2. ARE FUND ATTRIBUTES RISK DRIVERS? EVIDENCE FOR THE POLISH MUTUAL FUNDS

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Abstract

The purpose of this paper was to examine the dependence of the investment risk level on selected organisational fund characteristics that might be perceived as risk drivers and key factors used in decision by individual investors. Moreover, the intention of the study was also to verify the hypothesis regarding differences in the risk level depending on the developed investment policy of a fund. The analysis was conducted for 82 domestic equity funds operating in Poland during the 2000-2015 period. The study used four popular risk measures and four of the main organisational factors, such as fund size and age, family size, and investment policy. As a result of the analysis, it was noticed that fund attributes may be treated as risk drivers. Fund age was interpreted as a factor influencing investment risk to a statistically significant extent most frequently and its growth resulted in a limited variability of returns and, at the same time, increase in sensitivity of unit price changes to movements of returns on a benchmark. The factor related to asset size was also crucial for large funds as it made the achieved returns more variable. A certain dependence of the obtained results on the applied risk measure and the used estimation method was noticeable in the conducted analysis. To our knowledge, it is one of the first papers in the CESEE countries to evaluate determinants of investment risk with respect to fund attributes. Moreover, what contributes to the originality of the research is the application of a relatively extensive set of risk measures in the context of data from an industry that is representative for the European developing markets.

Keywords: mutual funds, risk, performance, fund characteristics
JEL Classification: G11, G23, G29

1. Introduction

The risk of investing in mutual funds may be described in several ways. From returns predictability, the risk can be defined as the level of change in the unit value. What could be a risk measure in this case is the variance of fund returns, represented as their variability. When a given mutual fund is characterised by high risk, its returns normally oscillate much

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below the average values achieved by the funds over a short period of time. Therefore, besides the returns, the risk levels should be taken into account when selecting funds.

Risk may also be determined on the basis of the impact of market swings upon the changes in the price of a given security. Similarly, fund risk can be shown as a benchmark's reflection in fund returns. This is when the management staff's skills of emulating the benchmark or becoming independent from its impact during downturns are evaluated. The above-mentioned sensitivity of returns to benchmark variations will be defined by the investment style applied in the mutual fund.

The level of risk typical for the individual funds may depend on certain organisational characteristics of these financial institutions. The features include, *i.a.,* fund size, fund age, turnover ratio, family fund size, expense ratio, and minimum initial investment (see Filip, 2015). Identifying the impact of fund attributes on the risk specific to the discussed entities could be significant to both the clients of the collective investment institutions and to the fund managers. In the case of the former group, the relatively high variability of net asset value per unit, caused by certain fund features, might discourage potential investors from investing in the products offered by the mentioned financial intermediaries. As regards the latter group, in turn, the fact of being characterised by appropriate attributes, which might result in a relatively low risk level, could be used by the financial institutions when preparing offers for prospective clients.

The purpose of this paper is to examine whether the investment risk level is related to the organisational characteristics typical and fundamental for the analysed entities. Moreover, the intention of the study was to verify the hypothesis regarding differences in the risk level depending on the developed investment policy of a fund. The analysis is conducted for 82 domestic equity funds operating in Poland during the 2000-2015 period. The study employs four risk measures and fund attributes, namely fund size, age, family size, and investment policy. The study fills the literature gap by providing quantitative analysis and overview of the factors influencing the investment risk. To our knowledge, it is one of the first papers in the CESEE countries to treat fund attributes such as risk drivers and key factors for individual investors when making investment decisions. Furthermore, what contributes to the originality of the research is the application of a relatively extensive set of risk measures in the context of an industry that is representative for the European developing markets.

The structure of this paper enables identification of its main parts. A brief review of the relevant literature, which allows reference to the main findings concerning the discussed issue, is provided in Section 2. It is followed by Section 3, which describes the data set, the methodological approaches and the risk measures used in the analysis. Section 4 reports on the empirical results and Section 5 offers a presentation of the main concluding remarks.

2. A Review of the Relevant Literature

One of the elements of asset management evaluation is measurement of the risk specific to a given security. According to Markowitz's portfolio theory (1952), investors look for investments that would optimize portfolio risk and return, with the assumption that capital markets are effective in terms of information. Hence, the discussed issue seems to be significant in the context of mutual fund analysis.

The finance literature dedicated to mutual funds, and in particular to examining their effectiveness, is extremely extensive. Virtually from the very beginning of conducting analyses concerning collective investment institutions, the studies pertained to investment risk analysis along with fund performance investigation. However, there are definitely fewer

papers illustrating risk determinants. Nonetheless, papers of Lintner (1965) or Blume (1971), which contributed to the development of investment risk measurement methods, worth mentioning. Moreover, it should be noticed that in the context of effectiveness evaluation, most of the later studies use Markowitz's findings related to diversification and the portfolio theory.

