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How Costly Are Sustainable Investment Goals to Investors? Optimisation Analysis between a Traditional and a Sustainable Portfolio with Restriction of the ESG-Criteria in the German-Speaking Area

verfasst von / submitted by

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Contents

Abstract

For more than 20 years, the areas of environmental, social, and governance (ESG) as topics of sustainability have influenced the investment decision-making process. For many years this influence was seen as a restriction on investment decisions and a deterioration in performance. However, some studies have proven otherwise, including this master's thesis.

The ESG model is still in the development phase. A wide variety of organisations (UN, EU, OECD, PRI, etc.) and forums are promoting standardisation at the international level. This should help to collect ESG data qualitatively and quantitatively, for the purpose of comparing them with one another.

The survey that I created and analysed for my master's thesis showed that private investors are ready for international standards and guidelines in the ESG area. In addition, the subject would give up an average of 15% of the return on a traditional portfolio for sustainability. Furthermore, it has been shown that the younger the investor is, the more likely they are to want to invest sustainably.

A comparison of traditional and sustainable portfolios in the German-speaking area (Germany, Austria, Switzerland and Liechtenstein) was sought using three different allocation strategies. The comparison of the long-term sustainable portfolios with traditional portfolios (benchmarks) gave the sustainable portfolios a better rating in terms of performance.

The analysis in the period from 2014-07-01 to 2020-03-31 showed a positive outperformance for the sustainable portfolio with higher returns and lower risk compared to its traditional peer. On average, the sustainable portfolio outperforms with an annual return of 0.47% to 3.03%. Therefore "ESG integration in the investment process can lead to better risk-adjusted returns and long-term value creation" (Cappucci, 2017, p. 2).

1   Introduction

The desire to implement the areas of environmental, social, and governance in capital investment decision-making is growing with each day. The topics of environmental protection, sustainable use of resources, equal rights among employees, and much more have made the annual general meetings (AHMs) of companies a place of lively discussion. According to UBS Asset Management, demand for sustainable investments has tripled since 2016 (Eccles, 2019, p. 32).

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (UNWCED: United Nations World Commission and Development on Environment, 1987, p. 41)

This was one of the conclusions of the United Nations World Commission and Development on Environment Report 'Our Common Future' in 1987. This result gives a simple but meaningful definition of sustainability. Many more specific definitions of sustainability and formal definitions use this first definition as a starting point (Dubs, 2015, p.14).

Initial definition of UNWCED does not deny the fulfillment of our needs, rather it suggests that we should always take into account the effects of current actions on future generations, remembering that they should also have the opportunity to meet their own needs. Current prosperity is not condemned, on the contrary, it should help us to avoid exploiting the Earth's last resources or destroying the possibility of future growth. It is our responsibility to steer demand in such a way that there is global prosperity, which the future generations can also experience.

This responsibility is perceived now more than ever, meaning that sustainability has increased in importance. On the part of customers, NGOs and governments, companies are prompted or forced to restructure towards sustainability by means of demand and policies. The management is also driven by the shareholders and investors to implement voluntary compliance and self-regulating initiatives to close gaps in national regulations (Scherer and Palazzo, 2011, p. 903).

However, not all companies meet sustainability criteria equally, therefore the definitions of sustainability should help to identify sustainable assets. Despite the strong urge for sustainability, no agreement could be reached on the meaning of the term. Nothing seems to be as popular as talking and writing about sustainability, yet at the same time, nothing seems as hopeless as the search for a mutually agreed upon definition of the term (Tremmel, 2004, p. 26). By what criteria should an investor or the investment department of a company determine whether its money is sustainable and fairly invested? For this purpose, many criteria, indices and ranking systems were developed. The overarching problem remains that there is no general framework of suitable criteria that reflect the status of a company, nor any standardised rating technique to measure these criteria. In the following Master Thesis I would like to concentrate on the ESG-criteria. According to a 2018 FTSE-Russell survey, more than half of asset owners worldwide are currently integrating the ESG model into their investment strategy (Eccles, 2019, p. 31). Therefore, in the second chapter I will explain the ESG model and try to shed light on the current development situation at an international level.

The question remains; Are private investors ready to be restricted by such standards? To answer this, I created a survey that 138 people took part in. The most poignant question in this survey surrounded whether the respondent would be willing to accept assumed losses due to sustainability. The third chapter describes the survey and discusses the results.

Since the implementation of ESG criteria in the investment decision-making process is quite difficult and there are no standards for ESG data on the basis of which a decision can be made, the fourth chapter examines how companies and investors can proceed to move the process forward. In addition, this chapter explains a tiered model that incorporates ESG into decision-making.

