

Article

Performance of Equity Fund Investment Strategies in Poland

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Abstract: The modern development of the investment funds industry is underpinned by the understanding of the efficiency and quality of asset management regarding the use of various investment strategies. The purpose of the article is to examine investment strategy performance in equity funds domiciled in Poland using standard relative and absolute measures. The proposed method uses the Sharpe ratios, the Treynor ratio and the Jensen ratios. The research covers investment funds, spanning the period 2017–2021. The study (using the Sharpe and Treynor ratios) finds that the financial instruments for investment funds domiciled in Poland may be attractive to conservative investors, as they provide excessive returns compared to the returns of risk-free assets and inflation, but for riskier investors, most of the investment funds analyzed were unattractive (negative value of the returns of funds compared to stock indices). Absolute measures of fund performance, using the Jensen ratio, are limited for comparing all groups of investment strategies. A specific negative feature in the study of investment strategies based on the Jensen ratio is their inefficiency, that is, all statistically significant values of this ratio are negative. The management of ESG-funds with investments in the European financial market was more efficient than most conventional investment funds.

Keywords: investment funds; fund profitability; fund performance; asset management; investment strategy



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1. Introduction

The modern development of the investment funds industry is an important element in ensuring the effective functioning of the financial instruments market and creating opportunities for investors to diversify the allocation of capital. For example, in Q4 2021, the net assets of investment funds in the United States were 22.5 trillion euro; in Europe—15.2 trillion euro; in particular, in Ireland—2.7 trillion euro; in Germany—2.2 trillion euro; in France—1.8 trillion euro. This sector of the financial system is significantly smaller in Central and Eastern Europe: investment funds in Poland have the largest assets (excluding Austria)—29.4 billion euro [1].

According to the results of the analysis of data from the Chamber of Fund and Asset Management of Poland (ISFA) at the end of 2021, the characteristic features of the Polish sector of investment funds (excluding non-public funds) are:

- (1) the predominant role of fund assets managed by Polish providers (the market share of the three largest domestic providers, PKO, Pekao and PZU, is almost 38%);
- (2) foreign providers are dominated by those from Europe (the market share of the three largest foreign providers, NN Investment Partners, Santander and Aviva Investors, was almost 28%);
- (3) the structure of asset types is dominated by bond funds (33.3% of the total net asset value) and non-public asset funds (33.2%). The market share of equity funds is 12.7%;
- (4) equity fund strategies primarily involve investments in domestic market financial instruments (Poland is defined as an investment region for 47% of the fund assets, and a global investment strategy is defined for 40% of the assets).

The current trend in the global investment fund market is to increase attention to investments in the financial instruments of companies that declare the implementation of ESG principles (environmental, social and corporate governance).

Asset managers applied an ESG investment approach to an estimated total of 11 trillion euro in assets by the end of Q1 2021. Around 55% of these assets (6 trillion euro) were managed in investment funds, with the remaining 5 trillion euro managed in discretionary mandates [2].

The confirmation of the growing role of this trend is the publication in the Global Financial Stability Report [3] on the sustainable sector of the investment fund, which, according to the report, can speed up the transition to a green economy.

Sustainable strategies are also being implemented in the Polish market, but the number of such funds is insignificant—22 investment funds at the end of 2021 (according to the data analizy.pl)—of which 9 funds are managed by NN Investment Partners, 5 are managed by Allianz, and only 2 funds are managed by Polish providers (since 2019—PKO Ekologii i Odpowiedzialności Społecznej; 2021—Pekao Ekologiczny). Among ESG funds, only two define Poland as a region of investment in their investment policies (NN Polski Odpowiedzialnego Inwestowania).

The European Union implemented the Sustainable Finance Disclosure Regulation (SFDR) in March 2021, which requires asset managers to make specific sustainability-related disclosures across their product range: (1) Article 8 requires funds that promote sustainability characteristics to specify, in pre-contractual disclosures, how they will promote environmental or social characteristics—or a combination of both—and how the companies in which they invest follow good governance practices; (2) Article 9 requires funds with a sustainability objective to specify, in pre-contractual disclosures, how they will attain such an objective and whether an index was designated as a reference benchmark [2]. Only three investment funds domiciled in Poland operate on the basis of Article 9 SFDR—Amundi Stars Global Ecology ESG, NN (L) Globalny Odpowiedzialnego Inwestowania, Generali Akcji Ekologicznych.

