator is defined:

$$CS_A = \frac{\bar{r}_A - r_f}{CVaR_A} \tag{19}$$

The presented review shows that most of the performance indicators are the ratio of the excess rate of return to risk. The surplus rate is the difference between the average percentage change in units $\bar{r}_A$ and the risk-free rate r_f, the minimum required rate of return r_{min} or the average percentage change in the benchmark $\bar{r}_b$. In contrast, the denominators of indicators are risks expressed in different formulas. Therefore, it can be stated that the discussed measures resemble the "classical" coefficient of variation, thus they refer to the surplus rate of return per unit of risk. The fact that these are relative measures allows them to be used to assess the performance of funds from various risk classes, but this study is limited to equity open-ended mutual funds.

4. Methodical assumptions

The subject of the research are all equity funds operating on the Polish capital market since 2003, namely (the abbreviations used in the further part of the study are given in brackets): Arka BZ WBK Akcji Polskich (Arka), Aviva Investors Polish Stocks (Aviva), Esaliens Akcji (Esal), Investor Akcji (Inv), Investor Akcji Spółek Polskich Akcji (InvPol), Investor Top 25 Small Companies (InvTop), Millennium Akcja (Mill), NN Akcja (NN), Novo Akcja (Novo), Pioneer Akcji Polskich (Pioneer), PZU Akcja Krakowiak (PZU), Rockbridge Akcji (Rock), Rockbridge Akcji Dynamicznych Spółek (RockDyn), Skarbiec Akcja (Treasury), UniKorona Stock (Uni). Equity funds are considered to be profitable. They are also associated with high risk. Therefore, they were chosen to be researched first. The research concerned the years between 2003 and 2017. The research period was divided into three five-year subperiods: 2003-2007, 2008-2012, 2013-2017. The basis for determining the performance indicators were the percentage changes in share units on a monthly basis. The calculation assumes that the risk-free rate is equal to the WIBOR 1M rate applicable in the relevant period. In particular, the geometric mean of rates in monthly periods was used as the average rate in 2003-2007. Similarly, values were obtained in two subsequent subperiods. As a result, the following average values of

monthly risk-free rates were used in calculations: $r_f^I = 0{,}4316\%$, $r_f^{II} = 0{,}3775\%$, $r_f^{III} = 0{,}1738\%$. The Roman numeral at the top of the symbol indicates the period to which the specified rate applies. The information ratio was calculated using the benchmark, which was WIG and WIG 20. The minimum required rate of return in the Sortino indicator was zero.

The basis for the assessment of the repeatability of ranking positions is the regression of Collinet and Firer [2003] percentile rankings. The method is based on normalizing the measures constituting the basis for creating the ranking in each of the periods in accordance with the formula:

$$NS_{A,t} = \frac{MW_{A,t} - MW_{min,t}}{MW_{max,t} - MW_{min,t}} \tag{20}$$

Where $NS_{A,t}$ is the percentile rank of the A fund in the period t$MW_{A,t}$, is the value of the measure obtained by fund A in period t, $MW_{min,t}$, $MW_{max,t}$ are the minimum and maximum values of this measure within a given period. Then the coefficient of d is estimated in the regression equation:

$$NS_{A,t} = \alpha + dNS_{A,t-1} + \varepsilon_{A,t} \tag{21}$$

$NS_{A,t-1}$ is one percent period delayed by a percentile ranking. Information about the repeatability or reversibility of ranking positions is obtained by testing the zero hypothesis: $H_0: d = 0$ and alternative: $H_1: d \neq 0$. There are no grounds to reject the null hypothesis means that the percentile rank in the t-1 period does not affect the ranking in the next period. If we formulate an alternative hypothesis in the form of inequality, we will get more precise information. The statistically significant positive coefficient d informs about the repeatability of ranking positions, while the negative – about the reversibility of position. The significance of the factor d is tested using the standard Student's t test. In research, the level of significance was assumed at 5%. The variable t adopts three values in this study: $t = 1$ – years 2003-2007, $t = 2$ – years 2008-2012 and $t = 3$ – years 2013-2017. Therefore, for each measure we deal with two regression equations and two conclusions regarding the repeatability or reversibility of ranking positions.