The problem of standardising ESG ratings is discussed in the fifth chapter, in addition to defining the difference to credit ratings. This is included in order to establish whether it is a credible or achievable option to standardise non-financial data and the associated ratings. It was noticed by Mooij that, "The first ESG fund was launched as a foundation and helped churches and charities incorporate their ethical principles into their investment allocation decisions. The demand from institutional investors for an ESG focus led to the introduction of a rating service that initially only covered the exclusion criteria" (Mooij, 2017, p. 15). Therefore, there is a desire to limit assets to sustainable assets. However, Lekovic wrote in his paper that "for the purpose of reducing the total risk, a traditional approach is to increase the amount of security in a portfolio, also known as simple diversification" (Lekovic, 2018, p. 172).

The question therefore arises whether the restriction to sustainability creates more risk in your portfolios. How does performance change compared to an unrestricted portfolios? In the end, does sustainability cost me anything? And if so how much? This master's thesis aims to answer these questions.

For this purpose, the companies of the indices, German-speaking countries, HDAX, ATX-Prime and SMI Expanded are included in a traditional portfolio. In comparison the sustainable portfolio includes companies from indices DAX 50 ESG, VÖNIX and SXI Switzerland Sustainability 25 which are indices with restrictions according to ESG criteria. The two portfolios receive a quarterly allocation through three allocations, after which the performance of the portfolios in the period from 2014-07-01 to 2020-03-31 is analysed. This time horizon includes the starting recession, caused by the coronavirus pandemic 2020. It is checked how much risk but also return is reduced by this restriction and whether costs arise from sustainability.

The assumptions and the composition of the portfolios are defined in Chapter 6. In Chapter 7, the three allocations strategies (value-weighted, maximum Sharpe and equally-weighted) are created. In the eighth chapter, the performance of the portfolios is analysed and a closer look is taken at the economic crisis caused by COVID-19. Finally, the ninth chapter investigates whether there are any costs for the restriction through ESG rankings and, if so, how high these are. I conclude and discuss the findings in the last Chapter 10.

2   The ESG Model

"One particular set of extra-financials has been experiencing soaring scrutiny within the past two decades, namely aspects related to environmental, social and governance (ESG) issues" (Bassen and Kovács, 2008, p. 184). "The search for a link between environmental, social, and governance (ESG) criteria and corporate financial performance (CFP) can be traced back to the beginning of the 1970s. Scholars and investors have published more than 2000 empirical studies and several review studies on this link since then" (Friede et al., 2015, p. 210).

Over 2700 investors representing some \$86 trillion (2019) in assets have signed the United Nations Priciples for Responsible Investment (UNPRI) to integrate ESG into equity investing (PRI, 2020b). This represents only one small example of how large the demand for ESG data has become.

To quote US SIF Foundation, "assets tied to ESG products stand at about \$12 trillion (as of Oct 2018), roughly 25% of total assets managed professionally in the United States. Europe, by far, has been the leading marketplace for ESG products with an ever-surging demand from its investor base. The 2018 Report on US Sustainable, Responsible and Impact Investing Trends cited this surge in client demand as the reason why asset managers are increasingly looking to integrate ESG in their offerings in some form. Many prominent data vendors now provide coverage on stocks from an ESG lens in some form" (Bharali, 2019, p. 3).

For example, "the providing platform Bloomberg registered a fourfold increase in the use of ESG data on their platform between 2010 and 2015. As the empirical evidence grows that positive ESG performance is related to positive financial performance and that incorporating material ESG data in investment decisions can contribute to superior returns, the demand for high quality and comparable ESG data will likely continue to grow" (Eccles and Stroehle, 2018, p. 2).

These efforts have resulted in a proliferation of ESG reports, associated ESG data and ratings, and organisations trying to develop a more rigorous and systematic reporting of ESG information (Kotsantonis and Serafeim, 2019, p. 2). These "ESG rating agencies, indices or rankings assess corporations based on their ESG performance. Besides many ESG ratings, there are about 500 rankings (in 2016), 170 different ESG related indices (in 2015), 100+ awards and at least 120 voluntary standards (in 2014). On top of that, there are think tanks, institutions, and other associations with their own interpretation of how to tackle the issue" (Mooij, 2017, p. 1).

"Disclosure of financial information is well-defined through national and international accounting standards, whereas disclosure of non-financial data remains highly unorganised, without universally accepted standards to refer to" (Eccles and Stroehle, 2018, p. 1). There are as many ways to define ESG integration as there are managers trying to do it (Cappucci, 2017, p. 2).

By far, the most prevalent definition of ESG investing is favouring companies with a

positive impact on the environment, having strong social and moral values and businesses run on the back of strong and ethical governance structures. This definition has been suitably mechanised to help investors identify companies with good ESG practices (Bharali, 2019, p. 4).

