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Betriebswirtschaftslehre
M.A. International Management and Finance (Double Degree)

Master's Thesis

Impact of Country-Level Sustainability on the Performance of Global Equity Portfolios

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Date of Submission:
May 9, 2021

Abstract

Driven by increasing attention to sustainability issues as well as superior financial performance of firms with sustainable business practice, sustainable investing is becoming mainstream. Currently, investors incorporate firm-level environmental, social, and governance (ESG) criteria into their investment decision to tilt portfolios towards firms performing well on ESG. To overcome drawbacks of the current micro approach to sustainable investing, such as massive divergence in ESG ratings or bias towards large cap stocks, this thesis introduces a macro approach to sustainable investing by using country-level sustainability (CLS) as a proxy for ESG exposure. A new data set covering sustainable development indicators for more than 50 countries from developed and emerging economies in the period 1987–2020 laid the foundation for a novel CLS index. Regressing CLS against ESG scores using panel regression models provided evidence supporting a positive macro–micro sustainability relationship. Having analyzed the performance of different CLS strategies that were inspired by smart beta and common approaches to sustainable investing revealed that CLS increased the exposure towards ESG and could have enhanced risk-adjusted returns. However, after accounting for risk factor exposure, in most cases, CLS strategies neither added nor destroyed value compared to market capitalization-weighted benchmarks.

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List of Abbreviations

ACWI ..... *MSCI ACWI Index*
APT ..... *Arbitrage Pricing Theory*
AUM ..... *Assets Under Management*
CAPM ..... *Capital Asset Pricing Model*
CFP ..... *Corporate Financial Performance*
CLS ..... *Country-Level Sustainability*
CMA ..... *Conservative Minus Aggressive*
CSR ..... *Corporate Social Responsibility*
DD ..... *Drawdown*
EMH ..... *Efficient Market Hypothesis*
EPI ..... *Environmental Performance Index*
ESG ..... *Environmental, Social and Governance*
HML ..... *High Minus Low*
MOM ..... *Momentum*
RMW ..... *Robust Minus Weak*
SDGs ..... *Sustainable Development Goals*
SMB ..... *Small Minus Big*
VaR ..... *Value at Risk*
VIF ..... *Variance Inflation Factor*

1 Introduction

Whether it's the pressing climate crisis, a large share of the world's population living in poverty, or the absence of human rights in some parts of the world, there are major challenges to sustainability around the globe. With the United Nations Sustainable Development Goals (SDGs), in 2015, a global framework was introduced that prompts the whole society and especially private sector entities to make the world more sustainable (United Nations, 2015b). With business playing a central role in sustainable development, environmental, social, and governance (ESG) criteria emerged to monitor firms' progress on the SDGs (Huber et al., 2018). Fueled by rising awareness on sustainability issues as well as an extensive body of research finding evidence for a positive relationship between sustainable business practice and financial performance, investors are increasingly incorporating ESG criteria into their investment decision (Friede et al., 2015; PRI, 2020). Deutsche Bank (2018) projects assets managed by an ESG mandate to account for 99 % of global assets under management (AUM) by 2035.

In an attempt to capitalize on the rapid growth of sustainable investing, rating agencies and data providers established hundreds of ESG rating schemes, which often diverge heavily in their scores for single companies, and thus can result in very different investment decisions (Lehmann, 2019; Wong & Petroy, 2020). Moreover, without mandatory corporate reporting on sustainability issues in many countries and with small-sized firms not having ESG disclosure mechanisms in place, evaluation of sustainability in business practices can be challenging and cause portfolio bias (Deutsche Bank, 2018; PRI & MSCI, 2016). Additionally, there is concern over unaudited ESG data and a lack of regulation of ESG ratings potentially leading to greenwashing and capital misallocation (ESMA, 2021).

Using country-level sustainability (CLS) as a proxy for the national level of sustainable business practice might be a promising alternative to the current micro approach to sustainable investing. With national institutional factors facilitating the widespread adoption of sustainable business practice and the private sector being indispensable in national sustainable development, the macro–micro relationship is twofold. Besides government-imposed regulation, other institutional drivers, such as societal pressure and cultural dimensions, were reported to

having a significant effect on the level of sustainability in national business (Alonso-Martínez et al., 2020; J. L. Campbell, 2006; Halkos & Skouloudis, 2016a). In return, due to firms' social responsibility as by far the largest employer, often extensive environmental footprint, as well as major role in driving national competitiveness, micro-level sustainability scales up to the macro level (de Larderel, 2009; Seitz, 2015; Shinwelli & Shamiri, 2018). This macro–micro sustainability relationship has received little attention in research. While preceding studies reported a positive relation, they were either limited to a small set of countries or did only take into account single dimensions of sustainability (Hult et al., 2018; Zhang et al., 2019). Even less research focused on the relation between CLS and firms' financial performance. However, two studies found evidence for an inverse relationship between CLS and cost of debt capital, indicating a positive link between CLS and financial performance (Hoepner et al., 2016; Stellner et al., 2015).

Assuming a positive relationship between macro- and micro-level sustainability, this thesis is the first to analyze the impact of CLS on the performance of global equity portfolios. The MSCI ACWI Index (ACWI) served as a global equity benchmark and its underlying country equity indices, which cover more than 50 developed and emerging market countries, as starting point to build CLS-integrated portfolios for the period 1988–2021. Therefore, a novel CLS index was calculated after aggregating a new empirical CLS data set covering more than 100,000 data points from various sustainability indicators for 52 countries during the period 1987–2020. In addition, CLS scores were matched with mean country-level ESG scores into a panel data set, allowing to provide new empirical evidence on the macro–micro sustainability relationship by utilizing panel regression techniques.

The thesis starts with a background section on portfolio theory and asset pricing models to outline quantitative concepts the empirical part draws upon. It further gives an overview on sustainable development and sustainable investing. This is followed by a review of related literature, which channels into the development of the underlying research hypotheses. The next section outlines the study's methodology as well as characteristics and sources of the underlying data. Finally, regression results and portfolio performance are presented and discussed (Timo Engelbertz, May 2021).

2 Theoretical Background

Divided into two parts, this section builds the theoretical foundation of the thesis. The first part outlines quantitative methods that are used to construct global equity portfolios and measure their performance. Beginning with the concepts of Modern Portfolio Theory and the Capital Asset Pricing Model, portfolio performance measures and the rationale of the value-weighted market portfolio are introduced. This is followed by an overview of multi-factor models explaining the motivation of deviations from the market portfolio. As the objective of this thesis is to analyze the impact of CLS on portfolio performance, the second part of this section covers theoretical background on sustainability. After defining sustainable development, landmarks on the way towards the SDGs are highlighted. Next, criteria to evaluate firms' sustainability performance are explained. Finally, common approaches to sustainable investing and market projections are outlined.

2.1 Portfolio Theory and Asset Pricing Models

2.1.1 Modern Portfolio Theory

In 1952, Nobel prize winner Markowitz published his theory of efficient portfolios in the Journal of Finance. The ideas introduced by Markowitz laid the foundation for what is today known as Modern Portfolio Theory (Fabozzi et al., 2002). Under the assumption that investors are risk averse and rational, Markowitz (1952) introduced a mathematical model that allows investors to maximize the expected return of a portfolio of assets at a given level of risk or to minimize the risk of a portfolio at a given level of return. The return of a portfolio comprising N assets i is the weighted sum of the individual assets' returns R_i. This can be written as:

$$R_p = \sum_{i=1}^{N} w_i R_i \tag{1}$$

where:

w_i = weight of asset i in the portfolio

A portfolio's risk is measured by the portfolio's variance:

$$\sigma_p^2 = \sum_{i=1}^{N} \sum_{j=1}^{N} w_i w_j \sigma_{ij} \tag{2}$$

By implying the covariance σ_{ij} of the assets i and j in measuring portfolio risk, Markowitz showed that portfolio risk is not reduced by simply increasing the number of assets. Rather, investors need to add assets with low covariance. Thereby, the variance of one asset offsets parts of the variance of the other asset. As a result, the portfolio's variance is less than the weighted average variance of the underlying assets and portfolio risk is reduced. The covariance can be written as:

$$\sigma_{ij} = \sigma_i \sigma_j \rho_{ij} \tag{3}$$

where:

σ = standard deviation of an asset

ρ_{ij} = correlation between assets i and j

However, no matter the level of diversification, according to Markowitz, *"diversification cannot eliminate all variance"* (p. 79). Due to broad market dynamics and the resulting correlation among assets, there will always be remaining risk. Nevertheless, using return, volatility, and correlation estimates as input parameters, Markowitz introduced an optimization model that allows investors to create portfolios that minimize portfolio variance or maximize portfolio return. Further, by drawing a mean–variance efficient frontier between these tail-portfolios, investors can choose from portfolios lying on every point of this frontier, which maximize return for a given level of risk or minimize risk for a given level of return.

While Markowitz solely included risky assets in his theory, Tobin (1958) integrated a risk-free component in the construction of efficient portfolios. Assuming that investors can borrow and lend at the same rate, meaning they can buy risky assets on margin or invest in a risk-free asset, Tobin separated portfolio construction into two steps. First, using the concepts of Portfolio Theory, investors should identify the optimal, or most efficient, portfolio of risky assets. Then, the decision needs to be made whether and how much to lend or borrow at the risk-free rate R_f. This depends on the risk aversion of the investor. Tobin's two-step method to portfolio construction is known as the Separation Theorem. The following figure illustrates how every investor ends up combining the risk-free asset with the same portfolio of risky assets of the efficient frontier, the tangency portfolio.

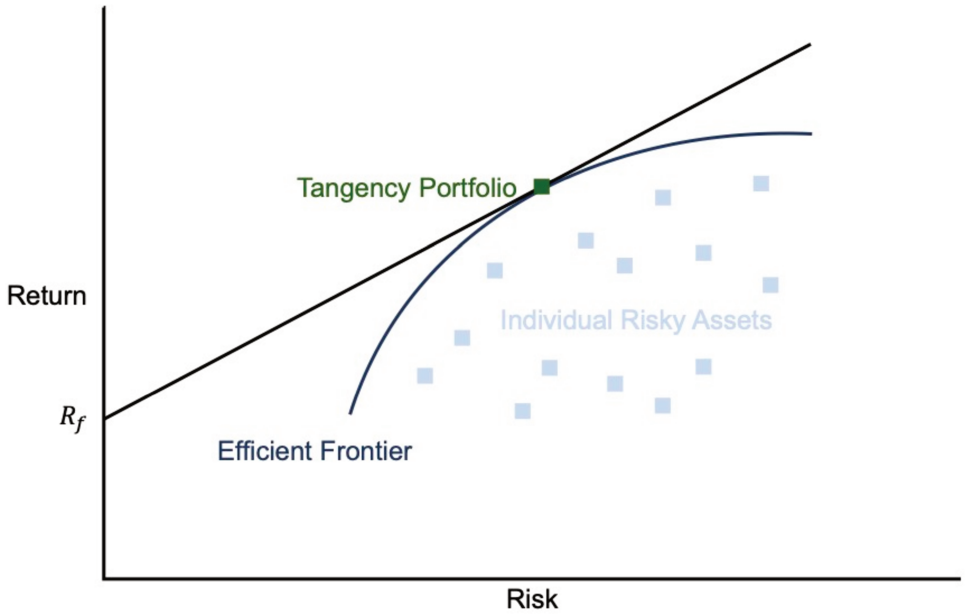


Figure 1 Combination of the Risk-Free Asset With the Tangency Portfolio (own figure based on Perold, 2004)

When drawing lines from the return of the risk-free asset to any portfolio lying on the efficient frontier, the line tangent to the efficient frontier is the one with maximum slope. Thus, the tangency portfolio is the best portfolio to be combined with the risk-free asset. No other portfolio offers more return per unit of risk. Under the inclusion of risk-free lending and borrowing, the efficient frontier turns into a straight line, which is called Capital Market Line, and the slope of that line is known as Sharpe Ratio. In his study on the performance of mutual funds, Sharpe (1966) introduced a measure to make funds' performance comparable. When comparing investment portfolios, a higher Sharpe Ratio indicates a higher return relative to the level of risk. This return–risk ratio can be written as follows:

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p} \tag{4}$$

where:

σ_p = standard deviation of portfolio's excess returns

Depending on their risk tolerance, investors move along the Capital Market Line, separating their funds between the tangency portfolio and the risk-free rate. The tangency point represents a 100 % allocation to the portfolio of risky assets and every point above represents portfolio combinations including leverage.

2.1.2 Capital Asset Pricing Model and Jensen's Alpha

Building upon the concepts of Markowitz and Tobin, Sharpe (1964) and Lintner (1965) introduced the Capital Asset Pricing Model (CAPM). The CAPM also assumes that investors can borrow and lend at a risk-free rate. Further assumptions are that investors have access to the whole universe of risky assets, use the concepts of Portfolio Theory, and have the same expectations regarding return, volatility, and correlations. Based on these assumptions and the insights from Tobin's Separation Theorem, all investors choose the tangency portfolio for the risky part of their portfolio, which therefore has to be the value-weighted market portfolio (Fama & French, 2004). If an asset would not be included in the tangency portfolio, demand for it drops, the price falls, and the expected return rises, which in turn causes the tangency portfolio to move to a new point where the asset is included. The same principle holds the other way around. Finally, asset prices are cleared, resulting in equilibrium and an efficient market portfolio containing all available assets in proportion to their market capitalization (Sharpe, 1964).

As mentioned earlier, according to Markowitz (1952) there remains a portion of risk that cannot be eliminated by diversification. Sharpe (1964) coined the kind of risk that can be diversified, unsystematic, and the remainder, which results from changes in overall economic activity, systematic risk. With the market portfolio being completely diversified, it exposes investors only to systematic risk. Thus, when assessing the return of an asset as a function of its risk, only its responsiveness to changes in the overall market is relevant. In the case the asset is unaffected by systemic changes, it returns the risk-free rate. The CAPM introduced a formula to compute the return of an asset taking into account the sensitivity of its return to that of the market. The sensitivity, called beta, is the slope of the regression of the asset's against the market's returns and is written as:

$$\beta_i = \frac{\sigma_{im}}{\sigma_m^2} \tag{5}$$

where:

σ_{im} = covariance of asset i with that of the market m

In order to arrive at the final CAPM formula for computing the return of an

individual asset, the market risk premium, which is the return of the market portfolio in excess of the risk-free rate, is adjusted by the beta factor of the asset:

$$R_i = R_f + \beta_i(R_m - R_f) \quad (6)$$

where:

R_m = return of the market portfolio

In the case $\beta_i = 1$, the asset is perfectly correlated with the market portfolio, and therefore results the same return. If $\beta_i > 1$, the asset's return has to be greater than that of the market portfolio as compensation for additional risk. For $\beta_i < 1$ the asset returns less than the market because it has less systematic risk exposure.

Following Sharpe's study on the performance of mutual funds, Jensen (1967) published a paper in the Journal of Finance evaluating the performance of more than 100 mutual funds within a 20-year period. Drawing on the assumptions and theory of the CAPM, Jensen presented a risk-adjusted performance measure that yields insights about the predictive ability of fund managers and its impact on the funds' performance. Jensen claims that there might be managers successfully predicting security returns, for example, through insider information. If so, those funds should earn higher returns than expected by the CAPM. In order to account for the prediction ability, Jensen added a new term α to the CAPM equation. Solving for α results a portfolio's excess return adjusted for systematic risk:

$$\alpha_p = R_p - [R_f + \beta_p(R_m - R_f)] \quad (7)$$

For $\alpha > 0$, the fund manager is assumed to have superior prediction abilities. In contrast, portfolios with negative α yield inferior risk-adjusted returns. On average and net of expenses, Jensen found an α of almost 0, though slightly negative. This is in line with the theory of efficient markets, which will be outlined next.

2.1.3 Efficient Market Hypothesis

In his book *A Random Walk Down Wall Street,* Malkiel (1999) suggested that a blindfold monkey could select securities as good as experts just by throwing darts

at pages of the Wall Street Journal. The idea is based on his assumption that stock prices follow a random walk model. According to Malkiel (2003), a random walk can be understood as *"(…) a price series where all subsequent price changes represent random departures from previous prices"* (p. 59). Asset prices following a random walk should be the consequence of Famas' (1970) Efficient Market Hypothesis (EMH) where efficient markets *"always 'fully reflect' available information (…)"* (p. 383). With market participants having access to all available information, this would imply that stock prices are unpredictable and hence there should be no opportunity to generate above-market returns without bearing greater risk. Taking into account different sources of available information, Fama introduced three ways to test for market efficiency.

Weak form tests for market efficiency are conducted using historical series of prices and returns as the source of information. In the case of weak form efficiency, prices cannot be predicted by technical analysis based on historical data, because this information is already reflected in the prices. Thus, prices follow a random walk. According to Fama, performed studies on weak form efficiency strongly support the EMH and the random walk theory. Next up, tests for *semi-strong* efficiency take into account newly released public information, such as earnings announcements or news about share buybacks. Again, Fama refers to studies conducted by himself and other scholars that find evidence for the EMH. Finally, studies on the *strong form* of capital market efficiency test for the reflection of insider information in asset prices. In this case, corporate insiders and experts working at security exchanges were found to have monopolistic access to information which they are able to capitalize on.

2.1.4 Multi-Factor Models

Although the majority of studies find that the average investor is not able to gain positive alpha, repeatedly, there are outliers that gain abnormal risk-adjusted returns (Carhart, 1997). However, starting with Ross' (1976) Arbitrage Pricing Theory (APT), there emerged a strain of research that explains superior returns by exposure to various systematic risk factors that are not captured by the CAPM beta. Unlike the CAPM, the APT does not assume that all investors act in the same manner and hold the value-weighted market portfolio. Instead, the APT is

based on the theory of arbitrage. In the case an asset has a lower expected return than another asset with the same systematic risk, some investors will become aware of the disequilibrium, sell those assets, for example, through shorting, and allocate the proceeds to the asset with a higher expected return. When all arbitrage opportunities have been exploited, asset returns follow a linear multi-factor model. While the CAPM explains the cross-section of asset returns by the exposure to a single systematic risk factor, the APT accounts for multiple factors in its linear model, which can be written as follows:

$$R_i = R_f + \beta_{i1}\lambda_1 + \cdots + \beta_{in}\lambda_n + \varepsilon_i \quad (8)$$

where:

β_{in} = beta of asset i to the nth factor

λ_n = systematic risk factor premium

ε_i = error term (unsystematic risk of asset i)

In order to derive risk premia on specific factors, one builds factor portfolios that have a $\beta = 1$ on the specific factor and $\beta = 0$, meaning no sensitivity, to the remaining factors. Running a multiple regression of the assets' returns on the factors gives the factor-specific β coefficients. As the APT assumes investors to hold diversified portfolios, the unsystematic risk component of an asset, represented by ε, can be neglected in a portfolio setting, as it will approach mean and variance zero when the number of assets increases (Bodie et al., 2012).

The APT does not state specific factors to be used, though, in a study later published by Ross together with Chen and Roll (1986), a factor model was introduced that takes into account innovations in macroeconomic factors, such as surprises in inflation or interest rates. However, today the most common factors used in modelling asset prices are fundamentals that describe specific stock characteristics (Bender et al., 2013). Adding two systematic factors to the CAPM, namely size and book-to-market, Fama and French (1993) established their renowned three-factor model. Empirical evidence showed that small-sized firms tend to generate lower earnings, especially after economic downturns. Moreover, firms with a low stock price relative to book value generate lower earnings compared to

firms with a relatively high stock price. Based on these findings, Fama and French suggest that higher returns of small firms and firms with high book-to-market ratios, can be explained by premia compensating for those risk factors not captured by the CAPM. The *small minus big (SMB)* premium is derived by sorting firms based on market cap and then subtracting the returns from the value-weighted portfolio of firms above the median size from the returns of the portfolio consisting of firms below the median size. Similarly, the *high minus low (HML)* premium is calculated after sorting by book-to-market ratios and then subtracting returns of the bottom third from returns of the top third portfolio. Expanding the CAPM by the SMB and HML factors results in the three-factor model (Bodie et al., 2012):

$$R_{it} - R_{ft} = \alpha_i + \beta_{im}(R_{mt} - R_{ft}) + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t + \varepsilon_{it} \quad (9)$$

Jegadeesh and Titman (1993) found evidence that buying past winners and selling past losers is a superior trading strategy. Looking at a 3- to 12-month period, stocks that performed well in the past continue to do so in the following period. Conversely, stocks that performed poorly tend to keep up the negative trend. Analyzing mutual fund performance, Carhart (1997) expanded the three-factor model by adding a *Momentum (MOM)* factor and was able to explain most alpha unexplained by the CAPM. In the premium calculation, firms are sorted by their past 11-month returns before finding the difference between the top 30 % and bottom 30 % portfolios. Equation 10 presents the Carhart four-factor model:

$$\begin{aligned} R_{it} - R_{ft} = \alpha_i + \beta_{im}(R_{mt} - R_{ft}) + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t \\ + \beta_{iMOM}MOM_t + \varepsilon_{it} \end{aligned} \quad (10)$$

More than two decades after publishing the three-factor model, Fama and French (2015) introduced two additional factors. The *robust minus weak (RMW)* factor is the difference in returns between firms with robust and firms with weak profitability, where profitability is operating profitability minus interest expenses. Representing investments, the *conservative minus aggressive (CMA)* factor, subtracts the returns of firms with high expected growth of book equity from firms with low expected growth. Famas' and French's five-factor model is stated as:

$$R_{it} - R_{ft} = \alpha_i + \beta_{im}(R_{mt} - R_{ft}) + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t + \beta_{iRMW}RMW_t + \beta_{iCMA}CMA_t + \varepsilon_{it} \quad (11)$$

With more than 40 years of research into factor risk premia and extensive evidence of risk factors explaining the cross-section of stock returns, factors found their way into the investing world. By tilting their portfolios towards or away from factors investors attempt to control the down- or improve the upside of their investments. A popular way to capture factor premia is by investing in alternatively-weighted indices that replicate factor performance (Bender et al., 2013). This approach to factor investing will be discussed in detail in chapter 3.1.

2.2 Sustainable Development and Sustainable Investing

2.2.1 Sustainable Development Goals

Sustainable Development is commonly defined as *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (United Nations, 1987). In each of its dimensions – economic, social, and environmental - humanity faces major challenges to sustainable development (United Nations, 2020). Individuals, governments, and businesses demand more natural resources than planet Earth can renew. At the current stage, humanity uses resources as if it lived on 1.6 Earths. This ecological overshooting leads to loss of biodiversity, limited freshwater, deforestation and ultimately, results in climate change (Global Footprint Network, 2020). Ecological threats spill over to and worsen pre-existing inequalities. Natural disasters and adverse weather resulting from climate change drive people deeper into poverty and insecurity (Amnesty International Ltd, 2018). Around 10 % of the world's population lives on less than $1.90 a day. In addition, there are ongoing conflicts in different parts of the world and according to Amnesty International (2018), there is no place on earth where human rights can be taken for granted.

Global challenges need global cooperation and action. For the first time in 1992, at the Earth Summit conference organized by the United Nations, an international partnership aiming at global sustainable development was established. Within *Agenda 21*, states agreed to support an international economic environment that

promotes market access, open trade, and the channeling of financial flows towards developing countries (United Nations, 1992). In 2000, after eight years into Agenda 21, world leaders gathered at the Millennium Summit to discuss the fight against poverty and other global issues. As a result, all member states agreed on putting into place the Millennium Development Goals (United Nations, 2015a). After 15 years and significant achievements in social, environmental, and economic issues, the eight Millennium Development Goals were replaced by the 17 SDGs in 2015. Under the *2030 Agenda*, all 193 member states committed to achieving more sustainability in all three dimensions by 2030. In contrast to prior development programs, the SDGs have a universal scope focusing not only on developing but all countries regardless of the level of development. Moreover, besides promoting sustainable development within the whole civil society, the SDGs also explicitly include business action and hence the private sector (United Nations, 2015a). The following graphic presents an overview of the SDGs.

