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ANALYSIS OF FINANCIAL INDICATORS DEVELOPMENT OF THE WORLD'S LARGEST ENVIRONMENTAL COMPANIES

Abstract: Ecological financing is part of sustainable financing and refers to investments that contribute to fulfilling environmental sustainability policy goals. The support of ecological financing is important because meeting environmental goals is an investment challenge. The contribution aims to analyze the development of the financial indicators of the largest global environmental companies. The Conditional Value-at-Risk (CVaR) measure of risk served as the theoretical basis. The analysis was carried out based on environmental companies' risk and return rates. The analysis was carried out on daily historical data of 19 companies for the period from 19.5.2017 to 30.12.2022. Based on the historical simulation, expected returns were calculated, and risk measure CVaR. Individual values were compared based on investment criteria measures and identified for a possible investment opportunity.

Keywords: Financial Indicators, Environmental Companies, Risk and Return rates

1. INTRODUCTION

In line with the increasing emphasis on environmental protection, investing in companies with an emphasis on direct environmental technologies or in companies with firm environmental commitments is becoming increasingly important. The goal of environmental investment is to support such business activities that have a positive impact on the natural environment (Cohen, Fenn, & Naimon 1995), (Feldman, Soyka, & Ameer 1997). Environmental investing focuses primarily on investment activities aligned with environmentally friendly business practices and the protection of natural resources and is primarily represented by Socially Responsible Investing (SRI) or environmental, social, and management criteria (ESG - environmental, social, and corporate governance). Socially Responsible Investing is an investment that is considered to be socially responsible because of the nature of the business that the company conducts. Environmental criteria consider the way a company protects the environment, including corporate policies. Social criteria examine how a company manages relationships with employees, suppliers, customers, and the communities in which it operates. Governance deals with corporate governance, executive compensation, audits, internal controls, and shareholder rights. There is evidence in the literature that investors and analysts consider environmental factors when making investment decisions and recommendations (Heinkel, Kraus, & Zechner, 2001), (Mackey, Mackey, & Barney, 2007), (Siedschlag, & Yan, 2021). Investors use various analytical tools when they are making decisions about the allocation of their financial resources. The aim of the paper is to present the possibilities of using the CVaR risk measure in comparative analyses of individual environmental shares. The choice of appropriate software tools conditions the effectiveness of the results achieved. Currently, the R language (Pfaff, 2013) is often used for statistical and financial analyses. R environment provides many packages intended for financial analyses. In the presented paper, the R language was used to analyze the development of the financial indicators of the most significant environmental companies in the world. Analyses were carried out on selected assets, while calculations of expected asset return and the Conditional value at risk (CVaR). The risk measure is often used in financial analyses (some common measurements of risk include standard deviation, value at risk (VaR), conditional value at risk (CVaR)).

The paper structure is the following. After introduction, second part deals with general information about environmental investment, and the methodological concept for presented analysis is mentioned at the end of the second part. Third part deals with the analysis of 19 environmental companies based on investment measures. Finally, the paper's conclusion summarizes the analysis results and formulates recommendations.

2. ENVIRONMENTAL INVESTING

Environmental (green, ecological) investments are those where most or all income and profits come from ecological business activities. Even if profit is not the only motive for environmental investment, environmental investment can correspond to or outperform the returns of more traditional assets. Environmental investments can also apply to companies with other business areas but focus on environmental initiatives. For example, some ecological companies are engaged in renewable energy research or developing ecological alternatives to non-ecological materials. In contrast, others may try to reduce pollution or other environmental impacts of their production processes (Eyraud, Clements, & Wane, 2013), (Azhgaliyeva, Kapsalyamova, & Low, 2019).

The basic areas of environmental investment include the following:

- Renewable energy (primarily water, wind and solar energy)
 - o Hydropower plants - among the largest companies in this industry can be included e.g. PG&E, Idacorp, Brookfield Renewable Partners;
 - o Wind energy – e.g. General Electric, NextEra Energy; Partners, Siemens Gamesa Renewable Energy, Vestas Wind Systems AS;
 - o Solar energy – e.g. First Solar, JinkoSolar Holding, Enphase Energy, Sunrun, Invesco Solar ETF;
 - o Geothermal energy – e.g. Ormat Technologies.
- Pollution controls (e.g. Fuel-Tech, VanEck Environmental Services ETF, Invesco MSCI Sustainable Future ETF)
- Ecological transport (e.g. Tesla, Ballard Power Systems)
- Waste reduction (e.g. Republic Services, Waste Management)
- Alternative agriculture (e.g. United Natural Foods, Mowi ASA)
- Investments in water (e.g. American Water, Essential Utilities).

