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MANAGERIAL FACTORS IN INVESTMENT RISK: EVIDENCE FROM POLISH MUTUAL FUNDS

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Abstract

The aim of this study is to examine whether investment risk is related to the managerial factors characterising portfolio managers. The study employs four risk measures and a set of individual manager characteristics, including socio-demographic variables determining a manager profile. The analysis is conducted based on data for 144 portfolio managers from 43 domestic equity funds operating in Poland in the period 2000-2015. The examinations are made possible by using static panel models. The obtained results indicate the existence of a relationship between managerial characteristics and risk measures, such as: standard deviation, beta coefficient, tracking error and bear-market percentile ranking. To our knowledge, it is the first paper to evaluate the investment risk of Polish mutual funds in relation to managerial characteristics.

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INTRODUCTION

In the field of finance, investment risk can be defined as the probability of losses with respect to the expected return on any particular investment. As regards mutual funds, risk might be interpreted as the level of change in the unit value, represented by variability of returns. Furthermore, risk can be described based on the impact of market turmoil on the changes in the price of a given holding in a portfolio. Thus, fund risk means also a benchmark's reflection in fund returns. Nevertheless, fund investors should treat investment risk, apart from the achieved returns, as a key factor when selecting a fund.

In general, investment decisions made by portfolio managers, including the accepted risk level, may be related to individual characteristics. Managerial characteristics are associated with acquired education, management tenure, and overall experience in the financial sector. The studies also concentrate on the socio-demographic data determining a manager profile. According to the human capital theory, factors such as education, experience, training, and the acquired certification attesting to professional qualification improve specialised professional skills, which should be reflected in the obtained investment results and risk proclivity. However, the financial literature analysing mutual funds from the perspective of the efficient market theory draws conclusions concerning the lack of abnormal returns without purchasing riskier investments.

This paper aims to examine whether investment risk is related to the managerial factors characterising portfolio managers. Empirical research on the determinants of investment risk in mutual funds could be significant for asset management companies and investors for several basic reasons, which can be complementary. Firstly, from the viewpoint of a business entity, mutual funds might cooperate with managers who demonstrate characteristics that are desirable for their clients. Individual characteristics might be a driver, to an extent, of less volatile returns. Secondly, for psychological and investment reasons, clients may make fund selection decisions based on fund managerial characteristics. This is possible because such data help investors choose funds whose managers may be predisposed to achieve better and less variable returns in the future.

The remainder of the present paper is organised as follows. Section 2 presents a brief literature review.

Section 3 includes the data set, the empirical strategy and the description of risk measures. Section 4 discusses and interprets the obtained empirical results. The final section summarises the major findings.

EXISTING LITERATURE

This study relies on a few strands of literature. The first group of works concentrates on demographic aspects. One of the theoretical studies concerning investment decisions made by managers is the paper by Scharfstein and Stein (1990). They examined some of the forces that could lead to herd behaviour in investment. They noticed that managers with stronger career concerns, especially younger ones, had lower risk levels, in particular regarding unsystematic risk, and followed more conventional investment styles. Therefore, the basic factor included in the related studies may be a manager's age. In the empirical study by Chevalier and Ellison (1999b), the labour market for mutual fund managers was discussed. Data regarding 453 managers of growth as well as growth and income mutual funds were sampled over the period 1992-1994. The researchers analysed fund attributes (such as fund assets, family size and expense ratio), as well as managerial characteristics (including managers' age and tenure) in relation to performance measures and risk metrics, e.g. systematic and unsystematic risk ratios. It was shown that younger managers held less unsystematic risk and had more conventional portfolios. It resulted from the fear of being removed from their positions due to bad performance.

Another commonly analysed factor is gender. The research on the relation between gender and risk aversion conducted so far has revealed that men and women differ as far as the perception of money, risk, and investment is concerned. For instance, Bliss and Potter (2002) analysed a sample of 2,571 individually managed domestic equity funds and 652 international equity funds operating for at least 10 years through the end of 2000. They took fund manager characteristics, such as in particular age, tenure and quality of education, into consideration and noticed that female managers held portfolios with marginally more risk than their male counterparts, depending on the risk measure used. The applied measures included total risk (standard deviation), market risk (beta), and bear-market rank (the Morningstar percentile measure of fund risk). Niessen-Ruenzi and Ruenzi (2011), in turn, tried to

find some organisational and managerial determinants of asset inflow to mutual funds while analysing performance of all singularly managed US equity funds from 1992 to 2009. They noticed that female fund managers followed more persistent investment styles than male ones although the achieved performance was almost equal in both groups.

