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# SUSTAINABLE INVESTING IN EMERGING MARKETS

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# SUSTAINABLE INVESTING IN EMERGING MARKETS

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# Abstract

As demand for sustainable investments continues to grow, asset managers are increasingly looking for ways to incorporate environmental, social and governance (ESG) factors into their investment strategies. However, sustainable investing in emerging markets has yet to reach its full potential. A lack of available ESG data and inconsistencies among ratings present significant challenges. With the aim of bridging the gap, this paper explores a capital market-based approach to integrate ESG aspects into portfolio management on the example of Brazil and Africa. Estimating different ESG factor betas of the stocks enables the construction of portfolios with high exposure to good ESG practices. The analysis shows that the performance of portfolios varies with the ESG factors as well as the geographic regions. None of the African portfolios with high exposure to an assessed factor outperformed the benchmark. In Brazil, the portfolio with a high exposure to factor G (governance) and ESG (MSCI ESG rating) presented a better risk-adjusted performance than the benchmark.

**Keywords**: ESG investing, portfolio construction, emerging markets, Brazil, Africa, climate finance, sustainable investing.

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# 1. Introduction

Increased awareness of climate change has played a major role in raising the issue of sustainability to the top of the agenda for investors, companies, and policymakers (Kerber and Jessop 2021). Companies around the world face increasing pressure to act responsibly and the incorporation of non-financial information, including environmental, social, and governance (ESG) data has become a major trend in portfolio management. The high number of ESG funds, newly developed industry standards, and ESG indices are testimony to this growing interest among financial market participants. Among the best-known examples of this surge in sustainable investing are the United Nations Principles for Responsible Investing (PRI 2021). With more than 4,000 PRI signatories from over 60 countries, these participating financial institutions have over USD 120 trillion in assets under management in 2021 (PRI 2021). It shows that investors are adapting to a changing regulatory environment and customer base by focusing on the sustainability and longevity of investments.

While ESG investing is a global trend, around 80% of the global sustainable investing assets are from the United States or Europe (GSIA 2021). However, in 2021 emerging markets experienced a surge that increased their sustainable assets market share (Gautam et al. 2022). Even if emerging markets are considered the engine of this century's global growth, they are still facing considerable challenges ranging from poverty and pollution to corruption and diseases (Odell and Ali 2016, 96). It is precisely because of these challenges inherent in emerging markets that the integration of ESG criteria is an even greater imperative. A meta-

study considering more than 2000 research papers on ESG and its impact on financial performance confirmed that ESG factors are even more relevant in emerging markets (Friede, Busch and Bassen 2015, 210). Generally, investments in emerging market equities are associated with 14.2% higher unmanaged ESG risk compared to developed market equities (Sustainalytics 2019). Nonetheless, EM investors lag in incorporating sustainability into their investment process compared to developed markets. Among the reasons thwarting investors include a lack of available ESG data and disclosure but also nascent capital markets and corporate ownership structures (Odell and Ali 2016, 96). With the aim of bridging this information gap, this thesis explores a capital market-based approach to integrate ESG aspects into portfolio management in the example of Brazil and Africa. Computing different ESG factor betas of individual stocks enables the creation of a portfolio with high exposure to good ESG practices without having to exclude companies that do not disclose sufficient non-financial information.

# 2. Literature Analysis

## 2.1. ESG in Emerging Markets

It does not come as a surprise that the economic and financial conditions across countries and regions are vastly different (Claessens and Yurtoglu 2013, 6). Emerging markets (EM) present interesting opportunities, but investors need to be aware that companies in EM operate in an environment characterized by a variety of environmental, social, and governance challenges (Odell and Ali 2016, 101). The following subchapters provide an overview of the differences between emerging and developed markets in terms of ESG aspects. This adds to understanding the complexity and the challenges of integrating ESG into the investment strategy in Africa and Brazil.

**Environmental Criteria**

The E in ESG stands for environmental criteria and includes greenhouse gas emissions, air and water pollution, impact on the environment, and awareness of climate change and population growth (Johnson 2020, 337). To go a bit more into detail, this includes waste management, resource scarcity, deforestation, sustainable land use, nuclear energy, and energy efficiency (Johnson 2020, 337). The environmental aspects are particularly important for frontier markets and emerging economies, as they are among the countries most exposed to the effects of climate change, resource scarcity, and severe local pollution (Odell and Ali 2016, 96). Extreme weather events caused by climate change are increasing in severity and frequency. Both regions considered in the research paper (Brazil and Africa) are among the most affected concerning flooding, typhoons, and droughts. Regarding resource scarcity, both the rising incomes and the rapidly growing population in emerging markets are intensifying the demand for resources. In

2050, the demand for food will be 60% higher than in 2016, and the global population is expected to exceed 9 billion people (Hutt 2016). Emerging Markets are among the most vulnerable to food and water stress. They have also shown a surge in demand for energy. The recent years have been marked by a shift towards sustainable energy due to external pressure from international organizations and foreign investors (Paramati, Ummalla and Apergis 2016, 40).

**Social Criteria**

The Social aspect of ESG covers how companies are managing their internal and external stakeholders such as employees, customers, suppliers, and communities affected by their operations (Johnson, 2020, p.337). Just to name some examples, this includes health and safety conditions for the workers, labor standards, employee relations, working conditions, human rights, supply chain standards, data security, and consumer privacy (Chauhan and Kumar 2018, 36).

Social issues in emerging markets are often a major concern for investors, who fear that inconsistent regulatory systems and weak institutions will lead to problems in the areas mentioned above. Especially consumer protection, employee exploitation, human rights abuses, and poor community relations are the areas of concern (Odell and Ali 2016, 97).

Poor working conditions, exploitative labor practices, and human rights abuses pose significant ESG risks associated with exposure to emerging markets. Investors must conduct thorough on-site inspections and due diligence checks regularly to put pressure on companies to improve these conditions. According to Hay (2020), it is better to engage with the company and relevant stakeholders than to abandon the investment altogether (Hay 2020).

**Governance Criteria**

The G in ESG stands for governance and concerns a firm's leadership, disclosure and audits, accounting, executive pay, board composition, gender balance, diversity, alignment of interest and ownership, cybersecurity, risk management, shareholder rights, anti-corruption, and bribery (Chauhan and Kumar 2018, 36). Corporate Governance has gained traction in recent years. This was due to the financial crises that erupted in Brazil, Russia, and Asia in 1998, triggered by poor corporate governance, which had far-reaching effects on major economies and threatened global financial stability (Claessens and Yurtoglu 2013, 2). Emerging Markets have significantly lower levels of disclosure and governance standards (Odell and Ali 2016, 97). Issues related to corporate governance are inherently different from developed markets. Reasons include restricted access to capital, low institutional ownership, and concentrated ownership structures (Claessens and Yurtoglu 2013, 3).

Both investors and local firms face vastly different challenges concerning governance in emerging markets. Odell and Ali (2016, 100) point out, that emerging markets are not necessarily suited for western-style shareholder activism due to sometimes insufficiently developed regulatory institutions. Companies in emerging markets are often owned by majority shareholders, including families and governments, making aggressive activism ineffective. The authors Odell and Ali (2016, 100) suggest that other approaches that are focused on collaboration are more suitable and successful in such environments.

## 2.2. ESG Data Availability and Quality

The previous paragraphs elaborated on the different realities and different challenges that firms are facing in emerging markets. Evidently, this results in differences that also translate into ESG ratings. Companies operating in emerging markets tend to lower ESG ratings in a global

comparison. An additional weight on the ratings is the lack of information. Historically, the level of disclosure in emerging markets has been much lower, and this lack of transparency complicates ESG assessments (Khanna and Palepu 2000, 869). However, there have been improvements made regarding transparency due to updated listing requirements and policy changes. An increasing amount of stock exchanges in EM are joining the United Nations Sustainable Stock Exchange Initiate (SSE), which is an initiative that fosters disclosure on social and environmental issues as well as governance reporting standards. Brazil for example introduces corporate governance codes (Viegas 2007). Insufficient disclosure remains prevalent, and it negatively affects not only the ratings but also a company's valuation and cost of capital (Chauhan and Kumar 2018, 33-34).

Regarding the quality of the ratings, it should be noted that several studies have shown significant divergences between the ESG ratings of different agencies (Chatterji, Durand, Levine and Touboul 2015, 1597). An extreme example was pointed out by the Financial Times author Allen (2018), who describes that in 2016 Tesla was placed last by FTSE among automotive companies, while it ranked in the top 10 in the MSCI ratings and Sustainalytics located Tesla somewhere around the average. This shows that even if third-party ESG ratings are available for a company, an investment decision should take other sources of ESG information into account.

# 3. Theoretical Foundation

To understand the methodology being used to build the ESG portfolios, it is essential to understand the underlying theory of the Modern Portfolio Theory (MPT) and its evolution to factor models.

## 3.1. Capital Asset Pricing Model

The Capital Asset Pricing Model that originated in the 1960s is the most fundamental theory in asset management and therefore factor theory. The CAPM is based on MPT and the portfolio selection principles described by Markowitz (1952) and it explains the relationship between the expected return of an asset and market risk. It was first studied by Sharpe (1964) with the following formula:

$$R_i(t) = \alpha_i + \beta_{mkt,i} R_{mkt}(t) + \varepsilon_i(t) \quad (1)$$

$R_i(t)$ stands for the return of asset i and $\alpha_i$ is the alpha of the same asset. $R_{mkt}(t)$ stands for the return of the market and $\beta_{mkt,i}$ is the market beta or the systematic risk of stock i while $\varepsilon_i(t)$ stands for the idiosyncratic risk. The author Ang (2014) characterizes it as the first model that considers asset risk in comparison to other assets instead of looking at the risk in isolation. In other words, instead of taking the volatility of an asset as the risk of this investment, the risk takes into account how an asset covaries with the market, which is the market beta. The market beta is the systematic risk that cannot be diversified away (Zaher 2019, 16). As a result, the CAPM implies that an asset's expected return is a function of market risk. Although empirical studies show that the CAPM only partially explains the risk premium of an asset, the model is still relevant in asset management practice and research (Ang 2014, 195). Especially the

premise, that the risk premium of an asset represents compensation for losses investors experience in “bad times” and that the risk premium is shaped by the underlying factors (Ang 2014, 197) is deeply embedded in modern factor theory.

## 3.2. Arbitrage Pricing Theory

In 1976, Stephen Ross published the Arbitrage Pricing Theory building upon the CAPM. It set the base for a multi-factor approach to explaining the relationship between risk and return of an asset. This already indicates that the risk premium is not only based on the market factor but can be influenced by several factors. Like the market beta, the other factors introduced by APT cannot be hedged by diversification or arbitrage. Following the argumentation of the APT, downtimes are not associated with a recession in the overall market but are determined by the individual factor itself. Also, the risk premium is factor specific. The factor-beta is the exposure of an asset to a variable (Ang 2014, 203-207). Stephen Ross (1976) named several macroeconomic factors such as inflation, exchange rate, and economic growth, but he did not define a set of specific factors. Chen, Roll and Ross (1986) identified four macroeconomic factors that influence the stock market and significantly explain the risk-return relationship of assets: economic growth, interest rates, inflation, and the yield curve. These factors affecting the asset premium have crossed the threshold from theory to practice. Nowadays, the focus shifted away from the market factor and the macroeconomic factors towards so-called style factors, which are factors within asset classes (Koedijk, Slager and Stork 2016, 195-196).

## 3.3. Fama and French Three-Factor Model

The best-known factors were introduced by Fama and French in 1992. They showed that the stock returns of US equities between 1963 and 1990 could be predominantly explained by two

factors in addition to the market factor. On the one hand, they introduced the size factor, which shows that small-cap stocks tend to outperform stocks with large market capitalization. This effect is captured by a mimicking portfolio that is constructed by a long position in the stock portfolio with high loadings to the chosen factor and a short position for the opposite (Asgharian 2004, 2). For this reason, the size factor is referred to as small minus big (SMB). On the other hand, they added the book-to-market ratio, which is mostly called the value factor. This factor reflects that value stocks on average outperform growth stocks (Investopedia, 2022). The factor is often referred to as the high minus low factor (HML). With their three-factor model, Fama and French (1993) introduced the next significant step in factor theory. It was the first time that style factors (rather than macroeconomic factors) successfully explained U.S. stock returns (Ang 2014, 227). In the formula, the size factor is represented by the variable $R_{smb}$ (t) while $\beta_{smb,i}$ is the size beta or the sensitivity of the asset i. $R_{hml}$ (t) is the value factor and $\beta_{hml,i}$ is the value beta.

$$R_i (t) = \alpha_i + \beta_{mkt,i} R_{mkt} (t) + \beta_{smb,i} R_{smb} (t) + \beta_{hml,i} R_{hml} (t) + \varepsilon_i (t) \quad (2)$$

In 1997, the three-factor model was extended by Carhart (1997) with the momentum (MOM) factor which is also called the winners minus losers factor (WML). The factor captures the tendency of stocks to move in the same direction as they used to in their previous history. In the formula $R_{wml}$ (t) is the return of the new factor while $\beta_{wml}$ is the momentum sensitivity of stock i.

$$R_i (t) = \alpha_i + \beta_{mkt,i} R_{mkt} (t) + \beta_{smb,i} R_{smb} (t) + \beta_{hml,i} R_{hml} (t) + \beta_{wml,i} R_{wml} (t) + \varepsilon_i (t) \quad (3)$$

This four-factor model has led to extensive empirical evidence and retains its legitimacy in academia and practice. Since then, few theories that fundamentally alter the model have been published. Instead, science is much more concerned with the study of specific factors than with the basic determinants of factor theory (Leippold and Rueegg 2020).

# 4. Methodology

## 4.1. Beta Estimation

A major difficulty in integrating ESG into portfolio construction is the quality and consistency of ESG ratings and the lack of disclosure by the firms. This is an even bigger problem in emerging countries with less legislation setting disclosure standards. To deal with this issue, this analysis follows a market-based approach (Gören, Jacob and Nerlinger 2020). By running OLS regressions of the returns of individual firms on an ESG factor, firms with positive loadings on the factor can be distinguished from firms with negative loadings, which are considered "bad" ESG companies. Due to the data intensity associated with running the monthly regression for the returns of more than 300 stocks, the analysis was performed using python. BPI Asset Management provided their African and Brazilian Stock universe containing 270 and 56 equities respectively of publicly traded companies in this geographic area. Different ESG portfolios were constructed using three different factors as ESG proxies as described in the subsequent paragraphs.

**Factor G**

With ESG being an umbrella term, proxies were considered to capture different aspects of ESG. The first factor used focuses on governance and was created by the authors Pedersen, Fitzgibbons, and Pomorski (2021). The foundation of creating the factor comes from the accounting literature that states that low accruals indicate a conservative accounting approach which is adopted by better-governed companies (Kim, Park and Wier 2012, 2). In accounting, accruals are referred to as income for which the firms have not yet received the associated cash. According to research (Sloan 1996) companies tend to have noticeably large accruals prior to becoming the subject of SEC enforcement actions. The SEC (U.S. Securities and Exchange

Commission) Division of Enforcement investigates possible violations such as accounting violations, insider trading, and foreign bribery. According to Sloan (1996), firms with high accruals are also more likely to restate earnings. The companies' accruals over assets are used to classify the firm into 5 categories, ranging from high accruals (G1) to low accruals (G5). A long-short portfolio is created by calculating G5-G1. In other words, the factor G reflects the excess returns by taking the returns of companies with good governance minus the excess returns of companies with bad governance. The monthly factor G beta is estimated by running the regression below, where $R_i$ (t) stands for the return of stock i, the alpha of the asset i is $\alpha_i$. $R_g$ (t) is the return of the G factor and $\beta_{g,i}$ is the G sensitivity or exposure of the stock i to good governance. Finally, $\varepsilon_i$ (t) stands for the idiosyncratic risk.

$$R_i(t) = \alpha_i + \beta_{g,i} R_g(t) + \varepsilon_i(t) \quad (4)$$

**Factor E**

The second factor was created by the same authors as factor G and the E stands for the Environment aspect of ESG (Pedersen, Fitzgibbons, and Pomorski 2021). As a proxy, the authors used the company's carbon intensity, which is calculated by dividing a company's carbon emissions by its revenue. To be more precise, only the firm's direct emissions (scope 1) and scope 2 emissions are taken into account. Scope 2 refers to indirect emissions that result from purchasing energy. Other indirect emissions (scope 3) are difficult to measure, seldomly reported, and therefore not included. The authors (Pedersen, Fitzgibbons, and Pomorski 2019) accessed relevant data through Trucost. Similar to factor G, the authors created five categories ranging from high emissions (E1) to low CO2 emissions (E5). The factor of this long-short portfolio is the result of subtracting the excess returns of the low-emission firms from those of high-emission firms (E5-E1). The monthly factor E beta is estimated by running the following regression where $R_e$ (t) is the return of the E factor and $\beta_{e,i}$ is the E sensitivity of the asset i.

$$R_i(t) = \alpha_i + \beta_{e,i} R_e(t) + \varepsilon_i(t) \quad (5)$$

**Factor S**

The third factor, also created by the same authors as factor G and E, stands for the social aspect of ESG. More specifically, this measure is a non-sin stock indicator: it gives a value of zero for sin stocks and a value of one for non-sin stocks. Higher values result in better ESG. Sin industries, as defined by Hong and Kacperczyk (2009, 16), include for example tobacco, gambling and alcohol. The factor is derived by the difference between the excess return of going long on non-sin stocks (S2) and going short on sin stocks (S1). Just like for the previous factors, the factor E beta is estimated by running the following regression where $R_S(t)$ is the return of the S factor and $\beta_{S,i}$ is the sensitivity or exposure of the asset i to factor S.

$$R_i(t) = \alpha_i + \beta_{S,i} R_S(t) + \varepsilon_i(t) \quad (6)$$

**Factor ESG**

The ESG Factor tries to incorporate the above-described Factors into one. As a proxy, the authors use the widely used MSCI ESG scores that try to incorporate all aspects of ESG. Just like previously explained, they create five categories and receive the excess return by calculating ESG5 (high ratings) – ESG1 (low ratings). The same regression is run, where $R_{esg}(t)$ is the return of the ESG factor and $\beta_{esg,i}$ is the ESG sensitivity of the stock i.

$$R_i(t) = \alpha_i + \beta_{esg,i} R_{esg}(t) + \varepsilon_i(t) \quad (7)$$

**Monthly OLS Regressions**

The stocks' monthly historical stock prices were retrieved from Bloomberg reaching back until January 2010. The arithmetic returns are calculated based on the adjusted closing price. As some companies are only listed at a later point in time, not all the stocks have data starting in 2010. The following paragraphs will clarify how this is taken into account. Since the factors computed by the authors Pedersen, Fitzgibbons, and Pomorski (2019) provide data until March 2019, the monthly beta calculations start in January 2015 and end in April 2019. This allows for a burn-in period of five years (January 2010 – December 2015) and leaves four years and three months to calculate the coefficients. As previously mentioned, data for some stocks is only available at a later point in the time series. The coefficient is only computed once a stock has data available for at least twelve months. Once the stock passed this threshold, the monthly coefficients are estimated by running an OLS regression of the stocks return on the excess return of the respective factor, as described in the previous subchapter. The output of the first Python notebook is a data frame containing the months as the index, the company ticker as column heads, and their respective coefficients in the rows.

The coefficients of factor G indicate the extent to which the company has exposure to good corporate governance. To express it more intuitively, the higher the coefficient, the better the corporate governance compared to other companies. The purpose of the second python notebook is to construct different portfolios building on the computed coefficients and to calculate their monthly returns. With the overarching goal of integrating ESG into the portfolio, the coefficients are sorted from highest to lowest for each month. For the Mean Portfolio G Top, the top tercile with the highest betas is selected for each month. More precisely, the top tercile of available betas is selected. As more data becomes available over time, the number of stocks that make up the portfolio increases. The next subchapter provides an overview of the portfolios and how they are constructed. After selecting the stocks for each portfolio, they are

matched with their respective returns to calculate the monthly portfolio returns. All the steps explained in the example of factor G are repeated for the other factors. The final part of the analysis is comparing the portfolios in a risk-adjusted and holistic matter by applying different metrics. This examination includes measuring cumulative returns, the Sharpe Ratio, Maximum Drawdown, the Conditional Value at Risk, Skewness, and Kurtosis.

## 4.2. Portfolio Construction

**Mean Universe Portfolio**

The Mean Universe Portfolios include all the stocks provided by BPI Asset Management for their Brazilian and African Investment Universe. They are used as a benchmark to see how the integration of ESG through exposure to a chosen factor impacts the risk-adjusted returns of a portfolio. For Brazil, a total of 56 stocks are included towards the end of the analyzed timeframe. For Africa, the universe includes a total of 272 stocks of companies from different countries, with Morocco-listed companies accounting for the largest number, followed by Kenya and South Africa. Some companies were not publicly traded in 2015, whereas others became listed companies after 2019. For example, the health care and diagnostic services company Rede D'Or Sao Luiz SA (ticker: RDOR3) had its initial public offering in December 2020 and was therefore not included in the analyzed timeframe (Laier and Mandl 2020). It is an equally weighted portfolio.

**Mean Portfolio Top**

The Mean Portfolio G Top is created by choosing the stocks within the BPI investment universe with high exposure to good ESG practice. As described in the methodology chapter, the returns of the individual stocks are regressed on factor G. Each month starting from January 2015, the coefficient for the individual stocks is estimated and the top tercile of stocks with the highest

exposure to good governance is taken to form the portfolio. In order to estimate the coefficients, stocks that have shown returns for at least 12 months are considered and the top percentiles are selected as the result of the highest betas derived by the regressions. As the coefficients are calculated for each month, the stocks that reach the top percentile change, which means that the stock composition can change every month. As more companies have data towards the end of the period, the Brazilian portfolio starts with 15 stocks and ends with 18. The African version of the portfolio starts with 77 stocks and ends with 84. The weights are evenly distributed among the stocks in the portfolio, not considering the companies' market capitalization.

**Mean Portfolio Bottom**

Similarly, to the previous portfolio "Mean Portfolio G Top", this portfolio is also built considering the individual stock exposure to good governance. However, instead of picking the top percentile of betas, the bottom percentile was selected. This approach aims to compare the risk-adjusted performance of such a portfolio with the benchmark and with the portfolio ranking higher in terms of exposure to good governance. Thus, it is the portfolio that contains the stocks that perform worse in terms of governance relative to their peers.

**Value Weighted Portfolio**

For each month, the Value Weighted Portfolio G includes the same stocks as Mean Portfolio G Top. Therefore, it is composed of stocks with high exposure to good governance. However, instead of equally distributing the weights, bigger companies in terms of market capitalization receive a higher weight. Market capitalization is calculated by multiplying the price of a single share by the number of shares outstanding. Respective data is retrieved from Bloomberg. This is also referred to as a capitalization-weighted construction method to build a portfolio or an index. The stocks are weighted according to the relative total market capitalization. Market

capitalization for Africa is retrieved in USD dollars to compute the relative market capitalization.

**Industry Weighted Portfolio**

Just like the previously described portfolio, the Industry Weighted Portfolio G includes the same stocks as Mean Portfolio G Top and therefore also includes stocks assumed to perform well in terms of governance. Instead of changing the weights to account for the size in terms of market capitalization, the weights were adjusted considering the different industries. In this approach, the weights of the stocks are distributed in a way that the industry receives the same weight within the portfolio as in the Portfolio Universe provided by BPI. The objective of the industry-weighted portfolio is to partially counteract part of an industry bias that might emerge by integrating the ESG layer into the portfolio. However, industries that did not pass the threshold due to the stocks not being part of the upper tercile, are not included. Only the weights of the stocks that are above the tercile threshold are adjusted. Since BPI Asset Management obtains the weighting from a bottom-up analysis, this portfolio approach is rather exploratory. However, this approach is beneficial when asset managers are aiming for a specific sector weighting.