Figure 2 United Nations Sustainable Development Goals (Project Everyone & Global Goals Campaign, n.d.)

Each of the 17 SDGs is assigned with up to 10 individual targets, which are measured by several indicators. For example, a target of SDG 1 is ending extreme poverty by 2030 for all people. The corresponding indicator is the proportion of the population that lives below the international poverty line (United Nations IAEG, 2016). As a result of the COVID-19 pandemic, which was declared in March 2020 and continues through 2021, the United Nations (2020) expects that much of the recent progress in sustainable development will be offset and the consequences of the pandemic will last into the next decades. Despite the

drawbacks of the pandemic, the United Nations urges to stick to the SDGs and take the opportunity to *"build back better in the post-COVID-19 recovery" (p.3)*. The financial industry plays an important role in allocating capital towards sustainable recovery and development in general. The next section presents an overview addressing sustainability issues in investing.

2.2.2 Sustainable Investing

With socially responsible investing, sustainable investing, ESG investing and other terms, which are often used interchangeable, there exist a range of terminologies describing the practice of integrating sustainability matters in investing. This thesis follows the internationally renowned Global Sustainable Investment Alliance (2018) in using the inclusive term sustainable investing, which is defined as "*investment approach that considers environmental, social and governance factors in portfolio selection and management"* (p. 7). ESG factors offer a framework to evaluate corporate commitment to sustainability and can be used to measure firms' performance on the SDGs. Moreover, rating agencies and other specialized firms provide ESG metrics, ratings, and indices, which are used by investors in the investment process (Huber et al., 2018). The following table outlines definitions for each ESG dimension and concrete examples of ESG issues.

Dimension	Definition	Examples
Environmental	Quality and functioning of the natural environment	- Climate change - Usage of natural resources - Pollution and waste - Energy efficiency
Social	Rights, well-being, and interests of people and communities	- Human rights - Workplace safety - Diversity and inclusion - Product liability
Governance	Governance of companies and other investee entities	- Board diversity - Executive pay - Business ethics - Risk management

Table 1 Definition of ESG Dimensions and Examples of ESG Issues (based on PRI, 2018b)

Depending on the level of impact investors aim to have with their investment, they choose from different approaches to sustainable investing. The Global Sustainable Investment Alliance (2018) established a global standard for the classification of the different ways to incorporate sustainability issues in investing. Starting with **ESG-screened investing**, where investors narrow the investment universe based on specific criteria. In negative/exclusionary screening, investors avoid investing in unsustainable and controversial sectors, companies, or practices. Conversely, within the positive/best-in-class approach, investors proactively increase exposure towards relatively strong ESG performance. Another screening method, called norm-based screening, limits the investment universe to business activities that are aligned with or perform well against international sustainability benchmarks (e.g., the UN Global Compact Principles). Next up, within **sustainability themed investing**, investors allocate their funds exclusively to sectors or business activities that are involved in specific ESG issues and benefit from trends in this area, such as renewable energy, education, or emerging market healthcare. The most active approach, known as **impact investing**, focuses on generating direct and measurable benefits in social or environmental issues. Investors following this approach direct their capital towards entities that provide solutions to pressing global sustainability challenges. Finally, **ESG-integrated investing** considers ESG factors alongside financial metrics in the investment-decision process to improve risk-adjusted performance. In contrast to the before mentioned approaches, ESG integration assesses companies regardless of the sector or focus on sustainability. Moreover, investors only take into account ESG factors that might affect a company's financial performance (PRI, 2018a).

In recent years, the growth of sustainable investing rapidly accelerated. From 2015 to 2020, the number of investors, asset owners, and service providers signed to the United Nations-supported Principles of Responsible Investment more than doubled, accounting for around 3,000 signatories as of March 2020. Together they manage more than $100 trillion in assets. Joining the mission to make the financial system more sustainable, signatories of the principles commit to integrating ESG into the investment process (PRI, 2020). As presented in the next figure, Deutsche Bank (2018) expects that by 2035 more than 99 % of the world's assets under management (AUM) will be managed by an ESG mandate.

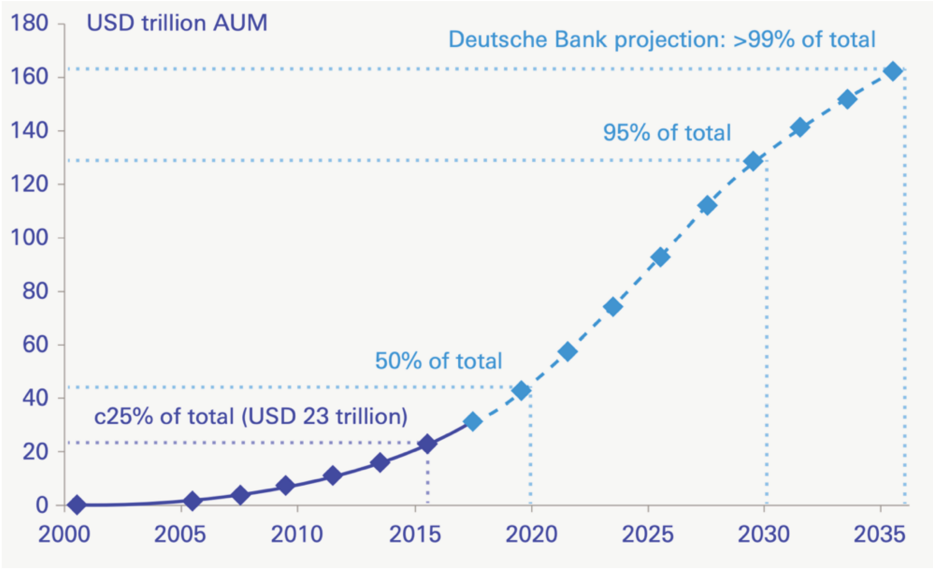


Figure 3 Projections of Global AUM With an ESG Mandate (Deutsche Bank, 2018)

One force behind the rise of sustainability-driven investing are regulatory changes, such as the European Commission's Sustainable Finance Disclosure Regulation, which requires financial services firms (e.g., fund managers) to disclose investment-related information on sustainability issues (European Parliament, 2019; Novick et al., 2020). Another driver is the growing evidence that investors can improve risk-adjusted returns by incorporating ESG factors into the investment process (Friede et al., 2015). Chapter 3.4 provides a detailed overview of the current state of research on the relationship between sustainable business practice and financial performance. Moreover, there is increasing awareness on sustainability issues around the world with investors wanting to have an impact through their investment. For example, the COVID-19 pandemic has raised awareness on sustainability, especially with respect to social issues. According to an institutional investor survey conducted by MSCI (2021c), 90 % of investors with more than $200 billion in AUM plan to increase their ESG investments as a response to the COVID-19 pandemic. Today, it is no longer questioned whether sustainable investing will become mainstream. Rather, it is a question of how fast it will become the new standard of investing. Besides looking into the research of alternative index-weighting, the next chapters review literature on the role of business in countries' sustainable development as well as the relationship between firms' ESG ratings and financial performance.

3 Literature Review

After laying out quantitative methods on portfolio construction and performance measurement as well as giving an introduction to sustainable development and investing, the following section reviews literature related to the objective of this thesis. Incorporating CLS in global equity portfolios results in weights deviating from the market portfolio. Thus, relevant research on alternative portfolio weighting schemes is discussed. Followed by two chapters laying out the macro–micro sustainability relationship. Herein one chapter examines the impact of national institutional factors on the sustainability performance of domestic firms and the other screens research on how corporate sustainability scales up to the macro level. Next up, an extensive body of research on the effects of sustainable business practice on financial performance is reviewed. Finally, insights from the literature review are used to develop the research hypotheses.

3.1 Smart Beta: Alternative Equity Weighting Schemes

Based on the insights from Portfolio Theory as well as Tobin's Separation Theorem, the CAPM argues that the market portfolio is mean-variance efficient, and therefore should be the only portfolio of risky assets held by investors. Index or exchange-traded funds replicating large cap-weighted indices, such as the ACWI which covers around 85% of the world's investable equity capitalization, provide investors with a cost efficient and comfortable way of capturing the market beta (MSCI, 2021b). With prevailing evidence that active management, on average, does not generate positive alpha and the rise of exchange-traded funds in recent years, those passive investment strategies gained momentum (Berk & van Binsbergen, 2015; Fama & French, 2010). For example, in the U.S., AUM in passive equity funds grew by more than 400 % from 2010 to 2019, when passive funds eventually outgrew active equity funds in AUM (Lauricella & DiBenedetto, 2019).

However, the CAPM grounds on very strict assumptions that may not hold in reality. Questioning the mean–variance efficiency of market cap-weighted indices, a strain of finance literature emerged that compares the efficiency of alternatively-weighted indices against cap-weighted market benchmarks. Starting with Haugen and Baker (1991), who contrasted the performance of a minimum

volatility portfolio with a market benchmark index. The volatility minimizing portfolio was constructed from a universe of the 1,000 largest U.S. stocks and its performance was tested out-of-sample against the cap-weighted Wilshire 5000 index, which represents the whole investable U.S. equity opportunity set. During the period 1972–1989, the optimized portfolio consistently experienced lower volatility by generating equal or greater returns. Another study, also using a sample of the 1,000 largest U.S. stocks, analyzed the performance of various alternative weighting schemes, such as equal weighting or industry clustering. From 1968 to 2011 all alternatives generated risk-adjusted outperformance against the market cap-weighted portfolio, which was calculated from the same sample. Further, the study computed 10 million randomly constructed indices as if the weights had been assigned by Malkiel's (1999) monkeys and showed that random simulations outperformed the market 60 % of the time (Clare et al., 2013). Drawing from a universe of more than 40,000 stocks from 23 developed market countries, Platen and Rendek (2017) compared the performance of an equally-weighted portfolio against a cap-weighted global equity portfolio. With the equally-weighted portfolio outperforming the market benchmark most of the time and overall generating a 68 % higher Sharpe Ratio, the authors provide further evidence that holding market capitalization-weighted portfolios comes at opportunity cost.

As a result of these findings as well as the evidence from factor research in explaining the cross-section of stock returns, alternative weighting schemes found their way into investment practice (Bender et al., 2013). Combining the benefits of cost-efficient, rules-based passive investing with the opportunity of capturing active returns through systematic shifts away from the market beta, alternative index weighting is commonly referred to as smart beta. The following figure illustrates where smart beta strategies are situated in the universe of investing.

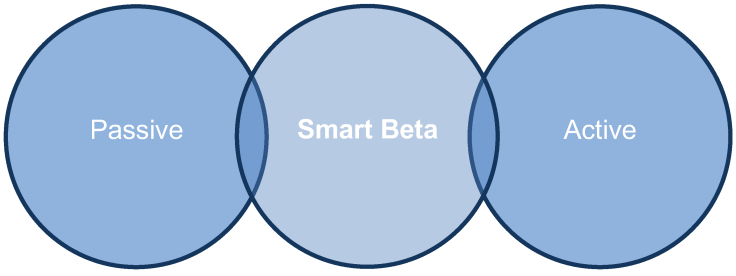


Figure 4 Place of Smart Beta Strategies in Investment Practice (own figure based on Bender et al., 2013)

Besides equal weighting and risk-focused strategies, such as minimum volatility, another approach to smart beta takes into account macroeconomic factors. With respect to market cap weighting, high concentration in single stocks, industries, or regions often raises concern. For example, in 1988, Japanese stocks made up more than 40 % of the ACWI while measured by its relative economic size, Japan would have accounted for less than 20 % (MSCI Barra, 2010). As of 2021, North American companies account for more than two thirds of the ACWI while emerging markets countries make up only around 12 %. Yet, companies from emerging market countries account for 42 % of revenues while North American companies generate less than 30 % (Ladure, 2021). Addressing this issue, a body of literature emerged that proposes a macro-based alternative weighting scheme. By re-weighting the constituents of traditional global market cap-weighted indices, such as the ACWI, several studies found evidence that weighting schemes based on economic size, measured by GDP, outperform market cap weighting without bearing significantly more risk. Moreover, GDP-weighted portfolios lower the concentration in single regions and can thus reduce the exposure to asset bubbles (H. R. Campbell, 2012; Deutsche Asset & Wealth Management, 2014; Hamza et al., 2007; MSCI Barra, 2010).

Another concern regarding cap-weighted portfolios is their tilt towards large cap and growth stocks. Both factors are exactly opposite to the risk premia producing factors suggested by the three-factor model. As mentioned earlier, Fama and French (1993, 1998) identified small cap stocks to produce higher returns than large cap stocks (size factor) and companies with low book to market ratios to perform better than growth companies with relatively high ratios (value factor). The findings from factor research motivated a micro approach to smart beta. Drawing from the whole U.S. equity universe, Arnott et al. (2005) constructed indices based on fundamentals, such as revenues or equity book value, and compared the performance against cap-weighted benchmarks. For the period 1962–2004, all fundamental indices generated active returns compared to the market and at least 40 % higher Sharpe Ratios. Another study comparing the performance of a global equity portfolio tilted towards the value factor with its cap-weighted counterpart verifies the superiority of smart beta by reporting an alpha of 1.5 % with only a slight increase in volatility of 0.2 % (Bender et al., 2013).

In recent years, index providers increasingly launched ESG-incorporated benchmarks, such as the MSCI ACWI ESG Universal Index. Passive investment funds replicating those indices are seeing massive capital inflows. For example, during 2020, global AUM grew by more than 80 % compared to 45 % growth in sustainable actively managed funds (Mooney & Mathurin, 2021). In a broader sense, such strategies can also be classified as smart beta, as they tilt portfolios away from cap weights. Recent research even suggests ESG to be an individual factor that yields return isolated from other factors (Cano & Minovitsky, 2021). This literature review on alternative portfolio weighting provides important insights for the design of global equity portfolios and will be returned to in the methodology section. The next chapter highlights the role of business in countries' sustainable development.

3.2 Institutional Drivers of Corporate Social Responsibility

For the achievement of global sustainable development, governments play an important role by translating transnational agendas into national public policy. Besides addressing sustainable development in civil society as a whole, governments' intervention is crucial in promoting sustainability in the private sector (Steurer, 2010). Campbell (2006) argues that firms from countries where governments prompt sustainable behavior through strong regulation are more likely to implement corporate social responsibility (CSR) in their business practices. According to the European Commission's (2011) common definition, socially responsible acting companies *"integrate social, environmental, ethical, human rights and consumer concerns into their business operations and core strategy (…)"* (p. 6). Governments use different voluntary and, where necessary, mandatory policy instruments to support the development of CSR. Informational tools are used to increase awareness for CSR and provide educational resources. Using economic measures, authorities incentivize CSR development, for example, through tax exemptions or subsidies. Legal tools are applied for mandating purposes such as stock exchange or pension fund regulation. Finally, governments partner with corporates via public-private partnerships and collaboratively fight against problems such as poverty or lack of healthcare. Apart from these tools, being role models, for example, by incorporating ESG factors in the investment

decision-making process of government funds or by publishing figures on the sustainability performance of public entities, governments can further support CSR (Peters & Röß, 2010; Steurer, 2010).

Transparency about the sustainability of business practices is crucial for sustainable investors to make informed investment decisions as well as for measuring sustainable development. Thus, governments play an important role in enhancing transparency by putting into place non-financial disclosure regulation that requires firms to report on their ESG performance (Peters & Röß, 2010). MSCI (2016) studied the impact of government imposed non-financial disclosure and responsible investment regulation on companies' sustainability performance within the ACWI universe. The study reveals that companies from both developed as well as emerging market countries score higher ESG ratings if there is institutional regulation in place compared to firms from countries where there exist no regulation. With an average increase of 43 % in developed markets the effect is stronger than in emerging markets with an average increase of 32 %.

Highlighting the need for government regulation to protect the environment, Porter and van der Linde (1995) claim that, at the same time, regulation increases national competitiveness. They emphasize that regulation is crucial for creating pressure to innovate and establishing a safe environment for companies to take on risks. Consequently, regulatory standards introduced by the government promote innovation and the resulting increase in productivity leads to firms becoming more competitive. As an example, the authors mention German car makers which gained competitive advantages through being among the first movers in improving their cars' efficiency after corresponding regulation was introduced. Another way governments enhance private sector impact on sustainable development is through policy making that promotes the formation of clusters, which describe geographically interconnected groups of companies, suppliers, service providers, and institutions, such as academia (Porter, 2003). For example, by launching a center of expertise that aims at enhancing cluster innovation and growth, the Norwegian government played a significant role in increasing employment, revenues, and innovation across Norwegian clusters (Røtnes et al., 2017). Another example from Norway is the Innovation Clusters project, where the government supports

private sector fueled sustainable development by leveraging cluster formation in areas such as clean energy or biotechnology (Innovasjonnorge, n.d.).

Besides public regulation, several other institutional channels drive the adoption of CSR (J. L. Campbell, 2007). An environment that promotes innovation (e.g., clusters) as well as appropriate technological infrastructure are key elements in enabling firms to improve CSR, especially in the environmental dimension. That was found by Alonso-Martínez et al. (2020), who studied country-level drivers of CSR among 370 European firms. Also, market pressure was identified to be an important factor in explaining national CSR. The authors argue that this effect results from consumers and society as a whole urging the private sector to improve on CSR issues. Having analyzed the influence of several country factors, such as microeconomic conditions and market competition, in a study covering 86 developed and developing countries, Halkos and Skouloudis (2016b) provide further evidence supporting the effect of societal pressure on businesses, as they found civil liberty and activism to be the most important factors in explaining country-level CSR. Drawing on a sample of more than 2,600 companies from 36 developed and emerging market countries within the period 2006–2011, another study provides additional support for a positive effect of societal pressure resulting from civil liberties and political rights. Moreover, the study reported cultural dimensions to have a significant effect on national sustainable business practice. In harmonious countries, where people have close relationships to their natural and social environment, adoption of CSR is greater than in countries with less harmony. The same holds for countries with a high degree of autonomy (Cai et al., 2016). Within an additional study on the impact of institutional drivers on national CSR, Halkos and Skouloudis (2016a) also looked at the impact of culture on CSR across the same sample of 86 developed and developing countries. Besides stating several cultural factors, such as long-term vs. short-term orientation, to impact national CSR, the authors also reviewed findings of related studies and concluded that there exists consensus regarding cultural dimensions affecting CSR, however, the factors and their importance differ across countries.

Drawing the essence from this review of literature, it can be concluded that institutional channels can enhance national CSR. Notably, institutional variations

across countries lead to differences in sustainable development and national competitiveness. Going one level further, the next section examines the role of business in countries' sustainable development.

3.3 Role of Business in Countries' Sustainable Development

"As the backbone of our economy, private sector investment and activity lies at the core of efforts to transform our world into sustainable and resilient societies" (International Chamber of Commerce, 2018, p. 29). Whether on the social, economic, or environmental dimension, business and the widespread adoption of CSR are major driving forces of national as well as global sustainable development. As all of the SDGs are interconnected so are the impacts of businesses on sustainable development (International Chamber of Commerce, 2018). For example, an emission-free economy, in the first place, improves the environmental dimension, though, the effects spill over to the social and economic dimensions as well. Stopping climate change results in less frequent and severe extreme weather events, which in turn reduces economic (climate) value at risk and poverty (Dietz et al., 2016). With most CSR research taking a firm-level perspective, there exists limited literature on how CSR scales up to the macro-level. However, the state-of-the-art is presented in the following.

Through emissions, waste, and use of natural resources the private sector has a direct impact on the local, national, as well as global environment. A cross-country study conducted by the World Health Organization (2015) found that health impacts from pollution impose significant economic costs. For example, in countries like Bulgaria or Ukraine, the economic effects amount to more than 20 % of GDP. In contrast, the economic costs of pollution in Nordic European countries, such as Norway or Sweden, account for less than 1 % of GDP. The findings suggest that there exist huge differences in the impact of business on the environment across countries. Besides the direct effects of business on the environment, firms also indirectly affect the planet's health through their essential role in enabling society to improve on its ecological footprint. Private sector investments and innovations allow people to consume environmentally friendly products, access clean and affordable energy, and use eco-friendly mobility as well as green

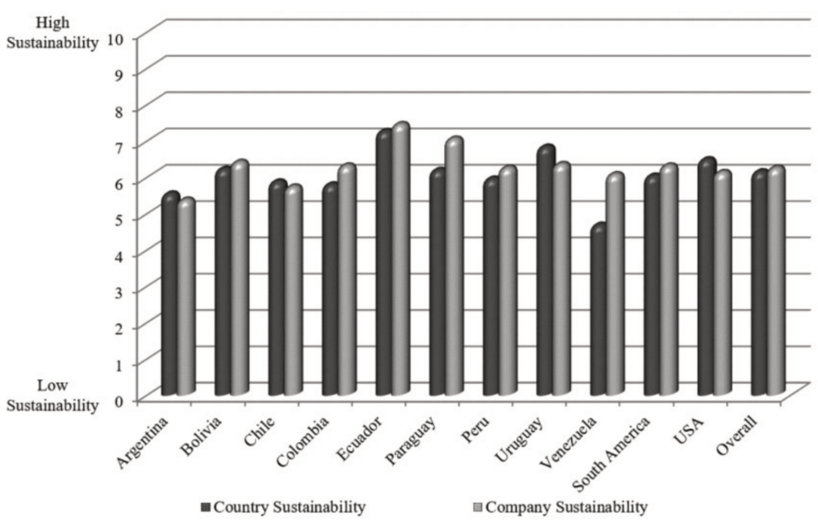
infrastructure solutions. Moreover, businesses can play a major role in raising the awareness of consumers (de Larderel, 2009; Shinwelli & Shamiri, 2018).

Whether looking at developed or developing countries, on average, around 80 % and 90 % of their respective population is employed by private sector companies (International Labour Organization, n.d.; OECD, 2015). Therefore, business plays a central role in driving forward the social dimension of countries' sustainable development. One major social pillar of CSR is diversity and inclusion in the workforce. A study measuring the effect of the inclusion of underrepresented groups in the workforce on economic output between 1960 and 2010 in the U. S. finds that the inclusion of women and black men explains 20 % of economic growth in the respective period (Hsieh et al., 2019). Examining the influence of the gender pay gap between men and women around the world, a World Bank study estimates a loss of $160 tn globally resulting from gender inequality in earnings (Wodon & de la Brière, 2018). Drawing further on the social dimension of the role of business in sustainable development, firms are responsible for creating safe working environments and protect the health of their consumers. A study on the economic impact of work-related injuries and sicknesses estimates the cost resulting from such adverse health impacts to account for around 4 % of global GDP. Notably, the effect is stronger in low- and middle-income compared to high-income countries (Elsler et al., 2017). Another area of the social dimension in which business makes a difference is in education. Besides educating employees, companies support education by building important relationships with academia through scholarships or opportunities for applied research. Seitz (2015) studied the impact of national CSR on the level of tertiary education across 148 countries and found a positive relationship over the whole sample. In countries such as Finland and Norway, the effect is especially strong compared to, for example, Cambodia or Morocco. The private sector also supports the social dimension with investments in communities, products that promote social interaction and partnership for the SDGs, or simply by providing social platforms that promote collaboration and relationships (Shinwelli & Shamiri, 2018).