Investment risk was analysed, *e.g.*, by Trueman (1988). He tried to provide an explanation why fund managers rationally engage in noise trading without using any fundamental data. On the basis of the developed model, he applied the Black's approach to noise trading and Bayesian rules and discovered that irrational investment decisions of managers were more commonly observed in riskier assets. The Trueman's analysis provides a conclusion that risk and turnover may be positively related because high-risk holdings offer a greater opportunity for better performance.

The study by Detzel and Weigand (1998) should be mentioned among the works concerning the level of risk taken in mutual funds. The researchers sought determinants of performance persistence in 61 equity funds during the 1976-1985 period. Apart from assets size, expenditure ratio and financial factors, the independent variable included in the regression models was the Beta coefficient, which represented the market risk. They applied the approach proposed by Fama-MacBeth (1973) to estimate regression models. The results show that market risk and expenditure ratio might explain the performance persistence phenomenon only to a minor extent.

Risk as a dependent variable was analysed in a paper by Golec (1996). He made an attempt to determine whether fund attributes, along with managerial characteristics, might explain, among others, the investment risk taken by funds. The research sample consisted of 530 equity funds operating during the 1988-1990 period. The author employed the three-stage least squares (3SLS) regression method for the analysis and used the Beta coefficient and standard deviation as risk measures. The empirical results indicate that both fund age and fund size are negatively related to the unsystematic risk level. When the Beta coefficient was included in the model, it was found that fund age had a positive influence on the systematic risk. The conclusion concerning assets size is well-founded since, along with a larger capital base, managers might invest in more holdings, which could entail higher variability of returns. On the other hand, the possessed portfolio may be considered as a diversified one, which is more responsive to benchmark changes.

The characteristics of managers and the overall labour market for fund managers were handled by Chevalier and Ellison (1999). They analysed the factors connected with the decisions made by 453 managers of growth as well as growth and income funds during the 1992-1994 period. The research sample was divided into two groups consisting of managers who held their positions or were promoted to large funds and managers who were made redundant or moved to small funds. They discovered that termination of younger managers' employment contracts resulted mainly from their poor performance. Chevalier and Ellison reveal that, for fear of being made redundant, the younger managers are more likely to avoid unsystematic risk and make conventional investment decisions than the older managers.

The paper by Bliss and Potter (2002), concerning 2,571 domestic and 652 foreign equity funds operating in the USA, in turn, focuses on the differences in the level of accepted risk and the obtained returns of portfolios managed by men and women separately. They used standard deviation, the Beta coefficient and the so-called Bear Market Percentage Rank, applied by Morningstar to compare individual funds in downtrend periods, as risk measures.

Bliss and Potter found no evidence of risk-taking differences, yet their findings need to be tested from other angles before drawing definitive conclusions.

Another noteworthy study is one by Bliss, Potter and Schwarz (2008), who endeavoured to examine if fund performance and its variability differ depending on the functioning management structure. The Fama-MacBeth (1973) approach was employed in the investment portfolio risk analysis. On the basis of 2,500 equity and mixed funds operating during the 1993-2003 period, the researchers established that there were no statistically significant differences in the generated risk-adjusted returns. However, it was noticed that the funds managed by teams were characterised by significantly lower-risk portfolios.

In one of the more recent studies dedicated to the emerging markets, Vijayakumar, Sivanmalaiappan and Chandrasekhara Rao (2012) investigated the relation between fund performance and characteristics. The analysis covered 14 funds investing in equity and debt-linked assets during the 2004-2008 period. The applied determinants included risk level (measured by standard deviation), fund size, turnover ratio, income ratio, and expenditure ratio. The cross-sectional time-series data and three models of estimations (OLS, FEM and REM) enabled the conclusion that the obtained investment returns were positively related to the unsystematic risk.

The research on determinants of investment risk in mutual funds are virtually non-existent in the finance literature coming from the developing European economies. To the author's knowledge, only the paper by Trzebiński and Majerowska (2019), who noticed a statistically significant relation between two selected measures of investment risk and fund size as well as fund age, could be mentioned in this vein. However, there are more studies devoted to the effects of assets management which include new risk-adjusted measures (*e.g.* Jakšić, Leković and Milanović, 2015; Zaremba, 2014; Erdõs and Ormos, 2009) or focus on introducing measures and comparing risk ratios (*e.g.* Bóta and Ormos, 2017; Filip, 2017; Gabriel, Nicolescu and Lupu, 2015; Prokopowicz and Gwoździewicz, 2015; Vyšniauskas and Rutkauskas, 2014). Therefore, the present paper on risk drivers may be considered as a contribution from the CESEE countries to the finance literature.