"In addition to the lack of consistent and standardised definitions and disclosure, analysts and investors consider that companies do not provide enough information to allow effective assessment of the impact of these factors. However, in a study from the European Centre for Corporate Engagement in 2007, 73% of the respondent companies indicated they had developed a policy for inclusion and that 91% actually include ESG issues in financial communication. The same report illustrates that there are significant differences across countries concerning the way this information is presented" (Bassen and Kovács, 2008, p. 185).

There have been attempts to standardise the criteria and the definition, for example the WBCSD in cooperation with the UNEP FI tried to narrow down and classify the term ESG in 2010. Although they don't provide a definitive list of ESG issues, they do define the following characteristics where ESG issues are typically found:

- Issues that have traditionally been considered non-financial or not material

- A medium or long-term horizon

- Qualitative objects that are readily quantifiable in monetary terms

- Externalities (costs borne by other firms or by society at large) not well captured by market mechanisms

- A changing regulatory or policy framework

- Patterns arising throughout a company's supply chain (and therefore susceptible to unknown risks)

- A public-concern focus (WBCSD and UNEP FI, 2010, p. 6)

After the first publication of the ESG key criteria 'ESG Key Performance Indicators' (KPIs) by the Deutsche Vereinigung für Finanzanalyse und Asset Management (DVFA) in 2007, their version from 2010 was also released by the European Federation of Financial Analysts Societies (EFFAS). As a motivation for the development of the KPIs, they claim that previous reports have not met the requirements of investors, financial analysts and lenders. These extra-financial performance indicators have also been developed to meet the needs of the financial industry and cover topics that can have an impact on the situation and development of business results (Keller, 2015, p. 12).

There are also many sustainability reports which are aligned with the Global Reporting Initiative's (GRI) Sustainability Reporting Guidelines G3. GRI is one of the leading global standards for company sustainability reporting. The G3 reporting framework, which is based on a multistakeholder approach, is a voluntary framework that contains a multitude of reporting items, although to achieve a specific application level companies must report a specific set of items (Arnold et al., 2012, p. 5).

Chapter 5 will further explore the issues surrounding definition and standardisation. Even if this is seen as the biggest problem in ESG integration, some studies give a positive impression in terms of performance.

The results of a study by Friede et al. show that the business case for ESG investing is empirically very well founded. Roughly 90% of studies find a nonnegative ESG–CFP relation. More importantly, "the large majority of studies report positive findings. It is highlighted that the positive ESG impact on CFP appears stable over time" (Friede et al., 2015, p. 2).

"More than forty years' of academic and empirical evidence suggest that ESG integration in the investment process can lead to better risk-adjusted returns and long-term value creation. And the gold standard for sustainable investing is the full integration of ESG factors into the investment process" (Cappucci, 2017, p. 2).
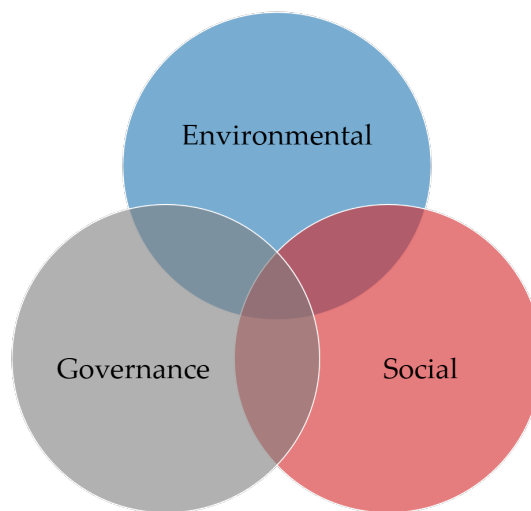
Figure 2.1: ESG areas

"Each of the three dimensions possesses multiple subtopics. For example, the environmental domain consists of the quality of environmental practices such as the introduction of environmental management systems, pollution abatement, or measures for limiting carbon emissions. Similarly, the social dimension of ESG consists of the human rights policies and the presence of particular worker safety standards, etc. The governance dimension comprises issues related to executive compensation, the firm's board structure, and antitakeover defences" (Clark and Viehs, 2014, p. 3).

Figure 2.1 illustrate these three areas of the ESG model, also showing that not all subtopics can be met equally. Some areas conflict with each other and are prioritised depending on the importance to the individual company.

2.1   Type of ESG Data

However, while the quantity of ESG data is constantly growing, ESG research firms are faced with a number of challenges regarding the accessibility and quality of accurate,

relevant, and meaningful ESG information for their rating exercises (Laermann, 2016, p. 12). In order to develop a picture that is as comprehensive and objective as possible, both information of the analysis object and secondary sources are used (rfu, 2014, p. 9).