## 4.3. Metrics

**Sharpe Ratio**

The Sharpe ratio measures the excess return per unit of risk. For the calculation, the excess return is the numerator. This is the return that exceeds the safe investment represented by the risk-free rate. Due to the low-interest environment of the analyzed timeframe, a risk-free rate of 0% is assumed. In the Sharpe Ratio formula below, the variable $R_p$ represents the portfolio's

expected return, $R_f$ stands for the risk-free rate, and $s_p$ is the standard deviation of the respective portfolio.

$$SR = (R_p - R_f) / s_p \quad (8)$$

**Maximum Drawdown**

The Maximum Drawdown measures the heaviest loss of an investment in a given period. Therefore, it is the highest possible relative loss that an investor would have suffered if he had bought at the peak and sold at the lowest price within a given period. It can be seen as an indication of the maximum potential loss (Hayes 2022). The formula is the following:

$$MDD = (\text{Trough Value} — \text{Peak Value}) / \text{Peak Value} \quad (9)$$

**Skewness**

Skewness is a statistical indicator that analyzes the extent to which a distribution deviates from the normal distribution. It analyzes, based on the asymmetry, to what extent a distribution deviates from the normal distribution. The normal distribution has a skewness of zero and is therefore symmetrical. Positive skew refers to a longer or "fatter" tail on the right side, whereas a negative skew refers to a left-leaning distribution. Since the standard deviation as a measure of risk assumes a normal distribution, the skewness can provide a better estimation of future return. A positively skewed investment return means that there were frequent small losses and a few large gains. The opposite is the case of a negatively skewed return, where the mean is smaller than the median, meaning that one can observe frequent small gains and a few large losses (Chen 2022).

**Kurtosis**

Kurtosis, just like Skewness, is another statistical measure describing the distributions of returns. Instead of comparing the extreme values of the left to the right tail, it measures the extremes on either tail. For kurtosis, the number of data points at the outer edge of a distribution is measured and compared to the rest of the distribution of the data. For a dataset with high kurtosis, the tails of the bell curve extend farther than the three standard deviations of the normal distribution. A normal distribution has a kurtosis of three, which is also referred to as a mesokurtic distribution. If Kurtosis is greater than three, it is referred to as a leptokurtic distribution and if it is less than three, it is a platykurtic distribution. A platykurtic distribution occurs when the extreme values are less extreme than in a normal distribution. For investors, this means that the returns are more stable with fewer extreme positive or negative outliers (Kenton 2022).

**Conditional Value at Risk**

As a risk indicator, the conditional value at risk represents an extension of the value at risk (VaR). CVaR quantifies the amount of tail risk that a portfolio has. It focuses on the extreme event, so on the residual probability that the loss in a year will exceed the specified VaR. The risk indicator is derived by calculating the weighted average of the values in the tail. The cutoff point is the Value at Risk of the respective confidence interval. VaR represents the loss in the worst case with a time horizon and a probability. In case the threshold of the worst case is crossed, CVaR indicates the expected loss (Chen 2022). The CVaR is calculated by taking the average of the values beyond the VaR.

# 5. Results

## 5.1. Factor G

### Brazil Factor G

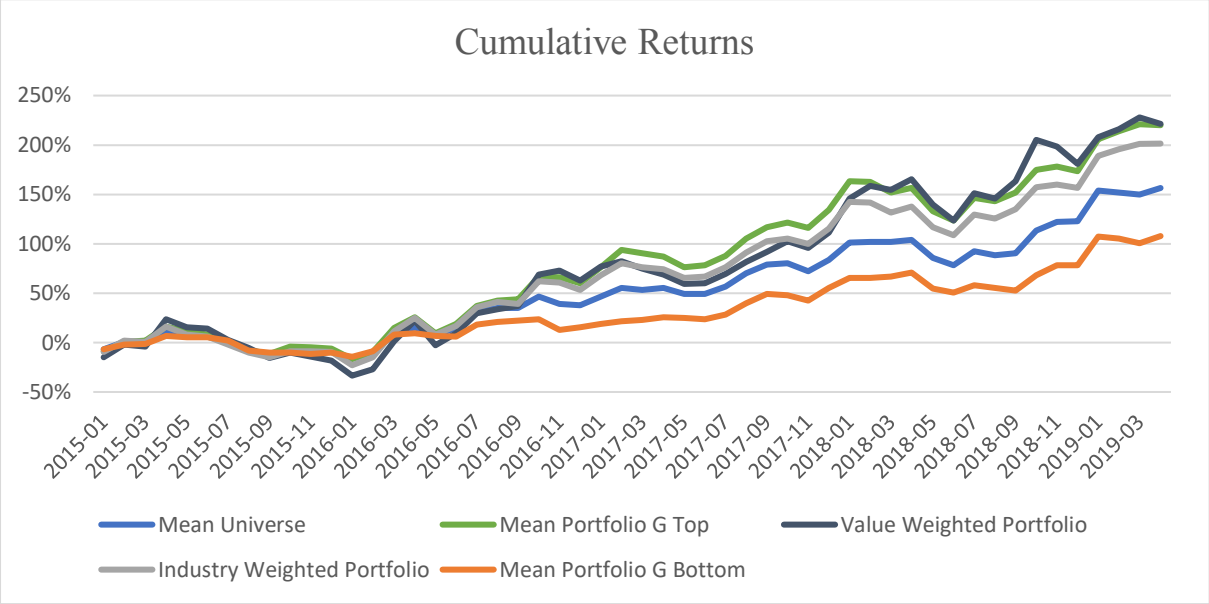


***Figure 1:*** *Cumulative Returns - Factor G Brazil*

The cumulative returns give the impression that all three portfolios created with high exposure to factor G (good governance) outperform the benchmark (Mean Universe portfolio). Only the Mean Portfolio G Bottom, which was created with the tercile of stocks with the lowest exposure to good governance underperformed the benchmark. The following metrics indicate whether the additional returns were realized by taking on more risk.

***Table 1**: Key Performance Indicators - Factor G Brazil*

| | Sharpe Ratio | Max. Drawdown | Skewness | Kurtosis | CVaR(95) |
|---|---|---|---|---|---|
| **Mean Universe** | 1.11 | -198% | 0.422 | 0.002 | -0.087 |
| **Mean Portfolio G Top** | 1.13 | -184% | 0.448 | 0.345 | -0.097 |
| **Mean Portfolio G Bottom** | 0.96 | -213% | 0.656 | 1.182 | -0.092 |
| **Value Weighted Portfolio** | 0.87 | -163% | 0.727 | 1.334 | -0.121 |
| **Industry Weighted Portfolio** | 1.01 | -192% | 0.634 | 1.193 | -0.107 |

*Notes: This table reports key performance indicators of the benchmark portfolio (Mean Universe) and the portfolios constructed with a desired exposure to the G factor for the Brazilian universe. Portfolios 1, 2, and 3 are equally weighted, while Portfolios 4 and 5 are weighted by equity market capitalization and industry weight, respectively.*

The Sharpe ratio, as a measure of return per unit of risk taken on, is highest for the Mean Portfolio G Top with 1.13 followed by the Mean Universe with 1.11. This means that the portfolio created with high exposure to good governance (Mean Portfolio G Top) outperformed the Mean Universe. The counter portfolio (Mean Portfolio G Bottom) has a lower Sharpe Ratio than the previously mentioned. When considering the portfolios with the rebalanced weights, the Value Weighted Portfolio has the lowest Sharpe Ratio and therefore the lowest risk-adjusted return for the analyzed time frame. In terms of rebalancing, the approach to rebalance with a target weight per industry leads to a better performance than the value-weighted approach.

***Table 2**: Annualized Risk and Return - Factor G Brazil*

| | Mean Return | Standard Deviation | Sharpe Ratio |
|---|---|---|---|
| **Mean Universe** | 27.07% | 21.86% | 1.11 |
| **Mean Portfolio G Top** | 35.28% | 27.14% | 1.13 |
| **Mean Portfolio G Bottom** | 20.52% | 19.53% | 0.96 |
| **Value Weighted Portfolio** | 40.42% | 39.42% | 0.87 |
| **Industry Weighted Portfolio** | 29.82% | 29.57% | 1.01 |

*Notes: This table provides information on the profitability and risk of the benchmark portfolio (Mean Universe) and the portfolios built with exposure to the G factor, a proxy for governance. Portfolios are constructed with equities from the Brazilian investment universe. All values are annualized.*

The volatility of the G Top portfolio (27.14%) is higher than both the Universe's (21.86%) and the G Bottom's (19.53%) annualized standard deviation. However, the average return of 35.28% exceeds the amount of additional return expected from taking on additional risk, resulting in a higher Sharpe Ratio. Nevertheless, the standard deviation shows that the high exposure to good governance did not decrease the risk. In fact, the Mean Portfolio G Bottom with the lowest exposure to good governance has the lowest standard deviation of 5.64%. The opposite can be observed when looking at the Value Weighted Portfolio, where the higher standard deviation is not compensated enough by additional returns to achieve the same Sharpe Ratio. Since larger companies, which are considered less volatile, are weighted higher in this portfolio, the increase in standard deviation is not the expected result (Investopedia, 2021). With regards to the maximum drawdown, the Value Weighted Portfolio (163%) does outperform the other portfolios. By rebalancing the weights, the portfolio experiences a drawdown of 184% (Mean Portfolio G Top**).** When comparing the Mean Universe Portfolio with the G Top and the G Bottom in terms of the maximum drawdown, the portfolio with high exposure to good governance (184%) outperforms the benchmark (198%), whereas the counterpart portfolio (213%) underperforms. Skewness and Kurtosis inform about the deviation of the return distribution from the normal distribution. All five portfolios are

positively skewed, which indicates a "fatter" right tail and therefore a right-leaning distribution. Positive skewness means that returns are characterized by frequent small losses and a few large gains. This can be confirmed by looking at Table. 3, where the average of the monthly positive returns is larger in absolute terms than the average negative returns. The mean is therefore bigger than the median.

***Table 3**: Average Positive and Negative Returns - Factor G Brazil*

| | Mean Universe | Mean G Top | Mean G Bottom | Value Weighted | Industry Weighted |
|---|---|---|---|---|---|
| **Skewness** | 0.422 | 0.448 | 0.656 | 0.727 | 0.634 |
| **Av. negative returns** | -3.56% | -4.25% | -3.05% | -6.67% | -4.71% |
| **Av. positive returns** | 6.11% | 7.94% | 4.95% | 10.44% | 8.19% |

*Note: The table shows to what extent the analyzed portfolios are positively skewed. The negative positive returns are bigger in absolute terms, meaning that investors experience frequent small losses and few large gains.*

All five portfolios have kurtosis below three and consequently a platykurtic distribution. For investors, this signals that the extreme values are less extreme than in a normal distribution. The Conditional Value at Risk is a risk indicator that quantifies the amount of tail risk an investment portfolio has. Unlike for the other metrics, where the Mean Portfolio G Top outperformed the other equally weighted portfolios, the CVaR of the "good governance" portfolio showed a slightly higher average loss in the worst 5% of returns (-9.7%) compared to the Bottom G (9.2%) and the Mean Universe (8.7%). The rebalanced portfolios have an even higher CVaR, indicating that certain higher-weighted industries and large market-cap companies are yielding higher negative returns beyond the 5% threshold.

**Africa Factor G**

Looking at the graph below, one can see that after the end of 2015, the G Top portfolio outperforms the G Bottom portfolio in terms of cumulative returns. The G top portfolio presented a similar performance to that of the benchmark, especially after mid-2017. The

equally weighted portfolio with low exposure to Factor G (bad Governance) resulted in the worst performance compared to the other portfolios according to the cumulative returns. The Sharpe Ratio provides further insight into the risk-return relation.

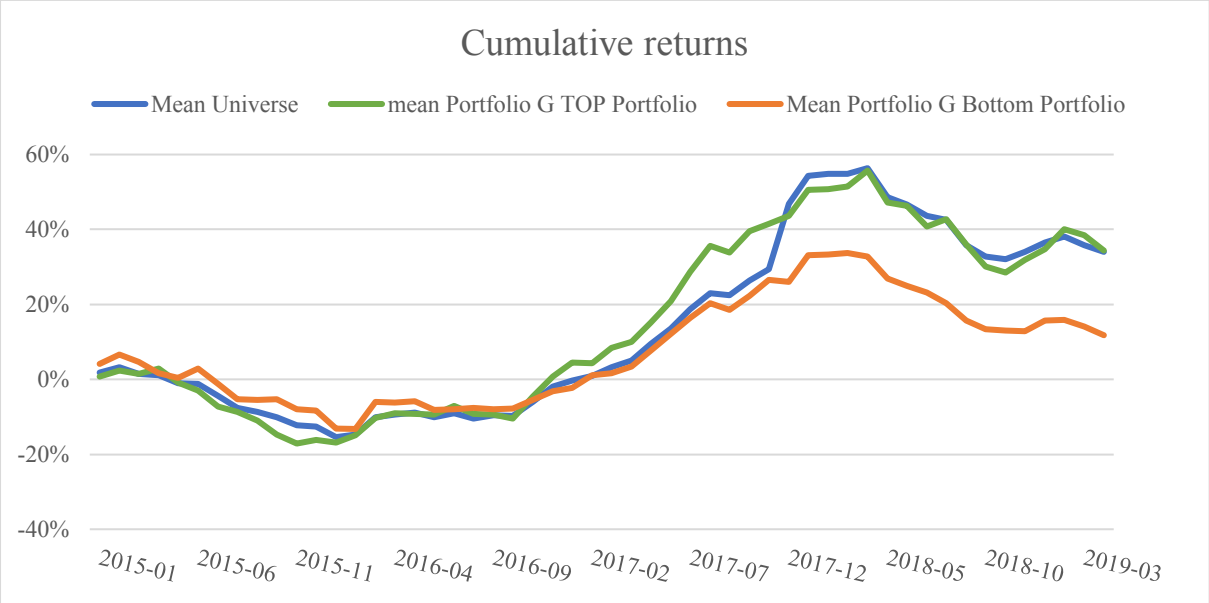


***Figure 2:*** *Cumulative Returns - Factor G Africa*

When looking at the performance of portfolios built from an investment universe of African companies, what stands out is the superior performance of the mean universe portfolio that presents the highest Sharpe Ratio (0.69), followed by the equally weighted portfolio with high exposure to factor G (good Governance), with a Sharpe Ratio of 0.68. Rebalancing the stocks of G top with a value-weighted (0.51) or industry-weighted (0.47) approach only lowered the Sharpe Ratio. Analyzing the rebalanced portfolios, the value-weighed portfolio, based on the market capitalization of the individual stocks, performed better than the industry-weighted portfolio in terms of Sharpe Ratio and Maximum Drawdown. The industry-weighted portfolio presents the lowest Sharpe ratio of 0.47 and the biggest loss of 386% in terms of maximum drawdown.

On the other hand, it is worth noting that the CVaR (95) for the value-weighted portfolio presents the lowest value (-13.7%), indicating that large market-cap companies recorded higher

negative returns beyond the 5% threshold. The other portfolios present similar CVaR (95) results, with the Mean Universe Portfolio having an average loss of 4.3% (CVaR(95)).

***Table 4:*** *Key Performance Indicators - Factor G Africa*

| | Sharpe Ratio | Max. Drawdown | Skewness | Kurtosis | CVaR(95) |
|---|---|---|---|---|---|
| **Mean Universe** | 0.69 | -287% | 1.38 | 4.77 | -0.043 |
| **Mean Portfolio G Top** | 0.68 | -381% | 0.03 | -0.81 | -0.049 |
| **Mean Portfolio G Bottom** | 0.32 | -226% | 0.43 | 0.26 | -0.046 |
| **Value Weighted** | 0.51 | -275% | 0.09 | 1.36 | -0.137 |
| **Industry Weighted** | 0.47 | -386% | 0.02 | -0.76 | -0.052 |

*Notes: This table reports key performance indicators of the benchmark portfolio (Mean Universe) and the portfolios constructed with a desired exposure to the G factor for the African. Portfolios 1,2 and 3 are equally weighted, while Portfolios 4 and 5 are weighted by equity market capitalization and industry weight, respectively.*

Regarding the maximum drawdown, high exposure to good governance resulted in a considerably higher drop of -381% than the mean universe (-287%). The counter portfolio G Bottom's biggest drop was 226%.

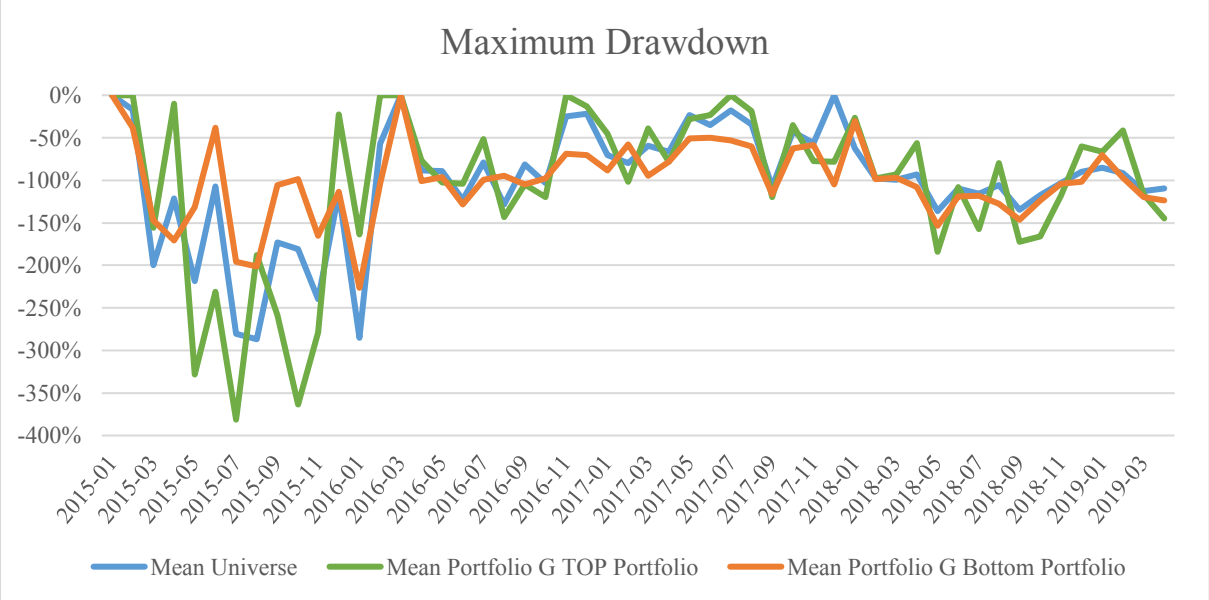


***Figure 3:*** *Maximum Drawdown - Factor G Africa*

When analyzing the distribution of portfolio returns from the graphs above and from Table 1, one notices that all ESG-created portfolios present a symmetrical distribution as their skewness is close to zero. On the other hand, the benchmark has the highest skewness (1.38). This combined with a kurtosis of 4.77, indicates large outliers and characteristics of a leptokurtic distribution. In contrast, the other portfolios present a platykurtic distribution resulting in thinner tails compared to a normal distribution and in fewer extreme positive or negative events.

***Table 5**: Annualized Risk and Return - Factor G Africa*

| | **Mean Return** | **Standard Deviation** | **Sharpe Ratio** |
|---|---|---|---|
| **Mean Universe** | 7.58% | 10.57% | 0.69 |
| **Mean Portfolio G Top** | 7.70% | 10.91% | 0.68 |
| **Mean Portfolio G Bottom** | 3.07% | 9.42% | 0.32 |
| **Value Weighted** | 13.95% | 25.90% | 0.51 |
| **Industry Weighted** | 5.25% | 11.00% | 0.47 |

*Notes: This table provides information on the profitability and risk of the benchmark portfolio (Mean Universe) and the portfolios built with exposure to the G factor, a proxy for governance. Portfolios are constructed with equities from the African universe. All values are annualized.*

As mentioned above, the Sharpe Ratio of the Mean universe (0.69) is only slightly lower than the Sharpe Ratio of the G Top portfolio (0.68). What should be noted, is that high exposure to good governance leads to an increase of risk in terms of standard deviation, whereas the G Bottom portfolio's volatility decreases. However, the lower standard deviation comes with much lower expected returns resulting in the lowest Sharpe Ratio of 0.32.

**Conclusion Factor G**

In conclusion, constructing a portfolio within the Brazilian stock universe with high exposure to good governance resulted in superior risk-adjusted performance. This is supported by the

fact, that the counter portfolio underperformed with a lower Sharpe Ratio than the benchmark for the annualized time frame. However, these results are not reflected within the African Universe. The African portfolio with high exposure to good governance had a very similar but slightly lower Sharpe Ratio than the Universe. For both Brazil and Africa, the G Bottom portfolios had lower risk-adjusted returns. It should also be noted, that for both geographic regions, selecting the top tercile of good governance stocks came with an increase in volatility. Whereas the opposite occurred by selecting the poor governance stocks, which resulted in a lower standard deviation.

## 5.2. Factor S

**Brazil Factor S**

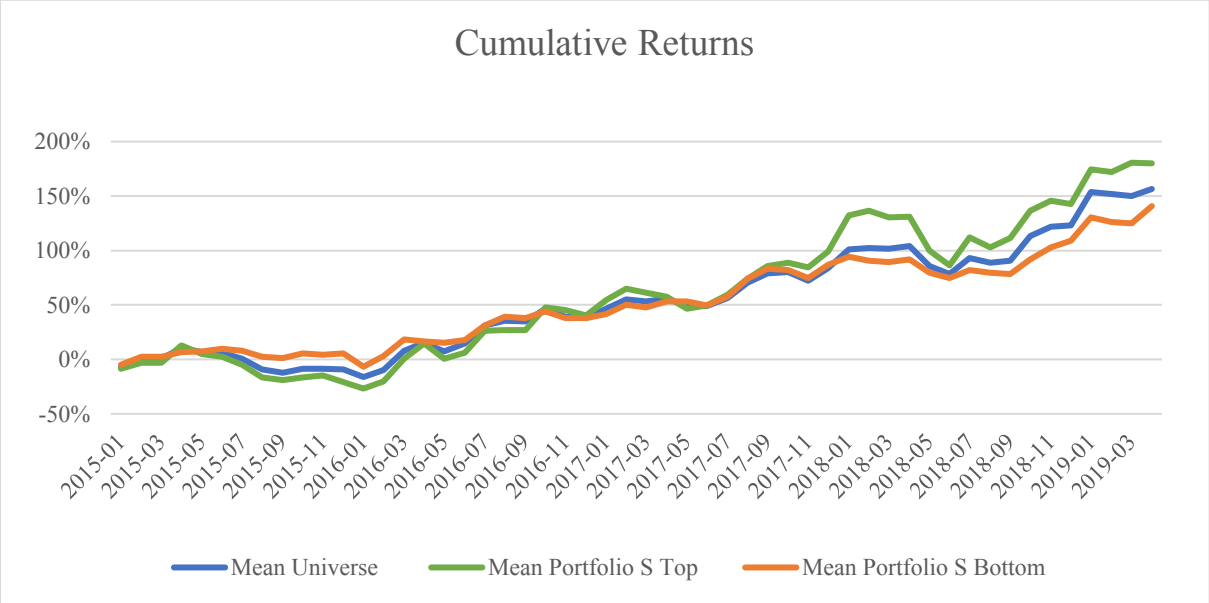


***Figure 4:*** *Cumulative Returns - Factor S Brazil*

From the graph above, one notices that the cumulative returns of the three portfolios present a similar trend for the analyzed period. Nevertheless, from the beginning of 2018 onwards, the

difference in cumulative returns becomes wider, and mean portfolio S Top outperforms both the Mean Universe and Portfolio S Bottom.