Through the social and environmental dimensions, CSR can translate into major economic benefits on macro level. However, there are also direct economic

effects of CSR, which increase income and wealth and at the same time reduce inequalities. Starting with a cross-country study measuring the impact of national CSR on GDP per capita in 19 developed countries from 2001 to 2006, it was found that overall, there exists a strong positive correlation between the level of sustainability in national business and economic output (Boulouta & Pitelis, 2014). Seitz (2015) tested the same but drawing on a larger sample covering 148 countries. The study also showed a strong positive correlation, driving the author to the conclusion that higher levels of national CSR improve national competitiveness, which is in line with the suggestions from Porter and van der Linde (1995). Further evidence for a positive relationship between national CSR and countries' competitiveness is provided by Zadek (2006), who incorporated national CSR along with macroeconomic factors in a multi-factor model in order to derive scores for sustainable economic growth on a country level. One more time, the Nordic European countries made it to the top of the ranking while countries like the Philippines or Ukraine were found at the bottom. Across the whole sample, covering 51 countries, the author found a positive correlation between national CSR and countries' competitiveness. Finally, a recent study took into account aggregated firm-level ESG data and measured the impact on GDP per capita for the period 2002–2017 in 30 developed and emerging market countries (Zhou et al., 2020). Isolating the E, S, and G pillars, the study shed light on the explicit drivers of the impact of CSR on economic growth. Across the whole sample, improvements in ESG scores resulted in economic growth. Notably, in developed market countries, only the social factor was a driver of economic growth while in emerging market countries, all ESG dimensions were relevant and significant.

The outlined research studied the impact of business on sustainable development isolated in the environmental, social, and economic dimensions. Moreover, most studies measure the effects of CSR on the macro-level solely in economic terms. Allowing for broader conclusions supporting a positive relationship between macro- and micro-level sustainability, Hult et al. (2018) compared country- and firm-level sustainability for the U.S. and 9 countries from South America. Underlying data is survey-based and comprises more than 4,000 companies from all economic sectors. The following figure presents the study's results.



	Country Sustainability	Company Sustainability
Argentina	5.54	5.37
Bolivia	6.22	6.41
Chile	5.87	5.73
Colombia	5.79	6.31
Ecuador	7.26	7.45
Paraguay	6.19	7.05
Peru	5.95	6.25
Uruguay	6.83	6.35
Venezuela	4.68	6.07
South America	6.03	6.31
USA	6.48	6.13
Overall	6.15	6.25

Figure 5 Comparison of Country and Company Sustainability (Hult et al., 2018)

With an overall average delta smaller than 2 %, the results suggest that macro-level sustainability was a very useful proxy for company sustainability and vice versa. Except for Venezuela, where companies outperform the country by almost 30 %. Another study analyzed the macro–micro sustainability relationship in China. Measuring the linear relationship between aggregated CSR and a customized sustainable development index, combining two indices measuring environmental performance and human development, the authors provide further evidence for a positive relation by finding a statistically significant strong positive correlation between macro- and micro-level sustainability (Zhang et al., 2019).

While the role of business in national and global sustainable development is indisputable, at the same time, making corporate practices more sustainable is a major business case. Driving innovations that tackle global challenges opens access to new customers, creates valuable partnerships, and spawns innovative business models. According to estimates from the Business & Sustainable Development Commission (2017), achieving the SDGs generates economic opportunities worth $12 tn in the four areas cities, energy, food, and health alone. With improvements in CSR, firms not only increase macro-level sustainability, but they also tap into new business opportunities, become more competitive, and ultimately may yield superior financial returns compared to peers with lower levels of CSR. The following chapter reviews the state-of-the-art on the relationship between firms' sustainability and their financial performance.

3.4 Relationship Between ESG and Financial Performance

In contrast to research on the impact of institutional factors on CSR as well as the role of business in country-level sustainable development, there exists an extensive and rapidly growing body of literature on the relationship between CSR and financial performance. This line of research commonly distinguishes between two perspectives of financial performance. Studies analyzing the relationship of CSR and corporate financial performance (CFP) measure the effect of CSR on metrics such as return on assets, return on equity, or simply the stock price. Taking an investor perspective, other studies examine the performance of (sustainable) investment portfolios and look at measures such as alpha or Sharpe Ratio (Tensie et al., 2021). Notably, some studies refer to the sustainability performance of firms as CSR and others as ESG. However, they can be used interchangeably, as ESG *"(…) is used to evaluate a company's commitment to CSR and ESG performance is the most suitable method for measuring the corporate sustainable performance"* (Miller, 2018; Hřebíček et al., 2014, as cited in Iamandi et al., 2019, p. 3).

Evaluating an aggregated sample of 60 review studies, covering more than 2,200 individual primary studies with an overlap as small as 13 % in the underlying samples, at the time of writing, Friede et al. (2015) conducted the most extensive review of empirical studies on the relationship between ESG and CFP. Across the whole sample, on average, more than 55 % of studies found a positive relationship between ESG and CFP while less than 8 % reported a negative relation. Moreover, from the mid-1990s up to 2015 the positive correlation is significant and stable over time. A more recent study with a comparable meta–meta-approach found similar results (Tensie et al., 2021). After reviewing studies published between 2015 and 2020, which together cover more than 1,000 primary studies, the authors found that 58 % of studies reported a positive and only 8 % a negative relationship between ESG and CFP. Isolating studies that examine the effect of ESG on portfolio performance, the authors found comparable results with 59 % of studies describing a positive and less than 15 % a negative impact.

One of the most cited primary studies on the effect of ESG on portfolio performance was conducted by Kempf and Osthoff (2007). Feeding the four-factor

model with timeseries return data of long-short U.S. equity portfolios, resembling a best-in-class screened strategy by buying high ESG-rated and selling low-rated stocks, the authors found a statistically significant annualized alpha of around 9 % for the period 1992–2004. Examining the effect of ESG on portfolio performance in emerging markets, another study compared the performance of the MSCI Emerging Market ESG index with its parent non-ESG index. In the period 2007–2016, the ESG index was found to yielding better risk-adjusted returns and incorporating less downside risk (Sherwood & Pollard, 2017).

Concerning the relationship between CSR and CFP, Eccles et al. (2014) published an influential paper that not only measures the effect on financial performance, but also suggests different channels through which CSR translates into CFP. Drawing on a sample of 180 U.S. companies, wherein the authors matched 90 firms with high levels and 90 firms with low levels of sustainability, a comparison of financial performance for the period 1993–2010 showed that companies with higher levels of sustainability yielded a better return on assets and equity as well as had superior stock market performance. Similar to the approach of Kempf and Osthoff (2007), stock returns were put into the four-factor model and it was found that companies with higher levels of CSR generated statistically significant positive alpha and produced better risk-adjusted returns than firms with low levels of sustainability. Besides having superior financial performance, the authors found more sustainable companies to have governance structures in place that make board members more responsible for sustainability issues. Moreover, those firms showed better stakeholder engagement, as well as long-term orientation, and they were more likely to disclose sustainability-related information. Finally, the authors suggested that superior organizational and financial performance compared to firms with low levels of sustainability may result from access to better human capital, more robust supply chains, less exposure to controversies, and increased competitiveness due to greater levels of innovation.

Another strain of research explains the superior financial performance of sustainable business practice with lower cost of capital. Ghoul et al. (2011) looked at a sample of more than 2,800 U.S. companies and noted that during the period 1992–2007, firms with high CSR scores benefited from lower cost of equity capital

compared to those that score low on CSR. The authors explain that better CSR performance translates into reduced information asymmetries and risk perception as well as access to a larger investor base, thus reducing a firm's cost of capital while increasing its valuation. Testing the effect for different time horizons, it was found that in more recent periods with increasing awareness on CSR issues the effect was stronger. Besides lowering the cost of equity capital, companies that incorporate CSR can reduce their cost of debt as well. A study measuring the effect of ESG scores on the credit ratings of more than 1,500 U.S. firms during the period 1991–2010, found a statistically significant positive relationship that was robust over different sample periods (Attig et al., 2013). In line with Eccles et al. (2014), the study argues that more sustainable acting businesses reflect better governance and stakeholder management, have less exposure to controversies, and reduce investors' risk perception. Having analyzed the effect of CSR on the spreads of about 4,000 bank loans to more than 1,200 firms from the U.S., Goss and Roberts (2011) reported similar results. During the sample period from 1991 to 2006, banks penalized poor CSR performance with higher cost of debt capital. There exists evidence that the inverse relationship between CSR and cost of debt capital is moderated by CLS (Hoepner et al., 2016; Stellner et al., 2015). For example, Hoepner et al. (2016) analyzed a sample of 470 loans that were issued between 2005 and 2015 to corporate borrowers from 28 countries and various industries. The authors found that higher levels of CLS translated into reduced bank loan credit spreads for companies.

After reviewing the status-quo of research on the relationship between ESG and firms' financial performance, it can be concluded that there is strong empirical evidence supporting a positive link between CSR and CFP. Firms capitalize on improvements in CSR through various channels, such as access to better human capital and lower cost of capital. Connecting the findings of the previous chapters, the next section develops hypotheses to empirically test the ability of CLS to serve as a proxy for ESG exposure, and thus enhance the performance of global equity portfolios.

3.5 Hypotheses Development

Apart from sustainability-themed investing, all common approaches to sustainable investing follow a micro approach by taking into account firm-level ESG data. At the time of writing, there exist no standards for the calculation of ESG scores and the availability of raw ESG data varies across firms (ESMA, 2021). Thus, ESG metrics and rating scores can diverge widely, creating a distorted picture that results in very different investment decisions (Berg et al., 2020; Immel et al., 2020). A study analyzed the difference in ESG scores from three different rating providers on a normalized scale ranging from 0 to 100. For example, Volkswagen received three massively different scores of 0, 19, and 65. Tesla scored 65, 28, and 13 respectively (Lehmann, 2019). There is growing concern that unaudited data as well as lack of regulation of ESG ratings lead to capital misallocation and greenwashing (ESMA, 2021). Once introduced to describe the practice of firms misleading consumers about their environmental footprint, today, the term greenwashing is used more broadly referring to practices leading people to believe a firm has better sustainability performance than is actually the case (Seele & Gatti, 2017). Another concern regarding the use of micro-level ESG data in the investment decision-making process is that portfolios tend to be biased towards companies with greater market capitalization. That is because small-sized firms often lack resources to install disclosure practices that provide raw ESG data necessary for the calculation of ESG scores (Deutsche Bank, 2018).

Switching from a firm- to country-level perspective in the investment decision-making process might be a promising way for global equity investors to overcome the aforementioned issues. Chapter 3.2 outlined the importance of national institutional drivers in promoting CSR. Government intervention and regulation increase awareness on sustainability issues, add transparency, and pressure the private sector to innovate. Also, consumer and society activism urge firms to act more socially responsible and provide solutions to achieve national and global sustainable development. Moreover, deeply rooted cultural factors, such as harmony and long-term orientation, play a role in driving CSR forward. Bottom line, powerful institutional drivers can enhance the level of national CSR. In reverse, section 3.3 concluded that widespread adoption of micro-level sustainability is

key in achieving macro-level sustainable development. By enabling society to improve on its environmental footprint, for example, by providing eco-friendly products or clean energy solutions, but also by improving its own footprint, the private sector is indispensable in achieving the environment-related SDGs. Whether it's by increasing diversity and inclusion in the workforce or by creating safe working environments, being by far the biggest employer, business also plays a crucial role in the social dimensions of sustainable development. Overall, improvements in CSR increase countries' competitiveness and lead to economic growth that lifts people out of poverty and reduces inequality. Assuming that countries cannot be sustainable without sustainable business practice and that institutional factors can play an important role in enhancing national CSR, there should be a positive macro–micro relationship with regards to sustainable development. Thus, CLS should be a useful proxy for the national level of CSR and vice versa, leading to the hypothesis:

Hypothesis 1: *CLS is positively associated with national CSR.*

Having determined the state-of-the-art regarding the impact of CSR on financial performance, it was found that the vast majority of research finds evidence for a positive link between sustainable business practice and financial performance. Access to better human capital and being more innovative translates into superior CFP of firms with high levels of CSR. Additionally, reduced risk perception and an increased investor base results in decreased cost of capital, and thus improves CFP. From an investor perspective, firms with better sustainability, and therefore financial performance, yield superior risk-adjusted returns. In the case of hypothesis 1 being true, global equity investors who want to capture superior financial performance from CSR may choose to apply a macro approach to sustainable investing and use CLS as an alternative-weighting method to tilt their portfolios towards firms with high levels of CSR without using micro-level ESG data. As sustainable firms yield superior returns, investors applying this approach should outperform cap-weighted benchmarks, resulting in the second hypothesis:

Hypothesis 2: *CLS-integrated global equity portfolios outperform market capitalization-weighted benchmarks*.

Besides having better CFP and yielding superior risk-adjusted returns in investment portfolios, socially responsible firms were found to produce positive alphas in common risk factor models. This was shown in studies focusing on developed as well as emerging market countries. With prevailing evidence that portfolios tilted towards companies with high levels of CSR produce positive alphas, the same should hold for CLS-integrated portfolios, giving the final hypothesis:

Hypothesis 3: *After adjusting for common risk factor exposure, CLS-integrated global equity portfolios produce statistically significant positive alphas*.

Closing the theoretical part of this thesis, Figure 6 illustrates how the developed hypothetical framework draws on the main findings from the literature review.

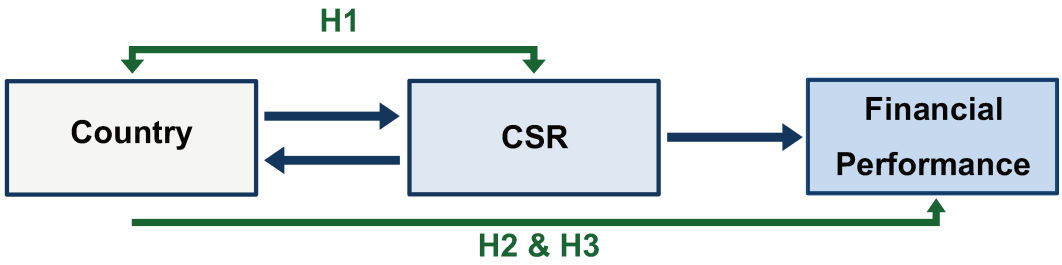


Figure 6 Theoretical Framework

Based on the macro–micro relationship concerning sustainable development, hypothesis 1 suggests that CLS is a useful proxy for the national level of CSR. With sustainable business practice resulting in superior financial performance, global equity investors using CLS in portfolio construction increase their exposure to firms with high levels of CSR and, according to hypothesis 2, should outperform cap-weighted benchmarks. Finally, hypothesis 3 proposes that after accounting for common risk factors, CLS-integrated portfolios produce positive alphas. By drawing on the concepts of section 2 as well as the rationale of alternative-index weighting, the following section outlines the research design to empirically test the developed hypotheses.

4 Research Design

With no appropriate CLS index available, this chapter first introduces the methodology of a novel aggregated index that measures CLS based on more than 50 sustainable development indicators. Having CLS scores in place, it is outlined how several statistical regression models were utilized to analyze the relationship between macro- and micro-level sustainability providing evidence for hypothesis 1. Next, strategies were designed that reweight the constituents of the ACWI based on different levels of CLS integration and influences from smart beta strategies. This is followed by a description of performance measures as well as factor regression models that were used to analyze portfolio performance and shed light on the remaining hypotheses. Measuring macro- and micro-level sustainability, as well as the performance of CLS strategies across 52 countries for a 33-year period requires an extensive amount of data. Therefore, a walk through the characteristics and sources of the underlying data closes the research design.

4.1 Methodology

4.1.1 CLS Index

There exist numerous indicators that can be used to measure sustainable development. However, data quality and availability vary widely across countries (Lafortune et al., 2018). Addressing the demand of policy makers to make available data more accessible and enable cross-country comparisons, several indices emerged that monitor national performance in specific areas of sustainable development (Böhringer & Jochem, 2007). A renowned example within the social dimension is the Human Development Index. Introduced in 1990 by the United Nations Development Programme (1990), the index assesses national development beyond economic growth by taking into account life expectancy, education, as well as gross national income. Looking at the environmental dimension, a popular example is the Environmental Performance Index (EPI), which ranks 180 countries based on their environmental performance in categories such as Climate Change or Air Quality (Wendling et al., 2020). As those indices assess countries' performance in specific areas of sustainable development, country rankings can vary widely based on the underlying index. For example, Singapore ranks 11th in the Human Development Index but only 39th in the EPI (UNDP, 2020;

Wendling et al., 2020). Therefore, unless combined into a single score to overcome the bias towards single dimensions of sustainable development, such indices are unsuitable to measure overall CLS.

As outlined in chapter 2.2.1, the 17 SDGs and their 169 targets cover all dimensions of sustainable development and address countries from both developed as well as developing economies. Drawing on the universal framework towards global sustainable development, Kroll (2015) established the SDG Index, which measures countries' performance on each target, and thus takes into account all areas of sustainable development. Other examples for measuring national sustainability across all dimensions, though not linked to the SDGs, are the Global Sustainable Competitiveness Index and the RobecoSAM Country Sustainability Ranking (Schieler, 2021; Solability, 2021). Although both schemes are suitable for measuring overall CLS, none of them provides historical scores dating back further than 2000, making them inapplicable for this thesis.

With no aggregated data set available for measuring CLS from 1988 to 2020, a new multidimensional CLS index was designed for the purpose of this thesis. In order to cover all areas of sustainable development, the index follows the SDG Index's approach in using the SDGs and its more than 200 indicators as guidance for collecting raw data (Lafortune et al., 2018). To achieve maximum explanatory power while maintaining efficiency, when applicable, indices that cover specific areas of sustainable development were used. While such indices, henceforth sub-indices, often underly a large number of unique indicators, the total number of indicators implied by the CLS index increases significantly while adding only a single new variable. Using sub-indices increases the chance of overlap within the underlying indicators, which may cause a bias towards specific indicators. To detect and address potential overlaps a test for multicollinearity between indicators was conducted after aggregating the final data set. As data availability varies widely across indicators and countries, it had to be dealt with issues of missing data. Drawing on the toolkit for the construction of composite indices by Nardo et al. (2005), single imputation methods were chosen to deal with missing data. In the cases where country data was missing only for specific points in time, missing values were replaced by the most recent available data. In the event that there

was no data for a country available at all, the mean of the values of countries with similar characteristics was applied. For example, missing data for an emerging market country was replaced by the mean of all emerging market countries.

As the indicators assess different areas of sustainable development, they are measured on different scales. While the share of the population living in poverty is recorded in percent, GDP per capita is measured in absolute values. Before proceeding with the collected data, each indicator was normalized. Following Nardo et al. (2005), min–max normalization was applied to rescale each data-point x_{sc}^t of country c within sub-indicator s at time t on a 0–100 scale:

$$\acute{x}_{sc}^t = \frac{x_{sc}^t - min_c(x_s^t)}{max_c(x_s^t) - min_c(x_s^t)} * 100 \tag{12}$$

where:

$min_c(x_s^t)$ = minimum value of sub-indicators x_s^t across all countries c at time t

$max_c(x_s^t)$ = maximum value of sub-indicators x_s^t across all countries c at time t

Having rescaled all individual sub-indicators, they were aggregated at goal level. To arrive at a final score S_{gc}^t within SDG g for a country at a given time, all normalized sub-indicator scores $\acute{x}_{sc}^t$ for a country were summed up and rescaled:

$$S_{gc}^t = \frac{\sum \acute{x}_{sc}^t - min_c(\sum \acute{x}_s^t)}{max_c(\sum \acute{x}_s^t) - min_c(\sum \acute{x}_s^t)} * 100 \tag{13}$$

Before combining the scores from each SDG into a composite CLS index, the weighting scheme had to be defined. In the case an SDG score is assigned more importance than others, again, there is potential for a bias towards specific dimensions of sustainable development. Lafortune et al. (2018) argue that each SDG has the same importance within the 2030 agenda, and thus apply an equal weighting scheme for their SDG Index. This is in line with other researchers finding equal weighting to be the most common approach when structuring composite indices (Farrugia, 2007; Nardo et al., 2005). Avoiding any subjectivity in the weighting scheme and following common practice, all goal-level scores were assigned equal weight, resulting in the final score CLS_c^t for a country at a given time:

$$CLS_c^t = \sum_{g=1}^{17} \frac{1}{17} S_{gc}^t \quad (14)$$

The final CLS scores result in an index that ranks each countries' sustainability against that of the remaining countries for each year of the sample period.

4.1.2 CLS–ESG Regression Models

After organizing an appropriate data set representing CLS, the methodology for testing the first hypothesis can be set up. It has already been mentioned in the literature review that there exists an extensive body of research on the impact of CSR on CFP. No matter whether studies run under a CSR or ESG title, sustainability in business practice is commonly measured using ESG scores or ratings (e.g., Friede et al., 2015; Stellner et al., 2015; Tensie et al., 2021). With the rise and widespread adoption of sustainable investing, ESG data availability massively increased. Established data and rating providers as well as new players enter the field aiming to secure their share in the rapidly growing market for ESG data (Wong & Petroy, 2020). Therefore, unlike in the case of CLS, data availability on ESG is not an issue. Details about the sources and characteristics of the data underlying the empirical study will be outlined in chapter 4.2.

In order to statistically test whether CLS and CSR are positively related as stated by hypothesis 1, firm-level ESG scores were averaged across all firms within a country, before merging CLS and ESG scores into an aggregated data set. As outlined in the literature review, preceding research on the macro–micro sustainability relationship found that individual dimensions of ESG can have different effects on macro-level sustainability (Zhou et al., 2020). To test whether there is a relationship across all dimensions, isolated ESG scores for the single pillars were included. Covering sustainability scores for several countries over multiple years, the final panel data set contains both cross-sectional as well as time-series data. Balancing the panel, countries with missing values were dropped from the sample. Scores were normalized to make the results more interpretable.

There exist various panel regression techniques to model cross-sectional time-

series data and due to their ability to account for cross-sectional differences as well as time-variant effects they are especially popular among scholars (Greene, 2018). However, a detailed analysis of the causal relation between CLS and ESG exceeds the scope of this thesis and may be subject to future research. Nevertheless, besides different models that were set up to evaluate the linear relation between CLS and ESG, additionally, a brief analysis of the isolated causal relationship was included to further support the robustness of hypothesis 1. Following Park (2011) pooled panel ordinary least squares regression models with CLS as dependent and ESG as independent variable(s) served as baseline models:

$$CLS_{ct} = \alpha + \beta ESG_{ct} + \varepsilon_{ct} \quad (15)$$

$$CLS_{ct} = \alpha + \beta_1 E_{ct} + \beta_2 S_{ct} + \beta_3 G_{ct} + \varepsilon_{ct} \quad (16)$$

where:

ESG_{ct}= mean ESG score of country c at time t

E_{ct}= mean environmental pillar score of country c at time t

S_{ct}= mean social pillar score of country c at time t

G_{ct}= mean governance pillar score of country c at time t

Similar to the construction of the CLS index, there could be issues of collinearity between the individual ESG factors as firms may do equally well across the single dimensions of CSR. This would distort the regression results if including all factors as independent variables. Therefore, as proposed by James et al. (2013), Variance Inflation Factors (VIF) were computed for the individual ESG components. The VIF measures the increase of a predictor's variance that results from correlation with the remaining predictors. In the case the VIF exceeds a value of 10, it is a sign of serious multicollinearity.

