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Investing in Sustainable Development as a Form of Alternative Investments in Financial Markets – Analysis of the Volatility of Rates of Return of Open-End SRI Funds in Poland

Keywords: socially responsible investments; SRI funds; mutual funds; performance evaluation of SRI funds

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Abstract

Theoretical background: Socially responsible investing (SRI) is a specific type of investment, combining both financial objectives and investor preferences regarding the environment, society, or corporate governance. Since the period following the 2007 global financial crisis, a significant increase in interest in assets that meet SRI policies has been observed, which translated into a shift in the mutual fund products offered. SRI investment funds play a significant role in the SRI market due to the size of assets under management. They also have an indirect impact on the interest of individual investors in the theory of responsible investment by adjusting their offerings adequately.
Purpose of the article: The aim of the study is to determine to what extent the performance of open-ended socially responsible investment funds reflects changes in asset prices on the capital market in Poland.
Research methods: The analysis was carried out for the period from 1 January 2020 to 1 January 2022. Daily quotes for SRI funds were used, while only funds that operated continuously during the set period were selected. The WIG and WIGESG indexes were used as stock market benchmarks. Due to the fact that

mutual funds are quoted once a day, a simple daily rate of return was used in the study. Using the linear correlation coefficient, a correlation matrix was constructed between the daily returns of the funds and the adopted benchmarks. The study was conducted with the use of the linear regression method to verify the impact of capital market price changes on the returns achieved by SRI mutual funds. Then, using the method of least squares, the model parameters were estimated for SRI funds.
Main findings: The results confirmed the influence of market benchmarks on the development of SRI fund returns in Poland. In addition, the results confirmed that the conventional benchmark (WIG) has a greater impact on fund returns than the ESG benchmark (WIGESG).

Introduction

Since the period following the 2007 global financial crisis (Tomaszewski, 2016), there has been a significant increase in interest in assets that meet socially responsibility investments (SRI) policies. According to the 2018 Global Sustainable Investment Review report, these assets totalled USD 30.7 trillion in 2018 in the world's five largest markets. This was a 34% increase over 2016 (*2018 Global Sustainable Investment Review*, p. 10). This specific type of investment, which combines both financial goals and environmental, social, or corporate governance preferences (Eurosif Report, 2018), is attracting many investors. The classical portfolio theory (Markowitz, 1952), which is based on the efficiency of the capital market and the investors' goal of maximizing the rate of return for a given level of risk (or minimizing risk for a given rate), has become insufficient. This is because there is an increased awareness among investors of social environmental and economic issues.

In response to the market's interest in SRI assets, a specific type of investment funds was created – SRI funds. These funds are characterized by the goodness of assets based on both classical portfolio theory and non-financial criteria related to social responsibility issues. SRI funds play a significant role in the socially responsible investment market due to the size of assets under management. The smallest net asset size of the SRI funds surveyed is 19.49 million (www1). Indirectly, SRI funds also influence the interest of individual investors in the theory of responsible investing by adjusting their offerings. Due to the growing interest of investors in SRI assets, a more in-depth investigation of the instrument in question is important from a scientific point of view.

This article may turn out to be novel to the discipline of finance due to the fact that, to the best of the author's knowledge, research in this area has not been conducted to date. Researchers have studied the returns of SRI funds and compared them to classic funds that do not incorporate SRI policies (Geczy et al., 2005; Tippet, 2001; Derwall et al., 2005), and investment profitability (Wolska & Czerwonka, 2013), however, there is a lack of research in the literature on the impact of the market on SRI fund returns.

The purpose of this article is to determine the extent to which the performance of open-ended socially responsible investment funds reflects asset price changes in the capital market in Poland. The research hypothesis is that the performance of SRI funds significantly reflects changes in assets in the capital market in Poland.

The article consists of 4 sections. The first section of the article reviews the literature on socially responsible funds. The next section of the article presents the research methods used in the analysis of the problem presented. Then, in section 3, the results of the research on the existence of a relationship between the variable return of SRI funds and benchmarks were illustrated. The fourth section of the article is devoted to the conclusions drawn from the results of the conducted research.