4. Findings

The rankings of the examined funds were created for three consecutive periods, taking into account all of the discussed performance indicators. The following tables contain the results obtained. The bold vertical lines separate indicators calculated based on similar risk definitions. As the risk measure the first group adopts standard deviation (Sharpe), standard deviation of percentage differences in share units and benchmark (information ratio calculated for WIG and WIG20), and standard semi-deviation (Sortino). In the second group of indicators, the risk is based on the relative changes in the value of share units in relation to their highest and lowest

price (Martin), the average dispersion of these relative decreases (Pain) and based on the maximum rate of return (Calmar). However, VaR and conditional VaR define the third group of indicators, namely Reward to VaR (RVaR) and modified indicator (mRVaR). The last in this group is a conditional Sharpe ratio (CS), in which the risk measure is a conditional Value at Risk. The results of rankings created in the first period were collected in table 1.

TABLE 1

Ranking positions of funds in the years 2003-2007

	Sharpe	IR WIG	IR WIG20	Sortino	Martin	Pain	Calmar	RVaR	mRVaR	CS
Arka	1	1	1	1	1	1	1	1	1	1
Aviva	2	2	2	2	3	2	6	2	2	2
Esal	4	4	4	5	5	5	4	4	4	4
Inv	6	7	7	6	8	6	7	6	6	6
InvPol	12	14	14	12	6	9	3	12	12	12
InvTop	7	3	6	7	13	12	13	7	7	7
Mill	14	13	13	14	14	14	14	14	14	14
NN	10	9	8	10	9	8	8	10	10	10
Novo	9	11	11	9	10	10	10	9	9	9
Pioneer	13	15	10	13	11	11	11	13	13	13
PZU	11	12	12	11	12	13	12	11	11	11
Rock	8	8	9	8	7	7	9	8	8	8
RockDyn	15	10	15	15	15	15	15	15	15	15
Skarb	3	6	5	3	2	3	2	3	3	3
Uni	5	5	3	4	4	4	5	5	5	5

Source: own elaboration.

Based on the content of the table, one can observe some regularities. First of all, the ranking positions of the funds change to a negligible extent as the risk of defining performance indicators changes. As for the Arka fund, it always occupies the first ranking position. Funds, such as Esal, Inv and Uni occupy almost identically high positions in all rankings (the position occasionally changes to a small extent). The same applies to Mill, Pioneer, PZU and RockDyn, but this time the positions are low. The InvPol fund holds low positions in the first and third group of indicators, and medium in the second group. The opposite situation occurs in the case of the InvTop fund, which is placed in medium positions in the second group, and in the first and third in very low positions. As a consequence, it can be concluded that the rankings created on the basis of performance measures using different risk definitions change the positions of the funds to a small extent. So the investment performance is reasonably resistant to whether the risk is a measure of volatility or loss. Of course, the proposal formulated only applies to the years 2003-2007. The second period of research, i.e. 2008-2012, leads to the results collected in table 2.

TABLE 2

Ranking positions of funds in the years 2008-2012

	Sharpe	IR WIG	IR WIG20	Sortino	Martin	Pain	Calmar	RVaR	mRVaR	CS
Arka	8	6	8	9	10	10	11	8	8	8
Aviva	2	3	2	2	2	2	3	2	2	2
Esal	3	4	3	3	3	3	2	3	3	3
Inv	12	14	13	12	12	12	12	12	12	12
InvPol	4	5	5	4	4	4	5	4	4	4
InvTop	15	12	14	15	14	14	14	15	15	15
Mill	6	8	7	6	6	6	7	6	6	6
NN	5	7	6	5	5	5	6	5	5	5
Novo	9	9	10	8	8	8	10	9	9	9
Pioneer	14	15	15	14	15	15	15	14	14	14
PZU	10	11	11	10	9	9	9	10	10	10
Rock	7	10	9	7	7	7	8	7	7	7
RockDyn	13	13	12	13	13	13	13	13	13	13
Skarb	11	2	4	11	11	11	4	11	11	11
Uni	1	1	1	1	1	1	1	1	1	1

Source: own elaboration.