As this study assumes countries with higher levels of CLS to have better national ESG performance, and thus superior financial returns compared to countries with lower levels of CLS, the cross-sectional CLS–ESG relationship (between) is of greater importance than the within-country variation over time. After averaging out time effects, the baseline model was transformed to a between estimator (Cameron & Trivedi, 2005; Greene, 2018). Regressing time-averaged CLS scores against averaged ESG scores per country gives a generalized impression

about the macro–micro sustainability relationship. Hypothesis 1 assumes the β coefficients of the following equations to be positive and statistically significant, meaning that CLS is higher in countries with higher national mean ESG scores:

$$\overline{CLS}_c = \alpha + \beta\overline{ESG}_c + \varepsilon_c \quad (17)$$

$$\overline{CLS}_c = \alpha + \beta_1\bar{E}_c + \beta_2\bar{S}_c + \beta_3\bar{G}_c + \varepsilon_c \quad (18)$$

Albeit not crucial for the purpose of this study but adding to the literature on the relationship between macro- and micro-level sustainability, the full panel data set was utilized to isolate the causal relationship between ESG and CLS. In order to account for unobserved heterogeneity across countries as well as time-specific effects, literature on the statistical analysis of panel data suggests applying either a random or fixed effects model (Greene, 2018; Wooldridge, 2010). Following studies with comparable data sets, a fixed effects model was the first choice (Crifo et al., 2015; Stellner et al., 2015). Fixed effects allow for avoiding variable bias, which is caused by time effects across all countries (e.g., macroeconomic shocks) as well as baseline differences between countries (e.g., institutional factors). Fixing both effects, two-way time and country fixed regression models were utilized by adding dummy variables for each year and country, except of one year and country to avoid collinearity. The baseline model was modified as follows:

$$CLS_{ct} = \alpha + \beta ESG_{ct} + \delta_t + \mu_c + \varepsilon_{ct} \quad (19)$$

$$CLS_{ct} = \alpha + \beta_1 E_{ct} + \beta_2 S_{ct} + \beta_3 G_{ct} + \delta_t + \mu_c + \varepsilon_{ct} \quad (20)$$

where:

δ_t= time dummy estimating common change in CLS to all countries in year t

μ_c= country dummy estimating common change in CLS to all years in country c

After presenting the methods applied to analyze the relationship between macro- and micro-level sustainability, the next section outlines the methodology of the construction of CLS-integrated global equity portfolios.

4.1.3 CLS Strategies

As mentioned earlier, the ACWI is a common benchmark for global equity

portfolios. As of late 2020, the index covers 23 countries from developed and 27 countries from emerging economies, representing more than 3,000 individual securities and 85 % of the investable global equity market capitalization. MSCI calculates individual market capitalization-weighted indices for each of the underlying countries that are then combined into regional indices (MSCI, 2021b). Based on the MSCI Market Classification Framework, which defines thresholds, such as economic development and market capitalization, countries are categorized as developed or emerging market countries (MSCI, 2020b). The following figure presents the structure of the ACWI as well as the recent market classification.

Figure 7 MSCI Market Classification and ACWI Universe (MSCI, 2021b)

Beneath the ACWI, MSCI clusters developed market countries within the MSCI World Index and emerging market countries within the MSCI Emerging Markets Index. Both indices are common benchmarks representing global developed and emerging equity markets. The ACWI's country index universe served as starting point for portfolio construction of the empirical study. There have been changes in the MSCI Market Classification during the sample period, for example, in 2014, Qatar and the UAE have been included in the Emerging Markets Index (MSCI, 2020b). Accounting for those changes, only countries that were covered by the ACWI in a given year were eligible for inclusion in the portfolios in the respective year. This ensures that the portfolios draw on the exact same opportunity set of

country indices and underlying securities. In order to make the results more comparable, for example, to compare overall CLS and ESG scores from portfolios with the benchmark, a twin version of the ACWI was calculated manually. This was necessary because MSCI does not publish the (historical) weights of the underlying country indices. Therefore, historical market cap weights were derived and served as weights for the twin version. The weight of a country c at time t is derived by dividing the country's stock market capitalization by the sum of the capitalizations of all countries that are covered by the ACWI during that time:

$$MCW_{ct} = \frac{MC_{ct}}{\sum_{c=1}^{C} MC_{ct}} \tag{21}$$

where:

MC_{ct} = market capitalization of country c at time t

With a correlation of 0.99, the twin version matched the original version fairly well (see Appendix A). Based on the insights from the literature review on smart beta, CLS scores were incorporated into several alternative weighting schemes. For each strategy, portfolios were constructed that re-weight the ACWI country indices based on the respective strategies' weights for each country. While the exposure to each country and the underlying securities change accordingly, the security weights within the country indices remain based on market capitalization. This approach is in line with preceding research on alternative portfolio weighting (e.g., Hamza et al., 2007). Now coming to the different CLS-integrated strategies. Starting with a plain CLS-weighted strategy called **CLS**. Deriving weights for each country based on its CLS score relative to that of the other countries, equation (21) was modified to a CLS version by dividing the CLS score of a country at a given time through the sum of all countries' CLS scores:

$$CLSW_{ct} = \frac{CLS_{ct}}{\sum_{c=1}^{C} CLS_{ct}} \tag{22}$$

Using the CLS country weights $CLSW_{ct}$ the portfolio weight of a country is greater the higher its CLS performance relative to the other countries. The next strategy is guided by common sustainable investing benchmarks, such as MSCI ESG

Universal indices that increase exposure to firms with high ESG scores while eying to capture the market beta as close as possible (MSCI, 2019). Under the strategy named **CLS Enhanced** portfolios were constructed that adjust the market capitalization weights of the country indices with a CLS factor. Following the methodology of MSCI ESG Universal indices, each country weight is the product of its market capitalization weight MCW_{ct} and its CLS weight $CLSW_{ct}$ (MSCI, 2019). Making sure the country weights sum up to 100 %, the weights were normalized by dividing the individually adjusted weights through the sum of all countries' adjusted weights, which results in the final CLS-adjusted market capitalization weight for a country at a given point in time:

$$W_{ct} = \frac{MCW_{ct} CLSW_{ct}}{\sum_{c=1}^{C} MCW_{ct} CLSW_{ct}} \tag{23}$$

By adjusting market capitalization weights with a CLS factor, portfolios are tilted towards countries with high levels of CLS and away from those with relatively low levels. This is because the market capitalization weight increases in the case the respective country's CLS weight is relatively high compared to those of the other countries and vice versa. Several studies within the smart beta literature found GDP-weighted global equity portfolios to outperform traditional cap-weighted portfolios (Deutsche Asset & Wealth Management, 2014; Hamza et al., 2007; MSCI Barra, 2010). With CLS integration being also a macro-level strategy, it seems reasonable to design a strategy that combines GDP and CLS weights. GDP weights were derived in the same manner as market capitalization and CLS weights applying equation (21/22). Using the exact same methodology as in the aforementioned strategy but swapping cap weights against GDP weights in equation (23), allowed to derive weights for the **GDP CLS Enhanced** strategy.

Next up is a strategy that is also inspired by common sustainable investing practice. Chapter 2.2.2 introduced the best-in-class approach as one of the ESG-screened sustainable investing strategies. While the following strategy also detects and overweights sustainability leaders, in contrast to ESG-screened strategies, it does not exclude constituents from the investment universe. As this study constructs portfolios at a country level, the exclusion would require dropping

entire countries, making benchmark comparisons less meaningful. Within the **CLS Leaders** strategy the top 10 CLS ranked countries were overweighted relative to the remaining countries. To assign each top performer a weight, the 10 biggest market capitalization weights $(MCW_{1t}, \dots, MCW_{10t})$ in a period t were derived and assigned to countries leading the CLS index, so that the country ranked first in the CLS index in that period was assigned the greatest weight MCW_{1t} and so on. After weighting the leading countries, the remaining weight had to be distributed among the other countries. For that purpose, first, equation (22) was applied to weight remaining countries relative to the other remaining countries based on their CLS scores. Finally, those remaining countries CLS weights $RCLSW_{ct}$ were multiplied with the remaining weight, resulting in weights for each of the countries that were not among the top performers in a given period t:

$$W_{ct} = \left(1 - \sum_{i=1}^{10} MCW_{it}\right) RCLSW_{ct} \tag{24}$$

This strategy may also be thought of as a modified version of the simple CLS strategy where the top 10 CLS ranked countries are systematically overweighted. It assumes that investors are willing to assign CLS leaders relatively heavy weights, though, not exceeding a level of concentration as in market capitalization-weighted benchmarks. Before moving to the next chapter, which describes how the performance of the CLS strategies was measured and compared against benchmarks, the following figure presents a summary of the CLS strategies.

Strategy	Weighting scheme	Description
CLS	$CLSW_{ct} = \frac{CLS_{ct}}{\sum_{c=1}^{C} CLS_{ct}}$	Weights based on CLS score
CLS Enhanced	$W_{ct} = \frac{MCW_{ct} CLSW_{ct}}{\sum_{c=1}^{C} MCW_{ct} CLSW_{ct}}$	Market cap weights adjusted by CLS factor
GDP CLS Enhanced	$W_{ct} = \frac{GDPW_{ct} CLSW_{ct}}{\sum_{c=1}^{C} GDPW_{ct} CLSW_{ct}}$	GDP weights adjusted by CLS factor
CLS Leaders	$W_{ct} = \left(1 - \sum_{i=1}^{10} MCW_{it}\right) RCLSW_{ct}$	Top 10 CLS ranked countries assigned top 10 market cap weights

Table 2 Overview of Different CLS Strategies

4.1.4 Portfolio Performance Measures

Following related research, common risk and return measures were calculated to evaluate the performance of CLS strategies and compare them to benchmarks (e.g., Platen & Rendek, 2017; Sherwood & Pollard, 2017). To measure monthly portfolio returns, Markowitz's portfolio return formula (1) was modified:

$$R_{pt} = \sum_{c=1}^{C} w_{cy-1} R_{ct} \tag{25}$$

where:

w_{cy-1} = previous year's weight of country c within the given strategy

R_{ct} = monthly country index return at time t

With changes from MSCI's Market Classification normally becoming effective at the end of May and the strategy weights being based on yearly data, portfolios were rebalanced annually at the end of May. When comparing portfolio returns with each other or benchmarks, returns were annualized. For measuring portfolio risk several indicators were calculated. Starting with the standard deviation of portfolio returns, which was also annualized in comparisons. Next up, the portfolios' maximum drawdown (DD) was calculated by computing the maximum drop of the return of a portfolio p from its running maximum (Pospisil & Vecer, 2008):

$$MDD_T = \max_{0 \le t \le T} \left(\max_{0 \le t \le T} R_{pt} - R_{pt} \right) \tag{26}$$

Additionally, the historical value at risk (VaR) at a 95 % confidence level was calculated. Applied to a series of portfolio returns R_{pT} over a period T the VaR at a 95 % confidence level is the cutoff value at the 95th percentile of the left tail of the return distribution. When comparing portfolio performance, the 95 % VaR can be interpreted as a downside measure that indicates the lowest return one could have expected with 95 % confidence, or put differently, only in five percent of the cases the return was lower than the threshold value (Linsmeier & Pearson, 2000). Having computed risk and return measures, the Sharpe Ratio was calculated to compare risk-adjusted performance. In this context, equation (4) was computed using the annualized excess returns and standard deviations of portfolio returns.

In addition to common portfolio performance measures, sustainability scores of each portfolio were measured over the respective period. For that purpose, again Markowitz's portfolio return formula was modified, though, this time, the previous year's country weights of a given CLS strategy were not multiplied with the country indices' returns but with the countries' CLS or mean ESG scores:

$$CES_{pt} = \sum_{c=1}^{C} w_{cy-1} CES_{ct} \tag{27}$$

where:

CES_{ct} = CLS_{ct} or ESG_{ct}

Including the CLS and ESG scores for the respective period in the set of portfolio performance measures allowed to not only compare portfolios from a risk and return perspective but also from a sustainability standpoint. This provided further evidence for the hypotheses, as it sheds light on the relationship between macro- and micro-level sustainability as well as the impact of sustainability on portfolio returns. The next chapter describes how the performance of the CLS strategies was analyzed in more detail by checking for risk factor exposure.

4.1.5 Factor Regression Models

While several studies documented inferior performance of portfolios that are tilted away from the market beta, an extensive body of studies found sustainable investing strategies to generate positive alphas (e.g., Eccles et al., 2014; Kempf & Osthoff, 2007). To analyze whether CLS strategies can produce abnormal returns after accounting for factor exposure, portfolio returns were plugged into the factor models that were introduced in section 2. Beginning with the CAPM, excess portfolio returns were regressed against excess market returns:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p\left(R_{mt} - R_{ft}\right) + \varepsilon_{pt} \tag{28}$$

As described in chapter 2.1.2, the coefficient β_p measures a portfolio's exposure to systematic risk. In the cases where the intercept α_p is positive after accounting for systematic risk exposure, a strategy portfolio generated positive abnormal

returns compared to the market portfolio. Using Fama and French's (1993) three-factor model, it was checked whether CLS strategies tilt portfolios towards small or large cap stocks or those with high- or low book-to-market ratios. Size and value factor loadings were checked using the following regression model:

$$R_{pt} - R_{ft} = \alpha_p + \beta_{pm}(R_{mt} - R_{ft}) + \beta_{pSMB} SMB_t + \beta_{pHML} HML_t + \varepsilon_{pt} \quad (29)$$

Carhart (1997) found evidence that buying past winners and selling losers can produce positive alpha. In order to test whether a CLS strategy exposes investors to this Momentum factor, Carhart's four-factor model was computed as follows:

$$R_{pt} - R_{ft} = \alpha_p + \beta_{pm}(R_{mt} - R_{ft}) + \beta_{pSMB} SMB_t + \beta_{pHML} HML_t + \beta_{pMOM} MOM_t + \varepsilon_{pt} \quad (30)$$

Representing the robustness of firms' profitability and their investment behavior, Fama and French (2015) added two additional factors to their factor set. Studies that found firms with higher levels of CSR to have superior financial performance argue that this effect might result from greater resilience and investments in innovation (e.g., Eccles et al., 2014). In the case CLS strategies' excess portfolio returns can be explained from exposure to such effects, loadings on the RMW factor should be positive and negative on CMA in the five-factor model:

$$R_{pt} - R_{ft} = \alpha_p + \beta_{pm}(R_{mt} - R_{ft}) + \beta_{pSMB} SMB_t + \beta_{pHML} HML_t + \beta_{pRMW} RMW_t + \beta_{pCMA} CMA_t + \varepsilon_{pt} \quad (31)$$

Having described the methodology of the empirical study, the next chapter outlines details about the collection and characteristics of the underlying data.

4.2 Data Characteristics and Collection

4.2.1 CLS Data

In the following, the main indicators and sources that were used to construct the CLS index will be outlined. As mentioned earlier, data collection was guided by the SDGs and their underlying indicators. Since the CLS index draws upon

numerous sub-indicators, for reasons of space, only a selection of indicators will be mentioned in the following. For a complete overview, see Appendix B. To further enhance clarity and analyze the impact of CLS in its single dimensions, the SDGs were grouped into the three dimensions of sustainable development (Kostoska & Kocarev, 2019; Stockholm Resilience Centre, 2017). The following figure presents the classification of the SDGs.

Figure 8 SDGs Categorized in the Dimensions of Sustainable Development

Beginning with the economic dimension, indicators such as GDP per capita and the share of children in employment were used to measure SDG 8 (World Bank, 2021a). To track development related to innovation, for example, the share of internet users and the expenditure on research and development were used (UNDP, 2021; World Bank, 2021a). Goal 17 was represented by inflows of foreign direct investments and tax revenues (World Bank, 2021a).

Coming to the environmental dimension, where historical data of the 32 sub-indicators of the EPI was used to measure CLS on goal level (NASA, 2021). In order to track development on SDG 6 indicators from the EPI category Sanitation and Drinking Water were used. Next up, Responsible Consumption and Production was represented by indicators from various categories, for example, Pollution and Waste Management. Goal 13 was measured by the EPI's Climate Change indicators, such as the CO2 growth rate or the greenhouse gas footprint per capita. With respect to goal 14, indicators from Fisheries and Biodiversity were used. Lastly, SDG 15 was represented by indicators from the categories Ecosystem Management and Biodiversity. EPI indicators were aggregated at goal level and

weighted according to the EPI's weighting framework (Wendling et al., 2020).

Finally, on the social dimension, the World Bank's (2021a) database on sustainable development was the main source of data. Measuring progress on SDG 1, the share of the population living below the international poverty line was taken into account. The share of renewable energy consumption was included to represent goal 7. Also, goals 11 and 16 were measured in part by World Bank data. For example, the share of the population living in slums as well as various governance indicators, such as government effectiveness and control of corruption, were used (World Bank, 2021c). Governance indicators were supplemented by data from the Freedom House (2021), which publishes indicators on civil and political rights. The Global Food Security Index, which covers food-related topics, such as affordability and availability, by incorporating 59 sub-indicators (e.g., food costs and volatility of agricultural production), served as the data source for SDG 2 (The Economist Intelligence Unit, 2021). Chapter 4.1.1 mentioned the Human Development Index as an index measuring sustainable development on the social dimension. The index itself consists of several sub-indices whose historical cross-sectional time series are provided by the United Nations Development Programme (2021). Health and Well-Being was represented by the Life Expectancy Index and Education by the Education Index, which includes indicators such as mean years of schooling. SDG 5 was represented by the Gender Inequality Index. Finally, the Coefficient of Human Inequality served for measuring SDG 10.

Within the methodology of the CLS index, it has already been mentioned that in some cases it had to be dealt with issues of missing data. However, the final CLS data set covers the period 1987–2020 for all countries that were included in the ACWI during that time. Aggregating 58 unique sub-indicators, the CLS index draws on a total of more than 100,000 data points. The next section describes the characteristics and collection of the study's underlying ESG data.

4.2.2 ESG Data

As mentioned earlier, with the rapidly growing number of new players entering the market for ESG data, studies reported massive divergence between the ESG scores from different data providers. Though, most commonly used in academic

studies and found to perform better compared to other ESG rating providers, is ESG data published by MSCI (Berg et al., 2020; Immel et al., 2020). This empirical study also draws on ESG data provided under exclusive license by MSCI (see Appendix H). MSCI measures firms' sustainability performance on 35 individual key issues that are grouped into 10 themes. For instance, under the environmental pillar, the Climate Change theme is measured by key issues such as carbon emissions and climate change vulnerability. With respect to the social pillar, Human Capital is tracked by labor management for example. Finally, the governance pillar includes themes such as Corporate Behavior, which is measured by business ethics and tax transparency (MSCI, 2020a). A complete list of the underlying indicators can be found in Appendix C. The ESG data set contains monthly scores for all firms that are covered by the ACWI's country indices and additionally thousands of small cap and private companies from the respective countries for the period 2007–2020. Including all available firms creates an even more comprehensive picture when analyzing the macro–micro sustainability relationship. Both the combined ESG score as well as the individual dimensions' scores were taken into account. As described in the methodology section, ESG scores were averaged across all firms that are listed within a country. With CLS and ESG data in place for testing the first hypothesis, the following chapter describes which further data was used to test the remaining hypotheses.

4.2.3 Data for Portfolio Construction and Factor Regressions

Since the CLS portfolios were constructed utilizing the ACWI's underlying country indices, the sample period directly depends on the availability of historical data of the country indices. Although for some developed market countries there is further back data available, the earliest year with data available for all countries is 1988 when the MSCI Emerging Markets Index with its underlying emerging market country indices had been launched. MSCI (2021a) provides historical data for country indices on a monthly basis. The index data underlying this study is denominated in U.S. Dollar and on price level with nearly no missing data. Only data for Venezuela was not available, which seems negligible, as Venezuela was only part of the ACWI until 2006 and had relatively low market capitalization compared to the other countries (MSCI, 2020b). However, the absence of Venezuela might lead to a tracking error between the original ACWI and the twin version. Finally,

the equity data set used to back test CLS strategies contained time series for 52 countries that were part of the ACWI in the period from the end of May 1988 until the end of February 2021. In order to compare the performance of CLS strategies not only against traditional but also against ESG benchmarks, historical time series of selected MSCI ESG indices were derived. Since the CLS Enhanced strategies were inspired by MSCI ESG Universal indices, those were included in the benchmark sample for direct comparison. Moreover, MSCI ESG Leaders indices were included because they come closest to the CLS Leaders strategy by overweighting firms with the best ESG performance in their sectors. The earliest available data for the ESG benchmarks range from late 2007 in the case of ESG Leaders indices to the end of 2012 for ESG Universal indices (MSCI, 2021a).

Coming to the macroeconomic data required for designing the CLS Enhanced strategies. The main source for stock market capitalizations was the World Bank's (2021b) databank of world development indicators. Supplementary data was derived from CEIC (2021). In the cases there was still missing data, the same imputation methods were applied as in the CLS index methodology. GDP data is based on current prices in U.S. dollars and was derived from the IMF (2021).

Finally, following common practice in factor research, necessary data for regressing CLS strategies against common risk factors is based on Fama's and French's research data sets. French (2021) provides international monthly factor return series for all factors covered by the five-factor model and additionally the Momentum factor for the period 1992–2021. The data is split into combined factor return series for developed and emerging market countries and is weighted based on market capitalization of the underlying countries. In both cases, French uses the U.S. Treasury bill rate to compute the excess market return. Therefore, CLS strategies' monthly excess returns were computed using the same risk-free rate. In order to regress the global CLS strategies' returns against the factors, a combined factor return series was computed based on the exposure to developed and emerging markets of the respective strategy. This resulted in a global factor return series with the same exposure to developed and emerging markets as the CLS strategy the factor returns were regressed against. Having described the research design, the next section presents and discusses the study's results.

5 Empirical Results and Discussion

In the final section of this thesis, the main findings of the empirical study are presented and discussed. Starting with a presentation of the CLS index presents a first overview of the level of sustainable development across countries underlying the ACWI universe during the sample period. Next up, setting country-level ESG and CLS scores into perspective, the relationship between macro- and micro-level sustainability is analyzed by interpreting the results from several regression models. Having provided evidence for hypothesis 1, the effect of CLS integration on the composition of global equity portfolios is examined by comparing country weights within different CLS strategies with that of the ACWI. After that, the performance of CLS-integrated portfolios is analyzed and discussed, providing evidence for hypothesis 2. After comparing the performance of CLS strategies with the market index, additionally, isolated back tests were analyzed to shed light on the impact of CLS in developed as well as emerging markets. Finally, factor regression results are interpreted to find out whether CLS integration exposes investors towards risk factors and whether they are able to produce statistically significant positive alphas, which provides evidence for the last hypothesis.

5.1 CLS Performance

Before presenting insights from the aggregate CLS index, the results of the test for multicollinearity as well as summary statistics will be outlined. As mentioned in the CLS index methodology, the aggregation of numerous sub-indicators and -indices, all measuring countries' performance in some area of sustainable development, may include some overlaps biasing the results towards specific areas of sustainable development. Following the SDG Index's approach, a pairwise correlation between the goals was measured (Lafortune et al., 2018). Coefficients above 0.9 indicate serious collinearity. Countries that do relatively well or poor in one area of sustainability may perform similarly in other areas. Therefore, naturally, correlation is expected to be relatively strong across indicators. Indeed, as illustrated in the following correlation heatmap, most of the goals are at least moderately correlated, though, there were no coefficients exceeding the critical threshold.

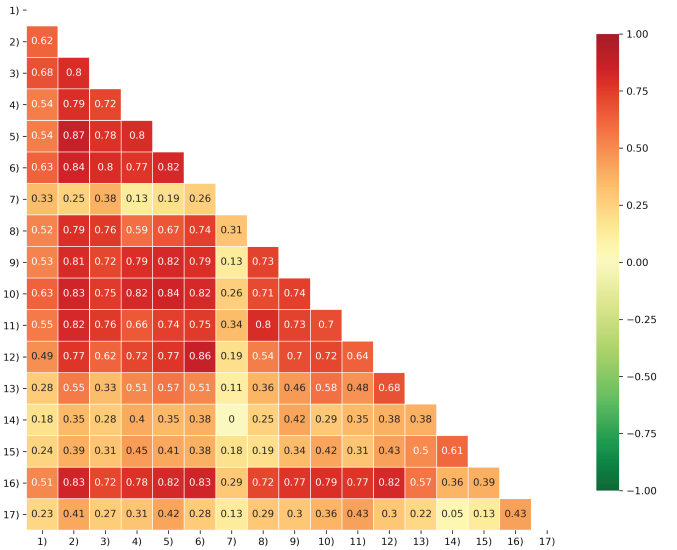


Figure 9 CLS Indicators Correlation Heatmap

With no signs of serious multicollinearity, all indicators are of importance in deriving total CLS scores for each country. The following figure presents summary statistics across all countries for the full sample period between 1987 and 2020, resulting in 1768 observations.