3. Methodological Issues

Characteristics of Risk Measures

As it was mentioned above, risk measurement is one of the elements of assets management evaluation. Its appraisal methods can be classified into a few categories. As part of one, *i.e.* variability measures, the standard deviation is mentioned. Variability metrics illustrate the variance between the investment effect obtained and the forecast and they can be treated as a measure for evaluating the dispersion of a probability distribution. The used metric is defined as a measure of total risk and is calculated on the basis of the formula (*e.g.* Isotalo, 2014):

$$SD_{i,t} = \frac{\sqrt{\sum_{i=1}^{n}(r_{i,t} - \bar{r}_i)^2}}{n-1} \quad (1)$$

where: $SD_{i,t}$ means standard deviation of fund *i*, $r_{i,t}$ is the rate of return of fund *i* in period *t*, $\bar{r}_i$ stands for the mean rate of return achieved by fund *i* over a year, and *n* is the number

of periods covered. The measure, which allows for the evaluation of historical variability of investment, shows the deviations of the fund's rates of return from the mean return value in a given period.

The second risk metric is one of the downside risk measures. The metrics measure the potential downside variability, which takes account of losses rather than unexpected gains on the basis of the following formula (Feibel, 2003):

$$SemiSD_{i,t} = \frac{\sqrt{\sum_{i=1}^{n}(r_{i,t} - \bar{r}_{i\_})^2}}{n-1}, \quad (2)$$

where: $SemiSD_{i,t}$ is the continuous semi-deviation of fund *i* returns in period *t* and represents the downside risk, which means the risk level of only those returns which are lower than the mean return.

Another way of measuring risk concerns the sensitivity measures, which reflect the influence of risk factors on returns. The risk measurement method used is the Beta coefficient, which represents the systematic risk. It is defined as a measure of unit price sensitivity to movement in market returns and it is expressed by the following formula (see Karacic and Bukvic, 2014):

$$\beta_{i,t} = \frac{Cov(r_i, r_m)}{Var(r_m)}, \quad (3)$$

where: $\beta_{i,t}$ means the Beta coefficient of fund *i*, $Cov(r_i, r_m)$ is a covariance of stock market return calculated on the basis of changes in the local equity index, with returns achieved by fund *i*, $Var(r_m)$ is the variance of stock market returns.

The last measure applied is tracking error. It may be treated as a measure of market risk and it is shown as the difference between fund returns and index returns. The finance literature presents different manners of calculating the extent to which a portfolio behaves like its benchmark (see Vardharaj, Fabozzi and Jones, 2004). In this study, it is computed as:

$$TE_{i,t} = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(r_i - r_m)^2}, \quad (4)$$

where: $TE_{i,t}$ stands for the tracking error of fund *i*. The typical risk measure levels should not be far from 0 for the exchange-traded funds (ETF), below 2% for the enhanced index funds, and 5%-10% for the high-conviction funds. It means that the lower the measure value is the better the index returns are reflected in fund returns, and so the lower the market risk is (cf. Miziołek and Zaremba, 2017).

Empirical Strategy

In order to justify the chosen model, it is reasonable to refer to a theory presented in Golec's (1996) paper. He noticed that size factors should have a negative effect on unsystematic risk because more assets require managers to invest in more companies. It should be

stressed that limitations on how much may be invested in one stock are imposed on most funds in the U.S. industry. Polish mutual funds, in turn, fall under the European regulations, which provide for different limitations. Therefore, findings from this much less developed market and from the USA might be different. Furthermore, as regards fund age, some standards which have evolved over many years of the funds' operation as well as internal procedures implemented by investment committees of more experienced funds might be expected to result in higher sensitivity of a portfolio to the movement in market returns as well as in systematic risk.

Thus, to present the relationships between multiple independent variables and a dependent variable in quantitative terms, the multivariable regression model is used. The relation between risk level and organisational characteristics of funds can be established in accordance with the following formula:

$$Risk_{i,t} = f(SIZE_{i,t}; AGE_{i,t}; FamilySIZE_{i,t}; INVEST.POL_{i,t}), \quad (5)$$

where: $Risk_i$ is fund *i*'s risk measurement method applied in a given model; *SIZE* means fund *i* size computed as a natural logarithm of the value of fund *i*'s assets under management; *AGE* stands for fund *i* age and is calculated as a natural logarithm of the number of months from the first pricing of unit share; *FamilySIZE* is the size of the fund family to which fund *i* belongs, and it is computed as a natural logarithm of the total assets of funds under asset management company in a given year; *INVEST.POL* is a binary variable standing for groups of entities with a similar investment policy and means 1 when funds invest in small and medium cap equity, while 0 – in universal stocks.

The verified null hypothesis assumes that the investment risk level is unrelated to individual organisational characteristics of funds and, hence, the value of the estimated parameters will be 0. The statistical significance of the coefficients will be verified with the *t*-test. The null hypothesis can be rejected in favour of the alternative hypothesis providing that risk ratios depend on certain fund attributes when the absolute value of *t*-statistics calculated from the sample is higher than the critical value for a given significance level. In order to verify the significance of the whole regression formula, the Wald test was used.