Thus, owing to financial integration into the EU, there is some positive progress in the investment funds sector in Poland, including in relation to current international trends in ensuring sustainable growth within the EU Strategy for Financing the Transition to a Sustainable Economy (2021).

Taking into account the current situation of the investment funds domiciled in Poland, the objective of this article is to investigate the efficiency and quality of asset management of investment funds (ESG and conventional) domiciled in Poland in the context of various investment strategies.

This paper contributes to the existing literature in several ways. First, this study attempts to calculate absolute measures for investment strategy performance in equity funds in Poland based on the most well-known regression models used to evaluate investment funds on the developed financial markets. Second, this study is one of the few contributions to date that has attempted to quantify the performance of ESG-funds in Poland.

The paper is organized as follows: Section 2 presents the research background of the issue of fund profitability and performance. Section 3 describes the research method based on the calculation of the relative and absolute performance measures for investment fund strategies, as well as data characteristics. Section 4 reports results where several investment strategies from asset managers in Poland are compared. Sections 5 and 6 present discussion and conclusions for scientists, investors and asset managers.

2. Literature Review and Hypotheses

The analysis of recent research can be carried out in two aspects (1) the performance measures for evaluating investment funds; (2) the fund performance in the ESG sector.

Perez [4] describes a technical and fundamental approach to investigating the performance of investment funds in Poland. The technical approach involves the use of classical (Sharpe and Treynor ratios, single- and multi-factor Jensen ratios) and modern fund performance measures (based on lower partial moments, based on VaR, taking into account the maximum loss of capital), and the fundamental approach concerns the study of features of

funds that affect their fundamental value (management, historical rates of return and their persistence, costs, size of funds, styles and strategies).

Bogołębska [5] analyzed the performance of investment funds (a group of 19 investment funds were selected) that invest their assets in the shares of small and medium-sized companies on the Polish market. The traditional indicators for assessing the performance of investment funds—the Sharpe, Treynor and Jensen ratios (for the period 2012–2017) were presented. The traditional group of performance ratios was compared with the rates of return for stock indices—mWIG40 and sWIG80.

Dittmann [6] investigated the empirical distributions of the holding period return of investment funds for the period 2005–2017 (investment horizons—5 and 10 years) on the basis of daily quotations of units of investment fund and came to the conclusion that a large variation in the excess rate of return raises doubts as to the appropriateness of estimating the risk premium as an average for a given fund and for the entire fund group. To calculate the risk-free rate, time series of the average interest rate on 3-month bank deposits for households (monthly data from National Bank of Poland) were used. In order to obtain answers to the research questions, minimum and maximum values, percentiles and measures of variation in rates of return and distribution characteristics were calculated.

Filip and Karaś [7] attempted to determine whether there was a long-term relationship between the participation cost index and the performance of investment funds. For this purpose, classical time series analysis tools were used, i.e., KPSS stationarity test and Engle–Granger cointegration analysis and Johansen test. The study was conducted on the basis of a relatively large research sample of four main segments from investment funds in Poland in the period 2002–2015. The Sharpe, Treynor, and Jensen ratios were calculated.

Homa and Mościbrodzka [8] examined the distribution of rates of return in selected investment funds with a diversified investment strategy (presented descriptive statistics for selected funds with a test of the normality of the distribution), and then, they verified the impact of the deviation from the normality of the distribution on the validity of the use of alternative measures (the Sharpe ratio, information ratio (IR), Sortino ratio, upside potential ratio, Omega ratio). Ten-year treasury bonds were used as a risk-free instrument. The study investigated the rates of return for 247 investment funds for December 2008 to November 2018.

Mościbrodzka [9] investigated changes in the efficiency (cumulative additional rates of return) of a group of alternative investment funds in response to the introduction of the amendment to the act on investment funds in Poland. Based on the weekly logarithmic rates of return for selected funds (from January 2013 to February 2020), their benchmark, the parameters of the CAPM model are estimated. For most funds, the Jensen ratio was statistically insignificant (an average of 5% of funds in each period had a significant intercept), and the statistical values for systematic risk (β) in all funds were statistically significant ($p < 0.0001$).

Following these studies, we assume the hypothesis:

Hypothesis 1 (H1). *Not all performance measures among existing ones in international investment practice are acceptable for evaluating investment funds domiciled in Poland.*

Current research in this area in developed markets focuses on investigating fund performance in the ESG sector and is often based on regression models for the calculation of the Jensen ratio.