Literature review

The concept of SRI is becoming more and more popular, and the value of the socially responsible investment is growing year after year around the world (*2018 Global Sustainable Investment Review*, p. 10). Global interest in SRI assets continues, including in Poland. There is no doubt, therefore, that researchers from around the world have decided to explore the topic of such investments more broadly. It was recognized that the model itself proved problematic, as well as constructing a portfolio in such a way as to take into account not only the preferred risk and return but also the investor's ethical values. For example, Barracchini (2004) described portfolio selection implemented on an ethical basis, creating an ethical index that quantifies the consistency of an investor's ethical values compared to the ethical values exhibited by an asset. Gupta et al. (2013) suggested a three-tier decision-making framework based on several conditions, among which are the following:

– the screening study (as stage one),
– the financial performance of the alternative investment (as stage two), and
– the creation of a hybrid optimization model (as stage three – the final step).

Researchers have recently become interested not only in the asset selection model itself but also in the performance of asset selection in line with SRI policies. Over the years, several researchers have presented results in which SRI funds demonstrated their inferior performance compared to classical funds (Geczy et al., 2005; Tippet, 2001). There were also research results that showed SRI funds in a better light – presenting the performance of SRI funds as outperforming compared to classical funds (Derwall et al., 2005). Ter Horst et al. (2007) in their study showed that the risk-adjusted returns of SRI funds in the United States and the United Kingdom are not significantly different from those of conventional funds and the volatility of cash flows is lower for SRI funds than for conventional funds. Humphrey & Lee (2011) research also shows no significant difference between the returns of SRI and conventional funds in the Australian market. Cortez et al. (2009) presented the results of a study based on socially responsible investment funds from seven European countries investing globally and/or in the European market. The results of their work show that European socially responsible funds present virtually neutral performance against both conventional and socially responsible benchmarks. Ito et al. (2013) presented results proving that SRI funds outperformed conventional funds

in the EU and US. A year later, Utz et al. (2014) theorized in their final results that conventional and socially responsible investment funds do not achieve significant differences in fund performance. Leite and Cortez (2015) presented results in which SRI funds demonstrated to perform significantly worse than conventional funds during non-crisis periods but matched their counterparts during market declines. Nofsinger and Varma (2014) research result also showed that compared to matched conventional mutual funds, socially responsible mutual funds outperform during periods of market crises. Wolska and Czerwonka (2013) carried out a research of the profitability of investment products available in Poland related to the SRI concept but it has not provided clear answers to the issue of the profitability of this mode of investment. Similar result present Lulewicz-Sas and Kilon (2014) analyzing the effectiveness of socially responsible investing funds in Poland but the analysis of the risk and returns of SRI funds in Poland in relation to the WIG index, as well as to the WIG20 and the RESPECT index portfolios does not allow to draw clear conclusions. They suggest that the differences of the financial performance should be treated rather as a direct result of their investment policies not SRI policy. In 2021, Pisani and Russo presented results proving that SRI funds outperform funds with a low ESG rating during a period of financial crisis determined by an exogenous shock. This result is in accordance with those of Albuquerque et al. (2020) and Mirza et al. (2020). The results are significantly different from the conclusions of Broadstock et al. (2021), Hartzmark and Sussman (2019), and Folger-Laronde et al. (2022). The studies carried out by Jamróz and Żebrowska-Suchodolska in 2021 shows that socially responsible funds noted lower results in the period directly before the pandemic but in the pandemic period, they, however, noted higher results than the WIG index.

Up to the year 2022, there have been no studies that can conclusively determine what impact the use of SRI strategies has on portfolio efficiency. On the other hand, considering the number of studies conducted on the extent to which the performance of open-ended socially responsible investment funds reflects changes in asset prices in the capital market, it should be noted that there are few. Cortez et al. (2009), in the aforementioned paper, further substantiated that conventional benchmarks are better able to explain fund returns than socially responsible benchmarks. These results are consistent with earlier studies by Bauer et al. (2005, 2006). Karkowska and Niewińska (2013) conducted a similar study, however, it was based on conventional funds and at the level of one country: Poland. The study showed that market benchmarks significantly affect the performance of open-ended equity market mutual funds in Poland. The research conducted for this article reduces the research gap in this area.

The lack of research in this area may be due to the fact that the SRI market is just developing in Poland. The Eurosif 2018 SRI Report confirmed that Poland still has many areas for development in socially responsible investment spectra. The report also showed little demand for SRI investments, with insufficient knowledge in the field cited as the main reason. In 2015, institutional investors investing according to ESG principles accounted for only 0.1% of all institutional investors in Poland. Total

assets allocated with ESG criteria in Q3 2015 amounted to about PLN 1,945,986 thousand and accounted for about 0.13% of institutional investors' financial assets (Doś & Foltyn-Zarychta, 2017). In comparison, in 2015, the value of socially responsible investments in Europe amounted to 11 trillion euros, which accounted for 52.38% of all assets under management in Europe (Eurosif Report, 2016).