In this case, the conclusions regarding the ranking positions are more confirmed by those concerning the years 2003-2007. Furthermore, the homogeneity of the ranking positions is now greater. There are no differences in the ranking items that had previously occurred for the InvPol and InvTop funds. It is worth noting, however, that in the years 2008-2012 the Arka fund lost its leading position in favour of the Uni fund, which occupies the first position in all rankings. However, the Arka fund is more or less in the middle of the ranking. Table 3 contains the rankings created for the third period, i.e. 2013-2017.

TABLE 3

Ranking positions of funds in the years 2013-2017

	Sharpe	IR WIG	IR WIG20	Sortino	Martin	Pain	Calmar	RVaR	mRVaR	CS
Arka	10	13	8	10	10	10	10	10	10	10
Aviva	5	6	6	5	5	6	5	5	5	5
Esal	9	10	9	9	11	9	9	9	9	9
Inv	1	1	2	1	1	1	1	1	1	1
InvPol	8	8	10	8	7	8	8	8	8	8
InvTop	2	2	4	2	3	2	3	2	2	2
Mill	11	11	11	11	9	11	11	11	11	11
NN	4	4	1	4	4	4	4	4	4	4

	Sharpe	IR WIG	IR WIG20	Sortino	Martin	Pain	Calmar	RVaR	mRVaR	CS
Novo	13	9	13	13	13	13	13	13	13	13
Pioneer	14	15	14	14	14	14	15	14	14	14
PZU	15	14	15	15	15	15	14	15	15	15
Rock	12	12	12	12	12	12	12	12	12	12
RockDyn	3	3	7	3	2	3	2	3	3	3
Skarb	7	7	5	7	8	7	7	7	7	7
Uni	6	5	3	6	6	5	6	6	6	6

Source: own elaboration.

Looking at the results presented in table 3, it can be concluded that this time the Inv fund was distinguished, which bears a resemblance to the previous periods when Arka and Uni reached the highest position. The exception is the IR WIG20 indicator, where the fund took the second position. It should be once again emphasized that in the first period (2003-2007), from the point of view of all indicators, with the exception of IR WIG20 and Sortino, the Arka fund was the unquestionable leader and held the first position. In the second period (2008-2012), it was replaced by the Uni fund and in the third by Inv.

5. Stability of ranking positions

In the previous chapter, it was observed that a different fund was a clear market leader in each of the analyzed five-year periods. Therefore, one should answer the question regarding the repeatability or reversibility of ranking positions of funds in different periods of time. The question concerns the tendency prevailing in the market, not individual entities. If the ranking items of a fund set in the previous period explain items in a later period, then of course we are dealing with a cause and effect relationship of rankings. However, this impact may be "positive" (better ranking positions remain better and worse ones are still worse) or "negative" (better ranking positions become worse, and worse ones are better). In the first case, we are talking about the repetition of ranking positions, and in the second about the reversal. Below, in table 4, the results of the regression of ranking positions in the form of the value of the coefficient d and p-value are presented. Significance was examined using one-sided tests, in which the null hypothesis assumed $d = 0$. If the result of the estimation led to the positive value of d, the alternative hypothesis assumed that $d > 0$. If the estimation led to a negative value, then the alternative hypothesis assumed that $d < 0$. In all cases, the significance coefficient was 5%.

TABLE 4

The results of the percentile regression

	Sharpe	IR WIG	IR WIG20	Sortino	Martin	Pain	Calmar	RVaR	mRVaR	CS
I regression	0.433	0.408	0.328	0.452	0.459	0.509	0.474	0.446	0.441	0.444
p-value	(0.081)	(0.058)	(0.117)	(0.073)	(0.084)	(0.070)	(0.074)	(0.073)	(0.077)	(0.075)
II-regression	-0.314	0.172	0.250	-0.255	-0.197	-0.197	-0.242	-0.324	-0.323	-0.322
p-value	(0.131)	(0.266)	(0.215)	(0.159)	(0.235)	(0.226)	(0.183)	(0.120)	(0.122)	(0.123)

Source: own elaboration.