Nofsinger and Varma [10] use three different factor models to calculate risk-adjusted abnormal return performance of the average US Socially Responsible Investment equity mutual fund relative to matched conventional funds: CAPM, Fama and French [11] 3-factor model and Carhart [12] 4-factor model. They emphasize that in non-crisis periods, conventional funds outperform SRI funds, depending on the factor model used; however, in crisis periods, SRI funds outperform.

Leite and Cortez [13] investigate the performance, investment styles and managerial abilities of French socially responsible investment funds investing in Europe during crisis and non-crisis periods and in another article—internationally oriented socially responsible investment funds, domiciled in eight European markets, in comparison with characteristics-matched conventional funds. To evaluate fund performance, they used a 5-factor model that incorporates an additional local factor (the difference in the returns of a local market index and the Global/European index used as benchmark) into the Carhart [12] 4-factor model. Their results show that SRI funds significantly underperform characteristics-matched conventional funds during non-crisis periods but match the performance of their peers during market downturns.

Lesser et al. [14] analyzed 213 internationally-investing sustainably screened funds. They employ three different performance measurement models—the four-factor model of Fama and French [11] and Carhart [12]; the quality factor model of Asness et al. [15], who extended the standard 4-factor model by a quality factor; the q-theory factor model of Hou et al. [16] that is derived from the q-theory of investment, building upon the economic intuition that the firm's investment behavior and profitability are the two fundamental drivers of expected returns. They find that socially responsible and green funds tend to underperform in non-crisis markets, faith-based funds perform similar to the market and their conventional peers during any market state.

Ibikunle and Steffen [17] conducted comparative analysis of the financial performance of European green, black (fossil energy and natural resource) and conventional mutual funds over the 1991–2014 period. Their methodology was based on 1-factor CAPM framework and the 4-factors framework of Carhart.

They show that over the full sample period, green mutual funds significantly underperform relative to conventional funds.

To summarize, we test the second hypothesis that:

Hypothesis 2 (H2). *The management of ESG-investment funds in Poland is less efficient than conventional investment funds for the sample period (2017–2021).*

3. Materials and Methods

The article identifies strengths and weaknesses of the methodology and its findings.

The raw rate of return will be calculated as the logarithmic monthly rate of return for the fund profitability:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

where:

R_t —raw rate of return in month t for the investment fund,

P_t —quotation of the unit of the investment fund in month t ,

P_{t-1} —quotation of the unit of the investment fund in month $t-1$,

To ensure that the raw rate of return can be compared in dynamics, it is important to take inflation into account, whose role has increased in recent years. Therefore, the real raw rate of return is calculated:

$$RR_t = \frac{R_t - i_t}{1 + i_t}$$

RR_t —real raw rate of return in month t for the investment fund,

i_t —inflation rate in month t .

The profitability analysis should not take into account the risk of the individual portfolio of the fund. It may happen that in a given fund group there are two funds with the same realized rate of return and with a completely different level of risk. One fund will be high risk and the other low risk. Then, on the basis of only the raw rate of return, we are not able to determine which of the funds has better quality and which of the managers is more effective in their actions [4].

Therefore, in the next stage, fund performance measures will be calculated, which simultaneously include the raw rate of return and investment risk, i.e., two groups of measures:

- (1) relative measures that allow funds and managers to indicate investment performance that is above average (high), average or below average (low) in relation to other funds [4];
- (2) absolute measures, which are single- and multi-factor Jensen ratios and their modifications, are not just about comparing a given fund to other funds or indices but about checking whether its manager has actually achieved positive (greater than zero) or negative (less than zero) risk-weighted returns [4].

Relative measures include the classical Sharpe ratio and Treynor ratio.

The Sharpe ratio (excess return information ratio) is calculated by dividing the excess return of a group of funds, which is a premium for taking investment risk, by the standard deviation of the return of that group of funds [4]:

$$S1_{pt} = \frac{R_{pt} - R_{ft}}{\sigma_{pt}}$$

where:

$S1_{pt}$ —the Sharpe ratio in month t for a group of investment funds p ,

R_{pt} —rate of return in month t for a group of investment funds p ,

R_{ft} —risk-free rate of return in month t ,

σ_{pt} —standard deviation of the rate of return in month t for a group of investment funds p .