***Table 6**: Key Performance Indicators - Factor S Brazil*

| | Sharpe Ratio | Max. Drawdown | Skewness | Kurtosis | CVaR(95) |
|---|---|---|---|---|---|
| **Mean Universe** | 1.11 | -198% | 0.42 | 0.00 | -0.087 |
| **Mean Portfolio S Top** | 0.94 | -175% | 0.47 | 0.04 | -0.113 |
| **Mean Portfolio S Bottom** | 1.25 | -251% | 0.21 | 0.29 | -0.078 |
| **Value Weighted Portfolio** | 0.87 | -156% | 0.73 | 1.02 | -0.168 |
| **Industry Weighted Portfolio** | 0.97 | -168% | 0.38 | 0.06 | -0.114 |

*Notes: This table reports key performance indicators of the benchmark portfolio (Mean Universe) and the portfolios constructed with a desired exposure to the S factor for the Brazilian universe. Portfolios 1,2 and 3 are equally weighted, while Portfolios 4 and 5 are weighted according to the stocks' market cap and the industry's weights respectively.*

The risk-adjusted returns provide a different picture. The Bottom S portfolio presents the highest Sharpe Ratio (1.25), beating both the Mean Universe (1.11) and the Top S portfolio (0.94), which occupies the last place in terms of performance. This is consistent with previous research showing that sin stocks exhibit higher expected returns than comparable stocks (Hong and Kacperczyk 2009, 15). One reason for this is that sin-stocks are neglected by a group of norm-constrained institutions, such as pension plans (Hong and Kacperczyk 2009, 23).

***Table 7:*** *Annualized Risk and Return - Factor S Brazil*

| | Mean Return | Standard Deviation | Sharpe Ratio |
|---|---|---|---|
| **Mean Universe** | 27.07% | 21.86% | 1.11 |
| **Mean Portfolio S Top** | 32.15% | 29.91% | 0.94 |
| **Mean Portfolio S Bottom** | 24.28% | 17.60% | 1.25 |
| **Value Weighted Portfolio** | 41.35% | 40.43% | 0.87 |
| **Industry Weighted Portfolio** | 37.51% | 33.14% | 0.97 |

*Notes: This table provides information on the profitability and risk of the benchmark portfolio (Mean Universe) and the portfolios built with exposure to the S factor, a proxy for non-sin stocks. Portfolios are constructed with equities from the Brazilian investment universe. All values are annualized.*

Furthermore, despite having the lowest mean return, the mean portfolio S Bottom has the lowest volatility, resulting in the highest Sharpe ratio. However, investors holding this portfolio experience the biggest loss of a -251% maximum drawdown compared to the other portfolios and a higher average (CVaR(95) = -7.8%) loss within the worst 5% of returns than the benchmark (CVaR(95) = -8.7%).

**Africa Factor S**

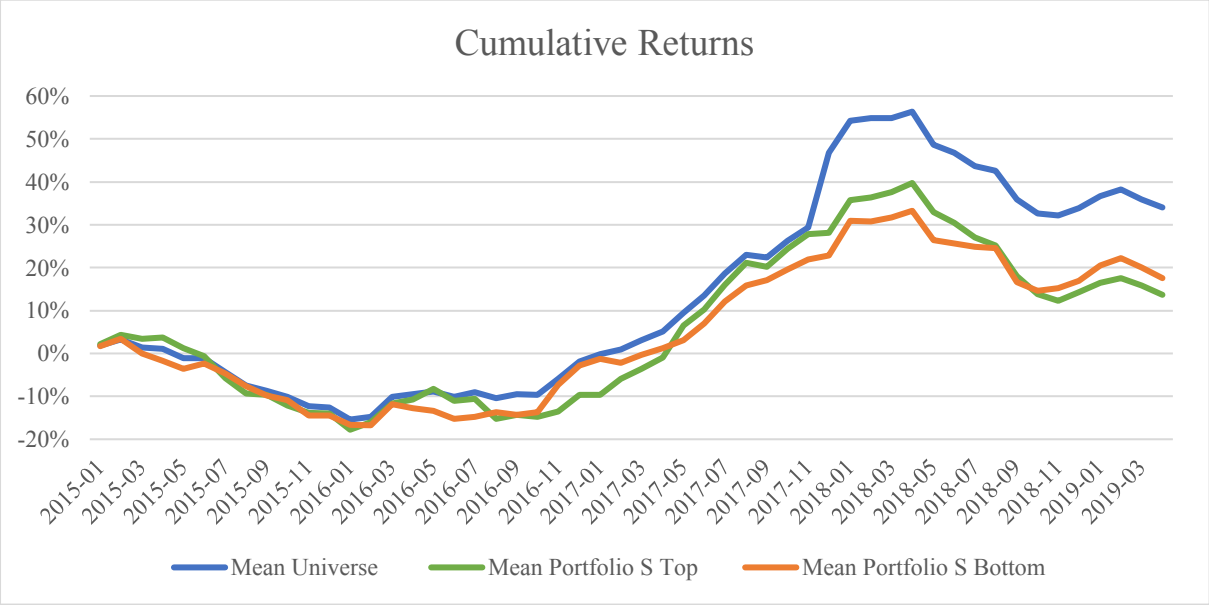


***Figure 5****: Cumulative Returns - Factor S Africa*

By analyzing the cumulative returns for the African universe, one can see that the mean universe, S Top and S Bottom present similar results until the beginning of 2016 when the mean universe portfolio starts outperforming the other two. As of November 2017, the gap between the benchmark and the S Top portfolio increases significantly.

***Table 8:*** *Key Performance Indicators - Factor S Africa*

| | Sharpe Ratio | Max. Drawdown | Skewness | Kurtosis | CVaR(95) |
|---|---|---|---|---|---|
| **Mean Universe** | 0.69 | -287% | 1.38 | 4.77 | -0.043 |
| **Mean Portfolio S Top** | 0.33 | -335% | 0.05 | -0.47 | -0.053 |
| **Mean Portfolio S Bottom** | 0.43 | -334% | 0.28 | 0.54 | -0.051 |
| **Value Weighted Portfolio** | 0.73 | -207% | 0.14 | -0.54 | -0.089 |
| **Industry Weighted Portfolio** | 0.41 | -258% | 0.11 | 0.04 | -0.053 |

*Notes: This table reports key performance indicators of the benchmark portfolio (Mean Universe) and the portfolios constructed with a desired exposure to the S factor for the African universe. Portfolios 1,2 and 3 are equally weighted, while Portfolios 4 and 5 are weighted according to the stocks' market cap and the industry's weights respectively.*

Looking at risk-adjusted returns, the median universe emerges as the winner among the equally weighted portfolios with the highest Sharpe ratio (0.69). The ratio is more than twice as high as that of the S Top portfolio (0.33) and also higher than that of the S Bottom portfolio (0.43). Furthermore, the benchmark presents the lowest MDD (-287%), relative to the mean portfolios, and the lowest average loss within the worst 5% of returns (CVaR(95) = - 4.3%).

***Table 9**: Annualized Risk and Return - Factor S Africa*

| | Mean Return (p.a.) | Standard Deviation | Sharpe Ratio |
|---|---|---|---|
| **Mean Universe** | 7.58% | 10.67% | 0.69 |
| **Mean Portfolio S Top** | 3.56% | 10.70% | 0.33 |
| **Mean Portfolio S Bottom** | 4.27% | 9.64% | 0.43 |
| **Value Weighted Portfolio** | 14.66% | 18.82% | 0.73 |
| **Industry Weighted Portfolio** | 4.45% | 10.62% | 0.41 |

*Notes: This table provides information on the profitability and risk of the benchmark portfolio (Mean Universe) and the portfolios built with exposure to the S factor, a proxy for non-sin stocks. Portfolios are constructed with equities from the African investment universe. All values are annualized*

Despite presenting similar volatility, the Mean Universe and the S Top portfolio present quite different mean annualized returns, as shown in the table above: returns of the S-top portfolio are less than half those of the benchmark, which means that investors in the S-top portfolio are not rewarded for taking on additional risk like investors in the median universe. Finally, the value-weighted portfolio presents the highest volatility and the highest mean return, resulting in the highest Sharpe Ratio of all portfolios analyzed.

**Conclusion Factor S**

Contrarily to Factor G, where for both universes the Bottom portfolio underperformed both the benchmark and Top mean portfolio in terms of cumulative returns and Sharpe Ratio, there is a different picture for Factor S. When analyzing the Brazilian universe, one notices that the Bottom S portfolio outperforms all portfolios, showing the highest Sharpe Ratio, and the lowest volatility. This is also in line with previous research proving that sin stocks exhibit outperformance relative to various benchmarks (Hong and Kacperczyk 2009, 35). However, in the case of Africa, the mean universe presented the highest Sharpe Ratio, followed by the S Bottom portfolio, which therefore still surpassed the S Top portfolio.

The conclusions one can draw from the analysis of this factor are that stocks with low exposure to the S factor outperformed stocks with high exposure to the S factor for both universes in terms of Sharpe Ratio, and in the case of Brazil, returns also outperformed the benchmark.

## 5.3. Factor ESG

### Brazil Factor ESG

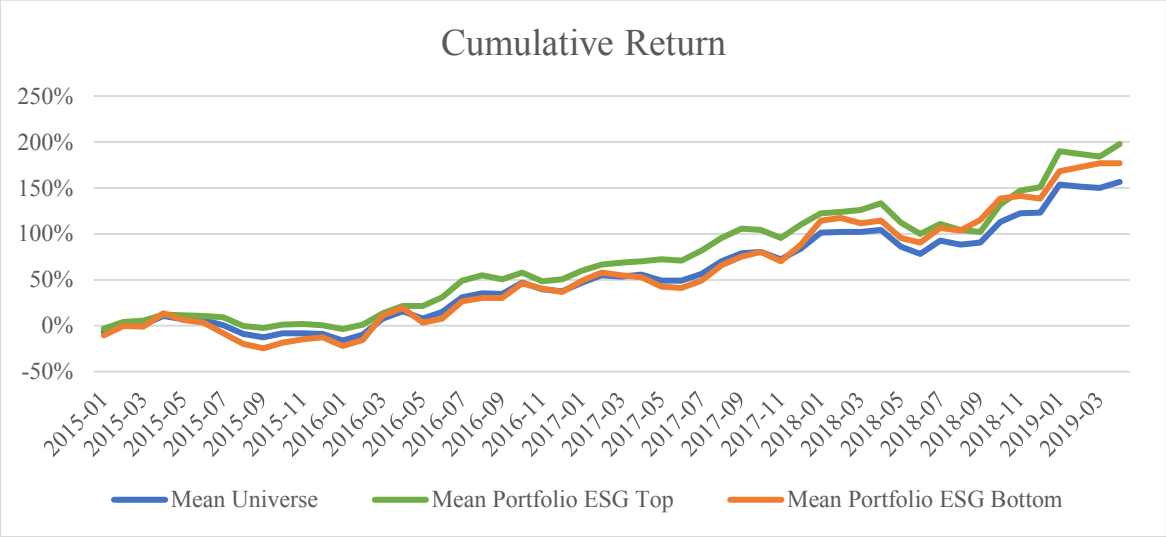


***Figure 6:*** *Cumulative Returns - Factor ESG Brazil*

The first impression given by the graph of the cumulative returns of the Mean Universe Portfolio, the ESG Top and the ESG bottom, is that their returns seem to be correlated with a visible trend. However, the ESG Top seems to outperform the Mean Universe throughout the analyzed time. Similarly, the ESG Top portfolio yields higher returns than the ESG Bottom, apart from a few months after mid-2018.

***Table 10:*** *Key Performance Indicators - Factor ESG Brazil*

| | Sharpe Ratio | Max. Drawdown | Skewness | Kurtosis | CVaR (95) |
|---|---|---|---|---|---|
| **Mean Universe** | 1.11 | -198% | 0.422 | 0.002 | -0.087 |
| **Mean Portfolio ESG Top** | 1.44 | -209% | 0.394 | 0.223 | -0.077 |
| **Mean Portfolio ESG Bottom** | 0.94 | -189% | 0.615 | 1.430 | -0.123 |
| **Value Weighted Portfolio** | 1.03 | -226% | 0.652 | 0.170 | -0.114 |
| **Industry Weighted Portfolio** | 1.26 | -174% | 0.364 | 1.428 | -0.081 |

*Notes: This table reports key performance indicators of the benchmark portfolio (Mean Universe) and the portfolios constructed with a desired exposure to the ESG factor for the Brazilian universe. Portfolios 1,2 and 3 are equally weighted, while Portfolios 4 and 5 are weighted by equity market capitalization and industry weight, respectively.*

The risk-adjusted metrics confirm the impression given by the cumulative returns. The Top ESG portfolio has a noticeably higher Sharpe ratio (1.44) than the other created portfolios and the Mean Universe (1.11). The last place in terms of the Sharpe Ratio is occupied by the ESG Bottom portfolio, which is the portfolio containing stocks with low exposure to good ESG ratings. Taking a closer look at the values forming the Sharpe Ratio in the table below, one can see, that the risk taken on by investing in ESG Top decreases while the returns increase. For the ESG Bottom, the returns are even higher, but the standard deviation also increases from 21.86% (mean portfolio) to 29.62% leading to a lower Sharpe Ratio (0.94).

***Table 11**: Annualized Risk and Return - Factor ESG Brazil*

| | Mean Return | Standard Deviation | Sharpe Ratio |
|---|---|---|---|
| **Mean Universe** | 27.07% | 21.86% | 1.11 |
| **Mean Portfolio ESG Top** | 30.78% | 18.88% | 1.44 |
| **Mean Portfolio ESG Bottom** | 31.68% | 29.62% | 0.94 |
| **Value Weighted Portfolio** | 35.28% | 29.74% | 1.03 |
| **Industry Weighted Portfolio** | 23.19% | 16.67% | 1.26 |

*Notes: This table provides information on the profitability and risk of the benchmark portfolio (Mean Universe) and the portfolios built with exposure to the ESG factor, a proxy for the MSCI ESG scores. Portfolios are constructed with equities from the Brazilian universe. All values are annualized.*

Although the ESG Top portfolio reaches a higher Sharpe Ratio, investors also experience the biggest loss of a -209% maximum drawdown compared to the other equally weighted portfolios. This low point is reached in September 2015. The ESG Bottom portfolio reached the maximum drawdown in the same month but not to the same extent (MDD = -189%). Although the MDD for the ESG Bottom portfolio is lower for the analyzed period, investors experience a higher average loss within the worst 5% of returns (CVaR(95) = -12.3%).

**Africa Factor ESG**

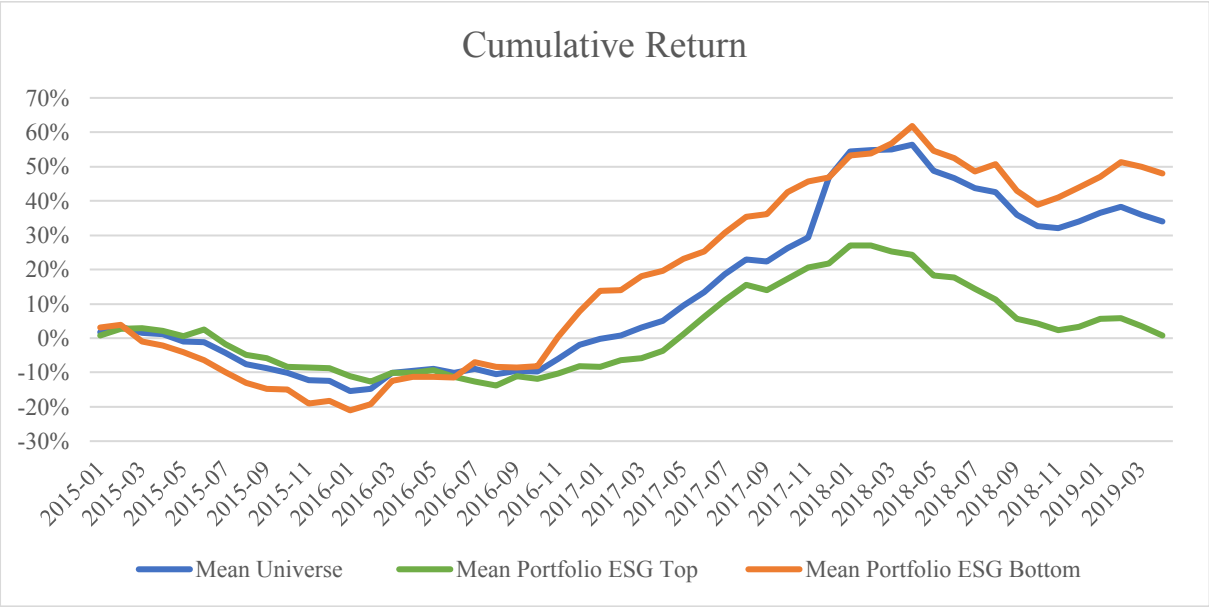


***Figure 7**: Cumulative Returns - Factor ESG Africa*

The chart illustrates that the cumulative returns of the equally weighted portfolios in Africa show larger differences than in Brazil. After September 2019, both the ESG Bottom and the Universe portfolio outperform the ESG Top portfolio until the end of the observed period.

***Table 12:*** *Key Performance Indicators - Factor ESG Africa*

| | **Sharpe Ratio** | **Max. Drawdown** | **Skewness** | **Kurtosis** | **CVaR (95)** |
|---|---|---|---|---|---|
| **Mean Universe** | 0.69 | -287% | 1.38 | 4.77 | -0.043 |
| **Mean Portfolio ESG Top** | 0.06 | -310% | 0.18 | -0.53 | -0.047 |
| **Mean Portfolio ESG Bottom** | 0.86 | -256% | 0.33 | 0.03 | -0.049 |
| **Value Weighted Portfolio** | 0.69 | -210% | 0.50 | 0.02 | -0.090 |
| **Industry Weighted Portfolio** | 0.02 | -274% | 0.19 | -0.01 | -0.054 |

*Notes: This table reports key performance indicators of the benchmark portfolio (Mean Universe) and the portfolios constructed with a desired exposure to the ESG factor for the African universe. Portfolios 1,2 and 3 are equally weighted, while Portfolios 4 and 5 are weighted by equity market capitalization and industry weight, respectively.*

This is confirmed by the risk-adjusted returns shown in the table, where the ESG Bottom has the highest Sharpe Ratio of 0.86. ESG Top, which is the portfolio with high exposure to good ESG ratings shows extremely poor performance for the analyzed time, with a Sharpe Ratio of 0.06. It also experiences the biggest loss with a maximum drawdown of -310%. By considering the size of the companies, as it is done for the Value Weighted Portfolio, the Sharpe Ratio remains at the same level as the Mean Universe (0.69) and the maximum drawdown is reduced from -287% to -274%. In terms of skewness, moving away from the Mean Universe (1.38), to an ESG Top (0.18) or bottom (0.33) portfolio, the distribution of the returns moves closer to a normal distribution. The Kurtosis shows that the Mean Universe has the only leptokurtic distribution with a kurtosis of 4.77. Therefore, the returns are less stable with more extreme positive or negative outliers. The conditional value at risk is similar to the equally weighted portfolios. In all three cases, investors can expect an average loss of below 5% (CVar(95)).

**Conclusion Factor ESG**

Building an ESG top portfolio based on the ESG factor led to a superior performance within Brazil (Sharpe Ratio Mean Universe = 1.11, ESG Top = 1.44) but caused a harsh drop in the Sharpe Ratio in Africa (Sharpe Ratio Mean Universe = 0.69, ESG Top = 0.06). When comparing the ESG Top and the ESG Bottom portfolio in both universes, the effect on risk-adjusted returns was diametrically opposite. In Brazil, the "good" ESG portfolio improved financial performance and the "bad" ESG led to lower returns. For Africa, the opposite can be observed.

# 6. Discussion

As a result of the portfolio analysis for the G, S, and ESG factors, there are similarities and differences between the Brazilian and African universes, which are elaborated on in the following passages.

First, for both investment universes, one can see that the portfolio with the low exposure to factor G underperformed the benchmark in terms of cumulative returns and risk-adjusted return. In the case of Brazil, the portfolio with high exposure to good governance outperformed the benchmark, whereas, in the case of Africa (0.68), the Sharpe ratio almost reached the level of the benchmark (0.69). For both geographic regions, the mean portfolios with high exposure to good governance presented the highest mean returns, but also the highest volatility. To conclude, high exposure to good governance could only yield superior risk-adjusted returns in Brazil, but low exposure to good governance decreased performance in both geographic areas.

In the case of the S factor, our results led to different conclusions between Africa and Brazil. Research on the financial performance of sin-stocks state that abstaining from them comes at a financial cost (Hong and Kacperczyk 2009, 35; Blitz 2017). This is reflected in the results for Brazil. Its S Bottom portfolio, with low exposure to non-sin stocks, outperforms both the benchmark and the "good" portfolio that avoids sin-stocks in terms of risk-adjusted returns. This indicates that sin-stocks in Brazil appear to yield a positive premium for the analyzed period. In contrast, considering the African universe, the S Bottom portfolio does outperform the S Top portfolio but underperforms the benchmark. As a result, in both geographic areas, the "good" portfolio containing the stocks with high exposure to the non-sin factor underperformed the sin-stock portfolio.

Finally, considering factor ESG, one can again observe diverging results between the universes. Looking at Brazil shows that the ESG Top portfolio results in superior risk-adjusted

performance compared to both the ESG Bottom portfolio and the benchmark. Conversely, in the African universe, it is the ESG Bottom portfolio with a Sharpe Ratio of 0.86 that outperformed the others. It should be emphasized that the top African ESG portfolio has by far the lowest Sharpe Ratio (0.06) of all the portfolios analyzed across the two geographic regions and the different factors. For both universes, the ESG Bottom portfolios are riskier as they present higher volatility. In summary, constructing a Brazilian portfolio with high exposure to good ESG scores results in superior returns, while the extreme opposite is observed in Africa. A recent study by Pastor et al. (2022) focusing on the U.S. stock market showed that on average green stocks outperformed their brown counterparts in the last decade. However, they note that this increase in realized returns was due to an unexpected increase in environmental concerns, rather than higher expected returns. The equilibrium model constructed by Pastor et al. (2021) predicts lower expected returns for green assets because investors prefer green assets that are consistent with their values and allow them to hedge climate risk. They argue that the recent outperformance of green stocks was caused by an unexpected green shift involving two aspects. Firstly, investor demand for environmentally friendly assets increased, resulting in a direct increase in the stock price. And secondly, consumers demanded more environmentally friendly products, which increased the profits of these companies also leading to an increase in the share price. Following the reasoning of Pastor et al. (2021), a possible explanation for the outperformance of the good ESG portfolio in Brazil could be the increased demand from investors and consumers. Whereas in Africa, the reason for the poor performance of "good" ESG portfolios may be that investors are less sensitive to ESG issues such as climate shocks. The research of author Zhang (2022) confirms that emerging markets tend to have a relatively low climate-risk sensitivity compared to developed markets. As Brazil is moving closer to a developed market status compared to Africa, its sensitivity to global climate risks might be

higher. In addition to lower sensitivity, the lack of trustworthy ESG information could also hinder investor demand for green stocks in Africa.