Although the market for SRI investments in Poland does not appear to be large, it is here that the first index in Central and Eastern European countries to bring together companies listed on the main market and additionally comply with ESG area standards was launched in 2009. In 2019, the WSE launched the WIG-ESG index, which replaced the previously existing RESPECT index (www3). That same year, the WSE also published the results of a survey, conducted among investors, on the impact of ESG factors on investment decisions. Nearly 70% of respondents noted an increase in investments made based on ESG criteria over the past three years (www3).

Methodology and data

The subject of the study is the analysis of daily simple rates of return of open-ended SRI investment funds operating on the Polish financial market. The study used the method of simple rates of return due to the chosen methodology of fund valuation chosen by the market. The analysis was carried out from January 1, 2020 to January 1, 2022. The choice of such an analysis period is due to the fact that although the first case of the coronavirus was recorded in China at the end of 2019, the outbreak of COVID-19 was still not acknowledged as a pandemic by the World Health Organization (2020) on March 11, 2020 (Kubiczek & Tuszkiewicz, 2022). Such choice of the analyzed period translated into a total of 502 observations. Only SRI funds that continuously operated during the study period were examined in the number 14 funds in total:

– Allianz Dynamiczna Multistrategia,
– Allianz Zbalansowana Multistrategia.
– Allianz Defensywna Multistrategia,
– Allianz Europe Equity Growth Select,
– NN Indeks Odpowiedzialnego Inwestowania,
– NN(L) Europejski Spółek Dywidendowych,
– NN(L) Globalny Długu Korporacyjnego,
– NN(L) Globalny Odpowiedzialnego Inwestowania,
– NN(L) Globalny Spółek Dywidendowych,
– NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna),
– NN(L) Spółek Dywidendowych Rynków Wschodzących,
– NN Polski Odpowiedzialnego Inwestowania,
– PKO Ekologii i Odpowiedzialności Społecznej Globalny,
– UNIQA Akcji Europejskiej ESG.

In view of the issue at hand – i.e. to indicate the relationship between the returns achieved by SRI funds and market returns – the WIG index and WIGESG were taken as market benchmarks.[1] The group of funds also included debt funds, investing in debt securities. The model took into account the debt securities market benchmark – PKO Obligacji Skarbowych, which invests primarily in debt instruments issued, guaranteed, or underwritten by the Polish Treasury or the National Bank of Poland (NBP).

In the article, the linear regression method was adopted as a method to verify the impact of price changes in the financial market on the rates of return achieved by SRI investment funds. Then, using the method of least squares, the parameters of the model were estimated for socially responsible investment funds in Poland. Table 1 presents the characteristics of the rates of return in the studied period.

Table 1. Characteristics of returns for SRI funds from January 1, 2020 to January 1, 2022

Variable	Descriptive statistics							
	Average return	Mediana	Min.	Max.	Variance	St. Dev.	Coefficient of var.	SKEW
PKO Obligacji Skarbu Państwa	-0.00005	0.00002	-0.01217	0.00276	0.00000	0.00086	-1643.75091	-6.02669
Allianz Dynamiczna Multistrategia	0.00014	0.00026	-0.02607	0.01106	0.00001	0.00273	2001.09888	-2.48203
NN(L) Globalny Długu Korporacyjnego	0.00014	0.00035	-0.03574	0.0262	0.00002	0.00459	3279.97588	-2.06341
Allianz Zbalansowana Multistrategia	0.00038	0.0008	-0.03757	0.01674	0.00003	0.0058	1511.45406	-1.39692
NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna)	-0.00022	0.00022	-0.04883	0.02642	0.00004	0.0062	-2829.72312	-1.40147
Allianz Defensywna Multistrategia	0.00057	0.00094	-0.04749	0.02863	0.00007	0.00808	1421.92432	-1.29186
PKO Ekologii i Odpowiedzialności Społecznej Globalny	0.00051	0.0006	-0.08535	0.06066	0.0001	0.01013	1982.62627	-1.12711
NN Polski Odpowiedzialnego Inwestowania	0.00068	0.00087	-0.11706	0.04788	0.00016	0.01247	1832.66129	-2.07581
UNIQA Akcji Europejskiej ESG	0.00031	0.00126	-0.05553	0.05596	0.00017	0.01299	4207.5069	-0.55223
NN(L) Europejski Spółek Dywidendowych	0.00034	0.00102	-0.1138	0.07385	0.00017	0.01317	3896.94106	-1.69291