The Sharpe differential return information ratio [4]:

$$S2_{pt} = \frac{R_{pt} - R_{bt}}{TE_{p,b}}$$

where:

$S2_{pt}$ —the differential return information ratio in month t for a group of investment funds p ,

R_{bt} —benchmark rate of return in month t for a group of investment funds p ,

$TE_{p,b}$ —tracking error—standard deviation of the differential return ($R_{pt} - R_{bt}$) in month t for a group of investment funds p .

The Sharpe ratio is a basic measure of the investment funds performance due to the simplicity of construction and interpretation.

To account for changes in the value of money, we also modified the Sharpe ratio to the inflation rate:

$$S3_{pt} = \frac{R_{pt} - i_t}{\sigma_{pt}}$$

where:

$S3_{pt}$ —the inflation Sharpe ratio in month t for a group of investment funds p .

The Treynor ratio shows the relation of excess returns of a group of funds to the beta indicator of a group of funds [4]:

$$T_{pt} = \frac{R_{pt} - R_{ft}}{\beta_{pt}}$$

where:

T_{pt} —Treynor ratio in month t for a group of investment funds p ,

β_{pt} —beta indicator in month t for a group of investment funds p .

In the Sharpe ratio, the total risk of the fund measured by standard deviation is considered. The Treynor ratio takes into account only part of this risk, i.e., the systematic risk of the fund measured by the beta. The main argument for using this ratio is that the

fund rate of return (especially those actively managed) is highly dependent on fluctuations in the financial market, so the risk associated with the fund should reflect the market risk.

The Jensen ratio (the intercept α) allows us to measure the increment in average returns due to the manager's security selection abilities [18]. Similarly to Pavlova and de Boyrie [19], in this article, we used different factor models to calculate the risk-adjusted abnormal performance of our equally weighted portfolios: (1) CAPM, (2) Fama and French [11] 3-factor model (FF3), (3) Carhart [12], and (4) Fama and French [20] 5-factor model (FF5):

$$\begin{aligned}
 R_t - R_{ft} &= \alpha + \beta \cdot (R_{mt} - R_{ft}) + \varepsilon_t \\
 R_t - R_{ft} &= \alpha + \beta \cdot (R_{mt} - R_{ft}) + \gamma_1 \cdot (SMB_t) + \gamma_2 \cdot (HML_t) + \varepsilon_t \\
 R_t - R_{ft} &= \alpha + \beta \cdot (R_{mt} - R_{ft}) + \gamma_1 \cdot (SMB_t) + \gamma_2 \cdot (HML_t) + \gamma_3 \cdot (WML_t) + \varepsilon_t \\
 R_t - R_{ft} &= \alpha + \beta \cdot (R_{mt} - R_{ft}) + \gamma_1 \cdot (SMB_t) + \gamma_2 \cdot (HML_t) + \gamma_3 \cdot (RMW_t) + \gamma_4 \cdot (CMA_t) + \varepsilon_t
 \end{aligned}$$

where R_t is the equally weighted monthly return in month t for a group of investment funds, $R_{mt} - R_{ft}$ is the excess monthly return on the market, R_{ft} is the monthly risk-free rate, SMB_t and HML_t are the size and value factors, respectively. WML_t denotes the momentum factor, while RMW_t and CMA_t are the profitability and investment factors (differences between the returns of portfolios of stocks with robust and weak profitability and the stocks of low and high investment firms, respectively).

Similarly to Leite and Cortez [13], for funds invested in the European region, the risk-free rate was proxied by the 1-month Euribor (euro interbank offered rate). Market returns were proxied by the MSCI Europe index. The SMB factor is the difference in returns between a portfolio of small caps, represented by the MSCI Europe Small Cap index, and a portfolio of large caps, proxied by the MSCI Europe Large Cap index. The high minus low (HML) factor was calculated as difference MSCI Int Europe Value Net EUR, and MSCI Europe Growth Net EUR. Momentum (WML) factor was derived from Kenneth R. French's data library (<http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html>, accessed on 2 May 2022) concerning Europe (MOM Europe Developed).

The risk-free rate being proxied by the 1-month WIBOR (Warsaw interbank offered rate) for funds investing in instruments of the Polish financial market. The market was proxied by the WIG index. The SMB factor is the difference in returns between the sWIG index and WIG20 index. The high minus low (HML) factor and momentum (WML) factors were derived from Kenneth R. French's data library concerning emerging market.