As a factor overarching trend, the risk-adjusted returns of portfolios within the Brazilian universe a considerably higher than for the African Portfolios. Another observable trend is the on average higher standard deviation among Brazilian returns compared to the African portfolio returns.

# 7. Conclusion and Outlook

The market-based approach used to construct ESG portfolios represents an alternative way to overcome the lack of ESG information, common in emerging markets. With this method, stocks are picked based on their level of exposure to different factors created with ESG proxies. An advantage of the approach lies in reducing the reliance on ESG ratings. As mentioned in the literature review, several issues are raised on this topic, such as the inconsistent ESG ratings given by different rating agencies.

The results show strongly diverging risk-adjusted returns between factors and regions. The authors of this paper, therefore, do not recommend building an African or Brazilian ESG portfolio based solely on exposure to the factors presented. None of the African portfolios with high exposure to an assessed factor outperformed the benchmark. In Brazil, the green portfolios based on factor G and ESG are able to outperform the benchmark in terms of the Sharpe Ratio. Nevertheless, none of the factors considered in this analysis achieved higher risk-adjusted results in both universes.

Pedersen, Fitzgibbons and Pomorsk (2021), who developed the factors used for the analysis, took returns of United States Equities to compute the factor mimicking portfolio. The construction of a region-specific factor presents an interesting opportunity to compute more accurate beta estimations by incorporating the challenges and characteristics of emerging markets. By building an in-house factor, asset managers are also able to choose proxies appropriate for the market, aligned with the investment vision, and reflecting their interpretation of ESG aspects.

As a limitation of this research, it should be noted that the portfolio analysis only extends to April 2019. This means that neither the effects of the Covid-19 crisis nor of the turmoil caused by the war in Ukraine are included in the results. This limitation is attributed to the constraints

of the data available for the factors developed by Pedersen, Fitzgibbons, and Pomorski (2021). For further research, it is strongly recommended that portfolio strategies built on the created factors are backtested over a longer period, including times of crisis, to assess their resilience. To name an example, it can be expected that the portfolio with low exposure to "no-sin stocks" outperforms the "good" ESG portfolio by an even larger margin during times of war. In addition, the backtesting of portfolio returns does not take into account stocks that cease to exist. Due to this survivorship bias, portfolio returns may be overstated.

In conclusion, the market-based approach for ESG integration in emerging markets can be used as an additional source of information. However, the best results are expected when used in combination with active ownership, engagement, and fundamental analysis. Direct contact and exchange with the local management can improve understanding of the business and cultural anchoring of the firms. Combined with in-depth research and fundamental analysis, this can fuel the creation of relevant and region-specific factors that help to bridge the gap of reliable ESG data available.

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# SUSTAINABLE INVESTING IN EMERGING MARKETS – ENVIRONMENTAL RISK IN AFRICA

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Abstract

Climate change is now regarded worldwide as a major risk and organizations are under pressure to disclose their carbon footprint; African companies still lag behind their peers in developed markets and only a few voluntarily disclose carbon information. Through a factor-based approach designed to deal with the lack of ESG information, this paper examines the impact of integrating the E factor on an African investment universe. The results show an outperformance of brown portfolios over green portfolios, raising questions about whether investors in emerging markets value sustainability as much as investors in advanced markets.

Keywords: carbon, Africa, climate change, disclosure, climate risk

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# 1. Introduction

The UN's Framework Convention on Climate Change, already in 2006 outlined that Africa was the most vulnerable continent to climate change risks. In particular, according to the African Development Bank (AfDB 2019), seven of the 10 countries most vulnerable to climate change belong to Africa.

As a matter of fact, despite accounting for only 4% of global greenhouse gas (GHG) emissions (World Economic Forum 2022) Africa faces climate-related risks, namely rising temperatures and increasingly severe weather events. Consequently, they are likely to intensify water stress, increase food insecurity, and multiply disruptions across the continent, undermining public health, livelihoods, and potentially the safety of citizens, as well as the health of economic systems (AfDB, GCA and UNEP FI 2021).

It doesn't come as a surprise the growing awareness of physical risks of climate change among African authorities and in the private sector. In this context, countries have expressed their aspirations to cut GHG emissions and adapt to climate impacts, in their Nationally Determined Contributions (NDCs) to the Paris Agreement (AfDB, GCA and UNEP FI 2021).

**Challenges**

On the other hand, transition risks associated with the move to a lower-carbon system may represent a major challenge in economies driven by the commodities sector, where oil and gas and mining companies account for a large proportion of employment and GDP. In particular, several African economies are dominated by carbon-intensive sectors and rely on power generation from coal. A successful transition to a lower-carbon economy requires adequate financial, technical, and capacity-building support to African countries (AfDB GCA and UNEP FI 2021), otherwise reductions in energy generation could result in adverse trickle-down

impacts for the concerned regions (Dove 2021). Moreover, unlike in developed markets such as the EU and US, non-financial information is rarely disclosed, and this poses challenges for investors to make informed investment decisions.

**Opportunities**

However, climate change also provides opportunities for Africa to exploit its huge resource potential to mitigate the impacts of climate change and move towards a sustainable economy. Addressing climate change in Africa will open significant market opportunities on the continent, especially for the private sector and institutional investors (AfDB 2019).

**Structure**

The paper is structured as follows. In the next section, an overview of relevant literature about carbon disclosure is provided. In section 3, the methodology used for the analysis is explained, which includes an overview of the chosen factor and of the characteristics of the constructed portfolios. Section 4 presents the findings resulting from the integration of the factor in the portfolios and from the industry composition of the constructed portfolios. Session 5 discusses the results. Session 6 concludes.

# 2. Literature review

## 2.1 $CO_2$ disclosure

According to the World Economic Forum (2020), failing to mitigate and adapt to climate change represents the primary risk by impact and secondly by likelihood over the next ten years. Consequently, companies worldwide are now increasingly under pressure by several groups of stakeholders to disclose their climate-related risks governance (Eleftheriadis and Anagnostopoulou 2015) as a result of concern about potential future carbon regulations and

physical risks caused by climate change (Borghei 2021). This explains why the number of companies worldwide voluntarily disclosing carbon information is on the rise.

However, as already thoroughly discussed in the group paper, emerging markets lag behind in the disclosure of non-financial information, and this includes also carbon emissions disclosure. This is due to the fact that EMs operate in an environment characterized by a variety of environmental, social and governance challenges, such as uneven governance, weak institutions and a lack of regulatory oversight (Odell and Ali 2016).

## 2.2 Factors impacting voluntary disclosure

Past research has studied in depth the factors influencing voluntary disclosure of carbon information but according to Borghei (2021), a lack of consistency among studies exists, primarily due to the use of different proxies to measure the level of carbon disclosure and carbon emissions. A few examples are below described.

As a matter of fact, according to Eleftheiadis and Anagnostopoulou (2015) there is no significant relationship between profitability/leverage and carbon disclosure; on the other hand, Okereke (2007) argues that profitability and leverage are two key drivers for carbon disclosure. Another inconsistent finding regards carbon performance as a motivation to disclosure. Sullivan (2009), Weinhofer and Hoffmann (2010), suggest that high-carbon companies have superior climate governance and disclosure practices. Nevertheless, Dawkins and Fraas (2011) argue that low-carbon companies differentiate themselves by voluntarily disclosing their carbon information. The reasons behind these divergent results could be the constant change in a company's carbon policy and the diverse carbon regulations worldwide (Borghei 2021).

## 2.3 Problems with disclosure

Although the number of businesses voluntarily disclosing carbon information is increasing, there are challenges arising from this action.

As a matter of fact, one of the main problems of carbon disclosure stems from the fact that it is voluntary and there is no specific standard that supports the enhancement of credibility and comparability of disclosed information (Kolk et al. 2008 742).

Moreover, according to Sullivan and Gouldson (2012, 60), businesses provide insufficient quality of disclosure, which makes investors' comparisons between companies even more complicated.

Finally, Depoers et al., (2016, 446), argue that carbon emission levels reported in corporate reports (CR) are lower than those reported in the CDP (Carbon Disclosure Project). They are two common communication channels used by companies to disclose their GHG emissions but are substantially different regarding objectives, content and target audience, as shown in the table below (Depoers et al. 2016, 447).

***Table 1**: Comparison about carbon disclosure between CDP and Corporate Reports*

| Features[a] | CDP | Corporate reports |
|---|---|---|
| Audience | Investors | General public |
| Disclosure of the volumes of firms' GHG emissions | This is the basic purpose of the CDP | Voluntary |
| Scope of reported emissions | Participation in the CDP requires the broadest scope possible | Free choice. Emissions for a single site or the whole group are possible |
| Calculation method used for GHG emissions disclosed | Free choice of method, but GHG Protocol recommended | Free choice |
| Presentation of GHG emissions | Required format by scope 1, 2 and 3, following the usual calculation standards (particularly GHG Protocol) (see Appendix 1) | Free choice |
| Related information | Required format. A set of questions related to the amounts of emissions reported | Free choice. No explanation of the figures reported required |

As a matter of fact, CDP is a highly structured, voluntary reporting channel focused on carbon emissions, whereas CR (except sustainability reports) are a mandatory reporting channel, and

their issuers have considerable margins regarding GHG emissions disclosures and which information to include, as GHG reporting in the CR is generally subject to little or no regulation (Depoers et al. 2016, 449).

Moreover, firms that receive the CDP questionnaire (that is the largest firms) are more likely to disclose environmental information in their CR (Brammer and Pavelin 2006; Cotter and Najah 2012; Meng et al. 2013). Taking into account these differences, a large number of firms may use both channels in parallel. The combined use of two communication channels with different characteristics to disclose the GHG figures gives investors a unique opportunity to study managers' cross-channel communication strategies, also to check eventual discrepancies between the two communication channels.

# 3. Methodology

The approach used for the construction of the portfolios is consistent to the one developed in the main paper apart from the use of a different factor and some changes in the methodology resulting from that. The following subchapters will describe how the factor E is created and explain the differences in the methodology used.

## 3.1 Factor E

**Environmental Risk Measurement**

Factor E stands for low carbon intensity and was built by the same authors of factors S, G and ESG discussed in the group work, namely Pedersen, Fitzgibbons, and Pomorski (2019).

In order to measure how green a company is, its carbon intensity (CO2), as the ratio between carbon emissions in thousands of tons and sales in millions of dollars, is computed.

To measure carbon emissions, the authors relied on the sum of scope 1 carbon emissions and of scope 2 carbon emissions. Therefore, only the firms' direct emissions (scope 1) and the

scope 2 emissions were taken into account. Scope 2 refers to indirect emissions resulting from purchasing energy. Other indirect emissions (scope 3) are difficult to measure, seldomly reported and are consequently not included. The authors (Pedersen, Fitzgibbons and Pomorski) accessed relevant data through Trucost. As in the case of Factor G, the authors created five different categories ranging from high emissions (E1) to low CO2 emissions (E5). The factor of this long-short portfolio is the result of the difference between the excess returns of low emission firms from those of high emission firms (E5-E1).

## 3.2 Portfolios

The analysis resulted in five portfolios, including the benchmark, in order to assess whether and to what extent it is beneficial to integrate this factor in investment decisions.

Differently to the portfolios created with the G, S and ESG factors where industry weights were taken into account, the portfolios presented for this analysis include a value-weighted portfolio constructed with the same stock composition of the mean portfolio E Bottom but redistributing weights according to the market capitalization of the individual stocks.

# 4. Results

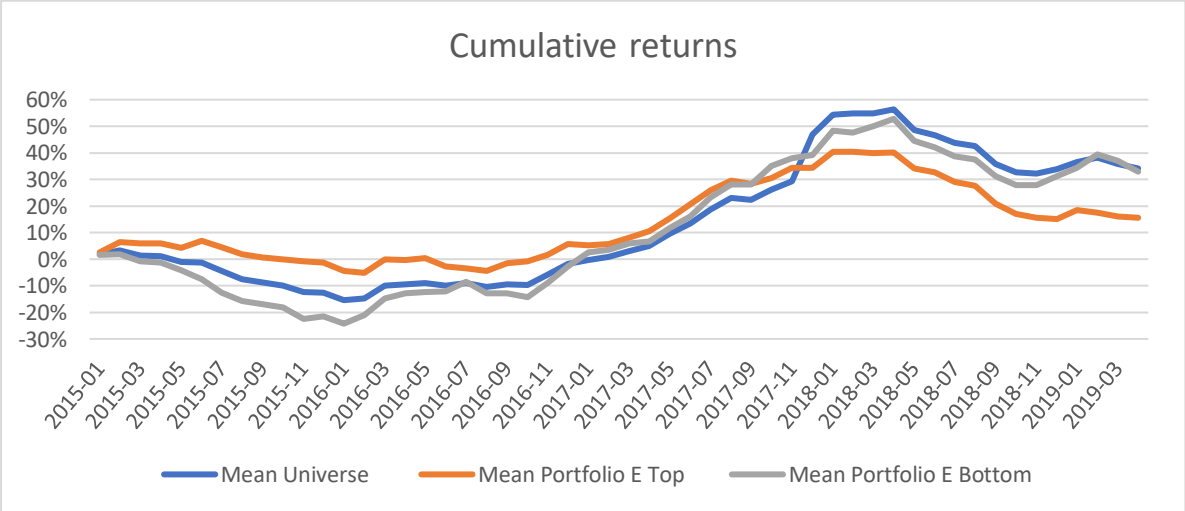


***Figure 1**: Cumulative Returns of benchmark and mean portfolios*

In terms of cumulative returns, the benchmark and the two equally weighted portfolios present a similar trend but also a different performance throughout the time span. As a matter of fact, until July 2017, the mean portfolio E Top outperformed the benchmark but from the following months onwards, it reported the worst performance. In contrast, the mean portfolio E Bottom ended with a similar performance to that of the mean universe.

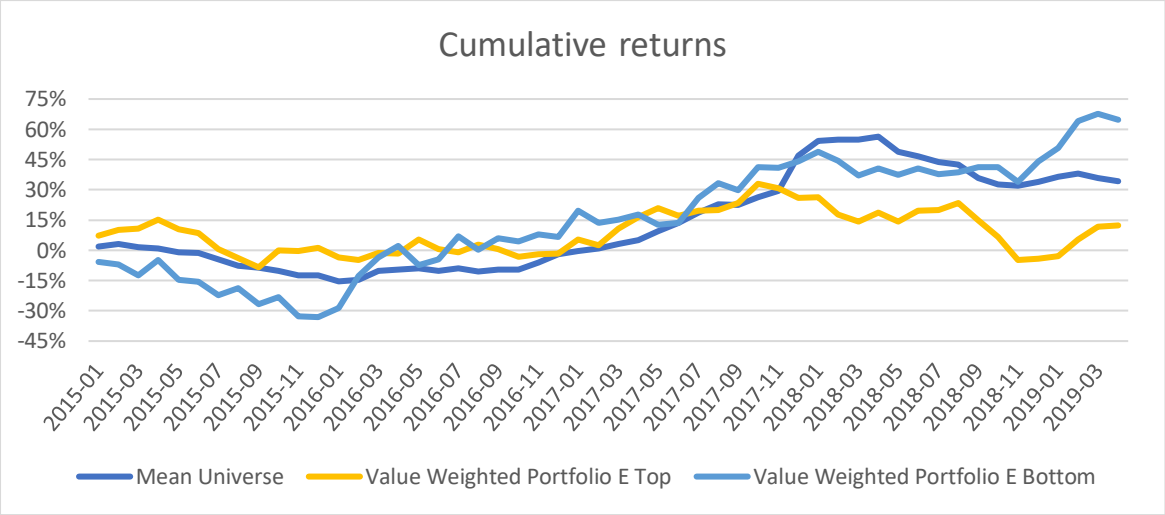


***Figure 2**: Cumulative returns of benchmark and value-weighted portfolios*

Looking at the performance of the value-weighted portfolios, as in the case of the equally weighted portfolios, the value weighted E Top portfolio outperformed the benchmark until November 2017 and thereafter its performance worsened. In contrast, the value weighted E Bottom portfolio presented a superior performance and in March 2019 its cumulative returns were almost as double as those of the benchmark.

Nevertheless, further metrics need to be taken into account to assess the risk-adjusted returns of all portfolios.

***Table 2:*** *Key Performance Indicators - Factor E Africa*

| | Sharpe Ratio | Max. Drawdown | Skewness | Kurtosis | CvaR(95) |
|---|---|---|---|---|---|
| **1. Mean Universe** | 0.69 | -287% | 1.38 | 4.77 | -0.04 |
| **2. Mean Portfolio E Top** | 0.44 | -201% | 0.16 | -0.48 | -0.04 |
| **3. Mean Portfolio E Bottom** | 0.60 | -463% | 0.17 | -0.77 | -0.05 |
| **4. Value Weighted E Top** | 0.25 | -219% | -0.06 | -0.56 | -0.09 |
| **5. Value Weighted E Bottom** | 0.62 | -247% | 0.45 | 0.86 | -0.11 |

Notes: This table reports key performance indicators of the benchmark portfolio (Mean Universe) and the portfolios constructed with a desired exposure to the E factor for the African universe. Portfolios 1,2 and 3 are equally weighted, while Portfolios 4 and 5 are weighted according to the stocks' market capitalization.

By looking at the risk-adjusted return, we witness that the Mean universe portfolio presents the highest Sharpe Ratio (0.69), followed by the value portfolio E bottom (0.62) and the mean portfolio E Bottom (0.60). In contrast, the mean E portfolio Top presents the lowest risk-adjusted performance (0.25). Therefore, both "Bottom" E portfolios outperform their "Top" peers but don't succeed in surpassing the benchmark in terms of Sharpe Ratio.

Combined with information about portfolios' volatilities (Table 3), we see that the mean universe and mean portfolio E bottom have almost the same mean annualized returns but due to the higher volatility of portfolio 3 (mean portfolio E Bottom), the resulting Sharpe ratio of portfolio 3 is lower. The value weighted portfolios' volatilities are higher, with that of the value weighted E Bottom portfolio more than double than that of the mean universe. However, its mean return (Portfolio 5) is almost double (15.01%) than that of the benchmark (7.58%), but not enough to achieve a higher Sharpe Ratio: investors are not rewarded enough for taking additional risk.

Finally, it is worth noting that the CVaR (95) for the value-weighted portfolio Bottom (-11%) and value-weighted portfolio Top (-9%) presents the lowest values, indicating that large market-cap companies recorded higher negative returns beyond the 5% threshold. This is also visible from the tables 1 and 2 in the Appendix. The other portfolios present similar CVaR (95) results, with the Mean Universe Portfolio having the average loss of 4% (CVaR(95).

***Table 3**: Annualized Risk and Return - Factor E Africa*

| | **Mean Return** | **Standard Deviation** | **Sharpe Ratio** |
|---|---|---|---|
| **1. Mean Universe** | 7.58% | 10.57% | 0.69 |
| **2. Mean Portfolio E Top** | 3.76% | 8.48% | 0.44 |
| **3. Mean Portfolio E Bottom** | 7.56% | 12.08% | 0.60 |
| **4. Value Weighted E Top** | 4.08% | 16.07% | 0.25 |
| **5. Value Weighted E Bottom** | 15.01% | 22.67% | 0.62 |

Notes: This table provides information on the profitability and risk of the benchmark portfolio (Mean Universe) and the portfolios built with exposure to the E factor, a proxy for carbon intensity. Portfolios are constructed with equities from the African universe. All values are annualized.

The value weighted E top portfolio is the only slightly negatively skewed portfolio (-0.09); in contrast, it can be observed that the other portfolios, except the mean universe, have really low skewness resulting in a fairly symmetrical distribution. Regarding Kurtosis, all E-built portfolios have a platykurtic distribution, meaning fewer extreme positive or negative events.

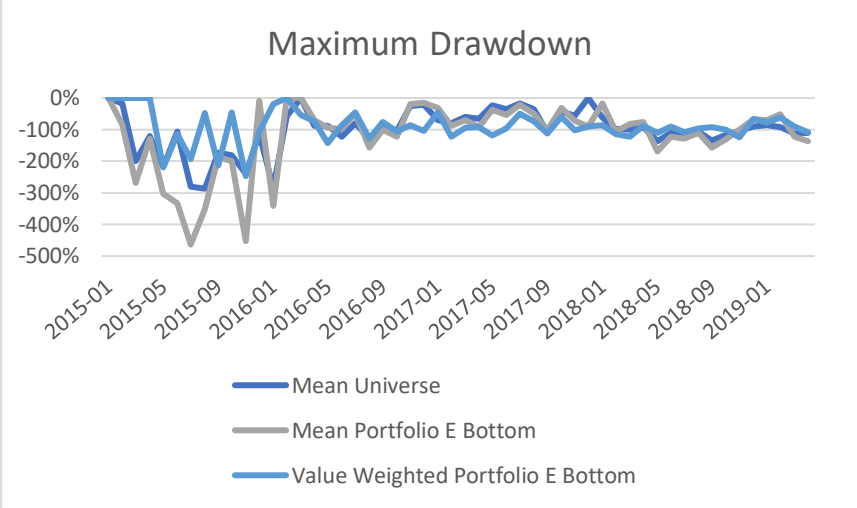


***Figure 3**: Maximum Drawdown*

By looking at the maximum drawdown, we notice that the portfolios in the graph present a similar trend in experiencing losses and in similar time periods. The mean portfolio E Bottom recorded the highest MDD of 463% in July 2015, a month before the MDD experienced by the mean universe portfolio (287%).

## Industries results

**Bottom portfolio - low betas (high CO2 emissions)**

Analyzing the average monthly industry composition of the portfolios (Appendix 5), we notice that the stocks occurring more often, accounting for the total number of stocks pertaining to an industry, belong to those industries generally regarded as high CO2 polluters. As a matter of fact, on average every month, 4 energy stocks appear in the mean portfolio E Bottom, created with the low exposure to factor E (high carbon emissions); it isn't a relevant number in absolute terms (4) but when considering its occurrence and the total number of energy stocks (7), it results in 63% in relative terms. This means that on average every month 4 out of 7 (or 63% of the energy stocks appear in the monthly rebalanced Portfolio E Bottom.

On an average monthly basis, 22 materials stocks are in the mean portfolio E Bottom, so around 58% of the total of materials industry stocks (38). On the other hand, the financials industry

also presents the highest number of stocks appearing monthly (22) but when compared with total number of stocks in the financial industry (75), it results in 29% in relative terms.

Finally, looking at Appendix 3, we notice some insightful aspects. As a matter of fact, by summing the market caps of stocks by industry, we find that in value weighted E bottom portfolio the materials industry weights 67% of the whole portfolio. We can conclude that materials stocks are not only the ones occurring more often on a monthly basis, but also those that present the highest weight. Moreover, looking at Appendix 1, it is possible to see that the two top stocks by market cap belong to the materials industry and account already for 44% of the portfolio's total weight.

**Top portfolio - high betas (low CO2 emissions)**

In contrast, when looking at mean E Top portfolio, composed with the highest coefficients and therefore with the "greener" companies, we observe from Appendix 4 that the industries occurring more often in relative terms are information technology (49%), industrials (44%) and communication services (44%). Confirming what we observed in the previous table (Appendix 3), when accounting for the total number of stocks pertaining to an industry, energy (14%), materials (18%) and real estate (17%) stocks are the ones occurring less frequently in relative terms.