Statistics	CLS Score	Economic	Environmental	Social
Observations	1768	1768	1768	1768
Mean	58.70	51.45	52.88	65.97
Std. Dev.	19.81	21.23	20.93	21.27
Min	16.89	9.40	16.68	14.13
25 %	41.97	31.80	34.07	49.63
50 %	61.79	50.96	53.61	69.01
75 %	76.65	70.50	66.61	84.94
Max	92.65	95.02	98.78	96.66

Table 3 Summary Statistics of the CLS Index

Looking at the single pillars of sustainable development, it can be seen that, on average, score distribution is relatively similar across all dimensions. Only the social dimension is outstanding with a mean more than 12 points higher compared to the other dimensions. Also, the quartile scores are relatively high with scores of at least around 50 in 75 % of the observations. This indicates that most countries perform relatively well on the social dimension with some outliers performing much worse. For example, while in most countries the share of people living in poverty is very small, there are outliers (e.g., India) where the share is

very high. In contrast to the social dimension, the quartile scores within the environmental and economic dimensions are more normally distributed. In the case of the economic dimensions, the distribution can be attributed to all the different stages of economic development across countries, which at the same time explains the largest gap across the dimensions between the min and max scores. Finally, across all countries and over the full sample period the mean CLS score is around 59 with a standard deviation of approximately 20 points.

Now coming to the CLS performance of the individual countries. Presenting the results of all countries for each year exceeds the capacity of this thesis. However, with a mean of approximately 2.5, the score variation within the countries over time is relatively small compared to a mean cross-sectional variation of around 20. Therefore, time-averaged scores present a good overview of the relative sustainability performance across countries. The following world map highlights all countries that were considered within the study based on their mean CLS scores during the sample period using a color scale ranging from dark red (worst score) to dark green (top score).

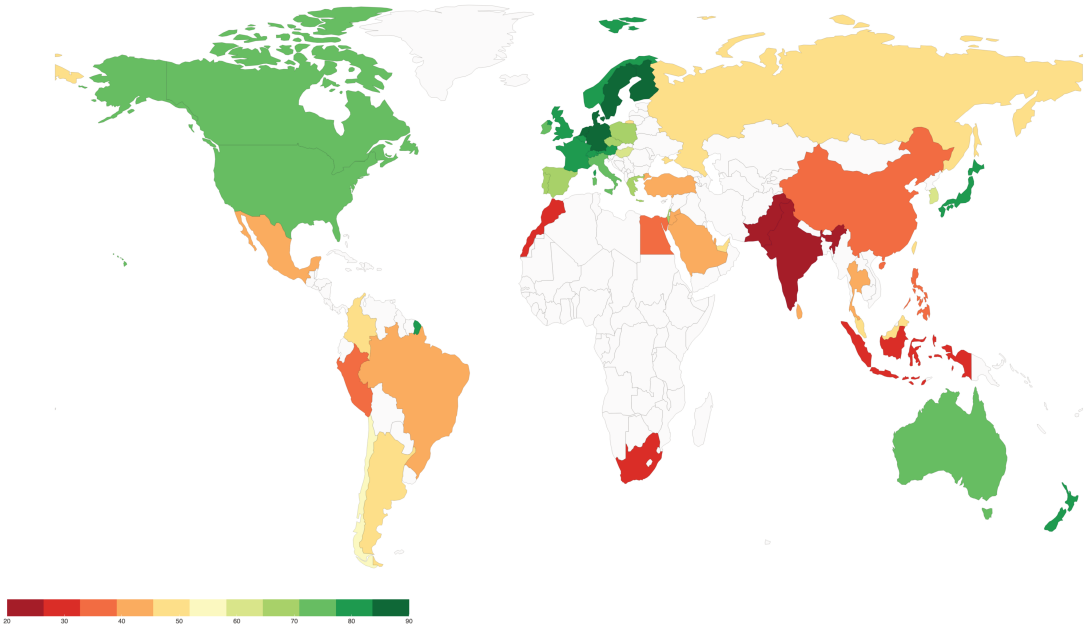


Figure 10 Mapped CLS Country Ranking

In line with findings from the literature review, it can be seen that European and especially Nordic European countries top the ranking (WHO Regional Office for

Europe & OECD, 2015; Zadek, 2006; Zhou et al., 2020). While Denmark, Finland, and Germany take the top three ranks, South Africa, Pakistan, and India make up the bottom of the ranking. The complete country ranking can be found in Appendix D. Overall, countries from developed economies clearly lead emerging market countries. Having examined the stage of CLS across the sample, the next section sheds light on the relationship between CLS and CSR.

5.2 Macro–Micro Sustainability Relationship

As mentioned in chapter 4.2.2, the study's underlying ESG data sample only covers the period from 2007 to 2020. Thus, within the analysis of the relationship between CLS and ESG, only the CLS scores for the respective period were taken into account. As described in the methodology section, the combined panel data set was normalized on a scale ranging from 10 to 100 in order to make the scores comparable. Nine countries were dropped from the panel due to missing ESG data, for example, Qatar was covered by the ACWI only since 2014. The following figure presents summary statistics of the panel data set and provides a first impression on the relationship between CLS and ESG.

Statistics	CLS	ESG	ESG E	ESG S	ESG G
Obs.	602	602	602	602	602
Mean	65.90	64.48	62.19	64.41	63.66
Std. Dev.	24.13	21.26	21.52	19.44	22.78
Min	10.00	10.00	10.00	10.00	10.00
25 %	42.78	51.46	48.20	53.44	47.75
50 %	72.81	66.45	63.55	66.41	66.04
75 %	86.43	81.26	77.51	78.20	81.98
Max	100.00	100.00	100.00	100.00	100.00

Table 4 Summary Statistics of the CLS and ESG Panel Data Set

When looking at mean CLS and ESG scores across all countries and for the whole sample period, it can be seen that the scores are almost identical. Moreover, the distribution of scores is very similar. Only the gap between laggards and leaders is wider in the case of CLS compared to ESG scores. While the sample statistics provides a first sign of a potential relationship, further investigation was conducted to determine whether the relationship is statistically significant or just random. The next figure plots mean CLS and ESG scores on country level to examine whether the relationship is consistent across sections.

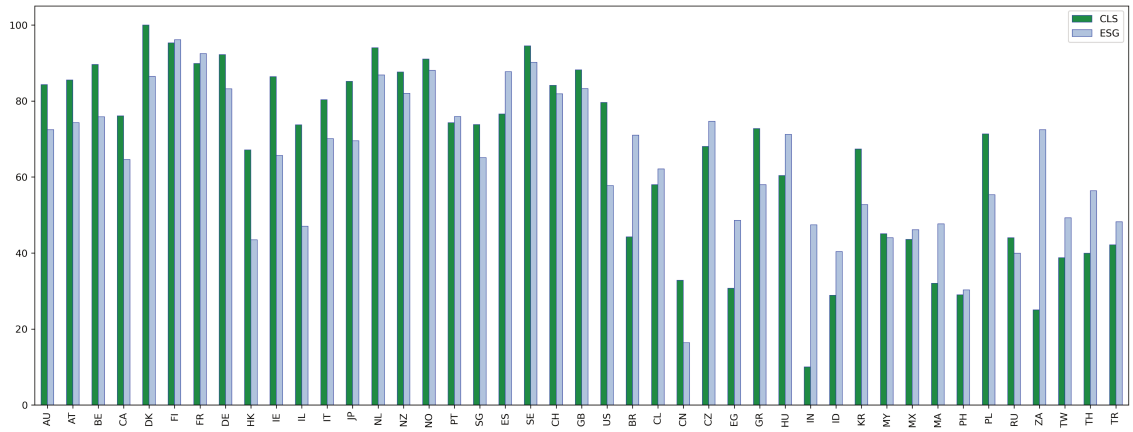


Figure 11 Mean CLS and ESG Scores per Country

Overall CLS and ESG scores match fairly well. Notably, when looking at the average delta, the distance between macro- and micro-level sustainability scores is closer in developed countries (left panel) compared to countries from emerging markets (right panel). However, when excluding outliers, such as South Africa and India, the delta in emerging markets is only around 3 % greater than in developed markets. Another observation is that in developed countries, CLS scores lead ESG scores in almost all cases, while in emerging market countries it is vice versa. The results are largely in line with Hult et al. (2018), who also found that in most cases, micro- leads macro-level sustainability in emerging market countries. For the U.S., the only developed country in their sample, the relationship was reversed, which is also in line with this study's findings. It stands out that the outliers all have much higher ESG than CLS scores, supporting the conclusion from the literature review that sustainable business practice is not directly dependent on CLS, but rather can be enhanced by institutional factors that are part of CLS under SDG 16. In contrast, it was concluded that CLS is not possible without widespread national adoption of CSR, which is also supported by the macro–micro sustainability score pairs since the scores either match fairly well or ESG exceeds CLS as is the case in most emerging market countries. These findings justify the decision to use CLS rather than ESG as the dependent variable in the upcoming regression analysis. Before presenting the results, pairwise Pearson correlation coefficients between CLS and ESG scores are shown. Additionally, the VIFs of the individual ESG scores are outlined to rule out multicollinearity when regressing CLS against single ESG pillars.

Correlation	CLS	ESG	ESG E	ESG S	ESG G
CLS	-				
ESG	0.66	-			
ESG E	0.57	0.84	-		
ESG S	0.43	0.76	0.55	-	
ESG G	0.58	0.71	0.55	0.33	-
VIF			1.81	1.43	1.43

Table 5 Collinearity of CLS and ESG Scores

Providing further evidence for hypothesis 1, a correlation coefficient of 0.66 between CLS and ESG indicates that there exists a moderate, rather strong positive linear relationship. The positive association holds when looking at the relationship of CLS with the single ESG pillars. Though, the positive linear relation was weaker in the social dimension. The correlation results are in line with results from preceding studies, which also reported a positive correlation between macro- and micro-level sustainability (Boulouta & Pitelis, 2014; Seitz, 2015; Zadek, 2006; Zhang et al., 2019). With VIFs far below 10, there are no issues of multicollinearity between the single ESG pillars, allowing to include all dimensions when regressing CLS against the individual ESG factors. As has already been mentioned in the methodology section, for the purpose of this study, especially the cross-sectional rather than the within-countries information is of interest. In the case there exists a statistically significant linear relationship between CLS and ESG scores across countries, CLS can be used as a reliable proxy for ESG exposure when constructing global equity portfolios. The results of the between estimator are as follows.

	Between Estimator (1)	Between Estimator (2)
ESG	1.0014*** (0.0000)	-
ESG E	-	0.3323 (0.1521)
ESG S	-	0.1570 (0.5339)
ESG G	-	0.7369*** (0.0006)
Intercept	1.3381 (0.8803)	-11.7790 (0.3086)
Observations	43	43
R-squared	0.59	0.63
p-values are reported in parentheses (*p<0.1; **p<0.05; ***p<0.01)		

Table 6 Between Regression Results

Across countries a one unit change of the ESG score resulted in an approximately one unit change of the CLS score. The result is highly statistically significant and strongly supporting hypothesis 1. When breaking the influence down to the single pillars, the G pillar had the strongest effect on CLS and was the only pillar statistically significant. Plotting CLS against ESG scores further illustrates the results.

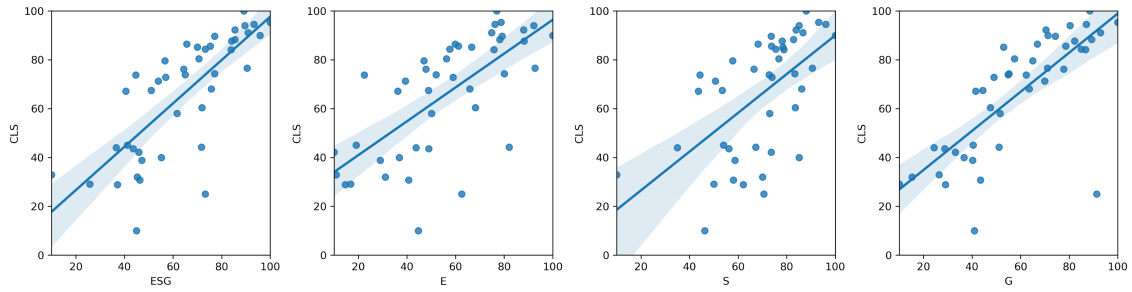


Figure 12 CLS Scores Plotted Against ESG Scores

Similar to Figure 11 the left plot shows the relationship between mean CLS and ESG scores per country. It further highlights that, except for a few outliers, there was a relatively strong positive linear relation between CLS and ESG. With respect to the environmental pillar, albeit the p-value of the regression result is rather low, the positive coefficient is not statistically significant. When looking at the respective plot, some outliers with much higher ESG compared to CLS scores seem to have distorted the picture, which otherwise also indicates a relatively strong positive linear relation. While in the social dimension the relation seems rather weak, the right figure, which plots CLS against the governance pillar, confirms the regression results, as, except for two outliers with much higher ESG scores, the relation seems to have been quite strong. From the regression results, it can be concluded that there existed a statistically significant positive relationship between macro- and micro-level sustainability. With support for hypothesis 1, integrating CLS in global equity portfolios should increase ESG exposure.

Coming now to the results from the fixed effects regression models. Again, the combined as well as the single ESG pillars have been regressed against CLS scores. Before accounting for both, time-specific as well as country-fixed effects in the panel regression, first, only the time-specific effects were taken into account. This allows to provide further evidence for hypothesis 1.

	FE (1)	FE (2)	FE (3)	FE (4)
ESG	0.7784*** (0.0000)	-	0.0053 (0.5810)	-
ESG E	-	0.3625*** (0.0000)	-	0.0016 (0.2170)
ESG S	-	0.1229** (0.0119)	-	-0.0019 (0.8248)
ESG G	-	0.4938*** (0.0000)	-	0.0269*** (0.0006)
Intercept	15.7130*** (0.0000)	4.0114 (0.1661)	65.5650*** (0.0000)	63.5950*** (0.0000)
Observations	602	602	602	602
R-squared	0.45	0.49	0.06	0.04
p-values are reported in parentheses (*p<0.1; **p<0.05; ***p<0.01)				

Table 7 Fixed Effects Regression Results

The results of the first time-fixed panel regression are in line with the results from the between estimator (1). Drawing on more than 600 observations and accounting for time-specific effects that are constant across countries, a one unit change in the ESG score led to an approximately 0.8-point increase in the CLS score. As was the case in the time-averaged regression, the effect is highly statistically significant. In contrast to the between estimator results, when analyzing the whole panel, all individual ESG pillars' positive coefficients are statistically significant (2). Again, the G pillar had the strongest effect, though, closely followed by the environmental dimension. For the period 2007–2020, national mean ESG scores had a statistically significant positive effect on CLS, providing further evidence for hypothesis 1 and meaning that during this period, CLS could have been used in the portfolio construction process to increase ESG exposure. When integrating CLS in equity portfolios to increase ESG exposure, there is no need for a true causal relationship between CLS and ESG, because one is only assuming countries with higher CLS scores to also have higher national levels of CSR, regardless of whether there is an isolated causal effect explaining the correlation. However, evidence on the causal effect adds to the literature on the macro–micro sustainability relationship and may be of high relevance for policy makers in driving sustainable development. Therefore, two-way time and country fixed effects models have been computed to analyze the causal relationship. When looking only at the effect of the combined ESG score on CLS, there is a small positive effect, though, it is not statistically significant (3). Broken down to the individual

dimensions, again, the coefficient of the G pillar is positive and highly statistically significant (4). A one-point change in the G pillar score resulted in a statistically significant increase of approximately 0.03 in the CLS score. Although the coefficient is very low compared to the aforementioned results, considering the numerous factors underlying CLS, the effect is significant and in line with results reported by a related study (Zhou et al., 2020). Controlling for country-fixed effects in the panel regression analysis shows that there are massive differences across countries with regards to sustainability performance.

The results from the regression analysis support hypothesis 1. Therefore, when integrating CLS in the construction of global equity portfolios in the next chapters, as ESG exposure is expected to increase so is the performance.

5.3 Portfolio Composition of CLS Strategies

Before analyzing the performance of CLS-integrated portfolios in the next chapter, this section examines changes in portfolio composition that arise from integrating CLS. With countries from developed markets scoring higher in the CLS index, CLS integration may reduce exposure to emerging markets. While emerging markets were more volatile compared to developed markets, lower allocation to countries from emerging economies could result in reduced portfolio risk. However, reducing the exposure to emerging markets may come at the cost of portfolio performance, as emerging markets historically delivered superior returns compared to developed markets (Melas, 2019). Presenting an overview about changes in portfolio composition when integrating CLS, the following figure shows the top 10 mean country weights for each strategy as well as the ACWI.

ACWI		CLS Enhanced		GDP CLS Enhanced		CLS		CLS Leaders	
US	37,54 %	US	39,95 %	US	30,91 %	DK	3,28 %	DK	37,74 %
JP	13,33 %	JP	14,82 %	JP	13,87 %	FI	3,16 %	DE	11,51 %
GB	6,73 %	GB	7,42 %	DE	8,16 %	DE	3,15 %	FI	7,07 %
CN	4,56 %	FR	3,77 %	GB	5,60 %	NL	3,14 %	NL	6,45 %
CA	3,50 %	DE	3,56 %	FR	5,41 %	SE	3,13 %	SE	5,55 %
FR	3,39 %	CA	3,55 %	CN	4,86 %	NO	3,05 %	NO	3,51 %
MX	3,20 %	HK	2,79 %	IT	4,26 %	JP	2,96 %	JP	2,07 %
HK	3,00 %	CN	2,56 %	CA	2,61 %	BE	2,95 %	GB	1,97 %
DE	2,98 %	CH	2,31 %	ES	2,25 %	GB	2,93 %	BE	1,90 %
SA	2,12 %	MX	1,96 %	AU	1,84 %	CH	2,93 %	AT	1,66 %

Table 8 Top 10 Mean ACWI and CLS Portfolios' Country Weights

Over the sample period, on average, the benchmark portfolio was quite concentrated in the U.S., making up more than one-third of the portfolio. Although Japan's share in the ACWI decreased from its high of more than 40 % in the late 1980s, on average, Japan still was the second largest constituent within the benchmark portfolio during the sample period. With a mean weight of around 4.5 %, China held the greatest portfolio share among emerging market countries. Looking at the weights within the CLS Enhanced portfolio, it can be seen that the top three constituents remained the same with slightly increased weights. However, all the remaining countries changed their place and Saudi Arabia, due to its low CLS performance, even lost its place within the top 10 to Switzerland. Countries with relatively high CLS scores moved up the ranking, for example, Germany improved by four places. Conversely, countries that score worse in the CLS index lost places, as their weights were reduced by up to around 50 % as in the case of China. Chapter 3.1 introduced GDP-weighting as an alternative weighting strategy that reduces concentration to single countries by deriving weights from GDP rather than market capitalization (e.g., H. R. Campbell, 2012; Hamza et al., 2007). Indeed, within the GDP CLS Enhanced strategy, the mean weight assigned to the U.S. during the sample period decreased significantly, while that from others increased. Again, Germany substantially improved its ranking, which is attributable to its relatively high GDP and superior CLS performance. Replacing Mexico and Hong Kong, with Italy and Spain, two additional European countries joined the top 10 ranking. Coming to the CLS portfolio, which assigned dramatically less weight to the leading constituents. By construction, the CLS index does not have extreme outliers because countries' performance is measured across numerous dimensions. Therefore, the CLS strategy was relatively equally weighted. However, there is still a significant gap between leaders and laggards. For example, Denmark was assigned more than four times the weight of Pakistan or India. The complete ranking can be found in Appendix E1. Ultimately, in the CLS Leaders portfolio, Denmark topped the ranking with an average weight of around 38 % during the sample period. The weight exceeded the U.S.' mean weight in the benchmark portfolio, because in 32 from 34 years Denmark led the CLS index, and therefore in almost every year has got assigned the top market capitalization weight, also during the period where Japan topped the ACWI ranking with weights above 40 %. However, concentration in a single country only

increased slightly compared to the benchmark. Next up, Germany topped Finland, as it was Germany which took Denmark's leading CLS position two times during the sample period. Being assigned a heavy weight in two years substantially increased Germany's mean weight. Overall, countries may rank slightly different in the CLS Leaders portfolio compared to the CLS index, as it depends on how often a country ranked among the top countries in the CLS index. For an overview of the weight of each country in the benchmark portfolio as well as the CLS strategies' portfolios over time, it is referred to Appendix E2.

Notably, in the CLS as well as CLS Leaders portfolio no emerging market country was among the top 10 constituents on average. As mentioned before, allocation towards emerging markets may impact the risk and return profile of global equity portfolios. To get an idea about the exposure of CLS-integrated portfolios towards emerging markets, the following figure plots aggregated weights assigned to developed (blue) and emerging markets (green) over the sample period.

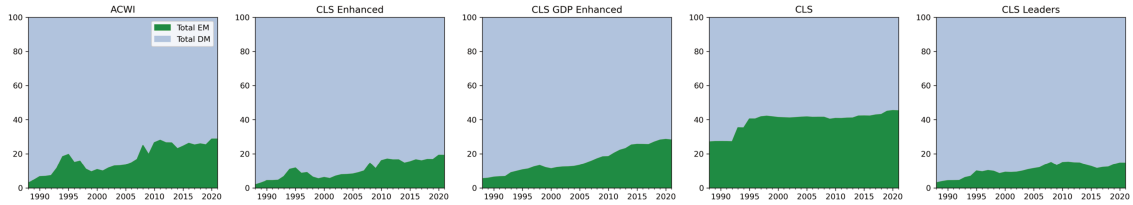


Figure 13 CLS Strategies' Developed and Emerging Markets Exposure

From 1988 to 2021, emerging market countries experienced significant economic growth which also translated into greater market capitalization (Melas, 2019). Integrating CLS into global equity portfolios would have reduced the exposure to emerging market countries, as can be seen in the second plot, which illustrates the weight distribution within the CLS Enhanced strategy. Looking at the GDP CLS Enhanced portfolio's plot, the continuous growth trend of emerging market countries is clearly visible and compared to the CLS Enhanced portfolio, emerging markets have been assigned significantly more weight within the GDP strategy. The exposure to emerging markets is greatest within the CLS strategy. The significant increase between 1990 and 1995 can be explained by the addition of several countries to the MSCI Emerging Markets Index during that period. Most of the time, there were more emerging market countries underlying the ACWI

universe than countries from developed economies. Resulting from the relatively equal weights assigned to each constituent within the CLS strategy, the exposure to emerging markets was relatively high and stable over time due to the low variation of CLS scores within countries over time. With the greatest weights assigned exclusively to developed countries, the share of emerging market countries within the CLS Leaders strategy's portfolio was the lowest among all strategies, which may have impacted the risk and return profile of the portfolio. This will be analyzed in the next chapter, when providing evidence for hypothesis 2 by examining the performance of CLS-integrated global equity portfolios.

5.4 Performance of CLS Strategies

Starting this chapter off with a look at the performance of individual countries offers a first impression of the impact of CLS on equity performance. Although all performance measures are important to get an understanding of the risk and return profile of countries or portfolios, the Sharpe Ratio served as the primary measure when ranking country or portfolio performance. While the other measures either look at the down- or upside performance, the Sharpe Ratio puts both into perspective, and therefore contains the most information. The next figure presents the five best-performing countries among the sample. A complete country ranking can be found in Appendix F1.