Due to the nature of the data set, where the records are listed in more than one period, it is reasonable to use time-series cross-section (TSCS) methods, which include time-series data observed for many units. The applied parameter estimation methods will be the pooled ordinary least squares (POLS) and the fixed effects regression (FEM). The former approach is applicable when there is no unobserved heterogeneity and it is uncorrelated with the regression parameters. The latter one, in turn, is more appropriate for panel methods when it might be an unnoticed factor that impacts the dependent variable. All of the applied models were diagnosed by the means of the Breusch–Pagan test and the Hausman test. The diagnosis was facilitated by the use of OxMetrics statistical software.

The Data Set

The applied study sample comes from one of the most representative industries for the European developing markets. According to the EFAMA reports, growth of the Polish mutual fund industry can be described as lasting and sustainable in comparison to other CESEE countries. The research sample consists of 82 open-end equity funds with the domestic geographical profile, which operated in Poland during the 2000-2015 period. It was also possible to ring-fence two largest groups of funds from the sample. These were entities investing in small and medium capitalisation equity (SME) and universal stocks. At the end of the time horizon, the number of funds from the first group (small-and-mid cap) was 22,

which is approx. 27% of all domestic equity funds, while the number of universal stock funds was 53, which amounts to 65% of the total number of the analysed funds.

In order to show the differences concerning the influence of organisational factors on the risk level in the groups of funds where the scale of individual entities' operation is similar, it was reasonable to divide the sample by the size of the funds' assets. The classification criterion applied was the median value by the capital base held. Thus, the total sample was divided into two subsamples: small funds (lower than the median of assets value – PLN 103 million) and large funds (higher than the median of assets value – PLN 103 million). More descriptions of the used data in relation to active mutual funds are presented in the summary statistics (Table 1).

The collected database concerned the values of risk levels as well as organisational aspects of the analysed entities' operation on the fund market. All annual risk ratios were calculated on the basis of monthly observations, while the organisational factors were established by values at the end of each year. In relation to the latter group of data, we decide to use the most popular in the literature fund attributes. For example, fund size reflects its market acceptance and popularity in the form of asset growth and the possibility to use the economies of scale. In turn, fund age may reflect the ability of a fund to survive, its prestige and the loyalty of investors. The period of existence of a fund may also result from managerial experience and fund social networks, while the family size reflects the prestige of a fund and the market share related possibilities. It is assumed that the economies of scale increase with the size of a fund company. The sources of the data were the information derived from reports of the Chamber of Funds and Asset Management in Poland (IZFA) and the analizy.pl website – a market leader among fund industry data providers. Moreover, the local equity market benchmark used in this study was the Warsaw Stock Exchange Index (WIG). The values of benchmark were gathered from the Warsaw Stock Exchange (GPW) website.

4. Results

The empirical section of this study consists of three parts. The first two provide only preliminary findings, whereas the third one presents the main conclusions. The collation of descriptive statistics related to both independent and dependent variables can be treated as an introduction to the results. Table 1 presents the preliminary description of the collected set of data on fund attributes of the entire sample and two subsamples.

The summary statistics related to the independent variables included in the panel models are presented in Table 1. Due to the relatively high values of standard deviation for all variables covered by the study, it was justified to take some measures to limit the influence of the above-mentioned deviations by recalculating the data into natural logarithm values. The highest number of extreme values was observed for the AGE factor, which could also mean that the distribution of the values is less concentrated than the corresponding normal distribution. For some variables, in particular for the SIZE factor, a right-skewed distribution may be identified.

Table 1

Descriptive Statistics for Funds' Factors

Panel A: Total sample

Fund Characteristics	*Observations*	*Mean*	*Median*	*Std. Deviation*	*Minimum*	*Maximum*
SIZE	688	320 260	103 068	656 230	44	5 414 142
AGE	688	71	59	52	2	240
FamilySIZE	688	4 535 496	2 349 237	5 061 860	38 043	28 701 743

Panel B: Larger Funds

Fund Characteristics	*Observations*	*Mean*	*Median*	*Std. Deviation*	*Minimum*	*Maximum*
SIZE	344	602 489	298 863	837 763	103 354	5 414 142
AGE	344	94	87	54	2	240
FamilySIZE	344	6 385 483	3 456 343	5 642 361	195 490	28 701 743

Panel C: Smaller Funds

Fund Characteristics	*Observations*	*Mean*	*Median*	*Std. Deviation*	*Minimum*	*Maximum*
SIZE	344	38 030	30 882	30 212	44	102 781
AGE	344	47	38	38	2	215
FamilySIZE	344	2 685 508	1 349 257	3 552 247	38 043	19 267 945

Note: The values of SIZE and FamilySIZE are in thou. PLN.
Source: Own compilation.