# 5. Discussion

Both portfolios constructed considering the highest coefficients (therefore with a higher exposure to low-carbon stocks) represented by portfolios 2 and 4, resulted in a worse performance against the benchmark in terms of Sharpe Ratio and of cumulative returns. On the other hand, portfolios constructed considering the lowest coefficients (therefore with a higher

exposure to high-carbon stocks) performed better than their "Top" peers in terms of risk-adjusted return but didn't surpass the mean universe. Therefore, none of the E-built portfolios considered for this analysis achieved higher risk-adjusted results compared to the mean universe.

Contrarily to previous studies (Pastor et al. 2022) showing the existence of a "greenium" (the outperformance of green stocks compared to brown stocks), the African portfolios with high exposure to green stocks ultimately underperformed not only their brown peers but also the benchmark. Indeed, the analysis developed in this paper used a different methodology and approach but some points in correlation to that study may be raised.

According to Pastor et al. (2022), after analysing the performance of German bonds and US stocks, they found that green assets reported high returns in recent years; however, their performance was a reflection of stronger and unexpected increases in climate concerns, rather than high expected returns. They concluded that green stocks outperform brown stocks when there is bad news about climate change, consistent with the idea that green stocks represent better hedges against climate shocks (Pastor et al. 2022).

However, despite that outperformance, Pastor et al. (2022) estimate that green stocks will have lower expected returns compared to brown stocks, consistent with past stock returns' literature focused on studying the inverse relation between realized returns and shifts in expected returns (Fama and French 2002; Pastor and Stambaugh (2001, 2009).

When looking at Africa, being labelled by UNFCC (2006) as the most vulnerable continent to climate change impacts, we may expect climate concerns to be felt more urgently than in other geographical areas and therefore to see green stocks performing better. Instead, the brown portfolios reported considerable better results both in terms of cumulative and risk-adjusted returns. As a matter of fact, despite their higher volatility, they still realized higher returns and

also higher Sharpe ratios compared to the "green" portfolios. This means that investors were remunerated for taking additional risk in investing in brown stocks, while in this case "doing well by doing good" didn't pay off.

On the other hand, researchers have also studied the existence of a carbon premium with divergent conclusions. As a matter of fact, according to Bolton and Kacperczyk's carbon risk premium hypothesis (2021), high-emission firms face several risks, from fossil-fuel energy prices and commodity price risks to carbon pricing risk and regulatory interventions to cut emissions. Therefore, Bolton and Kacperczyk argue that investors may want to be compensated for holding the stocks of high carbon emitters and for the associated higher carbon risk they are exposed to; this would consequently translate in a positive relation in the cross-section between a firm's own carbon emissions and its stock returns. Therefore, in our African case, companies operating in commodity exporting countries with a substantial fossil fuel production may face a greater transition risk (that is the risk in regard to carbon emissions the transition to renewable energy) and consequently, they may be linked with a higher carbon premium (Bolton and Kacperczyk 2021).

On the other hand, Zhang ( 2022) argues that there is no carbon or green premium on average internationally, contrasting Bolton and Kacperczyk (2020). Contrarily to BK (2020), Zhang argues that the carbon return variations across countries result from in-sample shocks, such as sustainable flows and climate concerns, complementing in Pastor, Stambaugh and Taylor's thesis (2022); he finally asserts that in equilibrium, being the brown firms more exposed to climate risk, they earn higher expected returns. Nevertheless, green firms can outperform when policy shocks kick in, consumer attention veers, and investor preferences turn in transition towards a net-zero economy (Pastor, Stambaugh and Taylor, 2022). Overall, he concludes by saying that capital markets are still in transition towards the equilibrium carbon pricing.

Furthermore, we notice that, from Appendix 3, in the portfolio with higher exposure to high-emission stocks, materials stocks account for 67% of the total weight, highlighting that materials stocks play a major role in the overall performance of the portfolio and not only are the ones appearing more often on a monthly basis (Appendix 5) but are also the ones with the highest market cap (the first two stocks by market cap belong to the materials industry and account for already 44% of the total portfolio - Appendix 1).

# 6. Conclusion

The market-based approach developed through the integration of E factor in portfolios' construction provides investors an option to deal with the lack of carbon information, extremely common in emerging markets. Moreover, as explained in the literature, CO2 disclosure presents challenges due to the absence of a specific standard that allows comparability of disclosed information (Kolk et al., 2008).

The results show an outperformance of the portfolios with a low exposure to good E (brown), compared to portfolios with a high exposure to good E (green). Considering the Africa has been labelled as the most vulnerable continent to climate risks and taking into account that green stocks are seen as hedging assets towards climate-related impacts, the expectation would have been to see green portfolios outperforming their brown peers. This wasn't the case.

After discussing potential explanations to this unexpected underperformance, a potential reason would be that investors in Africa don't perceive African "green" stocks as hedging assets. The outperformance of brown portfolios can also be explained by the lower investors' climate concerns. As a matter of fact, according to Zhang (2022), and as also discussed in the group paper, investors in emerging markets, where firms lag behind in ESG integration, show a low level of sensitivity to global climate risks. Furthermore, although progress over the past years has been made, emerging markets, (in our case Africa), because of their fossil-fuel

dependent industries, face more challenges to transition to a low-carbon economy, compared to advanced markets, these latter being more carbon efficient. This low sensitivity towards climate risk stresses the need for an increased effort to encourage greater awareness regarding climate risks and the merits of environmental performance among investors of emerging markets.

However, the findings resulting from this analysis take into account the stocks' exposure solely to one factor. It may be more insightful for future research to control for other factors in order not to give too much weight on just one factor.

As also already suggested in the group paper, the construction of a region-specific factor presents an interesting opportunity to compute more accurate beta estimations by incorporating the challenges and characteristics of a specific market. By building an in-house factor, asset managers would be also able to choose proxies appropriate for the market, aligned with their investment visions and reflecting their interpretation of ESG aspects.

As a limitation of this research, it is important to mention that the portfolio analysis extends to April 2019, which means that neither the Covid-19 crisis nor the turmoil caused by the war in Ukraine are included in our results. This limitation is attributed to the constraints of the data available for the factors developed by Pedersen, Fitzgibbons, and Pomorsk (2019). For further research, it is strongly recommended that portfolio strategies built on the created factors are back tested over a longer period of time, including times of crisis, to assess their resilience.

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# Appendix

| Value Weighted Portfolio Bottom - low betas (high CO2) | | | | | |
|---|---|---|---|---|---|
| **Company** | **Industry** | **Market Cap (US$ M)** | **Weights** | **Returns** | **Value Weighted Returns** |
| GLN SJ Equity | Materials | 83,026.69 | 33.85772% | -6.268% | -2.1221% |
| AMS SJ Equity | Materials | 25,553.66 | 10.42061% | -1.926% | -0.2007% |
| SBK SJ Equity | Financials | 17,835.36 | 7.27314% | 7.434% | 0.5407% |
| MTN SJ Equity | Communication Services | 14,923.87 | 6.08585% | 16.644% | 1.0129% |
| CPI SJ Equity | Financials | 13,745.62 | 5.60537% | -0.985% | -0.0552% |
| SOL SJ Equity | Materials | 11,054.57 | 4.50798% | 5.442% | 0.2453% |
| IMP SJ Equity | Materials | 10,191.08 | 4.15585% | -6.131% | -0.2548% |
| GFI SJ Equity | Materials | 9,887.05 | 4.03187% | 1.258% | 0.0507% |
| ANG SJ Equity | Materials | 7,918.42 | 3.22908% | -10.063% | -0.3249% |
| SSW SJ Equity | Materials | 7,563.48 | 3.08434% | -14.495% | -0.4471% |
| EXX SJ Equity | Energy | 4,479.05 | 1.82653% | -0.621% | -0.0113% |
| NPH SJ Equity | Materials | 4,390.36 | 1.79036% | -6.142% | -0.1100% |
| CLS SJ Equity | Consumer Staples | 4,205.77 | 1.71509% | 6.216% | 0.1066% |
| NRP SJ Equity | Real Estate | 3,667.35 | 1.49552% | -1.820% | -0.0272% |
| GRT SJ Equity | Real Estate | 2,851.27 | 1.16273% | 1.884% | 0.0219% |
| MNG MC Equity | Materials | 2,089.32 | 0.85201% | -1.496% | -0.0127% |
| NESTLE NL Equity | Consumer Staples | 1,910.85 | 0.77923% | -3.797% | -0.0296% |
| ETEL EY Equity | Communication Services | 1,624.20 | 0.66234% | -3.354% | -0.0222% |
| CSR MC Equity | Consumer Staples | 1,557.32 | 0.63507% | 5.915% | 0.0376% |
| EQBNK KN Equity | Financials | 1,402.40 | 0.57189% | -1.683% | -0.0096% |
| SEPLAT NL Equity | Energy | 1,390.75 | 0.56714% | -2.542% | -0.0144% |
| TRU SJ Equity | Consumer Discretionary | 1,355.82 | 0.55290% | 8.935% | 0.0494% |
| EKHO EY Equity | Materials | 1,345.57 | 0.54872% | -7.858% | -0.0431% |
| MFPC EY Equity | Materials | 1,232.54 | 0.50262% | -5.131% | -0.0258% |
| SWDY EY Equity | Industrials | 803.53 | 0.32767% | -0.825% | -0.0027% |
| TMGH EY Equity | Real Estate | 726.40 | 0.29622% | -0.873% | -0.0026% |
| COOP KN Equity | Financials | 594.87 | 0.24259% | -15.719% | -0.0381% |
| ABSA KN Equity | Financials | 510.73 | 0.20827% | 1.695% | 0.0035% |
| NCBA KN Equity | Financials | 430.40 | 0.17552% | -13.343% | -0.0234% |
| UBN NL Equity | Financials | 429.34 | 0.17508% | 5.263% | 0.0092% |
| BATK KN Equity | Consumer Staples | 354.05 | 0.14438% | -6.250% | -0.0090% |
| HELI EY Equity | Real Estate | 336.31 | 0.13715% | 4.158% | 0.0057% |
| GUINNESS NL Equity | Consumer Staples | 310.61 | 0.12666% | -22.178% | -0.0281% |
| SBIC KN Equity | Financials | 308.69 | 0.12588% | -0.250% | -0.0003% |
| CMT MC Equity | Materials | 293.63 | 0.11974% | 3.905% | 0.0047% |
| CLHO EY Equity | Health Care | 293.01 | 0.11949% | 8.386% | 0.0100% |
| ORHD EY Equity | Consumer Discretionary | 289.37 | 0.11800% | -7.537% | -0.0089% |
| JUFO EY Equity | Consumer Staples | 266.26 | 0.10858% | -4.083% | -0.0044% |
| INTBREW NL Equity | Consumer Staples | 266.04 | 0.10849% | -23.070% | -0.0250% |
| FLOURMIL NL Equity | Consumer Staples | 251.96 | 0.10275% | -9.722% | -0.0100% |
| IMH KN Equity | Financials | 229.86 | 0.09373% | 2.396% | 0.0022% |
| AMOC EY Equity | Materials | 226.00 | 0.09216% | -7.947% | -0.0073% |
| ORWE EY Equity | Consumer Discretionary | 211.12 | 0.08609% | -19.353% | -0.0167% |
| SHG SJ Equity | Consumer Staples | 210.29 | 0.08576% | 1.338% | 0.0011% |
| MTIE EY Equity | Consumer Discretionary | 177.84 | 0.07252% | 3.291% | 0.0024% |
| UMR MC Equity | Consumer Staples | 168.88 | 0.06887% | -0.030% | 0.0000% |
| SNP MC Equity | Materials | 150.81 | 0.06150% | -25.060% | -0.0154% |
| TOTAL NL Equity | Energy | 147.50 | 0.06015% | -15.255% | -0.0092% |
| MSE MP Equity | Consumer Staples | 134.70 | 0.05493% | -4.762% | -0.0026% |
| NMH MP Equity | Consumer Discretionary | 124.50 | 0.05077% | -3.166% | -0.0016% |
| AFM MC Equity | Financials | 121.74 | 0.04965% | -2.355% | -0.0012% |
| ADI MC Equity | Real Estate | 119.92 | 0.04890% | -2.353% | -0.0012% |
| GML MP Equity | Industrials | 119.05 | 0.04855% | -1.831% | -0.0009% |
| MUR SJ Equity | Industrials | 114.15 | 0.04655% | 6.793% | 0.0032% |
| BRIT KN Equity | Financials | 113.07 | 0.04611% | -3.104% | -0.0014% |
| OLFI EY Equity | Consumer Staples | 112.48 | 0.04587% | -1.034% | -0.0005% |
| OANDO NL Equity | Energy | 110.53 | 0.04507% | -12.389% | -0.0056% |
| TRANSCOR NL Equity | Utilities | 108.88 | 0.04440% | -8.264% | -0.0037% |
| DTKL KN Equity | Financials | 105.17 | 0.04289% | -6.154% | -0.0026% |
| PADFP MP Equity | Financials | 89.28 | 0.03641% | -3.571% | -0.0013% |
| PRO MC Equity | Health Care | 83.63 | 0.03410% | -5.882% | -0.0020% |
| ISPH EY Equity | Health Care | 83.50 | 0.03405% | 0.073% | 0.0000% |
| SWAN MP Equity | Financials | 83.23 | 0.03394% | 0.146% | 0.0000% |
| CUSTODIA NL Equity | Financials | 70.83 | 0.02888% | 4.098% | 0.0012% |
| COL MC Equity | Materials | 67.88 | 0.02768% | -1.947% | -0.0005% |
| RDS MC Equity | Real Estate | 50.04 | 0.02041% | 2.598% | 0.0005% |
| CTUM KN Equity | Financials | 43.31 | 0.01766% | -1.563% | -0.0003% |
| FINCORP MP Equity | Financials | 41.43 | 0.01690% | 0.000% | 0.0000% |
| MDIT MP Equity | Financials | 22.21 | 0.00906% | -5.814% | -0.0005% |
| MOR MP Equity | Consumer Staples | 15.63 | 0.00637% | -0.681% | 0.0000% |
| DCPL MP Equity | Financials | 12.78 | 0.00521% | 0.000% | 0.0000% |
| PAIL KN Equity | Financials | 10.31 | 0.00421% | -9.501% | -0.0004% |
| HFCL KN Equity | Financials | 9.87 | 0.00403% | -19.800% | -0.0008% |
| HMALLAC MP Equity | Industrials | 9.80 | 0.00400% | 0.000% | 0.0000% |
| SNA MC Equity | Industrials | 9.69 | 0.00395% | -6.204% | -0.0002% |
| AFI MC Equity | Industrials | 9.28 | 0.00378% | 3.112% | 0.0001% |
| ASL MP Equity | Consumer Discretionary | 7.45 | 0.00304% | -2.762% | -0.0001% |
| MDP MC Equity | Materials | 7.03 | 0.00287% | 12.315% | 0.0004% |
| TIM MC Equity | Industrials | 5.13 | 0.00209% | -17.857% | -0.0004% |
| SRM MC Equity | Industrials | 4.47 | 0.00182% | -17.431% | -0.0003% |
| STR MC Equity | Industrials | 4.44 | 0.00181% | -1.245% | 0.0000% |
| MCFI MP Equity | Materials | 4.08 | 0.00167% | 0.000% | 0.0000% |
| REB MC Equity | Materials | 1.90 | 0.00077% | 0.000% | 0.0000% |
| IBC MC Equity | Information Technology | 1.10 | 0.00045% | -2.460% | 0.0000% |

***Appendix 1:*** *Value Weighted E Bottom portfolio overview*

| Value Weighted Portfolio TOP - high betas (low CO2) | | | | | |
|---|---|---|---|---|---|
| **Company** | **Industry** | **Market Cap (US$ M)** | **Weights** | **Returns** | **Value Weighted Returns** |
| BTI SJ Equity | Consumer Staples | 90,429.36 | 29.5789% | -6.8008% | -2.0116% |
| CFR SJ Equity | Consumer Discretionary | 70,390.60 | 23.0243% | 0.1433% | 0.0330% |
| NPN SJ Equity | Consumer Discretionary | 63,703.26 | 20.8369% | 9.6923% | 2.0196% |
| MNP SJ Equity | Materials | 9,180.55 | 3.0029% | -1.0413% | -0.0313% |
| SAFCOM KN Equity | Communication Services | 8,140.85 | 2.6628% | 2.1779% | 0.0580% |
| SLM SJ Equity | Financials | 7,259.31 | 2.3745% | 3.7148% | 0.0882% |
| BID SJ Equity | Consumer Staples | 6,600.13 | 2.1589% | 1.3658% | 0.0295% |
| INP SJ Equity | Financials | 6,151.89 | 2.0122% | 8.3345% | 0.1677% |
| INL SJ Equity | Financials | 6,151.89 | 2.0122% | 8.3116% | 0.1673% |
| DSY SJ Equity | Financials | 4,923.13 | 1.6103% | 5.3070% | 0.0855% |
| COMI EY Equity | Financials | 4,594.01 | 1.5027% | 11.7165% | 0.1761% |
| REIN LX Equity | Financials | 3,385.66 | 1.1074% | -1.3158% | -0.0146% |
| BOA MC Equity | Financials | 3,235.64 | 1.0584% | 6.7427% | 0.0714% |
| LHM MC Equity | Materials | 3,159.74 | 1.0335% | 4.5333% | 0.0469% |
| ABUK EY Equity | Materials | 1,582.17 | 0.5175% | -0.4100% | -0.0021% |
| GAZ MC Equity | Energy | 1,480.79 | 0.4844% | -4.9722% | -0.0241% |
| AVI SJ Equity | Consumer Staples | 1,460.49 | 0.4777% | 1.8274% | 0.0087% |
| TMA MC Equity | Consumer Discretionary | 1,019.48 | 0.3335% | 0.7273% | 0.0024% |
| KNCB KN Equity | Financials | 985.32 | 0.3223% | -3.7457% | -0.0121% |
| STANBIC NL Equity | Financials | 893.90 | 0.2924% | -5.6556% | -0.0165% |
| CIH MC Equity | Financials | 785.15 | 0.2568% | 2.8970% | 0.0074% |
| IBLL MP Equity | Financials | 779.14 | 0.2549% | 1.9231% | 0.0049% |
| WAPCO NL Equity | Materials | 765.02 | 0.2502% | -6.1475% | -0.0154% |
| ACCESSCO NL Equity | Financials | 680.07 | 0.2224% | 7.7519% | 0.0172% |
| ATL MC Equity | Financials | 677.16 | 0.2215% | -1.3455% | -0.0030% |
| AFE SJ Equity | Materials | 594.34 | 0.1944% | 0.0731% | 0.0001% |
| ETI NL Equity | Financials | 592.83 | 0.1939% | -20.8333% | -0.0404% |
| UBA NL Equity | Financials | 554.25 | 0.1813% | -11.6883% | -0.0212% |
| SAH MC Equity | Financials | 408.28 | 0.1335% | 0.0000% | 0.0000% |
| CIEB EY Equity | Financials | 406.95 | 0.1331% | -8.7344% | -0.0116% |
| EFID EY Equity | Consumer Staples | 378.70 | 0.1239% | 0.2004% | 0.0002% |
| OKOMUOIL NL Equity | Consumer Staples | 359.65 | 0.1176% | -10.0000% | -0.0118% |
| ATH MC Equity | Consumer Discretionary | 343.90 | 0.1125% | -1.1515% | -0.0013% |
| SBMH MP Equity | Financials | 310.33 | 0.1015% | -1.0033% | -0.0010% |
| HDBK EY Equity | Financials | 275.46 | 0.0901% | -10.2227% | -0.0092% |
| FIDELITY NL Equity | Financials | 265.44 | 0.0868% | -7.7670% | -0.0067% |
| CIEL MP Equity | Consumer Discretionary | 236.15 | 0.0772% | 5.0633% | 0.0039% |
| SID MC Equity | Materials | 200.14 | 0.0655% | 1.1905% | 0.0008% |
| NEJ MC Equity | Consumer Discretionary | 174.12 | 0.0570% | 0.0000% | 0.0000% |
| CIM MP Equity | Financials | 155.90 | 0.0510% | 0.0000% | 0.0000% |
| RIS MC Equity | Consumer Discretionary | 154.29 | 0.0505% | 2.1407% | 0.0011% |
| EQD MC Equity | Financials | 150.16 | 0.0491% | 4.8544% | 0.0024% |
| FCMB NL Equity | Financials | 146.20 | 0.0478% | -0.5376% | -0.0003% |
| UNILEVER NL Equity | Consumer Staples | 142.24 | 0.0465% | -20.5128% | -0.0095% |
| TKNL KN Equity | Energy | 128.69 | 0.0421% | -5.1813% | -0.0022% |
| JBIC KN Equity | Financials | 115.26 | 0.0377% | -0.9174% | -0.0003% |
| AGMA MC Equity | Financials | 114.25 | 0.0374% | 3.0979% | 0.0012% |
| MAB MC Equity | Real Estate | 113.16 | 0.0370% | 5.9877% | 0.0022% |
| BMBC KN Equity | Materials | 100.90 | 0.0330% | -8.8462% | -0.0029% |
| STERLNBA NL Equity | Financials | 93.32 | 0.0305% | 12.5000% | 0.0038% |
| NKL MC Equity | Consumer Discretionary | 91.59 | 0.0300% | -4.2090% | -0.0013% |
| CTM MC Equity | Industrials | 65.96 | 0.0216% | -0.5525% | -0.0001% |
| ALM MC Equity | Industrials | 65.67 | 0.0215% | 17.8968% | 0.0038% |
| KKZI KN Equity | Consumer Staples | 60.90 | 0.0199% | 0.0000% | 0.0000% |
| NASCON NL Equity | Consumer Staples | 57.85 | 0.0189% | -9.5000% | -0.0018% |
| M2M MC Equity | Information Technology | 47.62 | 0.0156% | 0.9709% | 0.0002% |
| CRWN KN Equity | Materials | 45.57 | 0.0149% | -0.5965% | -0.0001% |
| KNRE KN Equity | Financials | 41.21 | 0.0135% | -1.4545% | -0.0002% |
| STCL KN Equity | Consumer Staples | 39.16 | 0.0128% | -3.1250% | -0.0004% |
| CBIL KN Equity | Materials | 29.07 | 0.0095% | -1.9355% | -0.0002% |
| CGEN KN Equity | Consumer Discretionary | 27.25 | 0.0089% | 1.1556% | 0.0001% |
| MTMD MP Equity | Utilities | 26.10 | 0.0085% | -8.1081% | -0.0007% |
| UDL MP Equity | Real Estate | 23.15 | 0.0076% | 0.0000% | 0.0000% |
| LBTY KN Equity | Financials | 21.16 | 0.0069% | 2.2495% | 0.0002% |
| UNGL KN Equity | Consumer Staples | 19.69 | 0.0064% | 3.6254% | 0.0002% |
| TPSEA KN Equity | Consumer Discretionary | 19.22 | 0.0063% | 11.7073% | 0.0007% |
| FBR MC Equity | Industrials | 17.57 | 0.0057% | 15.9953% | 0.0009% |
| S2M MC Equity | Information Technology | 15.36 | 0.0050% | -4.9083% | -0.0002% |
| NSE KN Equity | Financials | 14.41 | 0.0047% | -4.7273% | -0.0002% |
| BOCK KN Equity | Materials | 11.18 | 0.0037% | -13.5220% | -0.0005% |
| LMTC KN Equity | Consumer Staples | 8.24 | 0.0027% | -18.1818% | -0.0005% |
| KAPC KN Equity | Consumer Staples | 6.72 | 0.0022% | -1.8051% | 0.0000% |
| STNG KN Equity | Communication Services | 6.62 | 0.0022% | 2.6694% | 0.0001% |
| EAPC KN Equity | Materials | 5.87 | 0.0019% | -10.1604% | -0.0002% |
| DLM MC Equity | Industrials | 5.74 | 0.0019% | -5.0881% | -0.0001% |
| SAME KN Equity | Consumer Discretionary | 5.46 | 0.0018% | 14.7541% | 0.0003% |
| ZDJ MC Equity | Materials | 4.26 | 0.0014% | 0.0000% | 0.0000% |
| EGDL KN Equity | Consumer Staples | 3.02 | 0.0010% | -3.8462% | 0.0000% |
| EACL KN Equity | Industrials | 1.86 | 0.0006% | -17.3333% | -0.0001% |
| FTGH KN Equity | Industrials | 1.65 | 0.0005% | -1.9011% | 0.0000% |
| EVRD KN Equity | Consumer Discretionary | 1.32 | 0.0004% | -14.1509% | -0.0001% |
| DNKN KN Equity | Industrials | 0.98 | 0.0003% | -1.2000% | 0.0000% |
| EXPL KN Equity | Industrials | 0.87 | 0.0003% | -12.0000% | 0.0000% |
| UCSP KN Equity | Consumer Staples | 0.81 | 0.0003% | -32.1429% | -0.0001% |