	Ann. Return	Ann. Volatility	Sharpe Ratio	VaR (95 %)	Max DD.	ESG Score	CLS Score
DK	11.01 %	19.26 %	0.43	-8.75 %	-56.44 %	85.78	99.98
US	8.69 %	14.62 %	0.42	-6.89 %	-52.22 %	60.37	82.74
CH	8.58 %	16.32 %	0.37	-7.09 %	-49.01 %	82.12	87.47
MX	10.73 %	28.71 %	0.28	-11.46 %	-67.75 %	50.59	48.64
NL	7.34 %	18.56 %	0.26	-8.50 %	-61.44 %	86.00	94.79

Table 9 Top Five Best-Performing Countries Ranked by Sharpe Ratio

With Denmark and the Netherlands, two of the CLS leading countries were also among the top five countries with respect to equity performance. Notably, Denmark led both rankings with the highest CLS score, annualized return, and Sharpe Ratio of all countries. Despite emerging markets among the sample period delivering superior performance compared to developed countries, with Mexico, there was only a single emerging market country among the top performers.

When looking at the sustainability scores, it can be seen that Mexico performed significantly worse than countries from developed markets. As examined in the previous chapter, the U.S. had the greatest weight in market cap-weighted portfolios. Ranked second with a Sharpe Ratio close to Denmark, the U.S. was a major performance driver in cap-weighted portfolios. Although the U.S. had a relatively high CLS score, its ESG score was rather low. Though, three of the five leading countries had high CLS and ESG scores as well as superior equity performance, which is in line with literature on the impact of ESG on financial performance and highly in favor of hypotheses 1 and 2 (Friede et al., 2015).

Coming now to the performance of CLS strategies compared to the ACWI. To illustrate the performance against the benchmark, return series were based at 100 and plotted over the sample period.

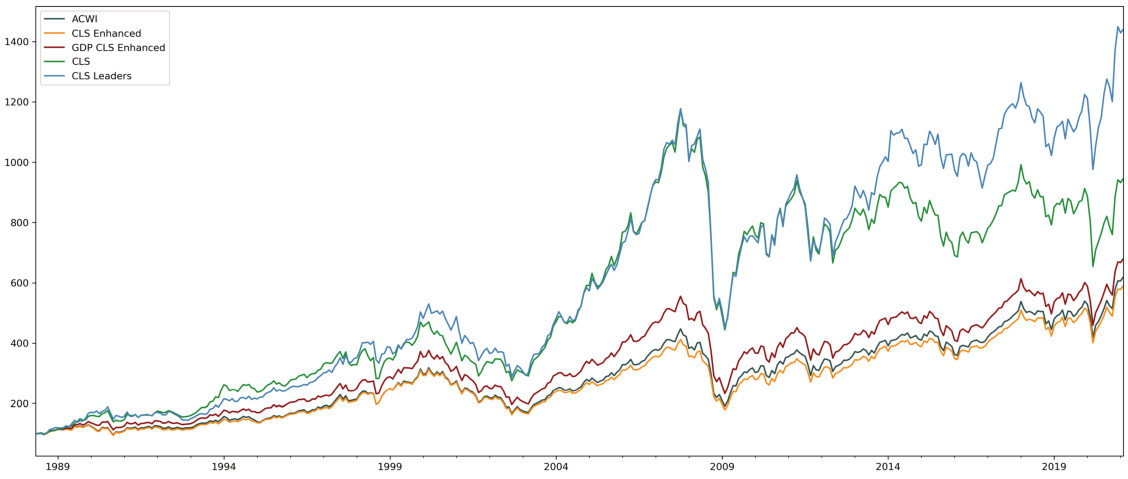


Figure 14 Performance of CLS Strategies vs. ACWI

Except for the CLS Enhanced strategy, all strategies outperformed the market portfolio. However, the tracking error between the CLS Enhanced portfolio and its parent, the ACWI, was very small. Also, the performance of the GDP CLS portfolio was close to the benchmark. Its excess returns may be attributable to increased exposure to emerging market countries. Both the CLS as well as the CLS Leaders portfolios generated outstanding performance compared to the remaining strategies and the benchmark. Occasionally switching the lead, both strategies performed relatively similar up to mid 2013. At this point, the CLS Leaders portfolio decapsulated and substantially outperformed all strategies, resulting

in a final portfolio value more than twice as high as that of the ACWI. Taking a closer look at the risk and return profiles of CLS strategies compared to the benchmark, the following table presents detailed portfolio performance statistics.

Portfolio	Ann. Return	Ann. Vol.	Sharpe Ratio	VaR (95 %)	Max DD.	ESG Score	CLS Score
CLS Leaders	8.46 %	17.78 %	0.33	-7.97 %	-61.50 %	80.80	90.84
CLS	7.08 %	17.75 %	0.26	-8.36 %	-62.25 %	68.73	72.31
GDP CLS Enhanced	6.01 %	15.91 %	0.22	-7.73 %	-58.18 %	65.69	79.64
ACWI	5.71 %	15.84 %	0.20	-7.54 %	-57.45 %	62.44	77.11
CLS Enhanced	5.56 %	15.62 %	0.19	-7.56 %	-56.77 %	65.23	80.73

Table 10 Performance Statistics of CLS Strategies and ACWI

With respect to the sustainability scores, it can be noted that all CLS strategies increased the exposure to ESG. Also, the CLS scores have been increased compared to the benchmark, except for the CLS strategy. As has already been mentioned in the previous chapter, the CLS strategy assigns relatively equal weights, which resulted in a significantly increased allocation towards emerging markets, as shown in Figure 13. Therefore, a lower CLS score is not surprising, but the corresponding ESG score is. Within the increased emerging markets exposure of the CLS strategy, countries with higher CLS scores were overweighted compared to those with lower scores. Those emerging market CLS leaders inflated the ESG score compared to the benchmark portfolio, which provides further evidence in favor of hypothesis 1. When looking at risk and return performance characteristics, there is only a minor gap between the CLS Enhanced portfolio compared to the ACWI. The CLS-integrated strategy was not able to capitalize on the slight increase in CLS and ESG exposure, which opposes hypothesis 2. In contrast, the CLS and CLS Leaders portfolios, which are the only true CLS strategies, delivered superior returns. Although all risk measures report slightly increased risk, the Sharpe Ratios were significantly higher compared to the remaining portfolios.

To check whether the CLS and CLS Leaders strategies' outperformance is

consistent over time, 3-year rolling window returns were computed (see Appendix F2). While the CLS Leaders strategy most of the time outperformed the remaining strategies, the CLS portfolio outperformance was more inconsistent, particularly in recent periods. Overall, especially the CLS Leaders strategy provides strong support for hypotheses 1 and 2, as the strategy significantly increased exposure to ESG and at the same time produced superior portfolio performance.

Chapter 3.1 mentioned the rapid growth of AUM in passive sustainable investing strategies that incorporate ESG metrics in the portfolio construction process. Compared to micro-based ESG strategies, the portfolio construction process of CLS strategies is substantially smarter, as only CLS scores are taken into account. Further, CLS strategies do not rely on the credibility of ESG ratings, as exposure to relatively sustainable firms is expected to increase automatically with greater allocation towards countries with high CLS scores. To analyze whether CLS strategies can take on micro-based ESG strategies with regards to performance, CLS portfolio returns were additionally compared to MSCI ESG Leaders and Universal indices. Especially the comparison between the CLS Enhanced portfolio and the ACWI ESG Universal Index is of high interest as the latter strongly influenced the former strategy and the only difference is that the ACWI's cap weights were not adjusted by micro-level ESG but macro-level CLS weights. Similar to Figure 14, the following graphic illustrates back tested return series based at 100 over the sample period, which, due to the limited data availability of the benchmarks, only covered the period 2010–2021.

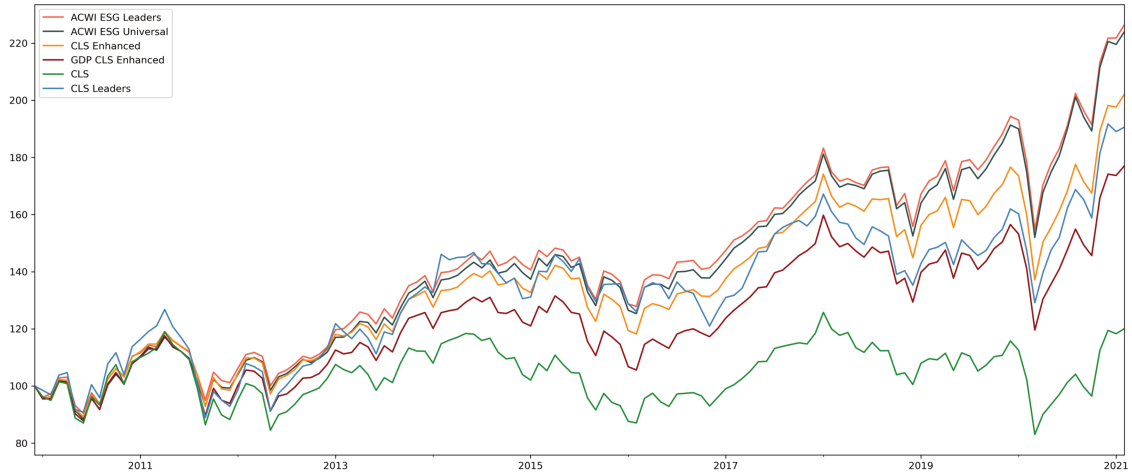


Figure 15 Performance of CLS Strategies vs. ESG Benchmarks

Over the whole period, both ESG benchmarks performed extremely similarly and outperformed CLS strategies. Especially in the second half of the sample period, micro-level sustainable investing strategies performed better than CLS strategies. Before, the CLS Leaders strategy most of the time outperformed ESG benchmarks, which can be seen when looking at 3-year rolling returns (see Appendix F3). In direct comparison to the ACWI ESG Universal index, the CLS Enhanced strategy performed slightly worse over the whole sample period. Also, the GDP CLS Enhanced strategy as well as the CLS strategy underperformed the benchmarks. Taking into account the portfolios' performance statistics, which are presented below, it can be seen that the CLS strategy did especially poor.

Portfolio	Ann. Return	Ann. Volatility	Sharpe Ratio	VaR (95 %)	Max DD.
ACWI ESG Leaders	7.73 %	14.06 %	0.51	-6.96 %	-20.42 %
ACWI ESG Universal	7.61 %	14.35 %	0.49	-7.17 %	-20.58 %
CLS Enhanced	6.59 %	14.93 %	0.41	-7.55 %	-22.34 %
CLS Leaders	5.91 %	16.91 %	0.32	-7.23 %	-29.84 %
CLS GDP Enhanced	5.36 %	15.80 %	0.31	-7.72 %	-25.17 %
CLS	1.78 %	17.47 %	0.07	-7.77 %	-33.99 %

Table 11 Performance Statistics of CLS Strategies and ESG Benchmarks

During the shortened sample period, developed outperformed emerging markets. This explains the poor performance of the CLS GDP Enhanced and especially the CLS portfolios since both strategies had greater exposure to emerging markets. CLS strategies produced lower returns while being riskier compared to ESG benchmarks. With no information about historical country weights of the ESG benchmarks available, CLS and ESG scores could not be compared. It can be concluded that CLS strategies were not able to match the performance of ESG benchmarks. However, the sample period had to be decreased substantially, which reduces the significance of the results. The performance of CLS strategies against ESG benchmarks may be a topic for future research once there is longer return series available.

While the results of the CLS strategies seem to be flawed by the worse performance of emerging markets in recent periods, the performance of CLS strategies was additionally analyzed split into developed and emerging markets. This time, the MSCI World and Emerging Markets indices served as benchmarks the CLS strategies were compared against. Again, based at 100, CLS portfolio performance was plotted against standard and ESG benchmarks over the sample period. In the study of CLS strategies' performance compared to ESG benchmarks, the sample period was reduced according to data availability of the benchmarks.

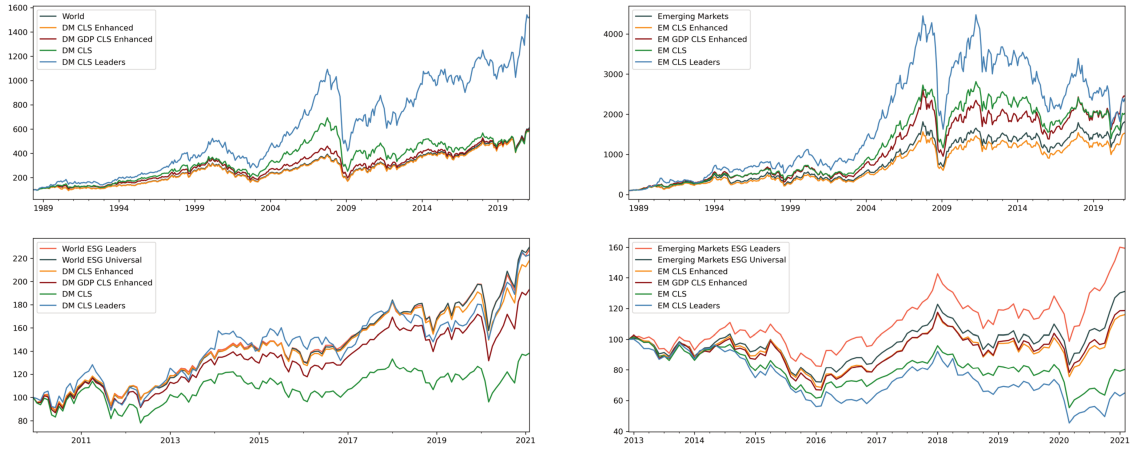


Figure 16 Performance of CLS Strategies vs. World/Emerging Markets (ESG)

Starting with the results of developed markets (labeled DM), which are presented in the first column. Since the CLS Leaders portfolio performance was primarily driven by Denmark, Germany, and other developed markets countries, it's not surprising that the performance of the DM CLS Leaders strategy looks very similar to the ACWI scenario as it significantly overweighted these countries (see Appendix F4). Analyzing the performance of the DM CLS portfolio confirms the assumption that the CLS strategy's performance was driven by increased emerging market exposure. In the developed markets scenario, the performance was much closer to the market portfolio. Moreover, the DM CLS strategy, in this case, had the second-highest CLS and ESG scores, confirming the assumption that the CLS portfolio's scores were deflated by increased emerging markets exposure (see Appendix F5). Both the DM CLS Enhanced and GDP CLS Enhanced portfolios performed very similarly to the benchmark. With a 0.01 higher Sharpe Ratio the MSCI World's outperformance against its CLS-adjusted versions was

negligibly small. The portfolio statistics provide further evidence for hypothesis 1 as all CLS strategies increased ESG exposure compared to the benchmark (see Appendix F5). The DM CLS Leaders portfolio's superior performance, which is almost consistent over the sample period when looking at rolling returns, provides further evidence in strong support for hypothesis 2 (see Appendix F6). The underperformance of the remaining portfolios may be interpreted as evidence opposing hypothesis 2, however, the lag was extremely small. With respect to the performance of CLS strategies against MSCI World ESG benchmarks in the developed markets scenario, the picture was very similar to the ACWI scenario. Notably, the performance gap between the CLS Enhanced version and its parent index, this time, the MSCI World ESG Universal Index, had been reduced. Though, based on Sharpe Ratios the ESG benchmarks still outperformed CLS strategies (see Appendix F7).

Now coming to the emerging markets performance of CLS strategies (labeled EM), which is presented in the second column of figure 16. Comparing the performance of the EM CLS Enhanced portfolio with that of its benchmark, the MSCI Emerging Markets, again, the CLS-integrated version performed worse, which opposes hypothesis 2. Looking at performance statistics, the CLS-integrated version produced slightly less returns at almost the same level of volatility, which resulted in a 0.02 lower Sharpe Ratio (see Appendix F8). In contrast to the ACWI and developed markets scenarios, the EM GDP CLS Enhanced strategy was able to significantly set itself apart from the market portfolio. However, when looking at rolling returns, the outperformance is attributable to only a few periods of outstanding returns with performance otherwise close to the market (see Appendix F6). While having produced slightly less returns than the EM CLS GDP Enhanced portfolio, the EM CLS portfolio was significantly less volatile, resulting in the highest Sharpe Ratio. Rolling returns show that up to the financial crisis, the EM CLS Leaders portfolio outperformed the remaining strategies as well as the benchmark almost all of the time. Yet, in the aftermath of the crisis, it performed in line with the other portfolios and substantially worse in recent periods. This is attributable to its great exposure to Greece and Poland, which were the leading emerging market countries in the CLS index and significantly underperformed the market during this period (see Appendix F9). In terms of sustainability, all but one

strategy outperformed the benchmark. Although the EM CLS GDP Enhanced portfolio had a higher CLS score compared to the benchmark, its ESG score was slightly lower. This can be explained by the increased exposure to China in the case of the EM CLS GDP Enhanced strategy, and thus is not opposing hypothesis 1, as it rather shows that due to the CLS adjustment the ESG score could have been brought almost to the same level (see Appendix F8). For the remaining strategies, CLS integration would have increased ESG exposure, supporting hypothesis 1. With mixed results in terms of performance, hypothesis 2 is only partly supported. Looking at the performance of CLS strategies against ESG benchmarks, once more the ESG benchmarks outperformed CLS strategies. However, due to limited data availability, the sample period was even shorter, covering only around eight years from 2013 to 2021. The EM CLS Enhanced strategy was not able to match the performance of the Emerging Markets ESG Universal Index lagging around 0.1 in Sharpe Ratio (see Appendix F10). Taking into account rolling returns only the EM GDP CLS Enhanced strategy was able to outperform ESG benchmarks in single periods (see Appendix F6). Due to their large exposure to Greece, both true CLS strategies performed substantially worse than the other strategies.

Having analyzed the impact of CLS on the performance of global equity portfolios against traditional cap-weighted benchmarks in three different scenarios, it can be concluded that in almost every case CLS integration increased ESG exposure. In the few exceptions where this was not the case, it could be explained by increased exposure to emerging markets. When taking this into account, all CLS strategies increased ESG exposure, which in addition to the regression results from chapter 5.2, is in line with preceding research and strongly supporting hypothesis 1 (e.g., Boulouta & Pitelis, 2014; Hult et al., 2018; Seitz, 2015). Drawing on findings from the literature review, hypothesis 2 assumes CLS strategies to outperform traditional market cap-weighted benchmarks by capitalizing on the increased ESG exposure. Only the CLS Leaders strategy outperformed traditional benchmarks in all scenarios, indicating that a substantial increase in CLS, and thus ESG was necessary to generate robust outperformance. The CLS Enhanced portfolios, which were closest to the market betas, slightly underperformed their parent indices in every scenario. In the developed markets scenario,

the remaining strategies were pretty much in line with the MSCI World Index. In contrast, when looking at emerging markets, the remaining CLS strategies outperformed the market portfolio, which is in line with preceding research on the performance of ESG-integrated portfolio performance in emerging markets (Sherwood & Pollard, 2017). Overall, the back test results provide mixed evidence for hypothesis 2 and indicate that the impact of CLS on equity returns is stronger in emerging than in developed markets. In contrast, when comparing the performance of CLS strategies against ESG benchmarks, CLS-integrated portfolios do better in developed than emerging markets. However, in all cases, CLS portfolios underperformed ESG benchmarks.

In contrast to common sustainable investing practice, CLS strategies do not exclude constituents from the underlying universe, and thus still expose investors to unsustainable or controversial companies. Inferior financial performance of unsustainable business practices may explain CLS strategies' lag behind ESG benchmarks. For example, Verheyden et al. (2016) showed that global equity portfolio returns can be enhanced by excluding the lowest scoring firms with respect to ESG. Including a negative screening module, which systematically excludes firms from the investment universe that are associated with unsustainable business activities, may close the gap towards pure ESG strategies and make CLS strategies truly sustainable investing strategies. The performance of such hybrid strategies that combine CLS with micro-level negative screening could be a promising topic for future research. The next chapter provides evidence for hypothesis 3 by accounting for risk factor exposure in CLS strategies' performance.

5.5 Performance of CLS Strategies Through a Factor Lens

Chapter 5.3 showed that CLS integration led to, sometimes substantial, changes in the portfolio composition compared to the market portfolio. Those changes may result in exposure towards common risk factors. Also, the increased allocation towards ESG might have resulted in correlation of CLS portfolio returns with that of risk factors. Several studies on the relationship between ESG and financial performance reported ESG-integrated portfolios to be tilted towards large cap stocks as well as firms with high book-to-market ratios (Madhavan et al., 2021).

Moreover, in some cases, positive loadings on the RMW and CMA factors were found, indicating greater exposure towards more profitable and conservatively investing companies (Alessandrini & Jondeau, 2020). To uncover whether CLS strategies would have exposed investors towards common risk factors, portfolio returns were regressed against benchmark and factor returns in several factor models. Besides shedding additional light on the risk and return characteristics of CLS strategies, the regression results provide evidence for hypothesis 3 by checking whether the occasional outperformance of CLS strategies is attributable to increased risk factor exposure or if CLS strategies, especially the CLS Leaders strategy, can produce statistically significant positive alpha. Starting with the CLS Enhanced strategies, factor loadings, as well as betas and annualized alphas, are presented in the table below.

	CLS Enhanced				GDP CLS Enhanced			
	CAPM	**3-Fac.**	**4-Fac.**	**5-Fac.**	**CAPM**	**3-Fac.**	**4-Fac.**	**5-Fac.**
RMW				-0.022				-0.062**
CMA				0.059***				0.012
WML			-0.005	-			0.002	-
SMB		-0.033***	-0.032***	-0.034***		0.069***	0.068***	0.057***
HML		0.006	0.003	-0.024**		0.058***	0.059***	0.054***
β	0.978***	0.977***	0.976***	0.983***	1.010***	1.014***	1.014***	1.008***
α	0.000	0.000	0.001	0.001	-0.001	-0.005	-0.005	-0.002
Obs.	344	344	344	344	344	344	344	344
R2	0.995	0.995	0.995	0.996	0.983	0.984	0.984	0.984
*p<0.1; **p<0.05; ***p<0.01; α annualized								

Table 12 Factor Regression Results of CLS Enhanced Strategies

In line with the back test results, a CAPM beta lower than 1 indicates that the CLS Enhanced strategy was less exposed to systematic risk. Despite its under-performance, alpha remains neutral, meaning that the reduced risk exposure explains the lag in performance. The highly statistically significant negative factor loadings on the SMB factor in all factor models show that the CLS Enhanced portfolio was tilted towards large cap stocks. While this might be a sign of increased ESG exposure, presumably, for the most part, the effect is driven by the high concentration in large cap stocks of the parent index (MSCI, 2021b). In the five-factor model, also loadings on the HML and CMA factors are statistically

significant, indicating that the CLS Enhanced portfolio had decreased exposure to value stocks and increased exposure to firms with less aggressive investment behavior. When looking at the developed markets scenario, almost all factor loadings are near 0 with a small positive exposure towards conservatively investing companies (see Appendix G1). Notably, the DM CLS Enhanced portfolio produced small negative annualized alphas of 0.1 %, which result from the portfolio's lag in return at almost the same level of risk compared to the market. Also, in the emerging market scenario, the CLS Enhanced strategy had betas very close to its benchmark and a small lag in return, however, the negative alphas are not statistically significant (see Appendix G2). Except for a small negative loading on the Momentum factor, which may explain parts of the reduced return compared to the Emerging Market Index, there was no noteworthy risk factor exposure. Overall, the CLS Enhanced strategy increased exposure to ESG without tilting the portfolio away from the market beta, though, at a small cost in performance.