The exploratory data analysis will be continued by the means of descriptive methods. In order to outline the main characteristics of the variables applied in the study, a synthetic summary of the used risk measurement methods is employed. Table 2 contains the descriptive statistics for dependent variables in the total sample as well as in the samples of large funds and their small competitors.

As demonstrated in Table 2, the largest dispersion of the mean values is observed for the Beta coefficient. In the case of other risk measurement methods applied, means and medians indicate relatively similar values. The Beta measure is characterised by a slightly left-skewed distribution. Furthermore, the descriptive statistics for tracking errors might imply a more peaked distribution than, *e.g.,* normal bell-shaped ones noticed for the remaining collated variables.

The second part of the Section is represented by the univariate analysis. It is one of the inferential methods. However, it does not take the panel nature of the data set into consideration. It also needs to be remembered that even if it was possible to identify any statistically significant relationships, the probability that they are driven by ignored factors cannot be excluded. Table 3 presents the results of the comparison of organisational characteristics of SME funds and their universal competitors.

Table 2

Descriptive Statistics for Risk Measures

Panel A: Total sample

Measure of Risk	*Observations*	*Mean*	*Median*	*Std. Deviation*	*Minimum*	*Maximum*
SD	688	0.0455	0.0420	0.0176	0.0011	0.1140
SemiSD	680	0.0252	0.0222	0.0141	0.0000	0.0781
Beta	601	0.9344	0.9428	0.1423	0.3826	1.4006
TE	633	0.0223	0.0196	0.0141	0.0039	0.1153

Panel B: Larger Funds

Measure of Risk	*Observations*	*Mean*	*Median*	*Std. Deviation*	*Minimum*	*Maximum*
SD	344	0.0463	0.0427	0.0178	0.0177	0.1128
SemiSD	340	0.0258	0.0231	0.0140	0.0043	0.0705
Beta	329	0.9410	0.9528	0.1187	0.5171	1.2496
TE	336	0.0193	0.0174	0.0103	0.0039	0.0711

Panel C: Smaller Funds

Measure of Risk	*Observations*	*Mean*	*Median*	*Std. Deviation*	*Minimum*	*Maximum*
SD	344	0.0448	0.0418	0.0172	0.0012	0.1140
SemiSD	339	0.0247	0.0217	0.0142	0.0010	0.0781
Beta	272	0.9263	0.9291	0.1664	0.3826	1.4006
TE	296	0.0256	0.0217	0.0169	0.0048	0.1153

Source: Own compilation.

Table 3

Comparison of Fund Attributes – SME Funds vs. Universal Funds

	SME Funds		*Universal Funds*	
	Mean	*Median*	*Mean*	*Median*
SIZE	143 868	101 998	403 119	115 222
AGE	55	51	78	66
FamilySIZE	5 513 160	2 829 633	4 231 628	2 007 794
	Tests for differences in			
	means		*medians*	
	t	*p-value*	*Z*	*p-value*
SIZE	-7.0738 ***	0.0000	-2.4475 ***	0.0000
AGE	-6.4164 ***	0.0000	-4.2758 ***	0.0000
FamilySIZE	2.6373 ***	0.0044	3.8215 ***	0.0000

*Note: ***, ** and * means that the null hypothesis about the equality of means and medians at the significance levels 1%, 5% and 10%, respectively, can be rejected. The standard t-test is applied to examine the differences among means, while the Mann–Whitney U test is applied for differences among medians.*
Source: Own compilation.

Many studies (*e.g*. Rodriguez, 2015) notice that the investment strategies and goals have a significant impact on many aspects of investment assessment, *i.e*. the investment risk, and therefore fund objectives and the investment management policy, should be taken into account. For instance, Högholm, Knif, Koutmos and Pynnönen (2017) found that some European large-cap funds were less risky than their U.S. counterparts. On the other hand, the U.S. funds, overall, outperformed the European ones as far as risk-adjusted returns were concerned. Hence, in order to find a justification for including into the model (5) one of the factors, which stands for an investment policy (INVEST.POL) applied by funds, it seems important to demonstrate the differences in unequal groups of funds (SME and Universal). To this end, the approach employed in the financial studies was used (see Hasan *et al*., 2014). Table 3 compares the existing organisational attributes among the mentioned groups. Both the t-statistics and Mann–Whitney U test values show that the differences in the samples' means and medians are statistically significant and, hence, it seems reasonable to include the investment policy factor in the study.

The third part of the empirical section is the core of the analysis. It consists of two examination areas. On the one hand, the findings for the total sample covered by the study are presented, and on the other hand, the differences in how organisational aspects influence risk levels of individual groups of funds characterised by the SIZE factor are demonstrated. The parameters of the TSCS models are estimated by means of the pooled ordinary least squares method (POLS) and fixed effects method (FEM). Table 4 presents the results of the estimates in which standard deviation (SD), semideviation (SemiSD), Beta coefficient and tracking error (TE) serve as dependent variables.