The study by Switzer and Huang (2007) aimed to examine whether performance of 1,004 small and mid-cap funds was related to individual characteristics of fund managers, e.g. gender. By means of the three-stage least square regressions of fund risk, measured by systematic risk (beta), they discovered that female managers demonstrated considerably less risk aversion and held lower risk portfolios than their male counterparts at a statistically significant level. Moreover, women engaged in more frequent trading. They also noticed that MBA holders tended to show higher risk, yet the results were statistically insignificant.

A manager's experience at the helm of a fund could also be classified into the above strand of literature. The most popular managerial factor investigated in studies on mutual funds is a manager's tenure. Philpot and Peterson (2006) examined the influence of individual manager characteristics on real estate mutual fund performance. Using the data of 63 mutual funds from the period 2001-2003, they analysed managers' tenure, holding of a professional certification, experience in the industry, and management structure. They argued that managers with a longer tenure tended to accept higher market risk levels.

The next strand of research pertains to educational and career trajectory characteristics, such as the MBA degree. The quality of the received education might be directly related to the level of a manager's ability to achieve good performance. Chevalier and Ellison (1999a) focused on the relationship between managerial characteristics (including a manager's age, the quality of a manager's education measured by the SAT score, a manager's tenure and the MBA designation), and fund performance. Using the data of 492 portfolio managers of actively managed growth as well as growth and income funds operating in the period 1988-1994, they noticed that managers with MBA degrees showed a statistically significant tendency to purchase stocks with low book-to-market ratios. Thus, MBAs hold more risky portfolios. They also argued that younger managers could work harder because they were more likely to be made redundant for poor performance. According to Boyson (2002), MBA

holders and longer-tenured managers generated returns with low volatility. She obtained the results on the basis of a sample including 982 hedge funds operating in the period 1994-2000. In order to capture investment risk, she used standard deviation, beta coefficient and tracking error as risk measures.

Apart from the mentioned educational aspect (MBA), some authors apply certification attesting qualification, especially the CFA diploma, as a factor determining performance. Andreu and Pütz (2012) tried to find out what the fact of holding two business degrees reveals about the investment behaviour of professional investors. They investigated a CFA designation and an MBA degree in performance, risk and style of domestic equity fund managers. The time perspective was 1996-2009. Andreu and Pütz concluded that MBAs and CFAs showed less extreme and more persistent performance. Moreover, managers with both degrees demonstrated more stable risk levels and less extreme investment styles. In the study by Gregory-Allen and Shawky (2018), the employed risk measures were the beta coefficient from the CAPM model and tracking error. Their sample was limited to 890 equity and fixed income funds where the information about CFA and/or MBA of key portfolio managers was available. The study covered the period 2005-2007. The researchers found no significant differences in performance resulting from managerial characteristics but noticed that CFAs reduced and MBAs increased portfolio risk.

Investigations concerning manager characteristics from European emerging markets have been conducted extremely rarely. The paper by Naidenova, Parshakov, Zavertiaeva and Tomé (2015), who analysed human capital characteristics of managers from Russian equity funds in relation to performance, deserves a mention here. Their results indicate that individual characteristics allow obtainment of abnormal returns. Managers with economic education and ones who graduated from Moscow universities performed better than others. The relationship between fund performance measures and a manager's experience has an inverted U-shape. In Poland, this kind of study is still non-existent. To our knowledge, there is only one paper confronting fund performance with the changes on the position of a portfolio manager (Asyngier & Miziołek, 2017). However, Filip (2018) tried to describe managers of Polish mutual funds on the basis of socio-demographic data, including age, gender, education, experience, and professional qualifications of local portfolio managers. On the basis of 336 individuals, it was

possible to describe the profile of a domestic mutual fund manager. Given the above, the analyses of the relations between individual characteristics and the effects of asset management in Poland, including investment risk, could fill in the existing knowledge gap in this area.

DATA AND EMPIRICAL METHODOLOGY

This part describes the data set, empirical strategy and risk measures. However, three research hypotheses are presented first. They serve the purpose of meeting the objective formulated in the introduction. The papers reviewed in the previous Section lead us to the following hypotheses:

H1: The demographic characteristics of fund managers do not influence investment risk.

H2: The educational and career trajectory characteristics of fund managers do not influence investment risk.