Moving on to the GDP CLS Enhanced strategy, betas indicate a slight increase in risk exposure compared to the ACWI, which is in line with findings from Hamza et al. (2007), who also report increased levels of risk in GDP-weighted global equity portfolios. As mentioned in the performance analysis, the increased risk exposure most likely stems from increased exposure to emerging market countries in GDP-weighted strategies. In contrast to the CLS Enhanced strategy, loadings on the SMB factor are positive in all models, indicating higher exposure to small cap stocks. Further, the portfolio had significant exposure to value stocks. Both findings were also reported by a related study on fundamentally-weighted indices (Deutsche Asset & Wealth Management, 2014). Against the findings from Alessandrini and Jondeau (2020), the CLS-integrated portfolio had a negative exposure to the RMW factor, which may also result from an increased exposure towards emerging markets, because the effect is reduced and insignificant in the developed markets scenario (see Appendix G1). Except for a positive loading on the Momentum factor, the remaining factors are almost identical to the ACWI results. As was the case for the CLS Enhanced strategy, alphas are negative. Especially in the four-factor model, the lag in performance is highly statistically significant with an annualized negative alpha of 1 %. Conversely, in the emerging market scenario, where the EM GDP CLS Enhanced portfolio significantly

outperformed the market, alphas are positive in all models, though not statistically significant (see Appendix G2). Notably, the EM CLS GDP Enhanced portfolio was substantially less exposed to systematic risk and the effect on the CMA factor loading turned negative and insignificant. The CLS GDP Enhanced strategy confirms the finding from the performance analysis that especially in emerging markets CLS integration can add value.

Coming to the true CLS strategies. With the CLS strategy showing characteristics of an equally-weighted strategy, the respective portfolios might show similar risk factor exposures as plain equally-weighted global equity portfolios. For example, Hamza et al. (2007) argue that equally-weighted portfolios are greater allocated towards countries with relatively low market capitalization, and thus capture a size premium. Indeed, when looking at the table below, factor loadings on the SMB factor are positive and highly statistically significant.

	CLS				CLS Leaders			
	CAPM	3-Fac.	4-Fac.	5-Fac.	CAPM	3-Fac.	4-Fac.	5-Fac.
RMW				-0.096				0.076
CMA				-0.060				-0.112
WML			0.023	-			0.043	-
SMB		0.326***	0.324***	0.306***		0.225***	0.217***	0.233***
HML		0.188***	0.199***	0.210***		0.030	0.052	0.085
β	1.099***	1.121***	1.126***	1.101***	1.025***	1.032***	1.043***	1.025***
α	0.001	-0.011	-0.013	-0.006	0.019	0.016	0.011	0.014
Obs.	344	344	344	344	344	344	344	344
R2	0.906	0.924	0.924	0.924	0.826	0.832	0.833	0.833
*p<0.1; **p<0.05; ***p<0.01; α annualized								

Table 13 Factor Regression Results of CLS and CLS Leaders Strategies

Moreover, loadings on the value factor (HML) are positive and statistically significant, which may result from the increased ESG exposure compared to the ACWI. Betas indicate a greater level of systematic risk, most likely resulting from an increased allocation towards emerging markets as was the case for the GDP CLS Enhanced strategy. Although the CLS portfolio substantially outperformed its benchmark, alphas are negative when looking at the multi-factor models, though, not statistically significant. While the CLS portfolio is dominated by developed

countries due to their higher CLS scores, the regression results in the developed markets scenario are almost identical (see Appendix G3). However, representing the inferior performance against the MSCI World, the negative annualized alpha of 1.7 % is statistically significant at the 10 %-level in the four-factor model. With respect to emerging markets, the CLS strategy incorporated far less systematic risk (see Appendix G4). A possible explanation for this effect might be reduced concentration in single countries compared to the benchmark and additionally, the relatively low correlation among countries within emerging markets compared to developed markets (Melas, 2019). As was the case for the EM CLS Enhanced strategies, the EM CLS portfolio had a negative loading on the Momentum factor. Moreover, it was positively tilted towards the CMA factor, which is in line with findings from studies on factor exposure of ESG strategies (Alessandrini & Jondeau, 2020).

Finally, the CLS Leaders strategy was the only one producing positive alpha in all factor models. Annualized alphas of up to 1.9 % would indicate substantial added value, however, the effect was not statistically significant. Again, across all models, the SMB factor was positive and significant. With great allocations towards countries with relatively low market capitalization, such as Denmark and Finland, the positive SMB loading can also be explained by the size effect reported by Hamza et al. (2007). As already indicated by the risk measures of the performance analysis, betas show that the CLS Leaders portfolio had a slightly greater level of systematic risk. In contrast to the CLS strategy, there was no significant tilt towards value stocks. With exactly the same constituents assigned heavy weights, regression results in the developed markets scenario were almost identical to those in the ACWI scenario (see Appendix G3). Only the loading on the CMA factor became additionally significant in the developed markets scenario, indicating that in developed markets CLS increases exposure to firms with aggressive investment behavior. Similar to the CLS strategy, regression results were significantly different in the emerging markets case (see Appendix G4). Again, the CLS strategy had less systematic risk exposure with betas below 1 across all models. Also, the loadings on the HML factor were positive and significant. With this being the case in both true CLS strategies, it can be assumed that CLS strategies expose investors towards value stocks in emerging markets.

Further, the loadings on the SMB factor were positive and highly statistically significant. Over all models and regional scopes both true CLS strategies had significant loadings on the SMB factor, meaning that, due to the increased allocation towards countries with relatively small market capitalization, CLS captures a size premium. Moreover, once more the loading on the Momentum factor was negative and statistically significant in the emerging markets scenario. Therefore, it can be noted that CLS strategies tilt investors away from Momentum premia in emerging markets. While in developed markets the CLS Leaders portfolio was tilted towards firms with aggressive investment behavior, the opposite was the case in emerging markets.

Summarizing the insights from several factor regressions of CLS strategies' portfolio returns in the ACWI, developed, and emerging markets scenarios, it can be noted that CLS strategies would have exposed investors to traditional risk factors. Especially size and value premia were captured by most strategies. When looking at developed markets, CLS integration increased the exposure to systematic risk. In contrast, CLS had risk-reducing effects in emerging markets. Further, all portfolios would have tilted investors away from the Momentum effect in emerging markets. None of the analyzed CLS-integrated global equity portfolios was able to generate a statistically significant positive alpha. Therefore, hypothesis 3 has to be rejected. While CLS strategies were not able to generate additional value, they also did not destroy value in most cases. Investors that wanted to increase their exposure towards comparatively sustainable countries and hence ESG without losing value compared to market capitalization-weighted benchmarks, may have done so by integrating CLS scores into the construction process of global equity portfolios.

6 Conclusion

Building on evidence for a positive relationship between macro- and micro-level sustainability, this thesis examined the effect of integrating CLS into global equity portfolios. Having analyzed back tested performance of different CLS strategies in a 33-year period, it can be concluded that, in most cases, CLS integration would neither have generated additional value nor destroyed value compared to market capitalization-weighted portfolios. Notably, the effect of CLS on portfolio performance seems to be more pronounced in emerging markets.

In order to incorporate CLS into global equity portfolios, historical sustainable development data was collected for more than 50 developed and emerging market countries and aggregated into a novel CLS index. Ranking and mapping countries based on their CLS scores revealed great differences between countries from developed and emerging economies as well as within those classes. While Nordic European countries almost all of the time led the CLS ranking, South Asian countries made up the bottom. Combined with ESG scores into a panel data set, several regression models provided empirical evidence supporting hypothesis 1, since there was a statistically significant positive relationship between macro- and micro-level sustainability. Notably, the sustainability score pairs revealed a pattern that in developed markets CLS moderated ESG while in most emerging market countries ESG led CLS. Inspired by smart beta and common sustainable investing practice, CLS strategies were designed that reweight the country indices underlying the ACWI. Adjusting market cap weights by CLS tilted portfolios away from emerging markets while a simple CLS-weighted strategy increased allocation towards emerging markets due to greater homogeneity in CLS scores compared to countries' stock market capitalizations. Although CLS integration increased ESG exposure of portfolios, this did not consistently translate into better risk-adjusted returns compared to market benchmarks, and therefore provided mixed evidence for hypothesis 2. Only portfolios that heavily overweighted CLS leaders outperformed the market in all cases. Moreover, the back test results indicate that CLS integration had stronger performance-enhancing effects in emerging markets. Surprisingly, CLS portfolios were not able to match the performance of ESG-integrated benchmarks, indicating that bottom-up sustainable

investing strategies are not substitutable by a top-down CLS approach. Deconstructing CLS portfolios' returns in risk factor models led to a rejection of hypothesis 3, as no CLS strategy generated a statistically significant positive alpha. Resulting from greater allocation towards countries with relatively small market capitalizations, CLS strategies tended to capture a size premium. With betas showing decreased systematic risk exposure in emerging and increased exposure in developed markets, again, there were signs of structural differences between emerging and developed markets with regards to the impact of CLS.

This study has a few limitations. Due to limited data availability, especially in emerging market countries, it had to be dealt with sometimes large data gaps, making the CLS index more homogenous and reducing its significance. Further, the study on the relationship between macro- and micro-level sustainability had to be reduced by 20 years and nine countries because of limitations in the ESG data set. While all missing countries are from emerging markets their inclusion might have impacted the results. Further, the MSCI ESG benchmarks had less than 12 years of historical return series in some cases, making the comparison against CLS strategies less meaningful. Finally, by setting ESG scores of firms listed in a given country in perspective to the CLS score of that country assumes the respective firms' business practices to be located in the same country, which has not to be the case. For example, multinationals operate in many different countries.

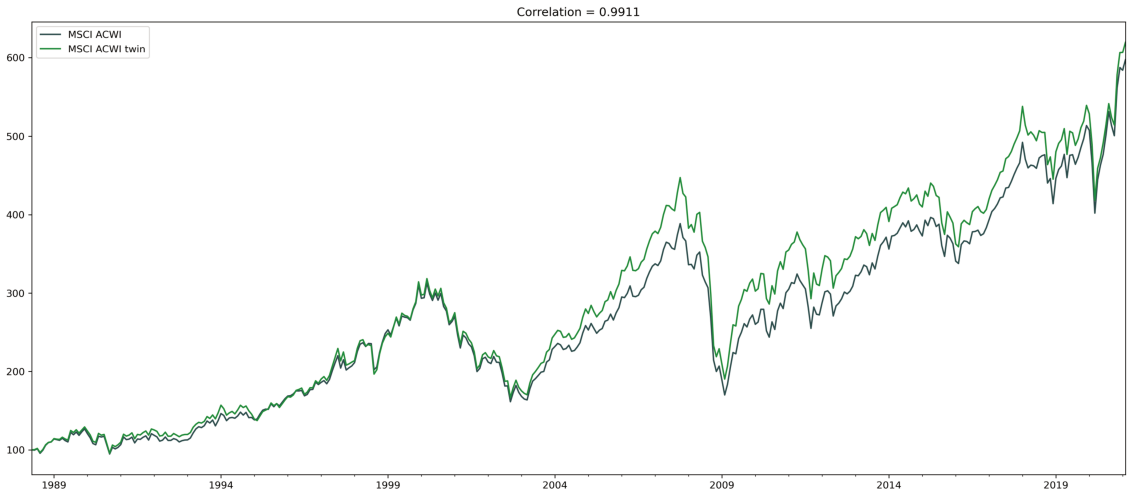
The aforementioned limitations can be translated into recommendations for future research. It may be worthwhile to conduct another empirical study on the relationship between CLS and ESG drawing on further back dating ESG data. Having mentioned the divergence between ESG ratings, future research may also include ESG scores from multiple providers and take into account average scores to improve robustness. To confirm the inferiority of top-down CLS strategies against micro-level ESG strategies evidence from longer time periods is necessary and could be provided once longer return series are available or alternatively, one could calculate custom ESG benchmarks. Moreover, with studies providing evidence for ESG-integrated portfolios being more robust during bear markets, future research could analyze the impact of CLS on portfolio

performance during downturns (Nofsinger & Varma, 2014). With significant differences in how countries cope with the COVID-19 crisis, the performance of CLS strategies during the related downturn may provide valuable insights. Since this study totally ignored transaction cost, inclusion in future studies on the performance of CLS strategies compared to benchmarks could be interesting because CLS strategies may produce far less turnover than, for example, ESG-integrated portfolios. Ultimately, expanding CLS strategies by a negative screening feature from common sustainable investing approaches may improve portfolio performance and make CLS strategies truly sustainable. Comparing the performance of such hybrid strategies with that of traditional and ESG benchmarks could yield valuable insights.

This thesis contributes to different lines of research. Having aggregated a novel CLS index containing more than 30 years of historical data extends the landscape of CLS beyond 2000, and thus adds to literature generally related to sustainable development. Further, this study contributes to research on the macro–micro sustainability relationship by providing new evidence on the relation including all dimensions of sustainable development and drawing on a sample covering a large set of countries as well as a comparatively long period of time. Shedding light on the impact of CLS on the performance of equity portfolios, this study further adds to literature on sustainable investing. Overall, the insights have implications for investors by showing that a macro approach to sustainable investing neither adds nor destroys value in most cases as well as for policy makers by emphasizing the crucial role of the private sector in national sustainable development.

Appendices

Appendix A: Performance of ACWI Twin vs. ACWI



Appendix B: CLS Index Data Sources

Goal	Dimension	Data used	Raw Data	Data Source
1) No Poverty	Social	- Share of population living at less than $1.90 a day		World Bank (2021a)
2) Zero Hunger	Social	- Global Food Security Index	Example sub-indicators: - Average food costs - Sufficiency of supply - Volatility of agricultural production - Nutritional standards and food safety	Economist intelligence unit (2021)
3) Good Health & Well-Being	Social	- Life Expectancy Index	- Life expectancy at birth	UNDP (2021)
4) Quality Education	Social	- Education Index	- Expected years of schooling - Mean years of schooling	UNDP (2021)
5) Gender Equality	Social	- Gender Inequality Index	- Maternal mortality ratio - Adolescent birth rates - Proportion of parliamentary seats occupied by females - Proportion of adult females and males aged 25 years and older with at least some secondary education - Labor force participation rate of female and male populations aged 15 years and older	UNDP (2021)
6) Clean Water & Sanitation	Environmental	- Sanitation & Drinking Water	- Unsafe sanitation - Unsafe drinking water	EPI (NASA, 2021)
7) Affordable & Clean Energy	Social	- Share of population with access to electricity - Share of renewable energy consumption - Energy intensity level of primary energy (MJ/$2011 PPP GDP)		World Bank (2021a)
8) Efficient Work & Economic Growth	Economic	- GDP per person employed (constant 2017 PPP $) - GDP per capita, PPP (constant 2017 international $) - Children in employment, total (% of children ages 7-14) - Informal employment (% of total non-agricultural employment) - Unemployment, total (% of total labor force)		World Bank (2021a)

Appendix B: CLS Index Data Sources (continued)

9) Industry Innovation & Infrastructure	Economic	- Mobile phone subscription (per 100 people) - Share of internet users - Research and development expenditure (% of GDP) - Researchers in R&D (per million people)		1 & 2: UNDP (2021) 3 & 4: World Bank (2021a)
10) Reduced Inequalities	Social	- Coefficient of Human Inequality	- Nutrition - Child mortality - Years of schooling - School attendance - Income per capita	UNDP (2021)
11) Sustainable Cities & Communities	Social	- Share of population living in slums		World Bank (2021a)
12) Responsible Consumption & Production	Environmental	- Pollution - Waste Management - Heavy Metals - Agriculture	Example sub-indicators: - lead exposure - Controlled solid waste - NOx growth rate - Sustainable nitrogen management	EPI (NASA, 2021)
13) Climate Action	Environmental	- Climate Change	Example sub-indicators: - CO2 growth rate - GHG intensity trend - GHG per capita - N2O growth rate	EPI (NASA, 2021)
14) Life Below Water	Environmental	- Fisheries - Biodiversity & Habitat	Example sub-indicators: - Fish stock status - Fish caught by trawling - Marine protected areas	EPI (NASA, 2021)
15) Life on Land	Environmental	- Ecosystem management - Biodiversity & Habitat	Example sub-indicators: - Protected areas - Species habitat index - Species protection index - Biodiversity habitat index - Tree cover loss	EPI (NASA, 2021)
16) Peace, Justice & Strong Institutions	Social	- World Governance Indicators - Freedom in the World Index	- Voice and Accountability - Political Stability & Absence of Violence - Government Effectiveness - Regulatory Quality - Rule of Law - Control of Corruption 25 different civil and political rights indicators Example sub-indicators: - Electoral process - Functioning of the government - Freedom of expression of belief	World Bank (2021c) & Freedom House (2021)
17) Partnerships for The Goals	Economic	- Foreign direct investment, net inflows (% of GDP) - Tax revenue (% of GDP)		World Bank (2021a)

Appendix C: MSCI ESG Framework (MSCI, 2020a)

3 Pillars	10 Themes	35 ESG Key Issues	
Environment	**Climate Change**	Carbon Emissions Product Carbon Footprint	Financing Environmental Impact Climate Change Vulnerability
	Natural Capital	Water Stress Biodiversity & Land Use	Raw Material Sourcing
	Pollution & Waste	Toxic Emissions & Waste Packaging Material & Waste	Electronic Waste
	Environmental Opportunities	Opportunities in Clean Tech Opportunities in Green Building	Opportunities in Renewable Energy
Social	**Human Capital**	Labor Management Health & Safety	Human Capital Development Supply Chain Labor Standards
	Product Liability	Product Safety & Quality Chemical Safety Financial Product Safety	Privacy & Data Security Responsible Investment Health & Demographic Risk
	Stakeholder Opposition	Controversial Sourcing Community Relations	
	Social Opportunities	Access to Communications Access to Finance	Access to Health Care Opportunities in Nutrition & Health
Governance*	**Corporate Governance**	Ownership & Control Board	Pay Accounting
	Corporate Behavior	Business Ethics Tax Transparency	

Appendix D: Mean CLS Score Country Ranking

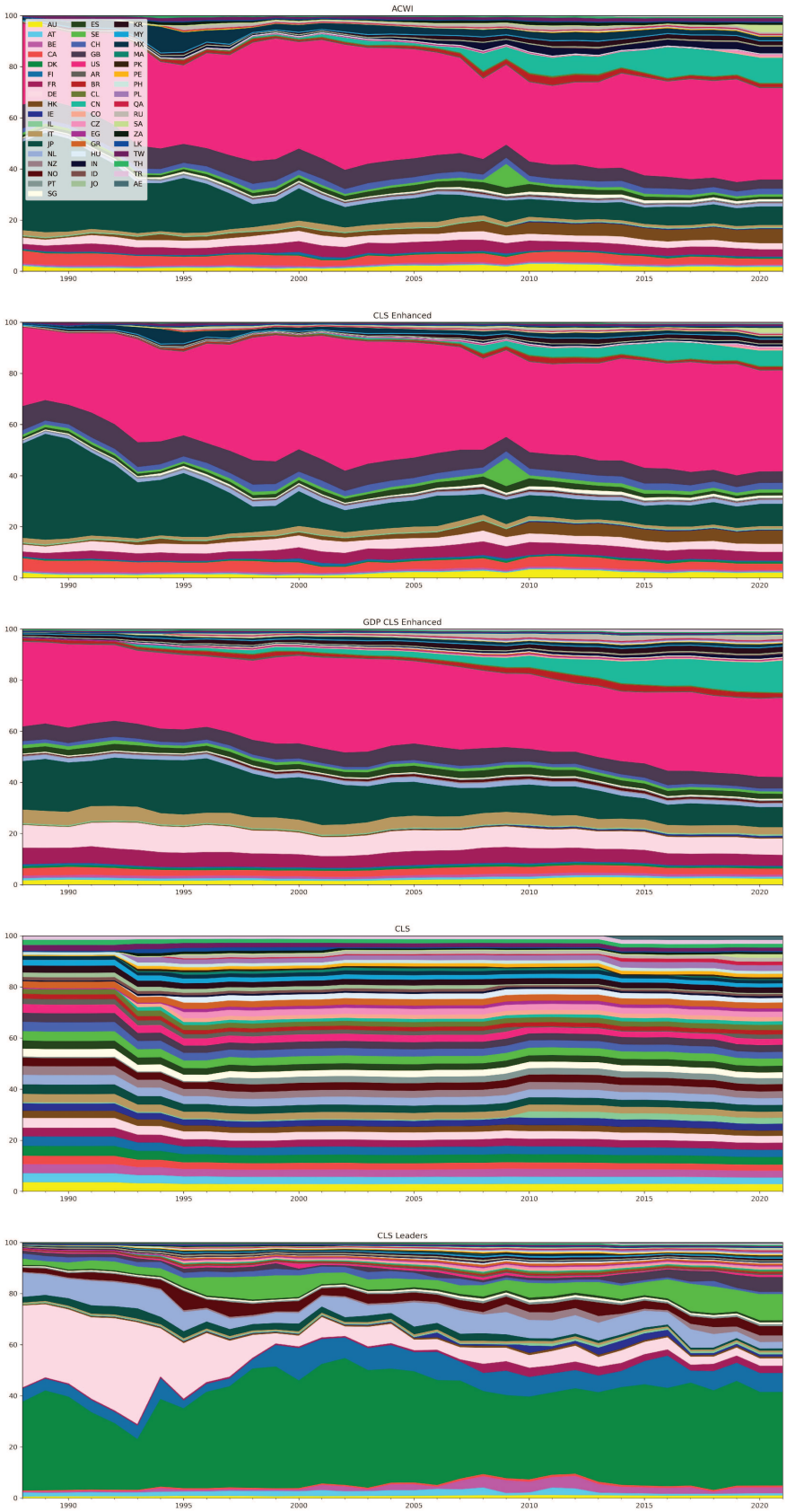
1. Denmark	12. France	23. Greece	34. UAE	45. Peru
2. Finland	13. New Zealand	24. Czechia	35. Colombia	46. Philippines
3. Germany	14. Ireland	25. Poland	36. Mexico	47. Egypt
4. Netherlands	15. Australia	26. Hong Kong	37. Brazil	48. Morocco
5. Sweden	16. United States	27. Korea	38. Thailand	49. Indonesia
6. Norway	17. Italy	28. Hungary	39. Turkey	50. South Africa
7. Japan	18. Canada	29. Chile	40. Qatar	51. Pakistan
8. Belgium	19. Spain	30. Malaysia	41. Saudi Arabia	52. India
9. UK	20. Singapore	31. Argentina	42. Jordan	
10. Austria	21. Israel	32. Russia	43. Sri Lanka	
11. Switzerland	22. Portugal	33. Taiwan	44. China	