What follows from the conducted analysis is that, regardless of the estimation method applied for certain risk measures, the level of variability (SD) and downside risk (SemiSD) grew only slightly in the total sample as the value of assets under management increased (see Table 4, Panel A). It means that, when their capital bases increase, the analysed equity funds might introduce insignificantly higher diversification to their portfolios and decide on more risky holdings, which, in turn, results in higher variability of returns. This issue seems quite interesting, in particular when comparing the findings from the developed markets, where unsystematic risk is expected to decrease as fund size increases (see Golec, 1996). However, the results should be treated as preliminary. Fund size is also positively related to the sensitivity coefficient (Beta), which indicates the reaction of unit prices to the changes in market indices, and negatively related to market risk (TE), reported as a divergence between the returns of the portfolio and the benchmark, yet for only one of the estimation methods used – FEM and POLS, respectively. The increase in the Beta coefficient value and the tracking error value could be explained by growth of assets under management only partly and the results should be treated with caution. It must be noticed here that for certain empirical studies, where similar risk measures were applied, the results were also ambiguous (*e.g*. Andreu and Pütz, 2012).

Table 4

The Impact of Fund Attributes on Investment Risk

Panel A: Total sample	POLS				FEM			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Variables	SD	SemiSD	Beta	TE	SD	SemiSD	Beta	TE
SIZE	0.0024 ***	0.0013 ***	0.0298	-0.0017 **	0.0022 ***	0.0009 *	0.0309 **	-0.0010
	(0.0007)	(0.0004)	(0.0183)	(0.0007)	(0.0008)	(0.0006)	(0.0151)	(0.0007)
AGE	-0.0039 ***	-0.0031 ***	0.1992 ***	0.0021 ***	-0.0065 ***	-0.0051 ***	0.2153 ***	0.0021 ***
	(0.0011)	(0.0008)	(0.0153)	(0.0008)	(0.0011)	(0.0009)	(0.0160)	(0.0008)
FamilySIZE	0.0008	0.0006 *	-0.0235	0.0019 ***	0.0012 *	0.0011 **	-0.0264 **	0.0015 ***
	(0.0005)	(0.0004)	(0.0146)	(0.0005)	(0.0007)	(0.0005)	(0.0120)	(0.0005)
INVEST.POL	0.0003	0.0001	0.0642 ***	0.0026 ***	0.0118 ***	0.0049 ***	0.2671 ***	-0.0004
	(0.0008)	(0.0005)	(0.0182)	(0.0009)	(0.0011)	(0.0005)	(0.0267)	(0.0011)
constant	-0.0001	-0.0001	-0.0170 ***	-0.0005 *	-0.0023 ***	-0.0021 ***	-0.0478 ***	0.0005 **
	(0.0002)	(0.0001)	(0.0060)	(0.0003)	(0.0003)	(0.0002)	(0.0048)	(0.0002)
No. Observations	1395	1398	1407	1407	1395	1395	1407	1407
R-square	0.7821	0.638	0.8453	0.5037	0.8089	0.6668	0.8803	0.5887
Wald (joint)	4219 **	3075 **	4327 **	739.2 **	568.7 **	299.9 **	1776 **	25.56 **
Wald (dummy)	0.0003	0.0783	8.0310 **	3.4030	222.1 **	189 **	37.14	9.020
Panel B: Larger Funds	POLS				FEM			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Variables	SD	SemiSD	Beta	TE	SD	SemiSD	Beta	TE
SIZE	0.0039 **	0.0035 ***	0.0412	-0.0024 **	0.0073 ***	0.0051 ***	-0.0197	0.0016
	(0.0018)	(0.0011)	(0.0304)	(0.0011)	(0.0018)	(0.0019)	(0.0219)	(0.0014)
AGE	-0.0057 ***	-0.0042 ***	0.1484 ***	-0.0004	-0.0091 ***	-0.0067 ***	0.1959 ***	-0.0006
	(0.0019)	(0.0010)	(0.0207)	(0.0011)	(0.0023)	(0.0015)	(0.0282)	(0.0015)
FamilySIZE	-0.0016	-0.0014 *	-0.0231	0.0003	-0.0026	-0.0027	-0.0301	-0.0032 **
	(0.0011)	(0.0008)	(0.0231)	(0.0006)	(0.0024)	(0.0022)	(0.0299)	(0.0014)
INVEST.POL	0.0009	-0.0008	0.0817	0.0072 ***	-0.0169 **	-0.0104 *	0.2000 **	0.0180 ***
	(0.0030)	(0.0019)	(0.0514)	(0.0019)	(0.0071)	(0.0060)	(0.0868)	(0.0041)
constant	0.0297	0.0064	-0.0579	0.0597 ***	-0.0022	0.0110	1.1409 **	0.0503 **
	(0.0337)	(0.0237)	(0.4075)	(0.0230)	(0.0400)	(0.0315)	(0.4981)	(0.0214)
No. Observations	344	340	344	344	344	340	344	344
R-square	0.0846	0.0733	0.2849	0.1736	0.36006	0.2453	0.7159	0.4992
Wald (joint)	15.11 **	33.51 **	54.45 **	64.43 **	53.81 **	58.97 **	81.54 **	35.5 **
Wald (dummy)	0.7741	0.0732	0.0202	6.724 **	47.96	57.90	154.9 **	47.24
Panel C: Smaller Funds	POLS				FEM			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Variables	SD	SemiSD	Beta	TE	SD	SemiSD	Beta	TE
SIZE	0.0022 **	0.0007	0.0415	-0.0015	0.0015	-0.0011	-0.0105	0.0018
	(0.0011)	(0.0009)	(0.0292)	(0.0011)	(0.0013)	(0.0014)	(0.0284)	(0.0017)
AGE	-0.0017	-0.0021 *	0.2504 ***	0.0051 ***	-0.0050 ***	-0.0039 **	0.2729 ***	0.004 ***
	(0.0013)	(0.0012)	(0.0284)	(0.0011)	(0.0017)	(0.0019)	(0.0280)	(0.0011)
FamilySIZE	0.0007	0.0019 ***	-0.0431 **	0.0002	0.0003	0.0006	-0.0309	0.0017
	(0.0009)	(0.0006)	(0.0209)	(0.0008)	(0.0020)	(0.0013)	(0.0304)	(0.0015)
INVEST.POL	0.0014	0.0019	0.1901 ***	0.0041	0.0006	-0.0086 **	-0.1991 **	-0.0117 **
	(0.0026)	(0.0018)	(0.0589)	(0.0027)	(0.0037)	(0.0042)	(0.0856)	(0.0055)
constant	-0.0020	-0.0197	0.0096	0.0249	0.0141	0.0309	0.3700	-0.0565
	(0.0194)	(0.0130)	(0.4849)	(0.0193)	(0.0502)	(0.0346)	(0.7677)	(0.0375)
No. Observations	344	339	344	344	344	339	344	344
R-square	0.0309	0.0548	0.4225	0.0629	0.4451	0.3523	0.7584	0.5704
Wald (joint)	10.34 *	26.88 **	273.3 **	31.37 **	10.12 *	10.02 *	83.63 **	7.467
Wald (dummy)	0.0106	2.281	0.0004	1.668	103.1 *	49.63	66.18	12.82