H3: Empirical results of the analysed relationships are unrelated to the risk measures used.

DATA AND EMPIRICAL APPROACHES

The supplier of a portion of the data was Analizy Online. The obtained reports provided us with the information about the returns of 43 domestic equity funds operating in Poland in the period 2000-2015. The institution which reports this kind of data also publishes the names of fund managers along with biographical sketches, including short information about them. However, unlike Morningstar Principia, a professional provider of portfolio tools and data from developed markets, the most useful information about Polish managers is unavailable or inconsistent in the above-mentioned base. To overcome the problem of fragmentary information related to portfolio manager profiles, we decided to complete the human capital base manually on the basis of the information from the website of each mutual fund company, the LEX Informator Prawno-Gospodarczy by Wolters Kluwer Poland, the Polish Financial Supervision Authority (KNF), the CFA (Chartered Financial Analyst) Institute, and various other sources, e.g. social media (GoldenLine and LinkedIn). The created database consisted of human capital characteristics and included managers' age, nationality and gender as well as the period of holding their stockbroker licences, and the period of experience in the mutual fund industry. Moreover, the data set contained a list of the higher education institutions from which the managers graduated. The database was completed at the end of 2016 and it is one of the measurable results of the research project implemented in the period 2015-2017. Due to the fact that women are rare in the community of fund managers (below 9%) and a small number of managers with PhD degrees (only 21 out of approx. 240), we resigned from presenting results for variables such as gender and academics. The final set of variables to be analysed for 144 portfolio managers are defined as follows:

TENURE – the tenure, in months, of a fund manager. If the fund is managed by more than one named manager, the average period over which they have managed a particular fund is used;

AGE – the age, in years, of a fund manager. If the fund is managed by more than one named manager, the most senior one is taken into account;

EXPER – the industry experience, in years, of a fund manager. If the fund is managed by more than one named manager, the average period over which they have managed a particular fund is used;

LICENCE – the period of holding a stockbroker or investment adviser licence, in years, of a fund manager. If the fund is managed by more than one named manager, the date of oldest licence is taken into consideration;

SCHOOL – a dummy variable takes the value 1 if any fund manager has graduated from a university of economics, 0 if they have graduated from a university of technology or another higher education institution;

CFA – a dummy variable takes the value 1 if any fund manager indicates a CFA designation, 0 otherwise;

TEAM – a dummy variable takes the value 1 if the fund has more than one manager, 0 otherwise;

CHANGE – a dummy variable takes the value 1 if the fund manager has been made redundant or if any of the team members has changed, 0 otherwise.

It should be mentioned that all gathered data concerning individual characteristics of fund managers constitute approx. 15% of the observations of the total population in the study period. The collation of summary statistics related to both dependent and independent non-binary variables can be treated as an introduction to the results. Table 1 presents the preliminary description of the collected set of data on managerial characteristics and fund risk measures.

A preliminary description of the analysed variables is

Table 1: Summary statistics for the applied variables

Panel A: Managerial characteristics						
Variable	**Observations**	**Mean**	**Median**	**Std. Deviation**	**Minimum**	**Maximum**
TENURE	236	30.149	21	28.915	1.0	162.3
AGE	165	37.818	37	7.242	24.0	56.0
EXPER	181	8.536	8	5.059	1.0	22.0
LICENCE	181	2.275	2.4	0.621	0.0	3.1
Panel B: Risk measures						
Variable	**Observations**	**Mean**	**Median**	**Std. Deviation**	**Minimum**	**Maximum**
σ	246	0.047	0.044	0.017	0.001	0.101
β	242	0.902	0.920	0.159	0.383	1.401
TE	246	0.019	0.017	0.011	0.004	0.077
BearRank	246	0.479	0.458	0.107	0.305	0.775

Source: Own study

presented in Table 1. The highest value of variability among independent variables was reported for *TENURE*. However, it results from monthly calculations as opposed to the rest of the presented managerial characteristics computed in years. In relation to risk measures, the greatest dispersion of the data set from its mean was observed for beta coefficients and the lowest – for tracking errors. Due to the lack of normal distribution of some applied variables, they were transformed into approximately normal data. We decided to normalise the data (*TENURE, AGE, EXPER* and *LICENCE*) with the natural logarithm for further stages of the study.