Appendices E

Appendix E1: Mean ACWI and CLS Portfolios' Country Weights

ACWI		CLS Enhanced		GDP CLS Enhanced		CLS		CLS Leaders	
US	37.54%	US	39.95%	US	30.91%	DK	3.28%	DK	37.74%
JP	13.33%	JP	14.82%	JP	13.87%	FI	3.16%	DE	11.51%
GB	6.73%	GB	7.42%	DE	8.16%	DE	3.15%	FI	7.07%
CN	4.56%	FR	3.77%	GB	5.60%	NL	3.14%	NL	6.45%
CA	3.50%	DE	3.56%	FR	5.41%	SE	3.13%	SE	5.55%
FR	3.39%	CA	3.55%	CN	4.86%	NO	3.05%	NO	3.51%
MX	3.20%	HK	2.79%	IT	4.26%	JP	2.96%	JP	2.07%
HK	3.00%	CN	2.56%	CA	2.61%	BE	2.95%	GB	1.97%
DE	2.98%	CH	2.31%	ES	2.25%	GB	2.93%	BE	1.90%
SA	2.12%	MX	1.96%	AU	1.84%	CH	2.93%	AT	1.66%
CH	2.06%	AU	1.92%	NL	1.75%	AT	2.93%	CH	1.63%
AU	1.77%	NL	1.70%	KR	1.68%	FR	2.90%	FR	1.61%
IN	1.56%	ES	1.54%	BR	1.59%	NZ	2.88%	NZ	1.24%
ES	1.55%	IT	1.45%	RU	1.34%	IE	2.84%	IE	1.03%
NL	1.43%	SE	1.44%	CH	1.17%	AU	2.80%	IL	0.77%
IT	1.39%	SA	1.37%	MX	1.12%	US	2.79%	US	0.74%
KR	1.30%	KR	1.18%	SE	1.11%	IT	2.76%	AU	0.71%
ZA	1.23%	RU	0.80%	BE	0.96%	CA	2.68%	PT	0.70%
RU	1.21%	TW	0.77%	AT	0.80%	ES	2.61%	IT	0.69%
SE	1.20%	BR	0.73%	NO	0.73%	SG	2.57%	CA	0.67%
TW	1.19%	SG	0.71%	DK	0.73%	GR	2.53%	ES	0.66%
BR	1.12%	BE	0.64%	IN	0.64%	PT	2.43%	CZ	0.65%
SG	0.71%	ZA	0.53%	SA	0.64%	IL	2.41%	SG	0.65%
BE	0.57%	DK	0.50%	TR	0.64%	HK	2.34%	PL	0.64%
TH	0.41%	FI	0.47%	PL	0.64%	PL	2.31%	GR	0.64%
DK	0.39%	IN	0.45%	TW	0.57%	CZ	2.30%	HU	0.60%
FI	0.39%	NO	0.37%	FI	0.56%	KR	2.30%	HK	0.59%
ID	0.36%	IL	0.33%	AR	0.51%	HU	2.11%	KR	0.58%
CL	0.32%	TH	0.26%	IL	0.47%	CL	2.02%	AE	0.54%
IL	0.32%	CL	0.25%	ID	0.45%	AE	1.82%	CL	0.51%
NO	0.31%	AE	0.24%	GR	0.44%	MY	1.81%	RU	0.46%
AE	0.30%	IE	0.22%	AE	0.44%	AR	1.77%	CO	0.46%
TR	0.26%	AT	0.20%	HK	0.41%	TW	1.72%	MY	0.45%
PH	0.21%	CZ	0.19%	IE	0.41%	CO	1.65%	SA	0.44%
IE	0.21%	ID	0.17%	PT	0.39%	RU	1.63%	TW	0.42%
QA	0.21%	PL	0.17%	SG	0.34%	MX	1.62%	QA	0.41%
CZ	0.20%	TR	0.16%	TH	0.32%	BR	1.62%	BR	0.41%
AT	0.18%	GR	0.15%	CZ	0.28%	TH	1.61%	MX	0.41%
PL	0.17%	PT	0.14%	CO	0.27%	TR	1.57%	AR	0.40%
MY	0.17%	QA	0.13%	NZ	0.27%	JO	1.56%	TH	0.40%
CO	0.15%	NZ	0.12%	MY	0.26%	LK	1.44%	TR	0.40%
GR	0.15%	MY	0.12%	CL	0.23%	SA	1.41%	EG	0.35%
PT	0.15%	CO	0.11%	ZA	0.22%	QA	1.39%	PE	0.35%
AR	0.13%	PH	0.10%	HU	0.18%	PH	1.28%	CN	0.35%
NZ	0.11%	AR	0.09%	EG	0.17%	CN	1.26%	JO	0.33%
EG	0.10%	EG	0.05%	PH	0.16%	PE	1.25%	PH	0.32%
PE	0.09%	PE	0.05%	QA	0.15%	EG	1.24%	MA	0.31%
PK	0.07%	HU	0.04%	PE	0.11%	ID	1.16%	LK	0.31%
MA	0.05%	MA	0.02%	PK	0.08%	MA	1.09%	ID	0.30%
HU	0.04%	PK	0.02%	MA	0.06%	ZA	1.05%	ZA	0.29%
JO	0.03%	JO	0.02%	LK	0.03%	PK	0.70%	IN	0.19%
LK	0.01%	LK	0.01%	JO	0.02%	IN	0.68%	PK	0.18%

Appendix E2: ACWI and CLS Portfolios' Country Weights Over Time



Appendices F

Appendix F1: Country Indices Performance Ranked by Sharpe Ratio

	Ann. Return	Ann. Volatility	Sharpe Ratio	VaR (95 %)	Max DD.	ESG Score	CLS Score
DK	11.01%	19.26%	0.43	-8.75%	-56.44%	85.78	99.98
US	8.69%	14.62%	0.42	-6.89%	-52.22%	60.37	82.74
CH	8.58%	16.32%	0.37	-7.09%	-49.01%	82.12	87.47
MX	10.73%	28.71%	0.28	-11.46%	-67.75%	50.59	48.64
NL	7.34%	18.56%	0.26	-8.50%	-61.44%	86.00	94.79
CL	8.40%	24.50%	0.24	-9.55%	-70.57%	64.65	56.37
SE	8.01%	24.14%	0.23	-11.19%	-73.78%	89.43	94.77
PE	8.64%	29.84%	0.22	-11.99%	-63.04%	58.81	30.17
HK	7.29%	24.37%	0.19	-10.95%	-60.12%	47.87	67.27
CA	5.73%	18.90%	0.17	-8.09%	-57.34%	66.45	78.74
FR	5.82%	19.97%	0.17	-9.47%	-58.67%	91.34	86.73
DE	5.88%	22.23%	0.15	-9.67%	-65.52%	82.96	95.14
IN	6.07%	28.50%	0.14	-12.49%	-69.36%	51.09	10.53
HU	6.41%	35.17%	0.13	-15.73%	-78.10%	73.90	62.77
EG	5.27%	31.85%	0.11	-11.85%	-75.47%	53.49	30.08
ZA	4.86%	26.44%	0.11	-11.84%	-62.15%	73.67	24.03
FI	5.32%	29.34%	0.10	-13.63%	-77.65%	94.89	95.71
AU	4.35%	20.53%	0.09	-8.21%	-65.04%	73.75	83.37
BR	6.78%	47.52%	0.09	-17.03%	-79.44%	72.28	42.21
NO	4.73%	25.36%	0.09	-10.13%	-69.03%	87.10	91.94
CO	4.80%	31.44%	0.09	-13.26%	-76.73%	59.05	44.93
MA	3.33%	19.59%	0.09	-7.84%	-62.33%	51.49	42.44
RU	5.95%	47.96%	0.09	-21.34%	-91.78%	44.34	45.94
SG	4.44%	23.62%	0.08	-10.74%	-67.73%	67.12	75.27
PH	4.68%	28.82%	0.08	-12.08%	-88.41%	36.27	30.19
AR	6.53%	55.96%	0.07	-20.65%	-84.86%	68.72	46.99
PL	5.22%	43.50%	0.07	-15.56%	-77.88%	58.87	68.75
KR	4.83%	34.27%	0.07	-13.39%	-83.61%	55.17	65.84
ID	5.37%	44.76%	0.06	-15.26%	-94.53%	45.27	26.41
CZ	3.18%	27.65%	0.05	-11.02%	-80.74%	75.81	69.89
TW	3.98%	32.16%	0.05	-12.13%	-78.01%	53.28	45.38
GB	2.94%	16.82%	0.03	-7.11%	-61.29%	83.28	87.95
BE	3.03%	20.19%	0.03	-9.15%	-74.53%	76.70	88.34
AT	3.16%	26.85%	0.03	-10.86%	-81.20%	75.59	87.53
MY	3.10%	26.06%	0.02	-10.78%	-87.71%	48.56	26.94
ES	2.99%	23.94%	0.02	-9.89%	-68.57%	86.94	76.64
TR	3.68%	52.21%	0.02	-19.71%	-83.49%	51.91	40.46
TH	2.99%	34.47%	0.01	-13.97%	-92.95%	59.89	41.65
SA	-0.35%	21.30%	-0.02	-9.33%	-31.15%	54.25	38.96
NZ	1.98%	21.91%	-0.02	-9.58%	-66.42%	82.23	86.10
IE	1.74%	21.58%	-0.03	-9.29%	-84.36%	67.67	84.54
IL	-0.59%	19.55%	-0.04	-10.47%	-47.23%	51.61	74.75
JO	1.50%	19.37%	-0.04	-8.04%	-56.20%	82.03	37.99
IT	1.44%	24.47%	-0.04	-11.29%	-71.97%	71.17	81.70
CN	0.43%	32.09%	-0.05	-13.83%	-89.79%	23.53	31.29
QA	-1.18%	20.68%	-0.06	-9.16%	-50.60%	48.66	39.40
AE	-1.45%	24.40%	-0.07	-10.10%	-61.80%	42.37	45.04
PT	-0.55%	22.39%	-0.09	-10.04%	-78.20%	76.33	73.91
LK	-2.13%	36.20%	-0.09	-14.03%	-88.03%	59.08	37.56
JP	0.25%	19.80%	-0.11	-8.57%	-65.36%	70.63	88.61
PK	-5.25%	38.71%	-0.18	-16.09%	-93.74%	33.97	10.90
GR	-5.14%	38.44%	-0.19	-16.62%	-98.71%	59.99	73.78

Appendix F2: 3-Y Rolling Returns of CLS Strategies vs. ACWI

Appendix F3: 3-Y Rolling Returns of CLS Strategies vs. ESG Benchmarks

Appendix F4: Mean MSCI World and DM CLS Portfolios' Country Weights

MSCI World		DM CLS Enhanced		DM GDP CLS Enhanced		DM CLS		DM CLS Leaders	
US	45.41%	US	44.64%	US	36.63%	DK	5.10%	DK	45.16%
JP	15.47%	JP	16.17%	JP	16.07%	FI	4.91%	DE	12.60%
GB	7.99%	GB	8.21%	DE	9.59%	DE	4.89%	FI	7.50%
CA	4.20%	FR	4.23%	GB	6.61%	NL	4.87%	NL	6.93%
FR	4.11%	DE	3.97%	FR	6.38%	SE	4.87%	SE	5.96%
HK	3.83%	CA	3.95%	IT	4.99%	NO	4.74%	NO	3.59%
DE	3.58%	HK	3.22%	CA	3.10%	JP	4.60%	JP	1.99%
CH	2.52%	CH	2.59%	ES	2.67%	BE	4.58%	BE	1.95%
AU	2.18%	AU	2.17%	AU	2.22%	GB	4.56%	GB	1.93%
ES	1.89%	NL	1.90%	NL	2.07%	AT	4.55%	FR	1.73%
NL	1.72%	ES	1.73%	CH	1.38%	CH	4.55%	AT	1.64%
IT	1.65%	SE	1.62%	SE	1.31%	FR	4.51%	CH	1.55%
SE	1.47%	IT	1.60%	BE	1.14%	NZ	4.48%	NZ	1.25%
SG	0.89%	SG	0.82%	AT	0.94%	IE	4.41%	IE	0.99%
BE	0.68%	BE	0.71%	NO	0.88%	AU	4.36%	US	0.68%
DK	0.48%	DK	0.56%	DK	0.86%	US	4.34%	GR	0.65%

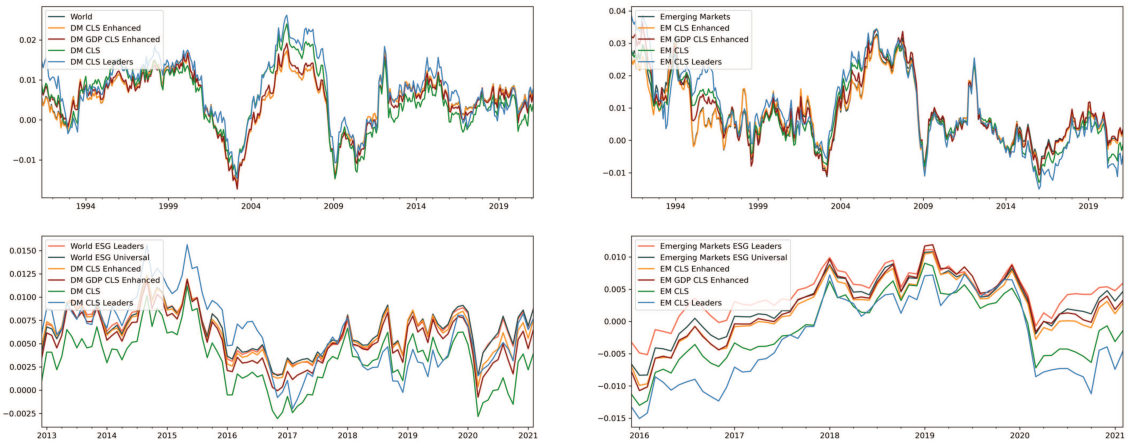
Appendix F4: Mean MSCI World and DM CLS Portfolios' Country Weights (continued)

FI	0.46%	FI	0.52%	FI	0.65%	IT	4.29%	AU	0.65%
IL	0.43%	NO	0.42%	IL	0.62%	CA	4.16%	IT	0.64%
NO	0.39%	IL	0.39%	GR	0.62%	ES	4.06%	PT	0.63%
IE	0.25%	GR	0.28%	IE	0.49%	SG	4.00%	CA	0.62%
AT	0.22%	IE	0.25%	HK	0.49%	PT	3.85%	ES	0.60%
GR	0.18%	AT	0.23%	PT	0.47%	GR	3.83%	SG	0.60%
PT	0.18%	PT	0.16%	SG	0.41%	IL	3.82%	IL	0.58%
NZ	0.13%	NZ	0.14%	NZ	0.32%	HK	3.64%	HK	0.54%

Appendix F5: Performance Statistics of DM CLS Strategies and MSCI World

Portfolio	Ann. Return	Ann. Volatility	Sharpe Ratio	VaR (95 %)	Max DD.	ESG Score	CLS Score
DM CLS Leaders	8.65 %	17.94 %	0.34	-7.78 %	-61.60 %	84.86	95.81
MSCI World	5.67 %	15.23 %	0.21	-7.26 %	-55.79 %	67.97	84.51
DM GDP CLS Enhanced	5.62 %	15.46 %	0.20	-7.24 %	-57.08 %	71.78	85.87
DM CLS Enhanced	5.56 %	15.31 %	0.20	-7.28 %	-55.81 %	68.58	84.85
DM CLS	5.55 %	17.20 %	0.18	-7.71 %	-63.53 %	77.25	86.29

Appendix F6: CLS Portfolios 3-Y Rolling Returns vs. World/EM (ESG)



Appendix F7: Performance Statistics of DM CLS Strategies and ESG Benchmarks

Portfolio	Ann. Return	Ann. Volatility	Sharpe Ratio	VaR (95 %)	Max DD.
World ESG Leaders	7.77 %	14.18 %	0.51	-7.16 %	-20.07 %
World ESG Universal	7.84 %	14.35 %	0.51	-7.38 %	-20.44 %
DM CLS Enhanced	7.30 %	14.72 %	0.46	-7.26 %	-21.66 %
DM CLS Leaders	7.36 %	17.05 %	0.40	-7.16 %	-30.80 %
DM CLS GDP Enhanced	6.16 %	15.57 %	0.36	-7.20 %	-23.23 %
DM CLS	3.01 %	17.27 %	0.14	-7.83 %	-31.43 %

Appendix F8: Performance Statistics of EM CLS Strategies and MSCI EM

Portfolio	Ann. Return	Ann. Volatility	Sharpe Ratio	VaR (95 %)	Max DD.	ESG Score	CLS Score
EM CLS	9.60 %	20.04 %	0.35	-7.94 %	-57.35 %	53.98	48.64
EM GDP CLS Enhanced	10.24 %	23.29 %	0.33	-9.49 %	-63.38 %	44.41	44.97
EM CLS Leaders	10.15 %	24.87 %	0.30	-10.25 %	-63.43 %	58.04	59.91
Emerging Markets	9.23 %	23.54 %	0.28	-10.16 %	-61.79 %	45.21	40.82
EM CLS Enhanced	8.66 %	23.53 %	0.26	-10.21 %	-61.43 %	46.20	44.29

Appendix F9: Mean MSCI EM and EM CLS Portfolios' Country Weights

Emerging Markets		EM CLS Enhanced		EM GDP CLS Enhanced		EM CLS		EM CLS Leaders	
MX	23.41%	MX	23.17%	CN	24.21%	PT	7.73%	GR	27.28%
CN	19.91%	CN	18.07%	KR	12.01%	GR	6.93%	PL	18.56%
TW	8.97%	KR	12.10%	BR	11.36%	KR	6.22%	CZ	13.23%
KR	8.45%	TW	9.75%	MX	8.39%	IL	6.17%	KR	10.86%
SA	7.51%	RU	7.86%	RU	7.58%	PL	5.97%	HU	8.93%
IN	7.44%	SA	7.45%	AR	4.85%	CZ	5.95%	CL	7.91%
RU	7.00%	BR	6.72%	TW	4.65%	CL	5.47%	AE	4.97%
ZA	6.71%	ZA	4.74%	TR	4.59%	HU	5.45%	MY	4.88%
BR	6.42%	IN	3.51%	PT	4.24%	MY	4.91%	TW	3.81%
TH	2.43%	CL	2.77%	PL	3.84%	AR	4.74%	CO	3.47%
CL	2.23%	IL	2.74%	IN	3.63%	AE	4.71%	RU	3.42%
ID	1.94%	TH	2.47%	GR	3.59%	TW	4.68%	AR	3.23%
TR	1.59%	PT	2.08%	ID	2.93%	MX	4.39%	MX	1.78%
PH	1.21%	TR	1.60%	IL	2.82%	BR	4.37%	TH	1.69%
IL	1.21%	ID	1.47%	TH	2.36%	TH	4.35%	LK	1.25%
AE	1.15%	AE	1.46%	SA	2.35%	CO	4.27%	JO	1.11%
GR	1.12%	PL	1.40%	MY	1.81%	TR	4.24%	TR	1.11%
AR	1.08%	CZ	1.29%	AE	1.71%	RU	4.22%	BR	1.06%
PT	0.93%	GR	1.24%	CZ	1.65%	JO	4.20%	CN	0.97%

Appendix F9: Mean MSCI EM and EM CLS Portfolios' Country Weights (continued)

PL	0.87%	AR	1.16%	CO	1.65%	QA	3.59%	PE	0.97%
MY	0.87%	MY	1.01%	CL	1.53%	SA	3.50%	EG	0.95%
CZ	0.83%	PH	0.98%	ZA	1.39%	PH	3.46%	MA	0.91%
QA	0.82%	CO	0.84%	PH	1.16%	LK	3.40%	PH	0.90%
CO	0.73%	QA	0.79%	HU	1.10%	CN	3.25%	SA	0.85%
EG	0.59%	EG	0.51%	EG	0.99%	PE	3.24%	QA	0.83%
PE	0.43%	PE	0.38%	PE	0.66%	EG	3.20%	ID	0.82%
PK	0.43%	HU	0.38%	QA	0.59%	ID	3.14%	ZA	0.81%
JO	0.33%	JO	0.30%	PK	0.58%	MA	2.83%	PK	0.55%
MA	0.28%	MA	0.20%	MA	0.45%	ZA	2.71%	IN	0.53%
HU	0.26%	PK	0.20%	LK	0.26%	IN	1.75%	IL	0.00%
LK	0.09%	LK	0.08%	JO	0.16%	PK	1.72%	PT	0.00%

Appendix F10: Performance Statistics of EM CLS Strategies and ESG Benchmarks

Portfolio	Ann. Return	Ann. Volatility	Sharpe Ratio	VaR (95 %)	Max DD.
Emerging Markets ESG Leaders	6.35 %	15.96 %	0.35	-6.20 %	-30.79%
Emerging Markets ESG Universal	3.86 %	16.17 %	0.20	-6.77 %	-32.04 %
EM CLS GDP Enhanced	2.71 %	17.36 %	0.12	-7.79 %	-34.92 %
EM CLS Enhanced	2.41 %	16.75 %	0.10	-7.36 %	-35.40 %
EM CLS	-2.10 %	17.99 %	-0.15	-6.93 %	-45.56 %
EM CLS Leaders	-4.51 %	21.17 %	-0.24	-8.49 %	-54.54 %

Appendices G

Appendix G1: Factor Regression Results DM CLS Enhanced Portfolios

	DM CLS Enhanced				DM GDP CLS Enhanced			
	CAPM	3-Fac.	4-Fac.	5-Fac.	CAPM	3-Fac.	4-Fac.	5-Fac.
RMW				-0.004				-0.025
CMA				0.012***				-0.006
WML			-0.001	-			0.019**	-
SMB		0.000	0.000	-0.001		0.070***	0.066***	0.063***
HML		0.003**	0.002*	-0.003*		0.067***	0.076***	0.060***
β	1.002***	1.002***	1.002***	1.003***	1.024***	1.028***	1.033***	1.025***
α	-0.001*	-0.001*	-0.001*	-0.001*	-0.006	-0.007**	-0.010***	-0.007*
Obs.	344	344	344	344	344	344	344	344
R2	1	1	1	1	0.985	0.987	0.988	0.987

*p<0.1; **p<0.05; ***p<0.01; α annualized

Appendix G2: Factor Regression Results EM CLS Enhanced Portfolios

	EM CLS Enhanced				EM GDP CLS Enhanced			
	CAPM	3-Fac.	4-Fac.	5-Fac.	CAPM	3-Fac.	4-Fac.	5-Fac.
RMW				-0.010				-0.087
CMA			-	0.005			-	0.078
WML			-0.014*	-			-0.070**	-
SMB		0.011	0.012	0.010		0.037	0.044	0.028
HML		0.008	0.005	0.003		0.120***	0.107***	0.064
β	1.001***	1.001***	1.000***	1.001***	0.938***	0.936***	0.930***	0.940***
α	-0.001	-0.002	0.000	-0.001	0.010	0.001	0.008	0.004
Obs.	344	344	344	344	344	344	344	344
R2	0.997	0.997	0.997	0.997	0.931	0.933	0.934	0.934
*p<0.1; **p<0.05; ***p<0.01; α annualized								

Appendix G3: Factor Regression Results DM CLS & CLS Leaders Portfolios

	DM CLS				DM CLS Leaders			
	CAPM	3-Fac.	4-Fac.	5-Fac.	CAPM	3-Fac.	4-Fac.	5-Fac.
RMW				0.050				0.115
CMA				-0.175***				-0.199*
WML			0.039*	-			0.054	-
SMB		0.253***	0.246***	0.253***		0.242***	0.232***	0.256***
HML		0.174***	0.193***	0.222***		0.033	0.059	0.093
β	1.109***	1.120***	1.130***	1.106***	1.061***	1.065***	1.080***	1.057***
α	-0.008	-0.013	-0.017*	-0.014	0.019	0.018	0.013	0.014
Obs.	344	344	344	344	344	344	344	344
R2	0.911	0.925	0.926	0.927	0.793	0.801	0.802	0.804
*p<0.1; **p<0.05; ***p<0.01; α annualized								

Appendix G4: Factor Regression Results EM CLS & CLS Leaders Portfolios

	EM CLS				EM CLS Leaders			
	CAPM	3-Fac.	4-Fac.	5-Fac.	CAPM	3-Fac.	4-Fac.	5-Fac.
RMW				-0.031				-0.098
CMA				0.270***				0.396***
WML			-0.117***	-			-0.170**	-
SMB		0.202***	0.214***	0.222***		0.351***	0.368***	0.370***
HML		0.275***	0.254***	0.173***		0.378***	0.347***	0.210**
β	0.790***	0.798***	0.788***	0.830***	0.836***	0.854***	0.839***	0.897***
α	0.010	-0.012	0.002	-0.013	0.014	-0.016	0.004	-0.016
Obs.	344	344	344	344	344	344	344	344
R2	0.838	0.855	0.859	0.861	0.697	0.725	0.730	0.734
*p<0.1; **p<0.05; ***p<0.01; α annualized								

Appendix H: MSCI

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Declaration of Academic Integrity

Hereby, I declare that I have composed the presented paper independently on my own and without any other resources than the ones indicated. All thoughts taken directly or indirectly from external sources are properly denoted as such. This paper has neither been previously submitted to another authority nor has it been published yet.

Siegburg, May 9, 2021