All factors were derived from Kenneth R. French's data library for fund investing in instruments for the emerging markets or developed markets.

Our database is sourced from stooq.pl and the Chamber of Fund and Asset Management of Poland—IZFA (izfa.pl). In the article, a sample of 76 investment funds domiciled in Poland are employed, which are grouped according to the classification of the IZFA, taking into account two criteria—the profile and region of investment (Table 1).

Table 1. Sample of investment funds in Poland (number of funds).

Profile	Region of Investment			
	Poland	European Markets	Emerging Markets	Developed Markets
index equity funds	4	1	1	0
universal equity funds	31	9	4	2
small and medium (S&M) capitalization equity funds	16	1	0	1
ESG funds ¹	3	3	0	0

¹ Environmental, social and corporate governance equity funds are identified based on data from analizy.pl.

The sample period is January 2017 to December 2021.

4. Results

Fund profitability calculations (Table 2) indicate that for the period 2017–2021, the highest average monthly raw rate of return was for the ESG group of funds with investments in assets in European markets and for universal equity funds with investments in developed markets. The maximum monthly fund profitability was for index funds that invested in European markets (15.99% in November 2020), and the largest losses were also recorded for index funds, but with investments in Polish and in emerging market instruments (more than 20% in January and March of 2020). Interestingly, the most volatile monthly fund profitability was for the ESG group of funds with investments in Poland.

Table 2. Profitability of investment funds in Poland (2017–2021).

Group of Funds	Region	Raw Rate of Return (Monthly)			Real Raw Rate of Return		
		Mean	Max/Min	SD	Mean	Max/Min	SD
Index	Poland market	−0.0034	0.0524/−0.2119	0.0297	−0.0063	0.0454/−0.2139	0.0297
	Emerging markets	0.0039	0.0933/−0.2237	0.0481	0.0010	0.0913/−0.2327	0.0491
	European markets	0.0063	0.1599/−0.1689	0.0471	0.0034	0.1589/−0.1709	0.0470
Universal	Poland market	0.0041	0.1397/−0.1690	0.0477	0.0013	0.1387/−0.1710	0.0481
	Emerging markets	0.0040	0.0936/−0.1646	0.0412	0.0011	0.0926/−0.1666	0.0418
	European markets	0.0053	0.1240/−0.1441	0.0385	0.0024	0.1230/−0.1461	0.0387
	Developed markets	0.0075	0.0936/−0.0886	0.0337	0.0046	0.0926/−0.0906	0.0341
S&M	Poland market	0.0052	0.1509/−0.1623	0.0465	0.0023	0.1519/−0.1643	0.0467
	European markets	0.0066	0.1141/−0.1099	0.0393	0.0038	0.1151/−0.1139	0.0399
	Developed markets	0.058	0.1095/−0.1915	0.0441	0.0125	0.0343/−0.0292	0.0204
ESG	Poland market	0.0040	0.1245/−0.1250	0.0488	0.0011	0.1235/−0.1270	0.0492
	European markets	0.0075	0.1100/−0.1415	0.0418	0.0046	0.1090/−0.1435	0.0417

Source: own calculations.

The index strategies with investments in the Polish market were unprofitable (based on the average raw rate of return).

The impact of inflationary processes led to a decrease in the highest average monthly real raw rate of return by almost a third.

At the next stage of the study, excess returns in comparison with the returns from risk-free assets and stock indices were determined, and the risk for certain groups of investment funds was taken into account (Table 3).

A negative value for the Sharpe ratio, i.e., S2, that is, a lower return compared to the return of stock indices, was noted for a significant number of investment fund strategies—for 8 strategies out of 12. Additionally, the most efficiency strategies according to this version of the Sharpe ratio were investment strategies concerning investments in the European market of index funds and S&M funds domiciled in Poland.

Index strategies for investing in financial instruments for the Polish market were unprofitable for all three versions of the Sharpe ratio. Other strategies provided higher returns than inflation and a risk-free rate of return.

The ESG strategies with investments in the European market were characterized by the second highest value of the Sharpe ratios (S1 and S2) and the third place relative to S3.