[1] It should be noted that the selected funds are not homogeneous and invest in different markets. However, due to the comparative nature of the research on the Polish market, a simplification was made. This simplification could be supported by the fact that as a consequence of globalization, modern financial markets are closely interconnected (Kondrakiewicz, 2010).

Variable	Descriptive statistics							
	Average return	Mediana	Min.	Max.	Variance	St. Dev.	Coefficient of var.	SKEW
NN(L) Spółek Dywidendowych Rynków Wschodzących	0.00025	0.00093	-0.09559	0.07025	0.00018	0.0133	5319.27833	-1.05665
NN(L) Globalny Odpowiedzialnego Inwestowania	0.00066	0.00107	-0.08405	0.07616	0.00018	0.01334	2020.62277	-0.79866
NN(L) Globalny Spółek Dywidendowych	0.00038	0.00057	-0.09538	0.08063	0.00019	0.0139	3683.52664	-1.18741
Allianz Europe Equity Growth Select	0.001	0.00164	-0.08864	0.07034	0.00021	0.01446	1451.61134	-0.93739
WIG	0.00043	0.00045	-0.12652	0.05795	0.00022	0.01492	3456.91576	-1.42838
NN Indeks Odpowiedzialnego Inwestowania	0.00033	0.0006	-0.12881	0.06216	0.00024	0.01546	4675.52588	-1.23136
WIG-ESG	0.00038	0.00077	-0.12895	0.06236	0.00024	0.01554	4131.8226	-1.21605

Source: Author's own study based on daily quotes from stooq.pl database rounded to five decimal places.

For the NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna) and PKO Obligacji Skarbu Państwa indices, the average of daily returns is negative, and so is the coefficient of variation. A negative volatility coefficient is not subject to interpretation.

The calculations in Table 1 were performed using Statistica software. Data, and daily quotes, are available in the stooq.pl database was used. Correlations between daily fund returns and assumed benchmarks were also verified using the linear correlation coefficient, building a correlation matrix (see Table 2).

Empirical results

A preliminary analysis of the data showed that the stock market benchmarks used – the WIG and WIGESG – had a higher standard deviation of returns than the SRI funds' returns, which indicates that the funds were less risky relative to the market. Of the 14 SRI funds studied, for as many as 13 the standard deviation took on a lower value than for the WIG and WIGESG. The exception is the fund NN Indeks Odpowiedzialnego Inwestowania.

Excluding the SRI fund, for which it is impossible to interpret the volatility coefficient, most of the SRI 8/13 funds achieved a lower volatility coefficient than the WIG and WIGESG. For two funds, the volatility coefficient took values lower than WIGESG, however, higher than WIG. The volatility coefficient of only 3 funds exceeded the value for both WIG and WIGESG. As many as 7 SRI funds achieved lower average returns than WIGESG and WIG. The average return of the two SRI

funds was lower than the WIG but higher than the WIGESG. For 5 funds, the value of the average return exceeded the performance of the WIG and WIGESG.

The correlation matrix between the variables used in the models is presented below (see Table 2). The calculations in Table 2 were performed using Statistica software for $N = 502$ observations and a significance level of $p < 0.05$. The data used was data, daily quotes, available in the stooq.pl database (www2). Correlation analysis proved that most SRI funds are positively correlated with stock market benchmarks. In addition, the correlation is statistically significant at $p < 0.05$ (highlighted in red). Only the Allianz Dynamiczna Multistrategia fund is not significantly correlated with market benchmarks. In addition, 13 SRI funds (excluding Allianz Zbalansowana Multistrategia) are also significantly correlated with the PKO Obligacji Skarbu Państwa.

In the next step of the analysis, an MLS linear regression model was created for individual funds with 3 explanatory variables (WIG, WIGESG, PKO Obligacji Skarbu Państwa). Table 3 below shows the baseline data. For most funds in the linear regression model using the listed explanatory variables a minimum of one variable is statistically significant. However, it can be noted that the measure of fit, which is R^2, is higher than 0.5 in only 3 cases, which indicates a moderate fit of the data.