In order to present the relations between multiple independent variables and a dependent variable in quantitative terms, the multivariable regression model 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 estimation of static panel models was conducted through the application of the least-squares dummy variables (LSDV) after running diagnostics with the use of the Hausman (1978) test. The adopted approach was the fixed-effects model (FEM). It was facilitated by use of OxMetrics statistical software. The relation between investment risk and individual characteristics of fund managers can be established on the basis of the following formulas:

$$RiskMeasure_{i,t} = f(TENURE_{i,t}; AGE_{i,t}; SCHOOL_{i,t}; CFA_{i,t}; TEAM_{i,t}; CHANGE_{i,t}), \quad (1)$$

$$RiskMeasure_{i,t} = f(TENURE_{i,t}; EXPER_{i,t}; SCHOOL_{i,t}; CFA_{i,t}; TEAM_{i,t}; CHANGE_{i,t}), \quad (2)$$

$$RiskMeasure_{i,t} = f(TENURE_{i,t}; LICENCE_{i,t}; SCHOOL_{i,t}; CFA_{i,t}; TEAM_{i,t}; CHANGE_{i,t}), \quad (3)$$

The verified null hypothesis assumes that the investment risk level is unrelated to managerial characteristics and hence the value of the estimated parameters is 0. The statistical significance of the coefficients was verified with the t-test. The null hypothesis can be rejected in favour of the alternative hypothesis providing that risk ratios depend on certain managerial factors when the absolute value of t-statistics calculated from the sample is higher than the critical value for a given significance level. We used robust standard errors suggested by Arellano (2003) in order to minimise possible negative effects of autocorrelation and heteroscedasticity (HAC). Moreover, the study used the Wald statistic to test the joint significance of several coefficients.

RISK MEASURES

Risk measurement is one of the elements of asset management evaluation. Its calculation arises at least from two aspects. The risk ratio could be an absolute or a relative measure. The first of the applied ratio is standard deviation. The absolute variability metric illustrates the variance between the investment effect obtained and forecast and it can be treated as a measure for evaluating the dispersion of the probability distribution. This metric is defined as a measure of total risk and is calculated based on the well-known formula:

$$\sigma_{i,t} = \sqrt{\frac{\sum_{i=1}^{n}(r_{i,t} - \bar{r}_i)^2}{n-1}}, \quad (4)$$

where $\sigma_{i,t}$ 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 c overed.

The second risk metric is one of the relative measures which reflect the influence of market factors on returns. The risk measurement method used is the beta coefficient, which represents systematic risk recognised as volatility (cf. Tarczyński, Witkowska & Kompa, 2013). It is defined as a measure of unit price sensitivity to movement in market returns and is expressed by the following formula:

$$\beta_{i,t} = \frac{Cov(r_i, r_m)}{Var(r_m)} \ , \tag{5}$$

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 (Warsaw Stock Exchange WIG Index), with returns achieved by fund i; $Var(r_m)$ is the variance of stock market returns.

Another relative risk measurement method is tracking error. It can be treated as a measure of active risk and it is shown as the difference between fund returns and its benchmark index return. The finance literature presents various manners of calculating the extent to which a portfolio behaves like its benchmark (cf. Petajisto, 2013):

$$TE_{i,t} = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (r_i - r_m)^2} \ , \tag{6}$$

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

The last measure applied is the bear-market percentile rank adopted from the Morningstar (2018) approach. A bear market is defined as all months, in yearly periods, when the return on WIG is worse than the risk-free return calculated as a weighted average yield on 90-day Treasury bills sold at auctions. Like Morningstar, we added up fund performance during each downturn month to reach the total bear-market return. Based on these returns, each fund was then assigned a percentage rank. A percentile ranking showed a relative position of a fund in performance distribution in a given period. It was calculated from the following formula:

$$BearRank_{i,t} = \frac{\overline{r_{i,t}} - r_{max}}{r_{min} - r_{max}} \ , \tag{7}$$

where: $BearRank_{i,t}$ is the percentile ranking of fund i in period t; r_{max} means the maximum value of the relative performance to all funds in its asset class in period t; r_{min} is the minimum value of the relative performance in period t. The risk rank details how a fund has performed relative to all funds during downturns. The most favourable percentile rank is 1 and the least favourable percentile

rank is 100. The presented gauge can be treated as an alternative to downside risk measures, i.e. semi-deviation. The metrics measure the potential downside variability, which takes account of losses rather than unexpected gains (cf. Jajuga & Jajuga, 2006).