The next phase of the study focused on calculating the Jensen ratio using different factor models to calculate the risk-adjusted abnormal performance for our equally weighted portfolios: (1) CAPM, (2) Fama–French [11] 3-factor model (FF3), (3) Carhart [12] and (4) Fama–French [20] 5-factor model (FF5).

Table 3. Fund performance (the Sharpe ratio) in Poland (2017–2021).

Group of Funds	Region	S1	S2	S3
Index	Poland market	−0.1489	−0.1688	−0.2113
	Emerging markets	0.0627	−0.1114	0.0213
	European markets	0.1411	0.0212	0.0728
Universal	Poland market	0.0657	−0.0545	0.0268
	Emerging markets	0.0752	−0.3343	0.0269
	European markets	0.1463	−0.0292	0.0628
	Developed markets	0.1963	−0.3377	0.1374
S&M	Poland market	0.0899	0.0115	0.0501
	European markets	0.1777	0.0231	0.0958
	Developed markets	0.1127	−0.4389	0.0676
	Poland market	0.0610	−0.0123	0.0230
	European markets	0.1876	0.0118	0.1106

Source: own calculations.

The results show that only 15 values of the Jensen ratio out of 48 for 5 of the 12 groups of investigated investment strategies are statistically significant (Table 4).

Table 4. Performance (regression models) of investment funds in Poland (2017–2021).

Group of Funds	Region	CAPM α	FF3 α	Carhart α	FF5 α
Index	Poland markets	−0.00540564 ** (−2.004)	−0.00674135 ** (−2.065)	−0.00817392 ** (−2.277)	−0.00829834 *** (−2.749)
	Emerging markets	−0.000909818 (−0.1484)	−0.000781068 (−0.1262)	0.00126597 (0.1768)	−9.74299e−06 (−0.01559)
	European markets	0.000929041 (0.3883)	0.00208944 (0.8799)	0.00293296 (1.191)	−0.00266596 (−1.086)
Universal	Poland markets	−0.000123449 (−0.08050)	−0.000884659 (−0.9399)	−0.00114221 (0.9950)	−0.00320405 (−1.047)
	Emerging markets	−0.00399185 ** (−2.072)	−0.00442717 ** (−2.528)	−0.00157983 (−0.8520)	−0.00437128 ** (−2.579)
	European markets	0.00106328 (0.5953)	0.000767192 (0.4173)	0.00177038 (0.9343)	−0.00351515 * (−1.854)
	Developed markets	−0.00207301 (−1.644)	−0.00281305 ** (−2.258)	−0.00266333 ** (−2.136)	−0.00260718 ** (−2.090)
S&M	Poland markets	0.00134412 (0.3969)	−0.000633808 (−0.5038)	−0.00125467 (−0.7537)	−0.00101905 (−0.2906)
	European markets	0.00311508 (0.7964)	0.000633506 (0.1841)	0.000887120 (0.2452)	−0.00314987 (−0.8851)
	Developed markets	−0.00619282 ** (−2.622)	−0.00410053 ** (−2.330)	−0.00396042 ** (−2.318)	−0.00432882 ** (−2.336)
ESG	Poland markets	0.000258325 (0.06982)	0.000107392 (0.02817)	0.000286135 (0.06437)	−0.00318181 (−0.7733)
	European markets	0.00282731 (1.191)	0.00160457 (0.6853)	0.00271867 (1.082)	−0.00315073 (−1.362)

Source: own calculations. The asterisks are used to represent the statistically significant coefficients at the 1% (***), 5% (**) and 10% (*) significance levels, based on heteroskedasticity and autocorrelation adjusted errors (following Newey and West [21]). The t-statistics are presented in parentheses.

The Jensen ratio was statistically insignificant for all ESG strategies. All regression models were acceptable regarding using the Jensen ratio for index strategies concerning investing in financial instruments for the Polish market and for S&M strategies concerning investing in financial instruments for developed markets. The values of the Jensen ratio for individual regression models were significant for almost all universal strategies (except for investments in the Polish market). Only the Jensen ratio from FF5 was statistically significant for five groups of investment strategies.

A specific negative feature noted in the study of investment strategies based on the Jensen ratio was their inefficiency, that is, all statistically significant values of this ratio were negative. The least inefficient was the universal investment strategy for investing in financial instruments for developed markets, since it probably provides the highest level of diversification of investments in the assets of various issuers.

The statistically significant Jensen ratio values gave similar results regarding the efficiency of asset management as the Sharpe ratio (S2), which is calculated on the basis of the return of funds in comparison with the return of stock indices.