"ESG data is intrinsically multifaceted and context dependent. Unlike traditional financial data that is structured and quantitative, most ESG data is unstructured, qualitative, scattered, and incomplete. These special characteristics of ESG data and the lack of a theoretical foundation have hampered the implementation of ESG strategies for most investors" (In et al., 2019, p. 5). "Data is used in different ways to create a specific range of indicators, representing qualitative and quantitative data dimensions, frameworks, and conventions which data vendors design" (Eccles and Stroehle, 2018, p. 5).

"Some of the ESG data relevant and material to corporate performance is quantitative and measurable. Standard financial models in mainstream investment houses are almost entirely dependent on quantitative data inputs. However, these quantitative inputs often require qualitative judgements. The difficulty with qualitative information is that it is not readily reducible for mathematical models and investor spreadsheets - it is not 'user-friendly' for asset managers. However, a review of the brand valuation journey demonstrates that qualitative data can be measured and valued" (WBCSD and UNEP FI, 2010, p. 11-14).

"Based on insights from company-investor dialogues, the report of WBCSD and UNEP FI recommends two approaches as a starting point to increase the flow of both qualitative and quantitative ESG data" (WBCSD and UNEP FI, 2010, p. 16):

- Standardised inputs for quantitative ESG data

- A formalised process for regular meetings and communications with companies to discuss the value and application of qualitative ESG data (WBCSD and UNEP FI, 2010, p. 16)

In order to comply to customer demand for more transparency and to demonstrate market and ethical leadership, Standard & Poor's and Moody's Corporation in 2015 already updated their overall credit rating methodologies by incorporating ESG risk assessments qualitatively and quantitatively (Laermann, 2016, p. 20).

2.2   ESG Areas and Their Criteria

As mentioned, the ESG model divides sustainability into three areas. The rating agencies develop criteria catalogues for each of these areas, for which a company receives a ranking after data analysis. In their 2018 study involving a database of 847 completed engagement sequences from 660 different companies from around the globe, Barko et al. established that "the engagements primarily concern social matters (43.3%) and environmental issues (42.3%), while only relatively few concern governance issues (14.4%)" (Barko et al., 2018, p. 2). However, there are also exclusion criteria for companies operating in sectors that are incompatible with sustainability. For example, the nuclear weapons industry or the coal-fired power plant industry to name just two sectors.

2.2.1   Environmental

"In the environmental arena, indications of massive pending legislative and regulatory framework transformations due to climate change also constitute factors increasingly gaining the attention of investors as a desideratum for corporate valuation" (Bassen and Kovács, 2008, p. 185).

"As one of the most prominent environmental issues facing companies, climate change has a particular relevance for financial markets. It is foreseeable that companies will have to operate under different conditions in the near future: where carbon-based energy sources may either face restricted use, increased taxation, or increased regulations. One can tell that carbon-intensive industries, such as oil, gas, and the utilities sector will be massively impacted, with further climate change regulations affecting all sectors, including those outside these specific industries. Thus, those which seize an early opportunity to develop technologies in anticipation of such new environment may offer a lower risk profile and enhanced return opportunities to their shareholders compared with competitors that do not adequately prepare for these developments. To assess potential future effects of such changes and the risks these bare in particular for carbon-dependent businesses, access to appropriate disclosures and metrics that allow meaningful comparisons between companies in the same industries or with similar risk profiles is essential" (Bassen and Kovács, 2008, p. 185).

"The environmental dimension of sustainability concerns an organisation's impact on living and non-living natural systems, including ecosystems, land, air, and water. Environmental indicators cover performance related to inputs (e.g., material, energy, water) and outputs (e.g., emissions, effluents, waste). In addition, they cover performance related to biodiversity, environmental compliance, and other relevant information such as environmental expenditure and the impacts of products and services" (GRI, 2011, p. 27).

Pillar	Themes	ESG Key Issues
Environment	Climate Change	Carbon Emissions
		Product Carbon Footprint
		Financing Environmental Impact
		Climate Change Vulnerability
	Natural Resources	Water Stress
		Biodiversity & Land Use
		Raw Material Sourcing
	Pollution & Waste	Toxic Emissions & Waste
		Packing Material & Waste
		Electronic Waste
	Environmental Opportunities	Opportunities in Clean Tech
		Opportunities in Green Building
		Opportunieties in Renewable Energy

Table 2.1: Key issues and themes for Environment, MSCI

Table 2.1 shows the main topics and the key isssues that the rating agency MSCI uses for its calculations in the area of environment. The next Table 2.2 shows a sample of considerations for environment which is defined by the WBCSD and UNEP FI, whereby the considerations have already been divided into quantitative and qualitative data as discussed in Chapter 2.1.