Note: The independent variables are fund size calculated as a natural logarithm of the value of fund i's assets under management; fund age computed as a natural logarithm of the number of months from the first pricing of unit share; family fund size calculated as a natural logarithm of the total assets of funds under asset management company; investment policy means 1 when funds invest in small and medium cap equity, while 0 – in universal stocks.
****, **, * indicate significance at 1%, 5% and 10% levels, respectively. Robust standard errors are given in parentheses.*
Source: Own work.

The factor which influences risk measures most is one defining the fund age. The statistically highly significant values were observed for all the models applied in the total research sample. Fund age was negatively related to variability measures (SD and SemiSD), which could be demonstrated by the fact that younger and less experienced funds take risks more frequently, which, in turn, leads to higher variability of investment results. On the other hand, the older the fund is the significantly higher value of portfolio sensitivity to overall market movements is. For instance, the Beta coefficient value increased by approx. 2% along with the 10% growth in the age of Polish funds. However, fund age could be a driver triggering marginal deviations of returns on a benchmark (tracking error). It represents a relatively coherent view of the age factor in the risk analysis and corresponds well with the findings presented in the finance literature. The conclusion concerning fund age as an eroding risk driver is similar to the findings of Golec (1996), who established that older funds obtained lower variable returns, but on the other hand, the funds were able to hold portfolios that were more sensitive to the changes in the benchmark value. However, it should be mentioned that a risk level is derived from the adopted investment strategy applied by a given manager. Staff turnover could occur over long periods of funds' operation, but this study does not take the fluctuation of manager resources into account. Family fund size was important mainly for the models whose parameters were estimated by FEM. The most noticeable influence of the factor was observed for the tracking error, yet in this case the impact should be compared to the results obtained for the subgroups of funds (Panels B and C). The applied investment policy translates into risk level for the funds investing in small and medium cap equity to a marginal extent.