However, the results obtained for the Jensen ratio indicate the limited suitability of this ratio (due to a significant number of statistically insignificant values) for comparing all groups of investment strategies used by investment funds domiciled in Poland.

In contrast to the Jensen ratio, for all constructed regression models, the value of the beta indicator (which, we assume, reflects the market risk of investments) is statistically significant (Table 5).

Table 5. Market risk of investment funds in Poland.

Group of Funds	Region	CAPM β	FF3 β	Carhart β	FF5 β
Index	Poland markets	0.251681 * (1.805)	0.265266 ** (2.273)	0.275171 ** (2.519)	0.309790 *** (2.957)
	Emerging markets	0.455929 *** (2.870)	0.466692 *** (3.939)	0.455995 *** (3.762)	0.487227 *** (3.979)
	European markets	0.913575 *** (18.75)	0.911241 *** (16.93)	0.863097 *** (15.59)	0.874874 *** (16.36)
Universal	Poland markets	0.842866 *** (20.22)	0.918949 *** (23.23)	0.920729 *** (23.34)	0.786193 *** (11.73)
	Emerging markets	0.823989 *** (15.55)	0.803840 *** (17.34)	0.788960 *** (17.82)	0.809984 *** (15.85)
	European markets	0.732559 *** (12.42)	0.696356 *** (11.78)	0.639099 *** (10.77)	0.687454 *** (10.95)
	Developed markets	0.747102 *** (37.37)	0.756664 *** (35.54)	0.743390 *** (25.17)	0.762647 *** (29.15)
S&M	Poland markets	0.732808 *** (9.257)	0.928168 *** (14.01)	0.932461 *** (14.10)	0.772376 *** (10.10)
	European markets	0.618894 *** (7.874)	0.671164 *** (9.476)	0.656688 *** (8.134)	0.703567 *** (9.441)
	Developed markets	0.959185 *** (12.22)	0.911535 *** (16.66)	0.899112 *** (15.51)	0.890145 *** (17.81)
ECG	Poland markets	0.702437 *** (13.71)	0.730744 *** (9.475)	0.729508 *** (9.078)	0.698568 *** (8.818)
	European markets	0.801274 *** (15.28)	0.849166 *** (16.36)	0.785579 *** (15.91)	0.820204 *** (12.52)

Source: own calculations. The asterisks are used to represent the statistically significant coefficients at the 1% (***), 5% (**) and 10% (*) significance levels, based on heteroskedasticity and autocorrelation adjusted errors (following Newey and West [21]). The t-statistics are presented in parentheses.

The highest value of the beta indicator (more than 0.9) was observed for S&M strategies concerning investments in financial assets in developed markets and in Poland, as well as for universal investment strategy concerning investments in financial assets in Poland. The lowest value of the beta indicator was observed for index strategy concerning investments in financial assets in Poland, which, at first glance, was strange, but two investment funds in this group (IPOPEMA Short Equity, QUERCUS short) implement the strategy based on the WIG20short Exchange index, the dynamics of which are opposite in comparison with the WIG index, which was used as a market portfolio in calculations.

Using the beta value, the performance of investment strategies was evaluated based on the Treynor ratio (Table 6). Based on this measure, the most effective actions of asset managers were identified within the groups of funds that use S&M strategy and ESG

strategy with investments in Europe, universal strategy with investments in developed markets. Similar data were obtained when calculating the Sharpe ratio (S1).

Table 6. Fund performance (Treynor ratio) in Poland (2017–2021).

Group of Funds	Region	T1	T2	T3	T4
Index	Poland market	−0.0176	−0.0167	−0.0161	−0.0143
	Emerging markets	0.0066	0.0065	0.0066	0.0062
	European markets	0.0073	0.0073	0.0077	0.0076
Universal	Poland market	0.0037	0.0034	0.0034	0.0040
	Emerging markets	0.0038	0.0039	0.0039	0.0038
	European markets	0.0077	0.0077	0.0077	0.0077
	Developed markets	0.0089	0.0088	0.0089	0.0087
S&M	Poland market	0.0057	0.0081	0.0088	0.0082
	European markets	0.0113	0.0104	0.0106	0.0099
	Developed markets	0.0052	0.0055	0.0055	0.0056
ESG	Poland market	0.0042	0.0041	0.0041	0.0043
	European markets	0.0098	0.0092	0.0100	0.0096

Source: own calculations. T1— β from the CAPM model is used for calculation; T2— β from the FF3 model is used for calculation; T3— β from the Carhart model is used for calculation; T4— β from the FF5 model is used for calculation.