EMPIRICAL RESULTS

The results of this paper will be presented in a table and discussed afterwards. The four panels in Table 2 are defined as different risk measures. Moreover, the applied models differ from each other by the demographic variables used. Due to their relatively high correlation, the following models (1), (2) and (3) include replacement variables: *AGE, EXPER* and *LICENCE*, respectively.

The obtained results are presented by the exogenous variables used. The main criterion of the division is the following types of variables: demographic and educational. In the former group of variables, as was shown in Table 2, the main variable, *TENURE*, was statistically significant only in the models where the beta coefficient and tracking error were endogenous variables (see panels B and C). In the former case, the sign of the factor indicates a positive relationship with systematic risk. It means that the longer the tenure as a portfolio manager, the higher the sensitivity to movement in market returns. It needs to be remembered that the beta coefficient level reached by a given fund is considerably affected by allocation decisions rather than stock-picking, unlike in the case of alpha, a performance measure. These findings correspond well with the impact of the said factor on the tracking error (TE) value. Here, negative and, for some models, statistically significant *TENURE* values influence the annualised standard deviation of excess return, calculated as the difference between a portfolio's returns and a benchmark's returns negatively. This can be seen as maturity of a manager on a given position for setting fund risk in relation to the benchmark. As the period in which a manager managed a fund's investment portfolio was extended, risk aversion, which could result in reducing the added value to fund participants, increased.

The next two characteristics, *EXPER* and *LICENCE*, reacted in a similar way to the changes in the values of risk measures. The former affects tracking error negatively (see panel C). The interpretation of this could be similar to the above. More experienced managers might avoid active risk, calculated as a fund's consistency versus a benchmark over yearly periods. For other risk measures, the analysed metrics were inconsequential. The impact of the latter characteristic, understood as the period of holding the licence (*LICENCE*), on active risk (TE) was also negative and statistically significant. At the same time, the factor might, to a limited extent, react positively to the beta coefficient, which means that the prolonged period of

Table 2: Panel data analysis

Panel A. Risk measure: Standard Deviation

Variable	(1)			(2)			(3)		
	Coefficient	*t*-statistic	*p*-value	Coefficient	*t*-statistic	*p*-value	Coefficient	*t*-statistic	*p*-value
const	0.03437	4.020	0.000	0.04060	4.860	0.000	0.03283	3.980	0.000
TENURE	-0.00292	-1.270	0.207	-0.00219	-0.979	0.329	0.00116	0.620	0.536
AGE	0.00062	0.443	0.659						
EXPER				-0.00249	-1.230	0.220			
LICENCE							-0.00046	-1.440	0.152
SCHOOL	-0.00253	-0.618	0.537	-0.00214	-0.520	0.604	-0.00546	-1.840	0.068
CFA	-0.00278	-0.823	0.412	-0.00218	-0.586	0.559	-0.00275	-0.737	0.462
TEAM	0.00839	1.850	0.066	0.00958	2.480	0.014	0.01020	2.290	0.024
CHANGE	0.00047	0.169	0.866	0.00067	0.247	0.806	0.00111	0.390	0.697
R-squared			0.487			0.490			0.447
Adj. *R*-squared			0.472			0.475			0.425
Wald test			12.950			22.920			16.170
Observations			208			208			161

Panel B. Risk measure: Beta Coefficient

Variable	(1)			(2)			(3)		
	Coefficient	*t*-statistic	*p*-value	Coefficient	*t*-statistic	*p*-value	Coefficient	*t*-statistic	*p*-value
const	0.17316	1.470	0.144	0.07811	0.574	0.567	-0.14992	-1.200	0.233
TENURE	0.09701	3.140	0.002	0.09237	2.990	0.003	0.12144	3.220	0.002
AGE	-0.02299	-1.300	0.196						
EXPER				0.01204	0.350	0.727			
LICENCE							0.00786	1.820	0.071
SCHOOL	0.09616	1.890	0.061	0.10345	2.040	0.043	0.06902	1.670	0.097
CFA	-0.01642	-0.305	0.760	-0.01697	-0.373	0.709	-0.00017	-0.004	0.997
TEAM	0.02728	0.893	0.373	0.00331	0.093	0.926	0.01292	0.332	0.740
CHANGE	0.07739	2.040	0.043	0.07785	2.020	0.045	0.08369	1.910	0.058
R-squared			0.675			0.668			0.622
Adj. *R*-squared			0.666			0.658			0.607
Wald test			75.230			30.620			52.930
Observations			210			210			162