KPI	'E' factor	Quantitative data	Qualitative data
ENVIRONMENTAL	Energy use and efficiency (From WRI/ WBCSD GHG Protocol)	■ Breakdown of energy costs and forecasts (power, manufacturing, mobility, buildings, consumers) ■ Breakdown of carbon costs and forecasts – primary effects (grid & off-grid electricity, industrial processes, fugitive emissions, waste emissions, storage or removal of emissions) and secondary and tertiary effects (supply chain) ■ R&D in plant and equipment to reduce energy use ■ Expected cost savings from energy-related R&D ■ % of renewable energy to energy consumed or generated	■ What is the company's exposure to future carbon regulation? ■ What is the company's current position on climate change, its responsibility to address climate change, and its engagement with governments and advocacy organizations to affect climate change policy? ■ What are significant actions the company is taking to minimize its climate risk and to identify opportunities? What specific actions is the company taking to reduce, offset or limit greenhouse gas emissions? ■ What are the company's corporate governance actions on climate change? Has the Board been engaged on climate change? Are there executives in charge of addressing climate risk? Is executive compensation linked to meeting corporate climate objectives?
	Greenhouse gas emissions (From UNEP FI Climate Change Working Group, 2006)	■ Actual historical direct and indirect emissions since 1990 ■ Current direct and indirect emissions ■ Estimated future direct and indirect emissions of greenhouse gases from their operations, purchased electricity and products and services	
	Water use (From WBCSD Water Working Group 2009 and the UNEP FI Water & Finance Work Stream, 2009)	■ Volume of water consumed by the company annually (giga liters) – per sales, per product? ■ Water footprint (metrics being developed by the Water Footprint Network) ■ Past and forecasted cost of water ■ R&D in plant/equipment to recycle water ■ Forecasted cost savings from water-related R&D (e.g., from reduced energy use) ■ % of recycled water to total water used	■ Where does water consumed come from (groundwater, desalination)? ■ Does the company operate in water-stressed areas? ■ Do employees have access to sanitation? ■ Does the company have secure access to water rights over the long term? If not, how does it intend to secure the access to water in the future? ■ Has the company consulted long-term water resource forecasts that take into account climate change and increasing consumption? ■ Has management carried out sensitivity analysis of the operational and financial effects of different levels of water availability and quality? ■ What efforts has the client made to reduce the water footprint of its facilities?
	Use of ecosystem services – impact & dependence (From WBCSD Business & Ecosystems 2007 and the UNEP FI Biodiversity & Ecosystem Services Work Stream)	■ % of forest product inputs that are certified (e.g., timber, pulp) ■ Number and/or % of production or extraction sites close to biodiversity hotspots and protected areas ■ % of marine product inputs that are certified (e.g., timber, pulp)	■ What are your impacts and dependence on ecosystem services (covering direct operations, suppliers and customers)? ■ What is the status of relevant ecosystem services? How do key trends affect your core business? How is your company reducing ecosystem impacts and scaling up solutions? What policies have you put into place? ■ Are there opportunities emerging in response to ecosystem changes, including new technologies, markets, businesses and revenue streams? ■ How is your company advancing the sustainability of ecosystem services externally – with research organizations, NGOs, industry associations and governments? ■ Are biodiversity losses addressed as part of the selection of site locations and site design? Are biodiversity offsets purchased? ■ In developing countries, do biodiversity-related risk management measures and standards only comply with local regulation or do they comply with OECD-level regulation?
	Innovation in environment-friendly products and services (UNEP FI work on Green Financial Products)	■ Sales forecast in new energy, water or ecosystem efficient product or service lines ■ % of current and forecasted sales of resource-efficient and/or recyclable products to overall sales	■ Are there any opportunities in the market to introduce a new product or service addressing an environmental problem or need? ■ Results of market research on consumer demand for energy, water or ecosystem efficient product or service lines

Table 2.2: Sample ESG considerations by sustainability theme 'Environmental'

2.2.2   Social

The social aspect of the model is the oldest, which intervened in business management before the other two areas. "Social criteria examines how a company manages relationships with its employees, suppliers, customers, and the communities where it operates" (Laermann, 2016, p. 3). However, we are far from global standards.

In 2012, at least 112 people died in a fire in a textile factory in Bangladesh. The factory had only three flights of emergency exit stairs, leading to the ground floor where the fire broke out. There are about 5,000 textile factories in Bangladesh, most with very difficult working conditions. The legal minimum wage is withheld from textile workers. There are few safety and health precautions in the factories, often many people work in a very small space. Customers of the textile factories include H&M, Wal-Mart, JC Penney, Carrefour and Tesco, i.e. large international clothing stores (ZEIT ONLINE, 2012).

Those who believe that employment relationships have improved somewhat in the past eight years are wrong. One of the largest construction sites worldwide records an enormous number of work deaths.