The basic types of environmental investment are:

- Green shares (purchase of shares in companies with firm environmental commitments).
- Green bonds (also climate bonds, which are loans that help banks, companies, and government bodies finance projects with a positive environmental impact).
- Green funds (investing in green exchange-traded funds (ETFs), which allow investors to spread their money across a diversified range of environmental projects instead of a single stock or bond).

Environmental investing, whether in ETFs or individual stocks, refers to investment activity focusing on companies whose businesses support or promote environmental protection efforts, alternative energy, clean air and water projects, and other environmentally responsible business decisions. For example, companies can be distributors of alternative energy or manufacturers of parts and equipment needed to produce energy, such as the photovoltaic cells needed to make solar panels. Each ETF has its criteria for determining asset acceptability requirements.

2.1. Historical yield simulation

The calculation of the return on assets is generally based on the construction of a discrete random variable X (represented by the vector \mathbf{r}) using price changes. If the price change is defined as relative to some initial price, then such a change is called yield. Let P_t be the price at time $t = 1, 2, \dots, T$, where T is the length of the monitored period. The rate of return between periods t and $t-1$ can be expressed as the relative rate of return r_t for the same time period (Pekár, Brezina, & Reiff, 2022a):

$$r_t = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (1)$$

When formulating certain models, the measure of the cumulative yield of the asset is also used, at time t it can be expressed as

$$y_t = \frac{P_t - P_1}{P_1} \quad (2)$$

This method's disadvantage is that the investigated period can be characterized by atypicality, which can lead to non-representative data. Therefore, selecting historical data according to time relevance, current correlation, and volatility is advisable. Some critics consider this method not very reliable in terms of revenue distribution and logical inconsistency.

2.2. Expected asset return

Assuming the representation of the random variable X by discrete values (vector \mathbf{r}), the expected rate of return can be calculated as a geometric mean. For the expected return $EG(\mathbf{r})$ ($\mathbf{r} = r_1, r_2, \dots, r_T$) of an individual asset owned for the T period, with the exact significance of individual observations, the following generally applies (Pekár, Brezina, & Reiff, 2022a):

$$EG(\mathbf{r}) = \left(\prod_{t=1}^T (1 + r_t) \right)^{\frac{1}{T}} - 1 \quad (3)$$

where r_t is the return of the discrete random variable in the t -th state, $t = 1, 2, \dots, T$. T is the total number of random states. The expected return of an asset as a geometric mean, based on the value of the cumulative return, can be expressed as

$$E = \left(1 + y_T \right)^{\frac{1}{T}} - 1 \quad (4)$$

2.3. Risk measure: Conditional Value at Risk

Conditional Value at Risk (CVaR), a very often used risk measure for financial analyses, can be defined as an expected loss exceeding the Value at Risk (VaR), so CVaR only considers higher loss values than the VaR value. The CVaR value is defined for a given confidence level α (Pekár, Brezina, & Reiff, 2022a):

$$CVaR_{\alpha}(X) = E(L(X) | L(X) \geq VaR_{\alpha}), \quad (5)$$

where X denotes the random variable representing the return, $L(X)$ denotes the loss function of the random variable X and is the value at risk. Assuming the existence of a discrete random variable X , represented by the vector $r = (r_1, r_2, \dots, r_T)$, where T is the number of components, the CVaR risk measure can be defined as

$$CVaR_{\alpha}(X) = VaR_{\alpha} - \frac{1}{\alpha} E[|\mathbf{r} + VaR_{\alpha}|_{-}]$$

$$CVaR_{\alpha}(X) = VaR_{\alpha} + \frac{1}{\alpha} \sum_{t=1}^T \max(- (r_t + VaR_{\alpha}), 0) \quad (6)$$