What is critical for the final conclusions is the comparative result for two subsamples of funds. As is presented in Table 4 (see Panels B and C), the fund size factor turned out to impact the risk measured by SD and SemiSD positively, especially for the large funds. Therefore, the findings regarding dependence of risk on the size of assets should be limited virtually to these measures and to the large funds. The most unequivocal empirical results, which are convergent with those obtained for the total sample, concerned the fund age for both large and small funds. As the age of individual funds grew, their returns were relatively more stable over time, and at the same time more vulnerable to the market index changes, in particular in the case of large funds, where the risk level was calculated as the Beta coefficient. It was noticed for the small funds that returns' deviations from the benchmark, computed as tracking error, were higher among the older entities. The above-mentioned findings are only partly consistent with those of Trzebiński and Majerowska (2019), who analysed equity funds, albeit to a lesser extent, in the context of time span and the risk measures used.

After dividing the sample into small and large funds, FamillySIZE was generally no longer significant and, hence, the conclusions drawn based on the total sample should be interpreted with caution. The strongest results concerning the investment policy applied by the discussed funds, similar to the findings regarding Panel A, were observed for the large funds in the models where tracking error was a dependent variable. However, the influence of the INVEST.POL factor on risk measures might be interpreted equivocally in both analysed subsamples. This observation seems interesting as it contradicts the conclusions presented in papers from more developed markets. Rodriguez (2015) found that a sample of micro-cap funds was riskier than samples of small-cap and mid-cap funds in relation to the total and idiosyncratic risk metrics applied.

To conclude, the fund attributes may be defined as risk drivers. This statement is adequate for several organisational factors used in the risk analysis of equity funds. For instance, fund age proved the most significant and restrictive of returns' variability. For the large funds,

assets under management were an important factor as returns could be changeable due to fund size itself. It was observed in the analysis that the results depended on the applied risk measure and the used estimation method to a certain extent. The last conclusion corresponds well with the findings of Högholm, Knif, Koutmos and Pynnönen (2017), who confirm that the results are sensitive to the employed methodological approach. Finally, fund attributes may be utilised by the mutual funds and individual investors for investment risk evaluation.

5. Summary

The measurement of investment risk in mutual funds, defined in a variety of ways, supports the managers' effectiveness evaluation and performance analyses. The risk level can depend on some organisational characteristics related to the mutual funds. The examination of influence of fund attributes on the risk specific to the discussed entities could be important to both the clients of collective investment institutions and to the fund managers.

The aim of this paper was to examine the relation between the investment risk level and organisational characteristics describing the analysed mutual funds. The analysis covered a relatively large segment of open-end equity funds. The research sample consisted of 82 domestic funds operating in Poland during the 2000-2015 period. The methodological strategy of the study was based on two regression methods for time-series cross-section data, *i.e.* pooled ordinary least squares and fixed effects regression. The used risk metrics, which were dependent variables, included standard deviation, semideviation, Beta coefficient and tracking error. The main independent variables were, in turn, fund age, fund size and family size. The diversity of portfolio composition, including those investing in small and medium capitalisation equity and universal stocks, encouraged the author to examine the investment risk both in the total sample and, separately, in the subsamples consisting of large and small funds.

As a result of the analysis, it was found that the AGE factor had a statistically significant influence on investment risk most frequently, and funds' ageing resulted in limiting the variability of their returns. On the other hand, growth of experience, calculated as the age of the analysed entities, brought about a significant dependence of unit price movement sensitivity to the returns on benchmark changes. It was observed that the analysed entities were characterised by higher return deviations from the index return caused by older age in both subsamples. The mentioned influence on investment risk might result from some standards that have evolved over many years of the funds' operation, as well as internal procedures implemented by investment committees of older funds. The factor related to asset size was also crucial, especially for the large funds, as it made the generated returns more variable. However, the positive relationship between fund size and some risk measures should not be surprising because the less liquid European markets face different limitations concerning securities held in a portfolio. Furthermore, it must not be overlooked that the mutual fund industries in the CESEE countries are still in the developing phase and the mutual funds are likely to expand in size while trying to maintain efficiency. On the other side, drawing more serious conclusions on the basis of family size factor is unjustified. The analysis enabled the observation that the results were somewhat dependent on the applied risk measure and the used estimation method.

Finally, fund attributes may be treated as risk drivers and exploited by the mutual funds and individual investors for investment risk evaluation. Moreover, what contributes to the originality of the research is the application of a relatively extensive set of risk measures in

the context of data from an industry that is representative for the European developing markets. However, the study is not free from limitations. The applied data of fund characteristics were transformed by means of the natural logarithm, and thus some data were lost, *e.g.* the opportunity to include asset flows or loyalty of investors. Therefore, further analysis should be extended by other characteristics as well as risk measures allowing for market tendencies. It would also be interesting for the study to make an attempt at capturing unobservable random variables that influence observations, *e.g*. by the means of the Markov chains.

Acknowledgements

The author acknowledges the financial support of the National Science Center (NCN), Poland, Project no. 2014/15/D/HS4/01227 entitled "Determinants of Mutual Fund Performance: Managerial characteristics and fund attributes".

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