If the Traynor's measure were calculated on the basis of the difference in the return from groups of fund to the return of stock indices, some of the values would be negative and would indicate the inefficiency of the asset managers.

5. Discussion

This study contributes to the current literature in the following two aspects. First, the article provides a complex approach to the investigation of the performance of equity fund investment strategies in Poland. Previous research emphasizes evaluating the performance of investment strategies based mainly on the classical Sharpe, Treynor or Jensen ratios, using the one factor regression model [5,7,9]. Second, to the best of our knowledge, this is the first study in which the profitability and performance of ESG equity funds in Poland were comprehensively evaluated. Lulewicz-Sas and Kilon [22] calculated only the Sharpe ratio and information ratio (which is a modification of the classic Sharpe ratio).

As highlighted by the results of this study, management of ESG-investment funds (domiciled in Poland) with investments in European financial market instruments was more efficient than most conventional investment funds. However, most of the analyzed articles in the literature review showed that ESG-funds tend to underperform conventional funds during non-crisis periods. We also do not identify the sample period of 2020–2021 as a crisis market (COVID-19 pandemic) because the rate of return for the MSCI Europe index was 3,09% in 2020 and 12,88% in 2021. Our results for funds with investments in other financial market instruments were compatible with the results of articles in the literature review.

Our results have practical implications for academia and asset managers. However, to better understand investment strategy performance for investment funds in Poland, another approach of performance should be applied to investment funds in Poland (Nakai et al. [23]—EGARCH model, Petrillo et al. [24]—the Analytic Hierarchy Process).

This research is also a way forward to wider development in the following areas: using standard and modified relative and absolute measures of performance for other types of investment funds in Poland (bonds, mixed funds); comparatively analyzing profitability

and the performance of ESG equity funds in Central and East Europe markets; constructing key scores to summarize a fund's profitability and performance.

Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

6. Conclusions

The study of fund profitability, performance and quality of asset management in investment funds domiciled in Poland in the context of various investment strategies for the period 2017–2022 showed that:

- (1) the raw rate of return (including inflation) is positive for almost all groups of investment strategies (except for index funds with allocation in Poland). The impact of inflationary processes led to a decrease in the highest average monthly real raw rate of return by almost a third;
- (2) fund performance depends on the modification of the Sharpe ratio. Financial instruments for investment funds may be attractive to conservative investors, as they provided excessive returns compared to the returns from risk-free assets and inflation (positive values of the Sharpe ratios S1 and S3), but for riskier investors, most of the investment funds analyzed were unattractive (negative value of the returns in funds compared to stock indices);
- (3) absolute measures of fund performance, using the Jensen ratio, are limited (due to a significant number of statistically insignificant values) for comparing all groups of investment strategies used by investment funds domiciled in Poland. A specific negative feature in the study of investment strategies based on the Jensen ratio is their inefficiency, that is, all statistically significant values of this ratio are negative. Our hypothesis that not all performance measures among existing ones in international investment practice are acceptable for evaluating investment funds domiciled in Poland is verified positively.
- (4) the fund performance based on the classical version of the Treynor ratio is similar to the results obtained for calculating the Sharpe ratio (S1). The most effective actions are those of asset managers within the fund groups that use S&M strategy and ESG strategy with investments in Europe, universal strategy with investments on developed markets;
- (5) management of ECG-funds with investments on European financial market instruments was more efficient than most conventional investment funds and our second hypothesis is verified negatively, but for funds with investments in other financial markets our second hypothesis is verified positively.

It is important to take into account that there are also some research limitations, such as limited publicly available data concerning investment funds domiciled in Poland, and using a longer research time horizon, a limited number of investment funds can be studied (only 6 out of 16 ESG equity funds, 6 out of 21 index funds, 44 out of 69 universal equity funds, 18 out of 24 S&M funds were the subject of this article's analysis). Furthermore, the Sharpe ratio does not have a normal distribution in the case of speculative funds; investors often use dynamic trading strategies and options that can change their returns; the Treynor ratio is determined based on a benchmark rate in beta sizing.

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