The results presented in table 4 clearly indicate the lack of correlation between the ranking items in the periods I (years 2003-2007) and II (years 2008-2012), and II and III (years 2013-2017). All d-factors are statistically insignificant. If you look at the coefficients of determination, in all cases (coefficients and periods) they range from 0.03 to 0.16. It clearly indicates that ranking positions in one period do not affect positions in the other period. Therefore, one should look for other variables, explaining the ranking in a given period, than the ones from the previous period. However, this is an issue that goes beyond the subject of this study.

6. Conclusions

The results presented here lead to several important conclusions regarding the equity open-end mutual fund market as a part of the Polish capital market in the years 2003-2017. First of all, it can be concluded that, apart from some exceptions, there are no funds that would occupy high ranking positions based on various factors. The exceptions are: Ark in the years 2003-2007, Uni in 2008-2012 and Inv in 2013-2017. Indeed, the above-mentioned leaders, in subsequent subperiods, are characterized by high positions due to the factors taking into account different risk definitions. Furthermore, ranking positions do not depend on whether the risk measure takes into account the spread of the rates of return around the average value, around the benchmark average or even equates risk with a loss. The difference does not appear also when the benchmark is WIG20 or WIG. The situation is unified when examining the stability of ranking positions in various subperiods. The method used to regress percentile positions unambiguously leads to the conclusion that there is no tendency for repeatability or to reverse rankings from period to period. Thus, positions taken by individual funds change in a random way. There are no decisive leaders in the whole researched period (2003-2017), but there are also no worst funds in this period.

Attention should be paid to the second and third group of measures. The positions of funds in given periods are virtually the same. Consequently, the conclusion is that the Martin, Pain, Calmar coefficients contain the same information about the investment performance of equity funds. A similar situation occurs for the RVaR,

mRVaR and CS indicators, when the ranking positions in each period are identical. Thus, it can be stated that all information about the performance is contained in any of the three measures in each of the two groups discussed.

The results obtained are to some extent consistent with the total expense ratio (TER). The table below contains this data supplemented with net assets.

TABLE 5

Characteristics of the funds

	Launch Date	TFI	Net Asset Value (million PLN), as of January 2020	TER*
Arka	02.04.1998	Santander TFI	694.1	3.48%
Aviva	08.04.2002	Aviva Investors Poland TFI	710.9	3.54%
Esal	04.01.1999	Esaliens TFI	724.7	2.91%
Inv	05.01.1998	Investors TFI	150.4	6.43%
InvPol	05.01.1998	Investors TFI	155.9	3.29%
InvTop	26.11.2002	Investors TFI	159.6	3.39%
Mill	03.01.2002	Millennium TFI	189.9	3.69%
NN	09.03.1998	NN Investment Partners TFI	897.0	3.02%
Novo	01.06.1998	Opera TFI	56.2	3.52%
Pioneer	18.12.1995	Pekao TFI	463.7	3.38%
PZU	25.10.1999	TFI Pzu	742.4	1.17%
Rock	28.07.1999	Rockbridge TFI	63.2	3.96%
RockDyn	08.02.2000	Rockbridge TFI	67.7	3.99%
Skarb	09.10.1997	Skarbiec TFI	188.7	5.25%
Uni	20.01.1997	Generali Investments TFI	485.9	3.60%

* TER – Total Expense Ratio of 30.06.2019

Source: own elaboration.

It should be noted that interest rates are similar. Only two funds stand out as a minus: Inv and Skarb, while PZU turned out to be the best. Such homogeneity of the obtained results additionally proves that there are no strong leaders. The results obtained depend partly on the value of the assets. The TER ratio of the NN fund, the largest in this respect, was 3.02%, and Novo, the smallest, slightly more – 3.52%. Larger assets offer greater portfolio diversification options. With changing market conditions and appropriate management skills, they should lead to better investment results than funds with relatively small capital. And yet it is not so. In conclusion, it should be emphasized that the research itself did not take into account the costs incurred by clients: commissions and management fees. Attention was, however, paid to them based on the TER ratio in the final interpretation. Including them significantly reduces the profitability of saving through participation units. That is why further research by the authors will focus on the relation between the results obtained and the costs incurred by the investor. In the long run, it may turn out that investing in treasury bonds, for example, is more profitable than in equity fund participation units at lower costs and less risk.

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