> "Thousands of dead, inhumane working conditions and ever new allegations of corruption: the massive criticism of the 2022 World Cup in Qatar does not stop."
> (Linde, 2014)

Linde started her 2014 report with this statement about the construction site of the 2022 World Cup in Qatar. At the time, 1200 migrant workers from India and Nepal had died on the construction site, the cause being the working conditions (Linde, 2014).

Incorporating the social dimension into sustainability affects "an organisation's impact on the social systems in which it operates. The GRI Social Performance Indicators identify important performance aspects surrounding labour practices, human rights, society, and product responsibility" (GRI, 2011, p. 29).

Labour practices: The specific Aspects under the category of Labour Practices are based on internationally recognised universal standards, including:

- United Nations Universal Declaration of Human Rights;

- United Nations Convention: International Covenant on Civil and Political Rights;

- United Nations Convention: International Covenant on Economic, Social, and Cultural Rights;

- Convention on the Elimination of all Forms of Discrimination against Women (CEDAW);

- ILO Declaration on Fundamental Principles and Rights at Work (in particular the eight core Conventions of the ILO consisting of Conventions 100, 111, 87, 98, 138, 182, 29, 105); and

- The Vienna Declaration and Programme of Action (GRI, 2011, p. 30).

"The Labour Practices Indicators also draw upon the two instruments directly addressing the social responsibilities of business enterprises: the ILO Tripartite Declaration Concerning Multinational Enterprises and Social Policy, and the Organisation for Economic Cooperation and Development (OECD) Guidelines for Multinational Enterprises" (GRI, 2011, p. 30).

Human rights: "There is growing global consensus that organisations have the responsibility to respect human rights. Human rights Performance Indicators require organisations to report on the extent to which processes have been implemented, on incidents of human rights violations and on changes in the stakeholders' ability to enjoy and exercise their human rights, occurring during the reporting period" (GRI, 2011, p. 32). "Among the human rights issues included are nondiscrimination, gender equality, freedom of association, collective bargaining, child labour, forced and compulsory labour, and indigenous rights. The international legal framework for human rights is comprised of a body of law made up of treaties, conventions, declarations and other instruments. The corner stone of human rights is the International Bill of Rights which is formed by three instruments" (GRI, 2011, p. 32):

    I. the Universal Declaration of Human Rights (1948);

    II. the International Covenant on Civil and Political Rights (1966); and

    III. the International Covenant on Economic, Social and Cultural Rights (1966).

"These are the first reference points for any organisation reporting on human rights. In addition to these three key instruments, the international legal framework for human rights is underpinned by over 80 other instruments: ranging from soft declarations and guiding principles to binding treaties and conventions, and ranging from universal instruments to regional" (GRI, 2011, p. 32).

Society: "Society Performance Indicators bring attention to the impacts organisations have on the local communities in which they operate, and the disclosure of which risks may arise including how they are managed and mediated. In particular, information is sought on the risks associated with bribery and corruption, undue influence in public policy-making, and monopoly practices. Community members have individual rights based on" (GRI, 2011, p. 32):

- Universal Declaration of Human Rights;

- International Covenant on Civil and Political Rights;

- International Covenant on Economic, Social and Cultural Rights; and

- Declaration on the Right to Development.

"While there is ongoing debate about collective community rights, indigenous and tribal peoples have collective rights recognised by ILO Conventions 107 and 169 and the UN Declaration on Indigenous Rights. In terms of identity, these people's rights are based on both the collective and the individual. Their right to free, prior and informed consultation in order to seek consent is a fundamental right expressly recognised in the reference points above" (GRI, 2011, p. 36).

Product Responsibility: "Product Responsibility Performance Indicators address the aspects of a reporting organisation's products and services that directly affect customers, namely health and safety, information and labeling, marketing, and privacy. These aspects are chiefly covered through disclosure on internal procedures and the extent to which these procedures are not complied with" (GRI, 2011, p. 38).

The implementation of these four aspects completely covers the social area. Since most of the social guidelines are international, there is a minimum standard in this area.

MSCI is also a pioneer in the creation of ESG scores with long historical traces. Table 2.3 shows the criteria and subject areas for the social part (Bruder et al., 2019, p. 3).

Pillar	Themes	ESG Key Issues
Social	Human Capital	Labour Management Health & Safety Human Capital Development Supply Chain Labour Standards
	Product Liability	Product Safety & Quality Chemical Safety Financial Product Safety Privacy & Data Security Responsible Investment Health & Demographic Risk
	Stakeholder Opposition	Controversial Sourcing
	Social Opportunities	Access to Communications Access to Finance Access to Health Care Opportunities in Nutrition & Health

Table 2.3: Key issues and themes for Social, MSCI

In collaboration between WBCSD and UNEP FI the United Nations Organisation also developed for the social area considerations. The most attention got human rights for employees and for poverty of the community. Table 2.4 shows these considerations also divided into quantitative and qualitative data.