***Appendix 2:*** *Value Weighted E Top portfolio overview*

| Industry | Industry weights | portfolio composition |
|---|---|---|
| 1) Communication Services | 6.75% | 2 |
| 2) Consumer Discretionary | 0.88% | 6 |
| 3) Consumer Staples | 3.98% | 13 |
| 4) Energy | 2.50% | 4 |
| 5) Financials | 14.77% | 21 |
| 6) Health Care | 0.19% | 3 |
| 7) Industrials | 0.44% | 9 |
| 8) Information Technology | 0.00% | 1 |
| 9) Materials | 67.29% | 18 |
| 10) Real Estate | 3.16% | 6 |
| 11) Utilities | 0.04% | 1 |
| **Total** | **100.00%** | **84** |

***Appendix 3:*** *Industry weights – Portfolio E Bottom*

| Industry | Industry weights | portfolio composition |
|---|---|---|
| 1) Communication Services | 2.66% | 2 |
| 2) Consumer Discretionary | 44.54% | 12 |
| 3) Consumer Staples | 32.57% | 14 |
| 4) Energy | 0.53% | 2 |
| 5) Financials | 14.45% | 29 |
| 6) Health Care | 0.00% | 0 |
| 7) Industrials | 0.05% | 8 |
| 8) Information Technology | 0.02% | 2 |
| 9) Materials | 5.13% | 12 |
| 10) Real Estate | 0.04% | 2 |
| 11) Utilities | 0.01% | 1 |
| **Total** | **100.00%** | **84** |

***Appendix 4:*** *Industry weights – Portfolio E Top*

| low betas (high CO2 emissions) - Bottom portfolio | | | |
|---|---|---|---|
| Industry | average monthly composition | Stocks pertaining to industry | Relative frequency |
| 1) Communication Services | 2 | 8 | 25% |
| 2) Consumer Discretionary | 7 | 25 | 27% |
| 3) Consumer Staples | 8 | 43 | 19% |
| 4) Energy | 4 | 7 | 63% |
| 5) Financials | 22 | 75 | 29% |
| 6) Health Care | 1 | 6 | 9% |
| 7) Industrials | 5 | 24 | 20% |
| 8) Information Technology | 2 | 7 | 23% |
| 9) Materials | 22 | 38 | 58% |
| 10) Real Estate | 7 | 14 | 52% |
| 11) Utilities | 1 | 6 | 22% |

***Appendix 5:*** *Monthly Absolute and Relative Frequency of Stocks by Industry – Portfolio E Bottom*

| high betas (low CO2 emissions) - Top portfolio | | | |
|---|---|---|---|
| Industry | average monthly composition | Stocks pertaining to industry | Relative frequency |
| 1) Communication Services | 4 | 8 | 44% |
| 2) Consumer Discretionary | 9 | 25 | 35% |
| 3) Consumer Staples | 17 | 43 | 39% |
| 4) Energy | 1 | 7 | 14% |
| 5) Financials | 24 | 75 | 32% |
| 6) Health Care | 2 | 6 | 33% |
| 7) Industrials | 11 | 24 | 44% |
| 8) Information Technology | 3 | 7 | 49% |
| 9) Materials | 7 | 38 | 18% |
| 10) Real Estate | 2 | 14 | 17% |
| 11) Utilities | 2 | 6 | 28% |

***Appendix 6:*** *Monthly Absolute and Relative Frequency of Stocks by Industry – Portfolio E Top*

A Work Project, presented as part of the requirements for the Award of a Master's degree in International Finance from the Nova School of Business and Economics.

# SUSTAINABLE INVESTING IN EMERGING MARKETS–

# CARBON RISK IN BRAZIL

CARMEN ZEHNDER

Work project carried out under the supervision of:

Professor Giorgio Ottonello

15/12/2022

# Abstract

As the implications of global warming become more apparent, nations are shifting towards becoming low-carbon economies, and portfolio managers need to consider environmental aspects. Brazil has large natural resources and therefore holds the potential to be a key player in the global transition. This paper examines a capital market-based approach to construct a "green" portfolio containing Brazilian listed companies. This is achieved by computing the carbon risk beta of individual stocks using a carbon risk factor-mimicking portfolio that incorporates comprehensive carbon and transition-related information. The analysis shows that the "green", as well as the "brown" portfolio in terms of carbon risk beta, result in an inferior risk-adjusted performance.

**Keywords**: ESG investing, carbon risk, portfolio construction, emerging markets, economic transition, brazil, climate finance, sustainable investing.

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# 1. Introduction

As the implications of global warming are becoming more apparent and threatening, humanity is scaling the efforts to move to sustainable energy and materials with the goal of limiting global warming to 1.5°C by 2050 (Sawaya et al. 2022). A recent McKinsey report estimates that yearly investments of over 3 trillion USD until 2030 are required to get companies to reach the carbon emission reduction targets (Sawaya et al. 2022). This would represent the largest capital relocation in human history (Sawaya et al. 2022). In 2020, the top seven emitters (China, USA, India, European Union, Russia, Indonesia, and Brazil) caused around half of the total greenhouse gas emissions (United Nations Environment Programme 2022). With Brazil being one of these seven countries, the decarbonization of Brazil's s economy is imperative. Simultaneously, Brazil holds the capabilities and natural resources which allow the country to become a driving force of global transition (Grottera et al. 2017).

The first necessary step is to change legislation around land ownership and to significantly reduce deforestation, which currently causes about half of the total emissions in Brazil (The Economist 2021). A recent McKinsey report identifies renewable energy, carbon markets, and bio-based energy and materials as the three areas where Brazil has the potential to take on a leading role (Sawaya et al. 2022). Not only is Brazil an agricultural powerhouse but it is also rich in renewable energy sources such as wind, solar, hydro, and biomass (Sawaya et al. 2022). Those natural resources present an opportunity to fuel global decarbonization. Brazil's green economy has the potential to attract significant investments.

Similar to the group contribution, this section makes use of the market-based approach to integrating ESG criteria into the composition of a portfolio. Instead of using factor E, which is a simple proxy for carbon emissions, a more integral factor, called factor C, is used to construct the portfolios. This factor results from the research of Görgen et al. (2017) who created it to quantify carbon risk. Factor C incorporates comprehensive carbon and transition-related

information. This enables the construction of a sustainable portfolio which doesn't only consider a company's carbon emission but also its ability to transition to a low-carbon economy. The portfolio would then consist only of "green" stocks, referring to stocks that were emitted by companies that are considered environmentally friendly (Pastor et al. 2021). Their counterparts are brown stocks, which are harmful to the environment.

# 2. Methodology

The general approach used to create the portfolios follows the same logic as described in the group contribution apart from the use of a different factor and some changes in the methodology resulting from that. The following subsections describe how the factor C is formed and provide an understanding of the methodology, including existing differences from the approach in the group contribution.

## 2.1. Carbon Risk

The factor C receives its name as it allows to generate the carbon beta of an individual stock. It is based on the approach presented by Görgen et al. (2017) who created the factor. The data is made available by the Institute of Business Administration and Sustainable Finance (University Augsburg 2022). The authors construct a carbon risk factor-mimicking portfolio to understand carbon risk from a factor-based asset pricing model perspective. Unlike the previously described factors E, S, G, and ESG (group part) that take relatively simple proxies, such as the accounting proxy to reflect governance, the factor C considers a wide range of relevant carbon risk values.

Before going into the details, the original motivation and idea behind the factor are elaborated. There is scientific consensus that human activities are affecting global warming and that corporations contribute to the rise in global temperatures by emitting CO2 (NASA 2022). An increasing number of countries are adopting carbon pricing to reduce greenhouse gas emissions and avoid the risks associated with global warming. The price of emissions coupled with institutional divestment from the fossil fuel industry should lead to lower stock prices and a risk premium for carbon-intensive companies to compensate for the additional risk, namely carbon risk (Bolton and Kacperczyk 2021). However, the authors (Görgen et al. 2020) point out that the carbon risk arising from uncertainties in the green transition is two-sided.

Therefore, both brown stocks and green stocks are risky. On the one hand, this means that under the assumption that governments accelerate efforts to achieve the net zero target, high-carbon stocks will be riskier. On the other hand, if politicians deny global warming and support carbon-intensive business models, low-carbon stocks will be riskier. The study that built the factor finds that even if the factor can partially explain systematic variation in returns, there is no evidence of a carbon risk premium. A possible explanation might be investors' inability to adequately quantify carbon risk. The research found that brown stocks tend to have higher returns, but when they become relatively browner, returns decrease. They also show that green firms are improving faster in terms of de-carbonization than brown firms causing them to outperform the brown firms.

To study this relationship between equity prices and carbon risk, the authors (Görgen et al. 2020) constructed the factor C thereby creating a Brown-Green-Score which determines the carbon risk performance of a firm. Afterward, the mimicking portfolio representing the factor C is created by subtracting the returns of the green companies from the brown companies.

## 2.2. Carbon Risk Measurement

The C factor is created by measuring the carbon risk of different companies and deriving a score, which the authors (Görgen et al. 2017) named the Brown-Green-Score. The score uses four ESG databases to retrieve fundamental carbon and transition-related information: MSCI ESG Stats and the IVA ratings, the Sustainalytics ESG Ratings, the Carbon Disclosure Project Climate Change questionnaire dataset, and the Thomson Reuters ESG dataset (Görgen et al. 2017). The considered variables are categorized into three main indicators, each resulting in a subscore. Those indicators are value chain, public perception, and adaptability. The value chain indicator covers the emissions a firm emits within its supply chain and production. Public perception accounts for a company's carbon policy and how the relevant stakeholders perceive it. The final indicator (adaptability) captures a company's readiness to adapt to a low-carbon

economy by assessing strategies and actions the company can take in response to a carbon tax or new regulations. It also includes plans for future emission reduction or mitigation strategies. The three subscores are calculated for over 1600 international stocks and then combined for the final BGS score to approximate their carbon risk (Görgen et al. 2017). The higher the score, the browner the company. It should be mentioned that the value chain subscore is weighted higher (70%) due to its relative importance. The other two indicators carry a 15% weight each. As a result, the authors (Görgen et al. 2017) calculate the Brow-Green-Score with the following formula:

$$BGS_{i,t} = 0.70\ \text{Value Chain}_{i,t} + 0.15\ \text{Public Perception}_{i,t} + 0.15\ \text{Adaptability}_{i,t} \quad (1)$$

## 2.3. Factor C - The factor-mimicking portfolio for carbon risk

With the resulting Brown-Green-Scores and the use of asset pricing theory, the understanding of the relationship between equity prices and carbon risk can be fortified. Görgen et al. (2017) create the factor C following common composition methods (Harvey and Liu, 2014). The authors (Görgen et al. 2017) refer to the factor as the Brown-minus-Green factor. However, for the sake of simplicity and consistency, it is called the C factor in the course of this thesis. It is a factor-mimicking portfolio for carbon risk and the construction is similar to the approach used for the renowned size factor by Fama and French (1995) or for factor G explained in detail in the methodology of the group part. Each year, the analyzed firms are allocated into six portfolios according to their BGS (High = H, Low = L) and their size (Small = S, Big = B), measured in market capitalization. The upper tercile and the median are used as breaking points. The factor C equation uses the value-weighted monthly returns as follows:

$$BMG_t = 0.5\ (SH_t + BH_t) - 0.5\ (SL_t + BL_t) \quad (2)$$

Figure 1 illustrates the cumulative returns of the brown-, the green- and the factor C portfolio (BMG). From 2010 to 2012, the factor C returns are slightly positive which means that brown stocks were outperforming green stocks. The reverse is observable from 2013 until the beginning of 2016 when the factor C (BMG) drops by around 20%. The drop is followed by an increase in 2017. For the sample period, green firms performed on average better than brown firms. The authors reason that after 2013 the global economy moved faster than expected toward a low-carbon economy, which boosted green stocks and caused them to outperform brown stocks (Görgen et al. 2017).

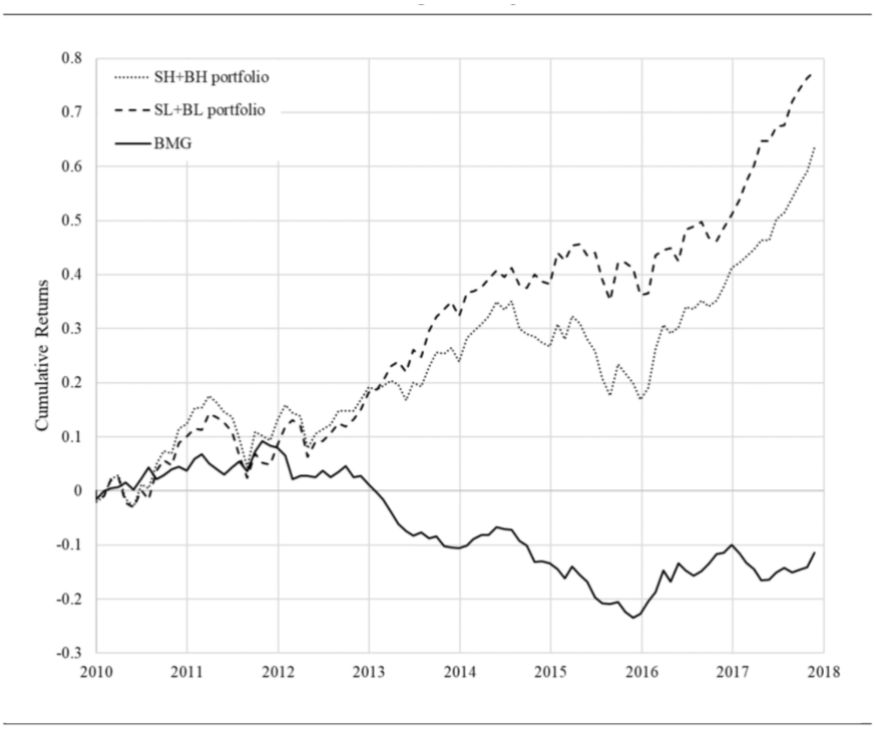


***Figure 1**: Cumulative returns of the BMG factor (C- factor). Source: Görgen et al. (2017)*

## 2.4. Carbon Beta Estimation

After clarifying the background and content of the C factor, the beta estimation follows the same logic as described in detail in the methodology part of the group paper. Therefore, the returns of the 56 stocks in the Brazilian Universe provided by BPI Asset Management are

regressed on the factor C to receive the monthly carbon risk beta. The formula for the regression is the following:

$$R_i(t) = \alpha_i + \beta_{c,i} R_c(t) + \varepsilon_i(t) \quad (3)$$

$R_i(t)$ stands for the return of stock i, the alpha of the asset i is $\alpha_i$. $R_c(t)$ is the return of the C factor and $\beta_{c,i}$ is the exposure of the stock to carbon risk. Finally, $\varepsilon_i(t)$ stands for the idiosyncratic risk. This market-based approach allows estimating the exposure to carbon risk for companies that do not have respective data available. The unavailability of carbon data is an underlying problem in emerging markets. How insightful the beta is, depends on market participants' ability to incorporate carbon risk information into the stock prices. Resulting from the methodology used in the factor creation, some adjustments must be made in the stock selection process to construct the portfolios. For the Mean Portfolio Top, which is the equally weighted portfolio with high exposure to the respective ESG practice, the tercile with the highest betas was chosen for factors described in the group contribution. For example, the factor G mimicking portfolio (group part) is computed by subtracting the returns of "bad governance" companies from "good governance" companies (G5-G1). Therefore, the highest coefficients for factor G represent the companies with good governance relative to their peers in the investment universe. Since factor C is created by taking the excess returns of brown companies minus green companies, the approach is reversed. The tercile with the lowest coefficients represents the companies included in the green portfolio (Mean Portfolio C Top). Consequently, the Mean Portfolio C Bottom is created by selecting the tercile of stocks with the highest betas (brown stocks). These are the stocks with high carbon risk resulting from the exposure to a high BGS score. As previously elaborated, the higher the score, the browner the company. The Mean Universe portfolio serves as a benchmark portfolio and includes all stocks in the Brazilian BPI investment universe. All three portfolios are equally weighted. By

rebalancing the weights of the Mean Portfolio C Top according to market capitalization and the target weight of the industry, the Value-Weighted C Portfolio and the Industry-Weighted C Portfolio are constructed. Therefore, they both include the same tercile of (green) stocks with the lowest exposure to a high Brown-Green-Score. The portfolios' performance is analyzed using the same metrics described in the group contribution: Sharpe Ratio, maximum drawdown, cumulative returns, skewness, kurtosis, and conditional value at risk.

# 3. Results

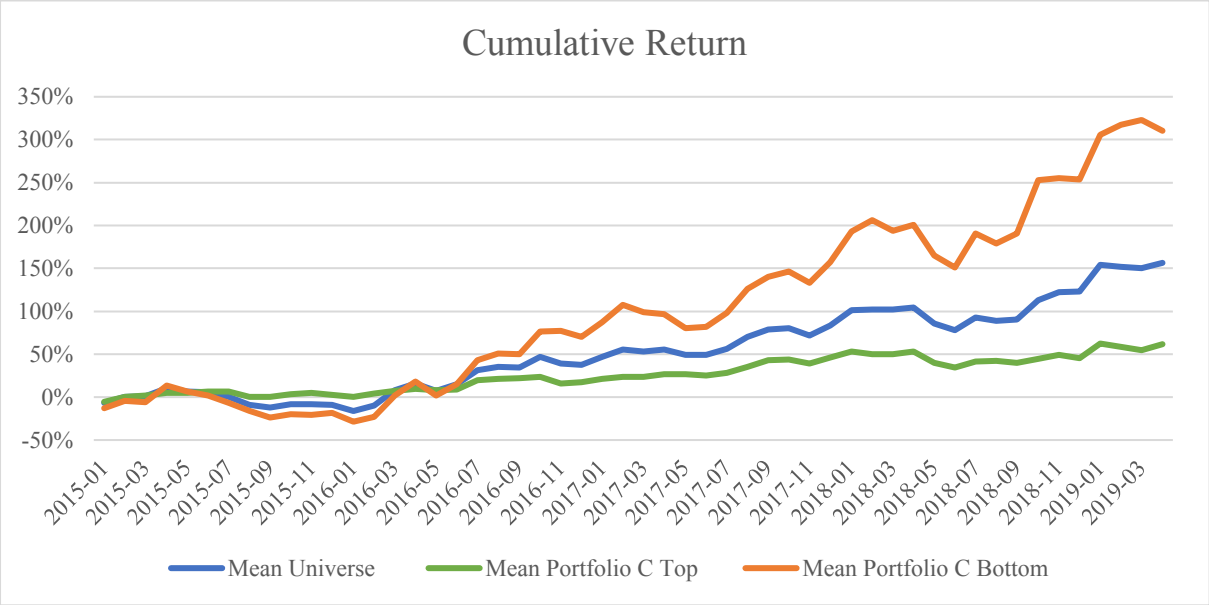


***Figure 2**: Equally weighted cumulative returns Brazil (C factor)*

The cumulative returns show that within the analyzed time frame, the brown portfolio (Mean Portfolio C Bottom) outperformed both other equally weighted portfolios. The Mean portfolio C top, which was constructed with the green stocks, has the lowest cumulative returns. As shown in Figure 3, including the rebalanced portfolios, a different allocation of weights did not increase the cumulative returns.

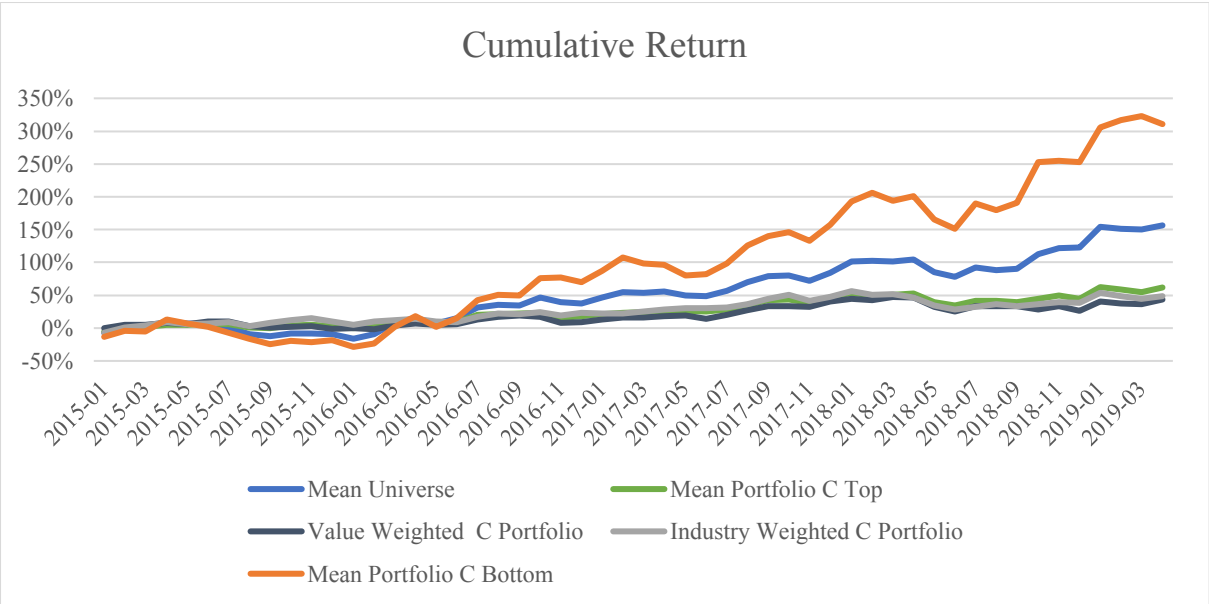


***Figure 3**: Cumulative returns Brazil (C factor)*

Therefore, none of the portfolios constructed with the green stocks were able to achieve returns in line with the universe portfolio. The risk-adjusted return metrics provide more insight into whether the higher returns were achieved by taking more risk. With a Sharpe Ratio of 1.11, the Mean Universe has the highest risk-adjusted return, followed by the "brown" portfolio. This result suggests that investing in the "brown" portfolio during this analyzed period exposes the investor to unrewarded risk. Choosing the top tercile green stocks resulted in a decrease in standard deviation (3.84%) compared to the Universe (6.32%) whereas the "brown" stocks portfolio experiences an increase (10.38%) and therefore a higher level of risk. Both rebalancing approaches cause the returns to decrease while the risk increases, resulting in the lowest Sharpe Ratios (Value Weighted Portfolio: 0,68, Industry Weighted Portfolio: 0,71).