Table 2. Matrix of linear correlation between individual funds and benchmarks (WIG, WIGESG, PKO Obligacji Skarbu Państwa) data from January 1, 2020 to January 1, 2022

	Allianz Dynamiczna Multistrategia	Allianz Zbalansowana Multistrategia	Allianz Defensywna Multistrategia	Allianz Europe Equity Growth Select
Allianz Dynamiczna Multistrategia	1.0000			
Allianz Zbalansowana Multistrategia	0.8494	1.0000		
Allianz Defensywna Multistrategia	0.7935	0.9848	1.0000	
Allianz Europe Equity Growth Select	0.3181	0.3907	0.4504	1.0000
NN Indeks Odpowiedzialnego Inwestowania				
NN(L) Europejski Spółek Dywidendowych				
NN(L) Globalny Długu Korporacyjnego				
NN(L) Globalny Odpowiedzialnego Inwestowania				
NN(L) Globalny Spółek Dywidendowych				
NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna)				
NN(L) Spółek Dywidendowych Rynków Wschodzących				
NN Polski Odpowiedzialnego Inwestowania				
PKO Ekologii i Odpowiedzialności Społecznej Globalny				
UNIQA Akcji Europejskiej ESG				
WIG				
WIG-ESG				
PKO Obligacji Skarbu Państwa				

	NN Indeks Odpowiedzialnego Inwestowania	NN(L) Europejski Spółek Dywidendowych	NN(L) Globalny Długu Korporacyjnego	NN(L) Globalny Odpowiedzialnego Inwestowania	NN(L) Globalny Spółek Dywidendowych	NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna)	NN(L) Spółek Dywidendowych Rynków Wschodzących	NN Polski Odpowiedzialnego Inwestowania	PKO Ekologii i Odpowiedzialności Społecznej Globalny	UNIQA Akcji Europejskiej ESG	WIG	WIG-ESG	PKO Obligacji Skarbu Państwa
Allianz Dynamiczna Multistrategia													
Allianz Zbalansowana Multistrategia													
Allianz Defensywna Multistrategia													
Allianz Europe Equity Growth Select													
NN Indeks Odpowiedzialnego Inwestowania													
NN(L) Europejski Spółek Dywidendowych													
NN(L) Globalny Długu Korporacyjnego													
NN(L) Globalny Odpowiedzialnego Inwestowania													
NN(L) Globalny Spółek Dywidendowych													
NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna)													
NN(L) Spółek Dywidendowych Rynków Wschodzących													
NN Polski Odpowiedzialnego Inwestowania													
PKO Ekologii i Odpowiedzialności Społecznej Globalny													
UNIQA Akcji Europejskiej ESG													
WIG													
WIG-ESG													
PKO Obligacji Skarbu Państwa													

NN Polski Odpowiedzialnego Inwestowania	NN(L) Spółek Dywidendowych Rynków Wschodzących	NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna)	NN(L) Globalny Spółek Dywidendowych	NN(L) Globalny Odpowiedzialnego Inwestowania	NN(L) Gobalny Długu Korporacyjnego	NN(L) Europejski Spółek Dywidendowych	NN Indeks Odpowiedzialnego Inwestowania	
0.0522	0.0228	0.1493	-0.0380	-0.0178	0.3415	0.1254	0.0541	Allianz Dynamiczna Multistrategia
0.1731	0.0323	0.1644	-0.0134	-0.0046	0.3296	0.2180	0.1748	Allianz Zbalansowana Multistrategia
0.2137	0.0724	0.2091	0.0252	0.0381	0.3828	0.2649	0.2171	Allianz Defensywna Multistrategia
0.5242	0.5947	0.4680	0.4932	0.5565	0.5567	0.6025	0.5080	Allianz Europe Equity Growth Select
0.9413	0.5145	0.5164	0.6559	0.5760	0.4436	0.7668	1.0000	NN Indeks Odpowiedzialnego Inwestowania
0.7885	0.6513	0.5572	0.8417	0.7268	0.5305	1.0000		NN(L) Europejski Spółek Dywidendowych
0.4397	0.4674	0.6525	0.4595	0.4687	1.0000			NN(L) Globalny Długu Korporacyjnego
0.6467	0.7608	0.4618	0.8520	1.0000				NN(L) Globalny Odpowiedzialnego Inwestowania
0.6909	0.7598	0.4361	1.0000					NN(L) Globalny Spółek Dywidendowych
0.5175	0.4921	1.0000						NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna)
0.5593	1.0000							NN(L) Spółek Dywidendowych Rynków Wschodzących
1.0000								NN Polski Odpowiedzialnego Inwestowania
								PKO Ekologii i Odpowiedzialności Społecznej Globalny
								UNIQA Akcji Europejskiej ESG
								WIG
								WIG-ESG
								PKO Obligacji Skarbu Państwa