Panel C. Risk measure: Tracking Error

Variable	(1)			(2)			(3)		
	Coefficient	*t*-statistic	*p*-value	Coefficient	*t*-statistic	*p*-value	Coefficient	*t*-statistic	*p*-value
const	0.02832	5.990	0.000	0.03694	7.740	0.000	0.03881	6.580	0.000
TENURE	-0.00420	-2.700	0.008	-0.00323	-1.950	0.053	-0.00163	-1.060	0.291
AGE	0.00093	1.470	0.143						
EXPER				-0.00332	-2.260	0.025			
LICENCE							-0.00074	-4.190	0.000
SCHOOL	-0.00536	-2.780	0.006	-0.00488	-2.630	0.009	-0.00794	-5.620	0.000
CFA	-0.00535	-2.710	0.007	-0.00456	-2.980	0.003	-0.00440	-2.610	0.010
TEAM	0.00151	0.508	0.612	0.00319	1.270	0.207	0.00298	1.240	0.217
CHANGE	0.00027	0.193	0.847	0.00052	0.377	0.707	-0.00023	-0.145	0.885
R-squared			0.534			0.547			0.552
Adj. *R*-squared			0.520			0.533			0.534
Wald test			43.430			45.340			82.390
Observations			208			208			161

Panel D. Risk measure: Bear-Market Rank

Variable	(1)			(2)			(3)		
	Coefficient	*t*-statistic	*p*-value	Coefficient	*t*-statistic	*p*-value	Coefficient	*t*-statistic	*p*-value
const	0.39800	6.380	0.000	0.35948	5.860	0.000	0.45073	6.280	0.000
TENURE	0.0.2641	1.460	0.146	0.02556	1.380	0.171	0.02521	1.120	0.266
AGE	-0.01152	-1.710	0.090						
EXPER				0.00062	0.038	0.970			
LICENCE							-0.00442	-1.490	0.138
SCHOOL	-0.06261	-2.950	0.004	-0.05778	-2.720	0.007	-0.04565	-1.480	0.142
CFA	0.01480	0.633	0.528	0.01610	0.605	0.546	0.00469	0.175	0.861
TEAM	-0.01668	-0.439	0.661	-0.02718	-0.721	0.472	-0.01427	-0.412	0.681
CHANGE	0.04811	2.080	0.039	0.04859	2.190	0.030	0.03660	1.570	0.120
R-squared			0.504			0.499			0.427
Adj. *R*-squared			0.490			0.484			0.405
Wald test			20.330			11.480			10.190
Observations			213			213			164

Source: Own study

holding the position of a broker or an investment adviser by a fund manager results in a consistent direction of changes in unit and benchmark values (see panel B). The last of the applied characteristics (*AGE*) from among the ones related to demographics (three correlated variables) was completely insignificant.

As regards educational features, the profile of the higher education institution from which a fund manager graduated can be distinguished. The *SCHOOL* variable, which specifies whether a given manager graduated from a university of economics or another higher education institution, not necessarily with an economic profile, e.g. a university of technology, was allowed for in this study. It was decided that variables referring to graduates from universities and universities of technology would be ignored due to a relatively low number of observations (there were ca. 27% of graduates from the former type of higher education institutions and ca. 20% of graduates from the latter). Moreover, in the course of the initial tests, the results obtained for the variables related to other types of higher education institutions (graduates of universities and universities of technology) proved statistically insignificant. The results of the omitted variables are available and can be provided upon request. As far as the *SCHOOL* variable is concerned, it can be stated with the probability of 99% that managers who graduated from universities of economics were able to reduce the tracking error value, and hence the difference between the index rate of return and the managed fund's rate of return was more often not very significant in this case (see panel C). The results achieved with the use of the beta coefficient as a dependent variable pointed to a more frequent sensitivity of the results achieved by the managers who graduated from universities of economics to changes of the benchmark value (see panel B). The association of the *SCHOOL* variable with the bear-market ranking also deserves attention. It was noticed that managers from universities of economics took less risk in their investments, which allowed their funds to be ranked lower by a bear-market (see panel D). Regretfully, due to the lack of data, we were unable to verify whether the majors completed by the managers translated into the acceptable risk level of the fund managed by a given manager.