3. ANALYSIS OF SELECTED ENVIRONMENTAL ASSETS

For analysis, 19 shares of the largest global environmental companies were selected. A list of the environmental companies is created by the company Value Today. It is a software analytics company that provides corporate information, companies' financial information, and world financial news. The Value Today concept is primarily based on providing information related to business analysis and characterizing how different companies in different sectors operate in different countries. The company provides data on global markets, sector performance, company market value, annual and quarterly company results, balance sheet and cash flow data, and key analytical indicators related to corporate companies. Based on Value Today data, the shares of the 19 largest global environmental companies were selected for analysis (of course, other entities list a different set of the largest environmental companies based on their own criteria): Waste Management (WM), Republic Services (RSG), Waste Connections (WNC), Veolia Environnement (VEOEY), China Conch Venture Holdings (0586.HK), Stericycle (SRCL), Clean Harbors (CLH), Fomento De Construcciones Y Contratas (FCC.MC), China Everbright International (CNE.SG), Cleanaway Waste Management (CWY.AX), Companhia De Saneamento Basico Do Estado De Sao Paulo – Sabesp (SAJA.BE), Casella Waste Systems (CWST), Beijing Enterprises Water Group (0371.HK), Daiseki (9793.T), Munters Group Ab (MTRS.ST), Harsco Corporation (HSC), Metawater (9551.T), China Everbright Greentech (CK7.F), Dredging Corporation Of India (DREDGEC).

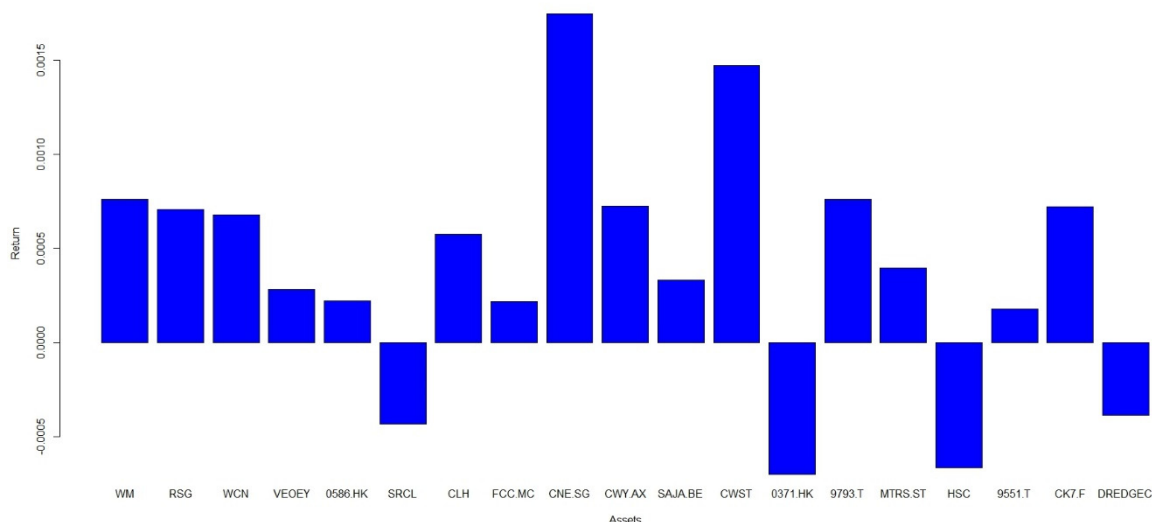
The analysis was carried out on daily historical data for the period from 19.5.2017 to 30.12.2022. The calculation of the considered returns and CVaR risk rate was based on the development of stock prices published on the finance.yahoo.com website based on relations (1), (3), and (6). The results are presented in Table 1 for all stocks considered.

Table 1: Values of average daily returns and CVaR risk measures

	WM	RSG	WNC	VEOEY	0586.HK	SRCL	CLH	FCC.MC	CNE.SG	CWY.AX
Return	0.08%	0.07%	0.07%	0.03%	0.02%	-0.04%	0.06%	0.02%	0.17%	0.07%
CVaR	-3.40%	-3.44%	-3.44%	-5.09%	-5.28%	-5.91%	-6.19%	-4.56%	-7.70%	-4.57%
	SAJA.BE	CWST	0371.HK	9793.T	MTRS.ST	HSC	9551.T	CK7.F	DREDGEC	
Return	0.03%	0.15%	-0.07%	0.08%	0.04%	-0.07%	0.02%	0.07%	-0.04%	
CVaR	-7.02%	-5.30%	-4.92%	-5.38%	-6.19%	-10.58%	-3.75%	-6.57%	-6.61%	