PKO Obligacji Skarbu Państwa	WIG-ESG	WIG	UNIQA Akcji Europejskiej ESG	PKO Ekologii i Odpowiedzialności Społecznej Globalny	
0.1306	0.0520	0.0506	0.4230	0.2540	Allianz Dynamiczna Multistrategia
0.0804	0.1732	0.1672	0.4789	0.3153	Allianz Zbalansowana Multistrategia
0.1032	0.2155	0.2092	0.5053	0.3726	Allianz Defensywna Multistrategia
0.4304	0.5084	0.5155	0.4551	0.6376	Allianz Europe Equity Growth Select
0.2256	0.9989	0.9919	0.2821	0.6759	NN Indeks Odpowiedzialnego Inwestowania
0.3105	0.7656	0.7682	0.3647	0.8823	NN(L) Europejski Spółek Dywidendowych
0.4598	0.4426	0.4484	0.4919	0.6422	NN(L) Globalny Długu Korporacyjnego
0.4034	0.5752	0.5883	0.3364	0.6858	NN(L) Globalny Odpowiedzialnego Inwestowania
0.3943	0.6544	0.6577	0.1912	0.7089	NN(L) Globalny Spółek Dywidendowych
0.3314	0.5154	0.5247	0.3693	0.6021	NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna)
0.4108	0.5115	0.5257	0.2517	0.5656	NN(L) Spółek Dywidendowych Rynków Wschodzących
0.2297	0.9399	0.9538	0.3087	0.6965	NN Polski Odpowiedzialnego Inwestowania
0.2741	0.6769	0.6779	0.5536	1.0000	PKO Ekologii i Odpowiedzialności Społecznej Globalny
0.2046	0.2826	0.2882	1.0000		UNIQA Akcji Europejskiej ESG
0.2255	0.9931	1.0000			WIG
0.2239	1.0000				WIG-ESG
1.0000					PKO Obligacji Skarbu Państwa

Source: Author's own study based on daily quotes from stooq.pl database, results have been rounded to four decimal places

Table 3. Estimation results of SRI fund return models data from January 1, 2020 to January 1, 2022