KPI	'S' factor	Quantitative data	Qualitative data
SOCIAL (From WBCSD Measuring Impact working group 2009 & WBCSD Facts & Trends on Sustainable Consumption, 2008)	Employees (UNEP FI Human Rights Toolkit)	■ Future labor demand given expected rate of growth ■ Retention rate of employees ■ Labor intensity of business ■ Health and safety measurements (illness, fatalities) ■ Employee training costs and return on training in productivity terms ■ Average employee remuneration relative to national, regional and sector average ■ % of equity held by non-management staff ■ Average working hours per week relative to national, regional and sector average ■ % of salary paid during sick leave; temporal length of paid salary during sick leave	■ How dependent is your business model on human talent? ■ How are you working towards being employer of choice in your industry? ■ How are you avoiding employee churn? ■ What programs do you have in place to ensure continuous improvement of employee health, safety and well-being? ■ How does this compare with your competitors? ■ Are the ILO labor standards applied in all sites around the world? Are suppliers chosen under consideration of their labor standard credentials? ■ In developing countries: Do employee health and safety standards comply only with local regulation or also with OECD-level standards?
	Poverty and community impact (UNEP FI Human Rights Toolkit)	■ Number of people at the bottom-of-the-pyramid served by products and services (and aspect of life improved as a result) ■ Number of people whose annual income the company has improved? ■ Average employee remuneration relative to national, regional and sector average ■ Amount of social investment (investments in special projects or infrastructure around operations) ■ % of social investment relative to turnover	■ How do your products and services improve the lives of the poor? ■ How much education or guidance is given with products and services to ensure that products are being used sustainably and as intended for maximum benefit? ■ How have social investments decreased risk for the company and secured its license to operate? ■ How are you demonstrating that your company is contributing positively to the societies, communities and well-being of people where you operate? ■ What programs does the company have in place to protect its 'license to operate'? For instance, are families of employees provided with access to healthcare if the conventional healthcare infrastructure is insufficient (particularly in remote areas of developing countries)?
	Supply chain management	■ Number and % of suppliers disclosing adherence to labor standards	■ Where do product components and raw materials come from? ■ How is information assured as credible? ■ How are processes assured as legal according to country and global standards? ■ Have the needs of local communities or indigenous peoples been addressed? ■ How are issues of environmental protection and bio-capacity addressed and secured? ■ Are fundamental human rights being respected in labor practices?

Table 2.4: Sample ESG considerations by sustainability theme 'Social'

2.2.3 Governance

"Governance deals with a company's leadership, executive pay, audits and internal controls, and shareholder rights" (Laermann, 2016, p. 3). It is often claimed that firstly corporate governance quality is easier to quantify than environmental or social performance and secondly the consequences are much easier to measure. The relevant literature has already provided evidence that superior governance quality leads to better financial performance because shareholders value good corporate governance, pointing to the fact that successful corporate governance structures limit managerial entrenchment (Clark and Viehs, 2014, p. 32).

The most widely acknowledged supportive example of this comes from Gompers et al. (2003). The empirical analysis of Gompers et al. (2003) reveals that a long-short portfolio of well-governed and poorly-governed firms leads to a risk-adjusted annual abnormal return of 8.5% over the period 1990 to 1999 (Gompers et al., 2003, p. 3)(Clark and Viehs, 2014, p. 33).

"Corporate governance report usually contains governance structure of the organisation,

including committees under the highest governance body responsible for specific tasks, such as setting strategy or organisational oversight (CEO, top management etc.)" (Hře-biček et al., 2011, p. 162).

In order to define a standard in corporate governance, for example, EU members were recommended in 2014 to set up a national corporate governance code in which the most important standards are legally laid down. The European Commission named the following founders for the creation of a code:

1. An effective corporate governance framework is of key importance to society, as well-run companies are likely to be more competitive and more sustainable in the long term. Good corporate governance is first and foremost the responsibility of the company concerned, and rules at European and national level are in place to ensure that certain standards are respected. These include legislation and soft law, namely national corporate governance codes.

2. Corporate governance codes aim to establish principles for good corporate governance in listed companies in Europe based on transparency, accountability and a long-term perspective. They provide standards and best practice for companies, enabling them to perform better and therefore contribute to fostering growth, stability and long-term investment. ... (EU Commission, 2014, p. 1)

The code pursues the goal of responsible management and control of companies and groups geared towards sustainable, long-term value creation. With this objective, the interests of everyone whose well-being is linked to the success of the company are best served. The code achieves a high degree of transparency for all of the company's stakeholders (IWP et al., 2002, p. 11). It is important that the corporate governance code becomes valid through voluntary commitment by the company (IWP et al., 2002, p. 12).