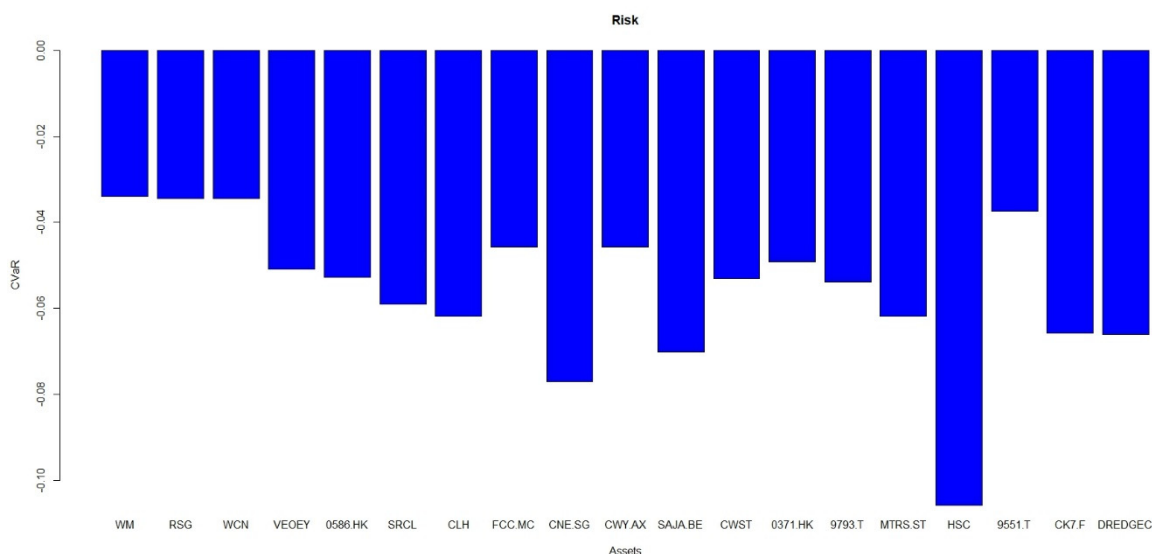
Source: Own processing.

Calculated values from Table 1 are graphically interpreted in Picture 1 and 2.



Picture 1: Values of average daily returns
Source: Own processing.

Based on Table 1 and Picture 1, it can be concluded that China Everbright International (CNE.SG) is the most profitable stock for the analyzed period, with a daily yield of 0.17%. On the other hand, from Table 1 and Picture 2, it is clear that using the CVaR risk measure, Waste Management (WM) appears to be the least risky stock with a risk of -3.40%, which represents the average of the worst 5% losses (CVaR risk rate) for the observed period. The lowest yield value is acquired by shares of Beijing Enterprises Water Group (0371.HK) with a value of -0.07%. Harsco Corporation (HSC), with a value of -10.58% appears to be the riskiest.



Picture 2: CVaR risk rate values
Source: Own processing.

From the analysis of selected shares of the largest global environmental companies presented in Table 1 and Figure 1, it can be observed that in the monitored period, most companies show a profit (15 companies, i.e., 78.95%). In comparison, only four companies show a loss, i.e., 21.05% (SRCL - Stericycle, 0371.HK - Beijing Enterprises Water Group, HSC - Harsco Corporation, DREDGEC - Dredging Corporation Of India).

4. CONCLUSION

Investing in environmental companies represents a relatively new investment tool that aligns with the increasing emphasis on environmental protection. The contribution presents the method of calculating the values of the rates of return and risk for the 19 largest global environmental companies, determined based on the selection of the company Value Today. The

CVaR risk measure, often used for financial analysis, and the yield values obtained as a geometric mean were used for the calculation. Experimental calculations (individual stocks with their development in the monitored period come from the website <http://finance.yahoo.com>, while 19 stocks were considered daily for the period from 19.5.2017 to 30.12.2022) present a real possibility of using the CVaR risk measure and yield values for evaluating the suitability of investing in selected environmental actions. From the calculations, when compared with classic investments e.g. (Pekár, Brezina, & Reiff, 2022a), (Pekár, Brezina, & Reiff, 2022b), (Pekár, Brezina, & Reiff, 2022c) it can be observed that investment in environmental companies shows similar values as an investment in standard industries in which comparable values of returns and risks are achieved, which provides scope for the development of companies by raising funds. Based on the historical simulation, expected returns were calculated, and risk measure CVaR. In the presented paper, individual values were compared based on investment criteria measures for all analyzed companies. Based on performed analysis most profitable is the waste management company from China, and on the other hand, less risky is the waste management company from the USA. The stated situation reflects the rapidly growing market in action, which can be observed by the highest yield. On the other hand, the least risky is the environmental company in the United States, where the analyzed segment has been operating for a long time. In future research, models of portfolio selection model will be constructed that will reflect correlation among the stocks and not just measures of individual stocks.

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