	*b**	Std. Dev.	*b*	Std. Dev.	t(500)	*p*	R^2
Allianz Dynamiczna Multistrategia			0.0002	0.0001	1.2926	0.1967	0.0178
WIG	-0.1062	0.3778	-0.0194	0.0690	-0.2811	0.7787	
WIG ESG	0.1294	0.3777	0.0227	0.0662	0.3426	0.7321	
PKO OBLIGACJI	0.1256	0.0456	0.3971	0.1441	2.7548	0.0061	
Allianz Zbalansowana Multistrategia			0.0004	0.0003	1.5099	0.1317	0.0335
WIG	-0.3544	0.3748	-0.1377	0.1457	-0.9456	0.3448	
WIG ESG	0.5150	0.3746	0.1922	0.1398	1.3747	0.1698	
PKO OBLIGACJI	0.0450	0.0452	0.3028	0.3043	0.9952	0.3201	
Allianz Defensywna Multistrategia			0.0006	0.0004	1.6175	0.1064	0.0514
WIG	-0.3571	0.3713	-0.1934	0.2011	-0.9619	0.3366	
WIG ESG	0.5569	0.3711	0.2896	0.1930	1.5005	0.1341	
PKO OBLIGACJI	0.0591	0.0448	0.5543	0.4200	1.3197	0.1875	
Allianz Europe Equity Growth Select			0.0011	0.0005	2.1077	0.0356	0.3706
WIG	-0.2542	0.3023	-0.2365	0.2813	-0.8409	0.4008	
WIG ESG	0.6933	0.3024	0.6718	0.2930	2.2926	0.0223	
PKO OBLIGACJI	0.3310	0.0365	5.5514	0.6121	9.0700	0.0000	
NN Indeks Odpowiedzialnego Inwestowania			0.0000	0.0000	-1.2405	0.2154	0.9978
WIG	1.0012	0.0180	0.9962	0.0179	55.6316	0.0000	
WIG ESG	-0.0028	0.0180	-0.0029	0.0187	-0.1569	0.8754	
PKO OBLIGACJI	0.0021	0.0022	0.0383	0.0390	0.9833	0.3259	
NN(L) Europejski Spółek Dywidendowych			0.0002	0.0004	0.5019	0.6159	0.6105
WIG	0.1968	0.2378	0.1668	0.2016	0.8276	0.4083	
WIG ESG	0.5401	0.2379	0.4768	0.2100	2.2705	0.0236	
PKO OBLIGACJI	0.1446	0.0287	2.2105	0.4387	5.0393	0.0000	
NN(L) Globalny Długu Korporacyjnego			0.0002	0.0002	1.1513	0.2501	0.3372
WIG	-0.1903	0.3102	-0.0562	0.0917	-0.6134	0.5399	
WIG ESG	0.5522	0.3104	0.1699	0.0955	1.7791	0.0758	
PKO OBLIGACJI	0.3779	0.0374	2.0130	0.1995	10.0918	0.0000	
NN(L) Globalny Odpowiedzialnego Inwestowania			0.0007	0.0005	1.4362	0.1516	0.4291
WIG	-0.6471	0.2879	-0.5555	0.2471	-2.2475	0.0250	
WIG ESG	1.1666	0.2880	1.0427	0.2575	4.0501	0.0001	
PKO OBLIGACJI	0.2852	0.0348	4.4126	0.5378	8.2054	0.0000	
NN(L) Globalny Spółek Dywidendowych			0.0004	0.0004	0.8157	0.4151	0.4964
WIG	0.0929	0.2704	0.0831	0.2418	0.3435	0.7314	
WIG ESG	0.5070	0.2705	0.4721	0.2519	1.8741	0.0615	
PKO OBLIGACJI	0.2592	0.0326	4.1784	0.5261	7.9416	0.0000	
NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna)			-0.0002	0.0002	-1.0095	0.3132	0.3254
WIG	-0.4093	0.3130	-0.1634	0.1249	-1.3078	0.1915	
WIG ESG	0.8805	0.3131	0.3661	0.1302	2.8123	0.0051	
PKO OBLIGACJI	0.2245	0.0378	1.6154	0.2719	5.9414	0.0000	
NN(L) Spółek Dywidendowych Rynków Wschodzących			0.0003	0.0005	0.5883	0.5566	0.3743
WIG	-0.7566	0.3014	-0.6473	0.2579	-2.5100	0.0124	
WIG ESG	1.2076	0.3016	1.0759	0.2687	4.0046	0.0001	

	*b**	Std. Dev.	*b*	Std. Dev.	t(500)	*p*	R^2
PKO OBLIGACJI	0.3079	0.0364	4.7483	0.5612	8.4613	0.0000	
NN Polski Odpowiedzialnego Inwestowania			0.0003	0.0002	1.9431	0.0526	0.9138
WIG	-0.5254	0.1119	-0.4216	0.0898	-4.6951	0.0000	
WIG ESG	1.4721	0.1119	1.2302	0.0936	13.1501	0.0000	
PKO OBLIGACJI	0.0154	0.0135	0.2227	0.1954	1.1394	0.2551	
PKO Ekologii i Odpowiedzialności Społecznej Globalny			0.0004	0.0003	1.2495	0.2121	0.4760
WIG	0.2661	0.2758	0.1735	0.1799	0.9646	0.3352	
WIG ESG	0.3849	0.2760	0.2614	0.1874	1.3946	0.1637	
PKO OBLIGACJI	0.1277	0.0333	1.5016	0.3914	3.8362	0.0001	
UNIQA Akcji Europejskiej ESG			0.0003	0.0006	0.5687	0.5698	0.1045
WIG	-0.2559	0.3606	-0.2139	0.3014	-0.7097	0.4782	
WIG ESG	0.5091	0.3608	0.4431	0.3140	1.4113	0.1588	
PKO OBLIGACJI	0.1471	0.0435	2.2157	0.6558	3.3786	0.0008	

Source: Author's own study based on daily quotations from the stooq.pl database results rounded to four decimal places.