**Table 1:** Annualized Risk and Return

| | **Mean Return** | **Standard Deviation** | **Sharpe Ratio** |
|---|---|---|---|
| **Mean Universe** | 27.07% | 6.31% | 1.11 |
| **Mean Portfolio C Top** | 12.67% | 3.84% | 0.90 |
| **Mean Portfolio C Bottom** | 46.86% | 10.38% | 1.09 |
| **Value Weighted Portfolio** | 9.72% | 3.98% | 0.68 |
| **Industry Weighted Portfolio** | 10.19% | 4.15% | 0.71 |

*Notes: This table provides information on the profitability and risk of the benchmark portfolio (Mean Universe) and the portfolios built with exposure to the C factor, a proxy for carbon risk. Portfolios are constructed with equities from the Brazilian BPI universe. All values are annualized.*

The rebalanced portfolios are also the only portfolios that are negatively skewed (Value Weighted Portfolio: -0.115, Industry Weighted Portfolio: -0.085). Investors would experience frequent small gains and a few large losses. The opposite can be observed for the other portfolios, which have a slight positive skew. With a skewness of 0.157, the returns of the Mean Portfolio C Top are closest to the normal distribution. The same applies to the kurtosis: all portfolios have a platykurtic distribution due to the kurtosis being less than three. For investors, this signals that the extreme values are less extreme than for normally distributed returns.

**Table 2:** Key Performance Indicator

| | Sharpe Ratio | Max. Drawdown | Skewness | Kurtosis | CVaR(95) |
|---|---|---|---|---|---|
| **Mean Universe** | 1.11 | -198% | 0.422 | 0.002 | -0.087 |
| **Mean Portfolio C Top** | 0.90 | -191% | 0.157 | 0.948 | -0.068 |
| **Mean Portfolio C Bottom** | 1.09 | -164% | 0.535 | 0.059 | -0.134 |
| **Value Weighted C Portfolio** | 0.68 | -237% | -0.115 | 0.509 | -0.078 |
| **Industry Weighted C Portfolio** | 0.71 | -199% | -0.085 | -0.094 | -0.072 |

*Notes: This table reports key performance indicators of the benchmark portfolio (Mean Universe) and the portfolios constructed with a desired exposure to the carbon risk factor for the Brazilian universe. Portfolios 1,2 and 3 are equally weighted, while Portfolios 4 and 5 are weighted according to the stocks' market cap and the industry's weights respectively.*

Not only does the brown portfolio (Mean Portfolio C Bottom) outperform the green portfolio (Mean Portfolio C Top) in terms of cumulative returns and Sharpe Ratio, but it also shows a lower and therefore better maximum drawdown (brown: -164% vs. green: -191%). However, both outperform the Mean Universe which experienced a drop of -198%. The maximum drawdown chart also illustrates the correlation of the portfolios as they experience lows at similar points in time.

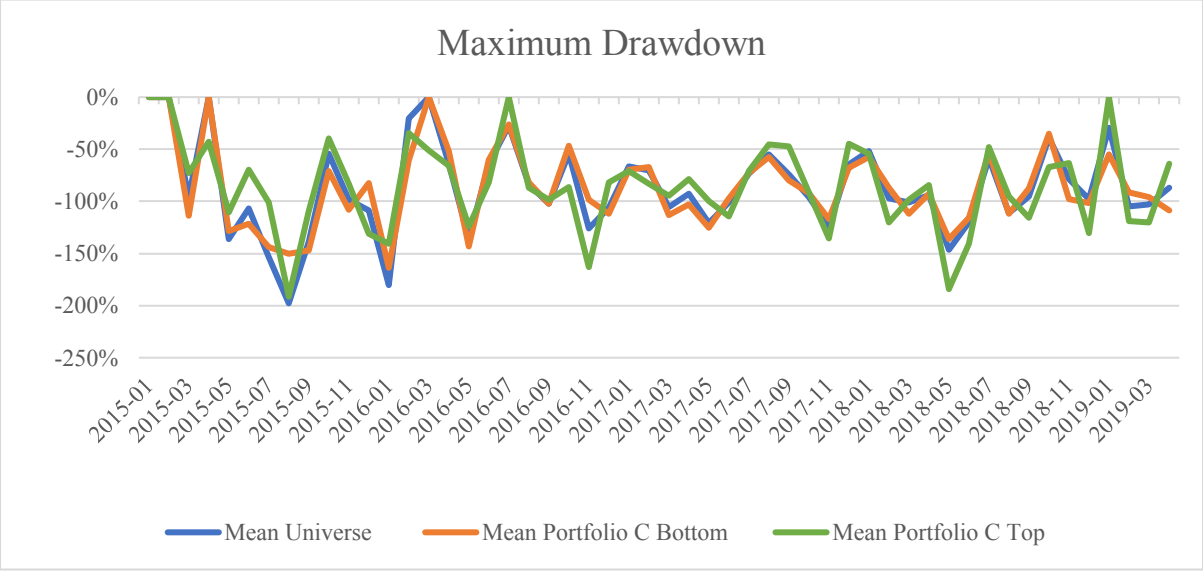


***Figure 4**: Maximum Drawdown Brazil (C factor)*

The mean universe and the "brown" portfolio have the biggest losses (maximum drawdown) only one month apart in August and September 2015 respectively.

**Table 3:** Maximum Drawdown and Date

| | Mean Universe | Mean C Top | Mean C Bottom | Value Weighted | Industry Weighted |
|---|---|---|---|---|---|
| **Max. Drawdown** | -198% | -191% | -164% | -237% | -199% |
| **Date** | 2015-08 | 2015-09 | 2016-02 | 2018-06 | 2018-06 |

*Notes: This table shows on what date the portfolios constructed with desired exposure to the carbon risk factor reached their maximum observed loss from a peak to a trough.*

Part of the reason behind the drop in the Brazilian stock market in the summer of 2015 was the downgrade of Brazil's S&P credit rating from BBB-minus to BB-plus, which is considered the highest so-called "junk" rating (Brandimarte 2015). A warning of a possible downgrade came two months prior on the grounds that mounting political problems were disrupting economic policy. More concisely, the government under President Dilma Rousseff failed to present a 2016 budget that included the policy corrections promised after her reelection in 2015 (Brandimarte 2015). In addition, the political and investment climate deteriorated in the wake of the Petrobras corruption scandal involving high-ranking officials (Jones 2017).

As investors' perceived risk rose, the cost of borrowing for the government and Brazilian companies increased, weighing on already troubled financial markets. In the first 3 months of 2015, Brazil's GDP shrank by 3.2% due to a steep decline in investment and lower family consumption (Economic Commission for Latin America and the Caribbean 2022). The chart shows that during this economic decline, as in other downturns, the brown portfolio did not drop as far as the green portfolio. This suggests that the green portfolio was less resilient to economic turbulence during the period under review. The only metric in which the green portfolio could outperform the others is in terms of average losses in the worst 5% of the returns. Its CVaR for the 95% confidence level is -6.8%, while the brown portfolio has a CVaR of -13.4% and the mean universe has a CVaR of -8.7%.

# 4. Discussion

The analysis shows that selecting the green stocks from the Brazilian investment universe provided by BPI Asset Management results in an inferior risk-adjusted performance for the analyzed period. None of the portfolios created can match or exceed the Sharpe Ratio of the Mean Universe portfolio. This occurs despite the global trend of green assets outperforming the market over the past decade (Pastor et al. 2021).

Although the green stocks on average outperformed the brown stocks in the factor C portfolio (Figure 1), this is not the case for the created portfolios in Brazil. The Mean Portfolio C Bottom, which contains the brown stocks, achieved a higher risk-adjusted return than the Mean Portfolio C Top, which represents the green portfolio. This is in line with the equilibrium model created by Pastor et al. (2021) which states that green stocks are expected to yield lower returns due to investors' preference for sustainable stocks and the possibility of hedging climate-related risks. Pastor et al. (2021) claim that green stocks can outperform brown stocks only when an unexpected increase in demand from the consumer and investor side causes stock prices to rise. The observed results suggest that for the analyzed time frame the effect of lower expected returns for green stocks overcomes the effect of unexpected changes toward a greener Brazilian economy.

Although the brown portfolio outperformed the green portfolio, neither surpasses the risk-adjusted performance of the benchmark. Following the reasoning of the authors Görgen et al. (2020), who created factor C with the dual nature of carbon risk, the results show that the additional carbon risk taken is not sufficiently remunerated on either side by the financial market. They name investors' inability to adequately quantify carbon risk as a possible explanation.

As a limitation, it should be mentioned that the factor C was created based on a global stock data sample that does not take into account the specific conditions of emerging markets. Since

the results are sensitive to the measure used, a factor C tailored to the characteristics of the Brazilian market has the potential to provide a better estimate of the carbon risk beta.

# 5. Conclusion

Brazil is in a unique position to step up as a leading player in the global transition to a net-zero economy. Factor C developed by Görgen et al. (2020) is a factor-mimicking portfolio for carbon risk which allows to generate the carbon risk beta for stocks even if no corresponding information is available. With the aim of constructing a green portfolio, the stocks with the lowest exposure to a high (brown) BGS score are chosen. The result is a green portfolio based on a monthly rolling coefficient for factor C that captures information on carbon emissions and green transition (Mean Portfolio C Top).

Given the results of this thesis, it is not recommended to build a green portfolio solely based on the introduced factor as the resulting portfolios underperform the benchmark in terms of risk-adjusted returns. Nevertheless, looking at carbon risk through the lens of a market-based approach gives investors a better understanding of a stock's carbon risk. It is especially valuable when the respective information is neither disclosed by the companies nor available from third-party data providers. Quantifying carbon risk allows asset managers to create portfolios with the desired level of exposure to that factor. ESG aspects can thus be integrated, but also beliefs about whether Brazil is capable of realizing its potential to become a major player in the transition to a low-carbon economy. The carbon risk beta is best used to complement information gained from an in-depth analysis and the direct exchange with the local companies. As mentioned in the group contribution and the previous discussion, the knowledge gained through engagement and fundamental analysis can be further used to create a region-specific version of the carbon risk factor. This would allow for a more precise estimation of carbon risk exposure of Brazilian stocks, enabling portfolio managers to account for and manage the risk arising from the uncertain transition process towards a net-zero economy.

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# SUSTAINABLE INVESTING IN EMERGING MARKETS – IMPLEMENTATION OF BPI SCREENING METHODOLOGY

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# Abstract

The following study proposes a methodology as integration into the existing BPI's internal framework. Considering the metrics investor must include according to international regulatory standards, this paper tries to select 11 unique metrics by prioritising the factors that increase the probability of success following engagement practices in emerging markets equities. Among the most relevant factors, it considers governance, board diversity and ownership structure as the essential attributes a company must have to facilitate ESG integration and successful engagement.


**Keywords** (*ESG integration, Screening, Governance, Africa*)

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# 1. Introduction

A few years ago, sustainable and responsible investing was an investment practice characterised by investment decisions that excluded companies involved in activities that could cause harm to society, such as producing alcohol, lethal weapons, cigarettes, and gambling (MSCI, 2022[1]). As ESG implementation has progressed, the modern sustainable investor tries to be directly involved with the target company to create a long-lasting positive impact for the company in many different areas.

By assessing the success of ESG integration, it emerges among the many strategies investor can use; screening and engagement are the most effective tools. In fact, according to a report published by the "Principle for Responsible Investment" (PRI, 2021[2]), negative screening represented US$19.8 trillion AUM globally in 2018. The report also showed that in 2019, 95% of the sample companies applied a negative screening approach to their portfolio construction, while around 60% used either positive or norms-based screening. Screening is only used as a first step towards selections; also, thematic investing and integration are incorporated simultaneously to narrow the pool of equities that will move forward to engagement and/or proxy voting. Among the factors that lead to exclusion through a negative screening, the listed are the main ones:

- Thermal Coal (extraction of thermal coal is greater than 5% of the revenue),
- Oil Sands (extraction of Oils Sands is greater than 5% of the revenue),
- Shale Energy (exploration or production is greater than 5% of the revenue),
- Tobacco (sales or distribution are above 10% of revenue and have a stake of 25% or more in a related business),
- Controversial Weapons (directly or via ownership, the stake is 25% or higher),
- Small Arms (selling, production, distribution is greater than 0% of the revenue).

This paper will introduce metrics not included in the BPI screener, following the values of good governance and board diversity which ultimately are critical components for ESG implementation. According to an article published by Michael Paterra in the "Economist Impact" (2022[3]), there is evidence that the board of directors plays a pivotal role in ESG integration. It can be considered the link between management and shareholders because once the ESG goals are set, the board ultimately assesses the respective measures, from requesting updates to incorporating feedback. Therefore, a good governance structure facilitates ESG integration and investor relations. In the emerging market scenario, is not easy to assess good governance metrics, firstly, due to the lack of disclosure and secondly because considering the level of corruption of certain states of Africa; it is difficult to distinguish companies that are corruption free. For this reason, the suggested metrics also include factors limiting these practices.

# 2. Methodology

The approach aims to identify a company more likely to have a positive engagement outcome following a screening. The model consists of three steps, each representing a screening level and a selection process as implementation to the existing BPI's internal framework. Considering factors affecting governance, the approach suggests screening the universe first, following a second deeper selection using BPI's current screener. Lastly, there is an ad hoc selection based on financial and qualitative metrics. Being the universe of BPI composed of African and Brazilian equities, this exercise considers only the African equities because the higher numbers of companies make the data more relevant and the selection more interesting.

## 2.1 Step.1 Application of the first level of screening

The overall 270 African-listed equities have been screened using the “MSCI Manager” tool (*Figure1*.) according to the below 11 metrics, which are not included in the existing BPI framework. Each metric presents the definition as disclosed by MSCI and why it has been chosen.

*1)EU Sustainable Investment – Board Diversity Test.* Indicates if at least 40% of board members are female for companies domiciled in developed markets, or at least 20% of board members are female for companies domiciled in non-developed markets. According to a study by Maria Angeles Fernandez et al. (2013[4]), generational diversity enhances ESG aspects' integration into the management process. The argument is based on the idea that an unequal division of power within a team and differences in opinions among members lead to better, unbiased decision-making. From the screening, there have been many results, fails, passes, and not disclosed. Only the "passes" and "non-disclosed” have been considered; 29 companies have been excluded.

*2)Bribery and anti-corruption policy*. Indicates if the company has a policy in place and the status of that policy. Companies that presented a "yes" have a policy in place. Also, companies whose result was a "yes "may have included, as a follow-up, a "Detailed formal policy on bribery and anti-corruption". There are instances of non-negative answers where some companies admitted to having "General statements of commitment to address bribery and corruption issues" but not a detailed policy. Companies that did not disclose anything have not been considered; 78 companies have passed. According to a report published by the PRI (2016[5]), companies involved with corruption activities or exposed to environments that do not condemn bribery can suffer many disadvantages. It can lead to excluding potential business opportunities, missing out on potential deals or limiting interaction with external investors.

Also, there is a risk of reputational damage for the investors involved in a company where corruption is divagated.

*3)Corruption Inst. Reliant Government Revenue*. This metric shows if the company relies on the government sector for a significant proportion (>20%) of revenues. It shows if the company rely heavily on sales to government entities. Companies more dependent on sales to government bodies are more at risk of involvement in corrupt business activities. Companies that presented a "yes" have not been considered. Considering that the 270 selected equities are listed in different countries of the African region, one must assess the level of corruption in each country during the screening process and assess the relationship between the government and the company. According to a table published by "Trading Economics" (2021[6]), Seychelles, Cape Verde, and Botswana are among the least corrupt countries. South Africa is ranked in the eighth position out of 54. At the bottom of the list, there is Libya, Somalia, and South Sudan. This metric has excluded three companies. Results show 30% of the universe have either a general or a detailed policy currently in place.

*4)Governance Pillar Score*. The Governance Pillar Score assesses risk and management practices related to Corporate Governance and Corporate Behaviour. The 0-10 score is based on the sum of deductions derived from crucial metrics included in the corporate governance (Board, Pay, Ownership & Control, and Accounting) and corporate behaviour (Business Ethics and Tax Transparency) themes. Low scores correspond to companies with weak corporate governance practices, weak business ethics programs, high exposure to corruption risk, and/or involvement in business ethics-related controversies. In contrast with BPI's current metric, considering a "pass" a company with a score above 2, only companies that performed 5 or above have been considered in this exercise. From the universe, 25 companies have been excluded.

The governance pillar score is the most influential tool for this exercise because it shows how well the company is being managed. A score below 5 cannot be considered sufficient, especially for publicly listed companies.

*5)Corporate Governance - Governance Pillar Deduction*. It refers to deduction from the Governance Pillar Score due to concerns over corporate governance structures around the board, pay, ownership & control, and accounting. Companies with values above 5 (-5 on the model) have been excluded. Overall, five companies have been excluded.

*6)Family Firm*. Family holds 10% or more of the voting rights and maintains at least one board seat in the company. Eight companies have been excluded as they presented a "yes". This metric has been considered as many studies present evidence that companies that have concentrated ownership tend to create macro-level negative externalities on competition, wealth distribution and fiscal transparency. It is often hard to make an impact on ESG integration with a company where power is concentrated. According to Shiyu Wu et al. (2022[7]), ownership concentration in the long term, lead to an increase in wealth appropriation by large shareholder at the expense of minority shareholders reducing the capacity of control. Therefore, an investor should spend resources and time on companies where the chances for a successful engagement are not limited initially.

*7)Founder Firm*. The founder serves as Chairman or CEO or retains significant influence at the company. As an extension to the previous metric, this one also represents a form of concentrated ownership in the form of power and control. According to a study presented by IE university (2021[8]), the concentration of power in the position of CEO, Chairman and founder weakens the board of directors and can destroy shareholder value. A higher power position has some

benefits, quick reaction to changes and more unified and improved leadership. However, in this exercise, priority is given to factors that enhance external intervention relations with foreign investors and the implementation of new approaches at the management level. Sahil Vora (2019[9]) affirms that most founders lack management strategy and managerial decisions and cannot relate appropriately with investors. Only a few exceptional founders, such as Bill Gates, Jeff Bezos and Mark Zuckerberg, maintain leadership positions within a firm. For these reasons, the fourteen companies that disclosed a "yes" have not been considered; the family holds 10% or more voting rights out of those four.

*8)Government Intervention Concerns*. This metric considers if the company's capital and ownership structure include a "golden shares" provision and the equivalent provision in national or State laws. It also considers whether or not the government have the right to nominate government representatives to the board. A "golden shares" provision allows a single significant shareholder, usually a national government, to override all other shareholder voting rights on certain decisions even with less than 50% ownership. As a report published by the Asian Development Bank (2022[10]) states, a company's leadership should be independent of government entities. Companies either have disclosed a 0 for non/intervention or a 1 for positive intervention, and eight companies have been excluded.

*9)State-Owned Enterprise*. A State-Owned Enterprise (SOE) is one where a State directly or indirectly holds 10% or more of the total voting rights. The State (or the regional State or province, or municipal government) owning the shares must be of the same country as the country of classification of the issuer for the issuer to be classified as an SOE in the MSCI ESG Governance model. A study by Philippe Benoit (2019[11]) explores the relationship between state-owned enterprises and climate action. The results show SOEs constitute a significant

driver for carbon emission reduction; however, he states more research is needed, especially in emerging economies where the energy demand is rising, and priority may be given to other areas. Companies that presented a "yes" have been excluded. Eleven companies have been excluded; 2 of them also flagged positive for "Government Ownership in Percentage" (metric n.10), "Eastern Company SAE", and "Capitec Bank Holdings Limited".

10*)Government Ownership in Percentage*. It indicates the percentage of the company, if any, that is government owned. From the universe, eight companies have been excluded because they had 10% or higher. This metric differs from the previous one (metric n.9) because companies that are not wholly state-owned may still have government-owned shares; moreover, only some shares have voting rights, if any. A high percentage of government ownership may create conflicts with the decision power of shareholders. For instance, "Attijariwafa bank" does not disclose any percentage of ownership; however, MSCI recognises it as a state-owned enterprise entirely. This is because the majority shareholder is a private investment institution called "Al Mada", which owns 47.77% of the shares (Bourse de Casablanca, 2022[12]). "Al Mada" is a holding company whose majority is in the hands of the Moroccan Royal Family. As this example shows, it is not very easy to assess certain companies' ownership levels; in addition to relying on different providers, the investor needs to do some additional research.

*11)Disclosure of engagement or proxy voting policy*. Indicates whether the company publicly discloses its engagement approach or proxy voting guidelines for investee companies. Companies that did not disclose have still been considered. The disclosure of this information is helpful to investors that are looking to engage with a company. From the universe, only nine companies have disclosed voting guidelines; two passed all the metrics, "Sanlam Limited" and "Old Mutual Limited".

## 2.2 Considerations about the metrics

Companies that did not disclose a specific metric were still being considered, while companies that did not reveal anything for the 11 metrics were excluded. This analysis has rejected 67% of the firms in the universe, indicating poor management or a complete lack of interest towards ESG integration. In countries such as South Africa, the level of disclosure, especially for banks, is higher because international guidelines such as the Global Reporting Initiative have been applied. However, since disclosure is voluntary and many African countries still need to enforce it, many companies fail to disclose. This is well explored in a corporate governance study conducted by Araniyar C. Isukul et al. (2017[13]). A low level of disclosure is an aspect that does not go along with ESG integration and successful engagement.

## 2.3 Step.2 Application of the second level of screening

From the initial 270, only 37 have been selected over the above 11 metrics (*Figure2.*). To make this exercise more realistic, these 37 equities have been screened a second time using BPI's internal framework (*Figure 3.*), including norms-based and internal metrics. BPI only engages with companies that respect the internal policy and sustainable investment guidelines; the bank would not consider equities that fail the internal screener. Out of the 270, only 11 companies have passed both screeners. Nevertheless, the reader and BPI are free to consider an engagement with any of the 37 companies and apply further metrics that are different than those in Step2 and Step3.

## 2.4 Step.3 Application of the third level of screening

At this stage, it is to be noted that all the remaining 11 companies represent the highest level of governance and disclosure of the African universe. In this last selection method, companies have been divided by qualitative and quantitative metrics, including sector and industry division, individual Beta and sector Beta, shares' ownership, ESG rating from 2018 to 2022, controversies reports and financial performance.

The sector and industry division serves to understand the positioning of the company concerning its peers; from this analysis, it emerges that seven companies are part of the "Basic Material" sector, three are part of the "Financial Services", and one is from the "Consumer Cyclical". It is interesting how the mining sector has thrived in terms of good governance and disclosure, despite considering the nature of the activities that characterise this industry. Also, mining has considerably lower ESG scores than the banking sector; hence, the average sector score has been considered not to create disadvantages.

When comparing the Betas, eight companies have a Beta below the sector Beta, meaning they are less volatile; the ones that outperformed have a Beta very close to the sector. Hence the risk and volatility are still low. It is to be noted that individual Betas have been taken from "Yahoo Finance" as "Stock Price Beta 5 years monthly". In contrast, the sector Betas have been extracted from the "NYU Stern, Emerging Market" table (Aswath Damodaran, last updated 05/01/2022[14]).