The *CFA* variable, which indicated the fact that a manager held a prestigious certificate confirming professional qualifications, contributed to a higher market risk aversion. It was manifested in tracking error values as the returns achieved by *CFA* holders were characterised by minor deviations from changes in the rates of return on the benchmark (see panel C). However, no significant results were observed when employing other risk measures.

The next factor, related to the portfolio management structure, is *TEAM*. The finance literature delivers a lot of findings that are consistent with the results of the

study. As was presented in Table 2, team managed funds demonstrated a much greater variability of returns than individually managed funds. The included risk measure was standard deviation (see panel A). It means that the responsibility for returns is spread among co-managers or teams and therefore they can afford to make riskier decisions.

The last variable applied was *CHANGE*. The yearly returns of funds, where a change of a manager's position took place, seemed related to systematic risk (beta) and, partly, to the fund position in the distribution of returns in downturn periods (bear-market ranks). For the models where the beta coefficient was an endogenous variable, its values were determined, among others, by any change of the fund's manager or team members. The situation when any of the managers was replaced resulted in the enhancement of the sensitivity to movement in market returns (see panel B). Furthermore, the changes had a negative effect on a relative rank of the fund during downturns (see panel D). However, the specificity of the metric should be remembered.

The values of the coefficient of determination indicated a relatively satisfactory goodness-of-fit in all models, which means that the total variation of the dependent variables was explained by the regression model at 0.4-0.6 levels. Furthermore, the values of the Wald statistic indicated the significance of all models applied.

The results obtained above seem interesting. They allow the verification of the formulated hypotheses, where observable characteristics influenced investment risk. They were both demographic and educational. The risk measures employed in the study varied in terms of their sensitivity towards managerial characteristics and their impact on variability, volatility, active risk, and relative ranks of the fund. However, individual investors also look for the findings concerning the relationship between individual characteristics and the achieved returns. Thus, it should be an object of future research to fulfil the existing knowledge gap.

Concluding Remarks

Investment risk is defined in this paper as variability and volatility of returns, and as measures showing the absolute or relative difference between fund and benchmark returns. It is assumed that the investment decision of portfolio managers, including the accepted level of risk, may be related to individual characteristics. Managerial characteristics are viewed as socio-demographic data determining the manager profile. The studies on the determinants of mutual fund investment risk may be significant for asset management companies as well as investors. First of all, mutual funds might employ managers who display characteristics

that are desirable for their clients from the risk-limited perspective. Consequently, individual investors could treat fund managerial characteristics as a key factor for selecting funds.

The paper aimed to examine whether investment risk was related to the managerial factors characterising portfolio managers. The study employed four risk measures and individual manager characteristics, including socio-demographic variables determining the manager profile. The analysis was conducted for the data on 144 portfolio managers from 43 domestic equity funds operating in Poland in the period 2000-2015. The obtained results indicated the existence of a relationship between managerial characteristics and risk measures, such as: standard deviation, beta coefficient, tracking error, and bear-market percentile ranking.

With regard to the objective and the formulated research hypotheses, it should be noticed that hypothesis *H1* on the influence of the lack of demographic characteristics on investment risk ought to be rejected. As was shown, variables such as: tenure, experience and the period of holding stockbroker licences, could significantly affect the risk level measured as a relation to the benchmark return. Hypothesis *H2* on the influence of the lack of educational and carrier trajectory characteristics on investment risk was also verified negatively. It was noted that graduation from universities of economics, holding of the CFA certificate, management structure,

and changes of a fund manager's position were drivers of investment risk expressed in fund returns. The verification of hypothesis *H3* on the lack of possible discrepancies in the results obtained using the selected risk measures was conducted only indirectly. The risk measures applied in the study varied in terms of their sensitivity towards the utilised managerial characteristics.

The paper makes several contributions to the literature. Firstly, the obtained findings show some differences from and similarities to the existing literature results from more developed markets. Secondly, it encompasses a relatively large number of variables describing the Polish portfolio manager profile, which is rather unique, especially in the literature from CEE countries. Thirdly, the findings of the study include implications for researchers and practitioners, as mentioned earlier. However, they should be also interested in further research concerning the relationship between individual characteristics and the achieved returns. This gives rise to a new research perspective. Fourthly, to our knowledge, it is the first paper to evaluate the investment risk of Polish mutual funds in relation to managerial characteristics. Thus, it enriches the existing finance literature by providing information about the Polish experience and sheds new light on the state of knowledge by addressing the issue of domestic mutual funds, which has not received attention in Poland to date.

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