Table 4. R^2 values of the two-variable model for individual funds data from January 1, 2020 to January 1, 2022

SRI fund	WIG	WIGESG
	PKO OBLIGACJI	PKO OBLIGACJI
Allianz Dynamiczna Multistrategia	0.01752	0.0176
Allianz Zbalansowana Multistrategia	0.02987	0.0318
Allianz Defensywna Multistrategia	0.04709	0.04961
Allianz Europe Equity Growth Select	0.36975	0.364
NN Indeks Odpowiedzialnego Inwestowania	0.98391	0.99777
NN(L) Europejski Spółek Dywidendowych	0.61001	0.60652
NN(L) Globalny Długu Korporacyjnego	0.33666	0.33294
NN(L) Globalny Odpowiedzialnego Inwestowania	0.42329	0.41027
NN(L) Globalny Spółek Dywidendowych	0.4963	0.49287
NN(L) Obligacji Rynków Wschodzących (Waluta Lokalna)	0.32312	0.31472
NN(L) Spółek Dywidendowych Rynków Wschodzących	0.36634	0.35411
NN Polski Odpowiedzialnego Inwestowania	0.90995	0.88383
PKO Ekologii i Odpowiedzialności Społecznej Globalny	0.47502	0.47395
UNIQA Akcji Europejskiej ESG	0.10357	0.10089

Source: Author's own study based on daily quotations from the stooq.pl database results rounded to five decimal places.

For most funds, in terms of the R^2 fit measure, the model with the explanatory variables WIG and PKO Obligacji Skarbu Państwa is a better fit. For four funds (Allianz Dynamiczna Multistrategia, Allianz Zbalansowana Multistrategia, Allianz Defensywna Multistrategia, Allianz Europe Equity Growth Select, NN Indeks Odpowiedzialneg Inwestowania) R^2 value is higher for the model with variables WIGESG and PKO Obligacji Skarbu Państwa. The results of the model fit measure are highest for the model with three explanatory variables, suggesting that the model with the variables WIG, WIGESG, and PKO Obligacji Skarbu Państwa is the best-fitting of all the models presented.

Conclusions

The question of whether SRI funds are riskier than the market is not well described in the literature. Most of the studies regarding SRI funds are dedicated to the US market, the most developed market for socially responsible investment. The European SRI fund market is less explored (excluding the UK market). This paper investigates the performance of SRI Poland's funds and reduces the research gap.

Based on the research presented, it can be assumed that SRI funds in Poland are less risky than the market representative of WIG (risk measured by standard deviation). Additionally, most funds also show less volatility than the market (WIG). Lower risk is associated with a lower average rate of return over the period under review than the market (WIG). The research shows that WIGESG has the highest absolute risk (measured by standard deviation) – all funds, that were examined, are less risky than ESG Benchmark. WIGESG is in the middle when it comes to the average rate of return over the period under review. Only three funds show more volatility than the WIGESG, and most of the funds show less volatility than the ESG Benchmark. The PKO Obligacji Skarbu Państwa fund is the least risky and the average rate of return is the second lowest. Theoretical models assume that treasury bonds are risk-free or at least very low-risk. The results confirm that assumption.

Most funds are statistically significantly correlated with the market (WIG), benchmark ESG (WIGESG), and PKO Obligacji Skarbu Państwa. This means that the variables are mutually related. It leads to a model with three explanatory variables. The model in most cases is statistically significant, but with an average fit. The results confirmed the impact of statistically significant market benchmarks on the formation of SRI fund returns in Poland. The study conducted provided the conclusion that the performance of SRI funds in Poland shows significantdependence from market benchmarks.

The analysis shows that SRI funds are more sensitive to the conventional index (WIG) than to the index ESG (WIGESG). In Table 4, it can be observed that for most cases the explanatory power of the model (R^2) is higher for the conventional benchmark (WIG). It suggests that WIG is more useful than WIGESG in explaining the performance of socially Responsibly Investment Funds. These figures are consistent with those of Cortez et al. (2009) and Bauer et al. (2005, 2006). It seems that index WIG should have a lower ability to explain the return of SRI funds than index WIGESG, which is constructed based on ESG rules. It raises the question of whether SRI funds are different from conventional funds in terms of the security selected. This issue may be the subject of further research on SRI funds. In addition, undoubtedly, a limitation of the research is the sample, which includes non-homogeneous funds. This problem may be the subject of further research on SRI funds.

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