Subsequently, to give an overview of the shareholder's ownership, the analysis shows the percentage of shares owned by institutions compared to a company's internal holders. As a study published by Elsevier (2021[15]) shows, a company with the most shares owned by institutions is more likely to perform engagement practices than one state-owned or has a higher percentage of internal majority holders. For this reason, "Anglo American Platinum Limited" has been excluded. According to Simply Wall St (2022[16]) and a report made by Credit Suisse

(2017[17]), the company is the biggest shareholder, with almost 80% of shares owned where only less than 15% are owned by private investors, of which 6% are institutions (288). Engaging with such a company will only give short-term benefits regarding voting rights and control over future decisions. Therefore, there cannot be an impactful control over the ESG score and sustainability implementation.

Further, the ESG score has been analysed by recording the ratings from 2018 until 2022 (some companies did not disclose the ESG rating for the years 2021 and/or 2022); the related trend has been assessed, resulting in two companies having an unchanged/stable rating, "Old Mutual Limited" (triple A) and Woolworths Holdings Limited" (double A). Since investors prefer to engage with companies with an uprising potential in terms of ESG score, an intervention with a five-year positive triple-A trend might be seen as futile as there is no margin for improvement. For this reason, "Old Mutual Limited" has been excluded.

The model also considers the controversies reported by MSCI and the areas where the company lacks the most compared to its peers. Despite the broad positive governance, six companies have moderate-low exposure to controversies, and only one has no controversies at all, being "AECI Limited". The significant risks include bribery concerns, health and safety, anticompetitive practices, labour rights and impact on local communities. However, the MSCI reports suggest no high-risk exposure or unresolved issues. A possible engagement could improve the area in which the target company lack the most by bringing expertise.

To represent BPI's investment philosophy, the model shows an overview of what analysts say about short-term future performance (1 year) and mid-term past and future performance (5 years forecast). Considering BPI's long-term investment strategy, priority has been given to companies with an optimistic long-term forecast, considering that the average engagement approach usually does not lasts less than three years. Companies that could have performed better during the current year were still being considered for a possible future positive outcome.

Most of the firms presented an optimistic share price forecast, ranging from a 5% to a 22.12% per annum increase. Only "Impala Platinum Holding Limited" and "Simbanye Stillwater Limited" showed a negative forecast respectively of -4.40% and -10.25% (this data was taken from "Yahoo Finance" and is only indicative, a proper valuation and forecast should be assessed to validate the trend).

# 3. Results

From this analysis, 2 of the 11 companies have been selected as possible targets of engagement practice. Namely, "AECI Limited" and "Northam Platinum Holdings Limited". From the first screening, it is clear that the companies disclosed a high percentage of information compared to the 270 listed equities. The outcome of the first screening also suggests that they have a robust governance structure willing to implement its strategy and increase its sustainability position. The firms favour external shareholders' intervention and effectively communicate their progress and policy changes. The ESG trend, when compared to the best performers of its industry, can be considered suitable for "AECI Limited" (A, A, A, AA) and acceptable for "Northam Platinum Holdings Limited." (BB, BB, BB, BB, BB). The first presents a positive uprising trend which is a sign that the management is trying to improve and integrate better practices, while the second one has a stable trend which suggests the company needs to do more. Additionally, there is a margin for improvement for both entities. In terms of financials, the firms present a five years per annum increase of 5% and 8.60%. According to the MSCI report, compared to peers, both entities lack in toxic emissions and waste management; however, with an effective engagement practice, this issue can be resolved, as a report from Robeco (2022[18]) shows.

# 4. Conclusion

This paper shows which metrics represent best a company's success in terms of ESG integration and possible successful engagement while using a screener. The model considers 270 companies listed on different African stock exchanges and includes three steps representing three screening levels. The first level includes some norms-based metrics and 11 unique metrics introduced to represent good governance. The second step includes selecting the 37 remaining companies through BPI's internal screener. A bundle of criteria is suggested at the third screening level, among which qualitative and quantitative components are presented.

The screening of the African universe does present some limitations due to the low level of the disclosure; although, the selection has shown that some companies are worth investing in.

Indeed, every investor is free to apply the metrics that are more aligned with its investment philosophy; however, this paper proposes some valid points worth exploring. Nevertheless, one should consider the 11 unique metrics proposed before making investment decisions starting from a more generic screening that considers the norms-based factors of the desired country and going into a deeper analysis.

# 5. Appendix

*Figure 1.*

| | ISSUER_NAME | BOARD_DIVERSITY_TEST | CORRUPTION_INST_POL_BRIB_CORR | BRIBE_ANTI_CORR_POLICY_NM | BUS_ETHICS_POLICY_ANTICORR |
|---|---|---|---|---|---|
| | **METRICS** | **EU Sustainable Investment – Board Diversity Test.** Indicates if at least 40% of board members are female for companies domiciled in developed markets, or at least 20% of board members are female for companies domiciled in non-developed markets. | **Bribery and anti-corruption policy.** Indicates if the company has a policy on bribery and anti-corruption in place and the scope of that policy. | **Bribery and anti-corruption policy or commits to related recognized external standards (1,0).** Flagged as "1" if company has a bribery and anti-corruption policy and/ or commits to related recognized external standard(s). | **Bribery and anti-corruption policy.** Inc and anti-corruption in place and the scope of |
| Fail | Attijariwafa bank SA | Fail | | | General statements of commitment t |
| Unknown | Alexandria Mineral Oils Co SAE | | | | |
| Fail | EXXARO RESOURCES LIMITED | Pass | Detailed formal policy on bribery and anti 1 | | Detailed formal policy on bribery and |
| Unknown | BOC Kenya PLC | | | | |
| Unknown | Crown Paints Kenya PLC | | | | |
| Unknown | Centum Investment Company PLC | | | | |
| Unknown | Oriental Weavers Carpet Co. S.A.E. | | | | |
| Unknown | Olympia Capital Holdings Ltd | | | | |
| Unknown | Housing and Development Bank SAE | | | | |
| Unknown | Alteo Agri Ltd | | | | |
| Unknown | National Investment Trust Ltd | | | | |
| Unknown | Lux Island Resorts Ltd | | | | |
| Unknown | PIM Ltd | | | | |
| Unknown | Swan General Ltd | | | | |
| Unknown | Sun Limited | | | | |
| Fail | SASOL LIMITED | Pass | Detailed formal policy on bribery and anti 1 | | Detailed formal policy on bribery and |
| Unknown | RISMA SA | | | | |
| Unknown | Nationale d'Electrolyse et de Petrochim | | | | |
| Unknown | Guinness Nigeria Plc | | | | |
| Unknown | MANAGEM S.A. | | | | |
| Unknown | COMPAGNIE DE TRANSPORT AU MARC | | | | |
| Unknown | Hightech Payment Systems SA | | | | |
| Unknown | Involys SA | | | | |
| Pass | ANGLOGOLD ASHANTI LTD | Pass | Detailed formal policy on bribery and anti 1 | | Detailed formal policy on bribery and |
| Fail | ASPEN PHARMACARE HOLDINGS LIMIT | Pass | Detailed formal policy on bribery and anti 1 | | Detailed formal policy on bribery and |
| Unknown | Sameer Africa PLC | | | | |
| Fail | FIRSTRAND LIMITED | Pass | Detailed formal policy on bribery and anti 1 | | Detailed formal policy on bribery and |
| Pass | IMPALA PLATINUM HOLDINGS LIMITED | Pass | Detailed formal policy on bribery and anti 1 | | Detailed formal policy on bribery and |
| Pass | INVESTEC LIMITED | Pass | | | Detailed formal policy on bribery and |
| Unknown | ABSA BANK KENYA PLC | | | | |
| Unknown | EVEREADY East Africa PLC | | | | |

*(**Step.1**, snap from the excel – the first level of screening - from the left a column with the names of the equities from the whole universe, at the top, the 11 metrics plus some norms-based factors)*

*Figure 2.*

| | ISSUER_NAME | Client_ID | ISSUI | ISSUER_ISIN | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Passed the engagement screaner | | | | Passed BPI internal screaner | | | New Portfolio for Engagement | | | |
| 1 | A E C I LIMITED | ZAE000000220 | AFE | ZAE000000220 | A E C I LIMITED | AFE | ZAE000000220 | A E C I LIMITED | AFE | ZAE000000220 | 1 |
| 2 | ABSA GROUP LIMITED | ZAE000255915 | ABG | ZAE000255915 | ABSA GROUP LIMITED | ABG | ZAE000255915 | ABSA GROUP LIMITED | ABG | ZAE000255915 | 2 |
| 3 | Anglo American Platinum Limited | ZAE000013181 | AMS | ZAE000013181 | Anglo American Platinum Lir | AMS | ZAE000013181 | Anglo American Platinum Limited | AMS | ZAE000013181 | 3 |
| 4 | ANGLOGOLD ASHANTI LTD | ZAE000043485 | ANG | ZAE000043485 | ANGLOGOLD ASHANTI LTD | ANG | ZAE000043485 | ANGLOGOLD ASHANTI LTD | ANG | ZAE000043485 | 4 |
| 5 | Avi Ltd | ZAE000049433 | AVI | ZAE000049433 | BRITISH AMERICAN TOBACC | BATS | GB0002875804 | Gold Fields Limited | GFI | ZAE000018123 | 5 |
| 6 | Banque Populaire SA | MA0000011884 | BCP | MA0000011884 | COMPAGNIE FINANCIERE RI( | CFR | CH0210483332 | IMPALA PLATINUM HOLDINGS LIMITEI | IMP | ZAE000083648 | 6 |
| 7 | BID CORPORATION LIMITED | ZAE000216537 | BID | ZAE000216537 | DANGOTE CEMENT PLC | DANGC | NGDANGCEM008 | Northam Platinum Holdings Limited | NPH | ZAE000298253 | 7 |
| 8 | CLICKS GROUP LIMITED | ZAE000134854 | CLS | ZAE000134854 | DISCOVERY LIMITED | DSY | ZAE000022331 | OLD MUTUAL LIMITED | OMU | ZAE000255360 | 8 |
| 9 | Commercial International Bank (Egypt) S.A.E. | EGS60121C018 | COMI | EGS60121C018 | FIRSTRAND LIMITED | FSR | ZAE000066304 | SANLAM LIMITED | SLM | ZAE000070660 | 9 |
| 10 | East African Breweries PLC | KE0000000216 | EABL | KE0000000216 | Gold Fields Limited | GFI | ZAE000018123 | SIBANYE STILLWATER LIMITED | SSW | ZAE000259701 | 10 |
| 11 | Ecobank Transnational Incorporated S.A. | TG0000000132 | ETI | TG0000000132 | IMPALA PLATINUM HOLDIN( | IMP | ZAE000083648 | WOOLWORTHS HOLDINGS LIMITED | WHL | ZAE000063863 | 11 |
| 12 | E-finance for Digital and Financial Investements | EGS743O1C013 | EFIH | EGS743O1C013 | Juhayna Food Industries SAE | JUFO | EGS30901C010 | | | | |
| 13 | EQUITY GROUP HOLDINGS LIMITED | KE0000000554 | EQTY | KE0000000554 | MCB GROUP LIMITED | MCBG.I | MU0424N00005 | | | | |
| 14 | FIDELITY BANK PLC | NGFIDELITYB5 | FIDEL | NGFIDELITYB5 | MONDI PLC | MNDI | GB00B1CRLC47 | | | | |
| 15 | Gold Fields Limited | ZAE000018123 | GFI | ZAE000018123 | MTN GROUP LIMITED | MTN | ZAE000042164 | | | | |
| 16 | GUARANTY TRUST HOLDING COMPANY PLC | NGGTCO000002 | GTCO | NGGTCO000002 | Northam Platinum Holdings L | NPH | ZAE000298253 | | | | |
| 17 | IMPALA PLATINUM HOLDINGS LIMITED | ZAE000083648 | IMP | ZAE000083648 | OLD MUTUAL LIMITED | OMU | ZAE000255360 | | | | |
| 18 | INVESTEC LIMITED | ZAE000081949 | INL | ZAE000081949 | Prosus N.V. | PRX | NL0013654783 | | | | |
| 19 | Kapchorua Tea Kenya PLC | KE4000001760 | | KE4000001760 | REMGRO LIMITED | REM | ZAE000026480 | | | | |
| 20 | MTN NIGERIA COMMUNICATIONS PLC | NGMTNN000002 | MTNN | NGMTNN000002 | SAFARICOM PLC | SCOM | KE1000001402 | | | | |
| 21 | MultiChoice Group Limited | ZAE000265971 | MCG | ZAE000265971 | SANLAM LIMITED | SLM | ZAE000070660 | | | | |
| 22 | NASPERS LIMITED | ZAE000015889 | NPN | ZAE000015889 | SBM Holdings Ltd | SBMH.I | MU0443N00005 | | | | |
| 23 | Nedbank Group Limited | ZAE000004875 | NED | ZAE000004875 | SIBANYE STILLWATER LIMI | SSW | ZAE000259701 | | | | |
| 24 | Nestle Nigeria PLC | NGNESTLE0006 | NESTL | NGNESTLE0006 | VODACOM GROUP LIMITED | VOD | ZAE000132577 | | | | |
| 25 | Nigerian Breweries PLC | NGNB00000005 | NB | NGNB00000005 | WOOLWORTHS HOLDINGS I | WHL | ZAE000063863 | | | | |
| 26 | Northam Platinum Holdings Limited | ZAE000298253 | NPH | ZAE000298253 | | | | | | | |
| 27 | OLD MUTUAL LIMITED | ZAE000255360 | OMU | ZAE000255360 | | | | | | | |
| 28 | SANLAM LIMITED | ZAE000070660 | SLM | ZAE000070660 | | | | | | | |
| 29 | SIBANYE STILLWATER LIMITED | ZAE000259701 | SSW | ZAE000259701 | | | | | | | |
| 30 | Stanbic Holdings Plc | KE0000000091 | | KE0000000091 | | | | | | | |
| 31 | STANBIC IBTC BANK PLC | NGSTANBIC003 | STANI | NGSTANBIC003 | | | | | | | |
| 32 | STANDARD BANK GROUP LIMITED | ZAE000109815 | SBK | ZAE000109815 | | | | | | | |
| 33 | THE BIDVEST GROUP LIMITED | ZAE000117321 | BVT | ZAE000117321 | | | | | | | |
| 34 | TotalEnergies Marketing Maroc SA | MA0000012262 | TMA | MA0000012262 | | | | | | | |
| 35 | TRUWORTHS INTERNATIONAL LIMITED | ZAE000028296 | TRU | ZAE000028296 | | | | | | | |
| 36 | UNITED BANK FOR AFRICA PLC | NGUBA0000001 | UBA | NGUBA0000001 | | | | | | | |
| 37 | WOOLWORTHS HOLDINGS LIMITED | ZAE000063863 | WHL | ZAE000063863 | | | | | | | |

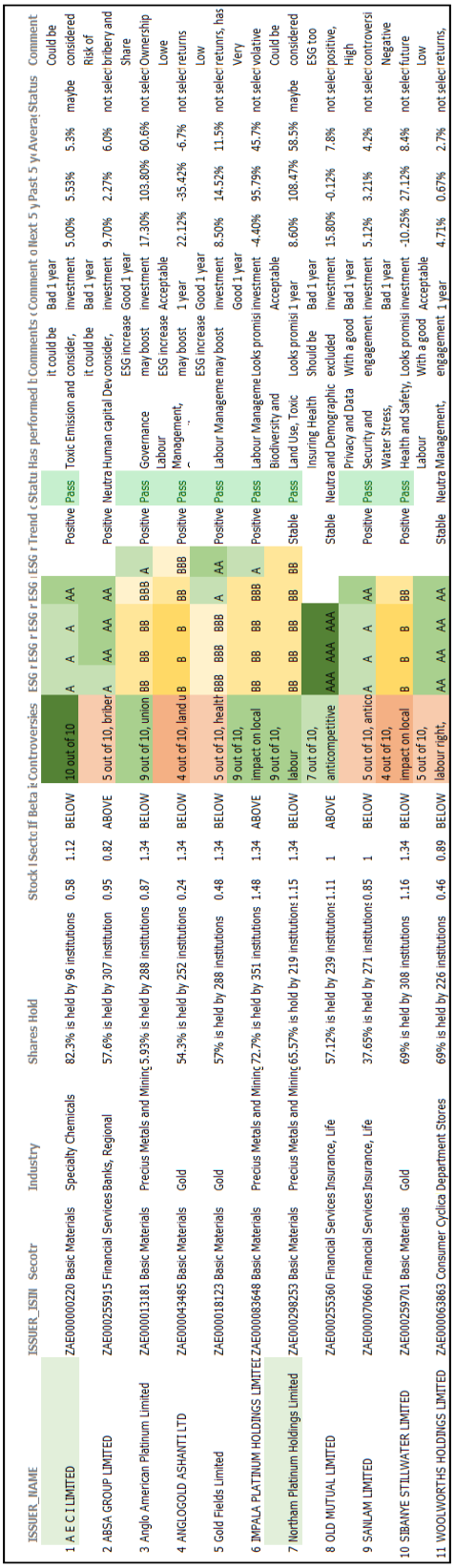
(***Step.2***, *Snap from the excel – the second level of screening - from the left are the 37 equities that passed the first screener, in the middle the companies that passed the BPI internal screener, at the right the resulting portfolio.)*

*Figure 3.*

| Factor Name | Operator | Criteria |
|---|---|---|
| Oil Sands - Maximum Percentage of Revenue | > | 10 |
| Controversial Weapons - Any Tie | = | True |
| Weapons - Nuclear Maximum Percentage of Revenue | > | 5 |
| Generation Thermal Coal - Maximum Percentage of Revenue | > | 25 |
| Thermal Coal - Maximum Percentage of Revenue | > | 25 |
| Weapons - Maximum Percentage of Revenue | > | 35 |
| Company Summary - Overall Flag | = | Red |
| Global Compact Compliance | = | Fail |
| Human Rights Compliance | = | Fail |
| Labor Compliance - Core | = | Fail |
| Labor Compliance - Broad | = | Fail |
| O&G Related Activities - Maximum Percentage of Revenue | > | 50 |
| Low Carbon Transition Management Score | < | 5 |
| Three-year trend of average carbon emissions intensity (Improving, Stable, Worseni... | = | Worsening |
| Three-year trend of average carbon emissions intensity (Improving, Stable, Worseni... | = | Not Determinable |
| Arctic Oil - Maximum Percentage of Revenue | > | 10 |
| Arctic Gas - Maximum Percentage of Revenue | > | 10 |
| ESG Rating | = | CCC |
| Government ESG Rating | = | CCC |
| Governance Pillar Score | < | 2 |

*(BPI's internal framework – here listed the metrics utilized by BPI in the screener).*

*Figure 4*



| | ISSUER_NAME | ISSUER_JSIN | Secotr | Industry | Shares Held | Stock | Secto | If Beta is | Controversies | ESG r | ESG r | ESG r | ESG r | ESG r | Trend | Statu | Has performed h | Comments | Comment o | Next 5 y | Past 5 y | Averag | Status | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A E C I LIMITED | ZAE000000220 | Basic Materials | Specialty Chemicals | 82.3% is held by 96 institutions | 0.58 | 1.12 | BELOW | 10 out of 10 | A | A | A | AA | | Positive | Pass | Toxic Emission and | it could be consider, | Bad 1 year investment | 5.00% | 5.53% | 5.3% | maybe | Could be considered |
| 2 | ABSA GROUP LIMITED | ZAE000255915 | Financial Services | Banks, Regional | 57.6% is held by 307 institution | 0.95 | 0.82 | ABOVE | 5 out of 10, briber | A | AA | AA | AA | | Positive | Neutra | Human capital Dev | it could be consider, | Bad 1 year investment | 9.70% | 2.27% | 6.0% | not selec | Risk of bribery and |
| 3 | Anglo American Platinum Limited | ZAE000013181 | Basic Materials | Precius Metals and Mining | 5.93% is held by 288 institutions | 0.87 | 1.34 | BELOW | 9 out of 10, union | BB | BB | BB | BBB | A | Positive | Pass | Governance | ESG increase may boost | Good 1 year investment | 17.30% | 103.80% | 60.6% | not selec | Share Ownership |
| 4 | ANGLOGOLD ASHANTI LTD | ZAE000043485 | Basic Materials | Gold | 54.3% is held by 252 institutions | 0.24 | 1.34 | BELOW | 4 out of 10, land u | B | B | B | BB | BBB | Positive | Pass | Labour Management, | ESG increase may boost | Acceptable 1 year | 22.12% | -35.42% | -6.7% | not selec | Lowe returns Low |
| 5 | Gold Fields Limited | ZAE000018123 | Basic Materials | Gold | 57% is held by 288 institutions | 0.48 | 1.34 | BELOW | 5 out of 10, healtr | BBB | BBB | BBB | A | AA | Positive | Pass | Labour Manageme | may boost | Good 1 year investment | 8.50% | 14.52% | 11.5% | not selec | returns, has Very |
| 6 | IMPALA PLATINUM HOLDINGS LIMITED | ZAE000083648 | Basic Materials | Precius Metals and Mining | 72.7% is held by 351 institutions | 1.48 | 1.34 | ABOVE | 9 out of 10, impact on local | BB | BB | BB | BBB | A | Positive | Pass | Labour Manageme | Looks promisi | Good 1 year investment | -4.40% | 95.79% | 45.7% | not selec | volative |
| 7 | Northam Platinum Holdings Limited | ZAE000298253 | Basic Materials | Precius Metals and Mining | 65.57% is held by 219 institutions | 1.15 | 1.34 | BELOW | 9 out of 10, labour | BB | BB | BB | BB | BB | Stable | Pass | Biodiversity and Land Use, Toxic | Looks promisi | Acceptable 1 year | 8.60% | 108.47% | 58.5% | maybe | Could be considered |
| 8 | OLD MUTUAL LIMITED | ZAE000255360 | Financial Services | Insurance, Life | 57.12% is held by 239 institutions | 1.11 | 1 | ABOVE | 7 out of 10, anticompetitive | AAA | AAA | AAA | | | Stable | | Insuring Health and Demographic | Should be excluded | Bad 1 year investment | 15.80% | -0.12% | 7.8% | not selec | ESG too positive, |
| 9 | SANLAM LIMITED | ZAE000070660 | Financial Services | Insurance, Life | 37.65% is held by 271 institutions | 0.85 | 1 | BELOW | 5 out of 10, antico | A | A | A | AA | | Positive | Pass | Privacy and Data Security and Water Stress, | With a good engagement | Bad 1 year investment | 5.12% | 3.21% | 4.2% | not selec | High controversi |
| 10 | SIBANYE STILLWATER LIMITED | ZAE000259701 | Basic Materials | Gold | 69% is held by 308 institutions | 1.16 | 1.34 | BELOW | 4 out of 10, impact on local | B | B | B | BB | | Positive | Pass | Health and Safety, | Looks promisi | Bad 1 year investment | -10.25% | 27.12% | 8.4% | not selec | Negative future |
| 11 | WOOLWORTHS HOLDINGS LIMITED | ZAE000063863 | Consumer Cyclica | Department Stores | 69% is held by 226 institutions | 0.46 | 0.89 | BELOW | 5 out of 10, labour right, | AA | AA | AA | AA | | Stable | | Labour Management, | With a good engagement | Acceptable 1 year | 4.71% | 0.67% | 2.7% | not selec | Low returns, |

(***Step.3***, *snap from the excel – the third level of screening – on the left are the 11 listed companies and on the top row are the unique qualitative and quantitative factors*)

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