Even without such a code, a dualistic system is advantageous because management and monitoring of the company are separate. In such a system, a company consists of four mandatory bodies: the Management Board, the Supervisory Board, the General shareholders' Meeting and the auditor.

1. The Management Board is responsible for managing the company and representing it externally.

2. The appointment and dismissal of the Management Board and its supervision are assigned to the Supervisory Board. There are also approval powers for large or abnormal transactions.

3. The appointment and dismissal of the Supervisory Board and the auditor are assigned to the general shareholders' meeting. It also has to decide on changes to the articles of association and the distribution of profits. The general meeting consists of all shareholders of a company.

4. The auditor is responsible for checking the accounting and issuing the auditor's report (Mader, 2017, p. 75-76).

This structure of society has a very high standard but in Europe and North America roughly every company has this structure. There are efforts to spread such a control system worldwide and to consolidate it as a standard. As key issues, MSCI also uses this system and other control topics for the area of governance, as can be seen in Table 2.5.

Pillar	Themes	ESG Key Issues
Governance	Corporate Governance	Board
		Pay
		Ownership
		Accounting
	Corporate Behaviour	Business Ethics
		Anti-Competitive Practices
		Tax Transparency
		Corruption & Instability
		Financial System Instability

Table 2.5: Key issues and themes for Governance, MSCI

Table 2.6 shows a sample of considerations for governace, defined by the WBCSD and UNEP FI, whereby the considerations have been divided into quantitative and qualitative as for the other two areas.

KPI	'G' factor	Quantitative data	Qualitative data
Governance (From WBCSD Beyond Reporting 2006)	Codes of conduct and business principles	■ Number of sustainability initiatives and networks where the company is an active signatory or member	■ How does your business model provide value to society? ■ What core business decisions and new market opportunities have been driven by your understanding of material sustainability issues? ■ What drives value in your business and what sustainability issues are central to those drivers?
	Accountability	■ Number of independent directors on the Board	■ How are corporate functions, management and employee incentives aligned to value drivers and understanding of material sustainability issues? ■ What processes are in place to work with stakeholders according to key accountabilities? ■ Based on drivers of value, what is the company accountable for and who is the company accountable to?
	Transparency and disclosure	■ Number of legal disputes against company filed ■ Fees paid for litigation costs ■ Remuneration of senior management and board members in absolute terms; and relative to national, regional, sector average and company (internal) average	■ What policies does your company have to communicate market sensitive information to investors as soon as it arises? ■ What policies do you have to prevent bribery and corruption within your company? ■ How does your proposed M&A activity affect your company's corporate disclosure obligations?
	Implementation – quality and consistency	■ Code of conduct	■ Is your company's code of conduct consistently implemented? Is it biting (reinforcing good practice)? Is there evidence that the code of conduct contributes to overall performance?

Table 2.6: Sample ESG considerations by sustainability theme 'Governance'

2.2.4 Exclusion Criteria

The three areas by which the ESG model is described and with which one can create a rating and ranking for sustainability is supplemented by exclusion criteria. It completely

excludes sectors and industries from the rating and ranking, since they cannot be sustainable through their business. "In the early days of socially responsible investing, much of the focus was on using negative screens to exclude companies in certain industries or sectors for moral or ethical reasons" (Cappucci, 2017, p. 2).

How high the tolerance is for the exclusion criteria depends on the investor or the rating agency. The exclusion can also depend on how significant the activity is for the total turnover, whereby the values are usually at most between 0 and 10 percent. If the tolerance limit is exceeded, investments cannot be made in terms of sustainability and the company receives no rating (rfu, 2014, p. 2). I would now like to list the most common exclusion criteria :

- Defence industry: ABC weapons, weapon systems, conventional military weapons, specifically military material or specifically military services (e.g. nuclear weapons, tanks, fighter jets, military equipment)

- Atomic energy producer: Electricity from nuclear power plants and service providers in the field of nuclear fuels (e.g. operators and technology suppliers of nuclear power plants, uranium mining)

- Generation or trading of environmentally harmful technologies and products

- Production or trade in addictive substances (e.g. tobacco, tobacco products, alcohol and drugs)

- Gambling: Operation of games of chance and betting (e.g. casinos, betting offices, internet betting providers, gambling machine manufacturers)

- Genetic engineering: Ethically or socially problematic human genetic engineering, ethnically or ecologically problematic genetic engineering in agriculture and animal husbandry (e.g. genetically modified seeds)

- Operator and service provider of animal experiments

- Companies that are discriminatory against races or minorities

- Companies with serious violations of human rights and labour standards (ILO Conventions)

- Companies with balance sheet manipulation or which are corrupt

- Companies that seriously harm nature (e.g. heavy pollution)

- Companies that harm human health and dignity (e.g. child pornography) (rfu, 2014, p. 2)(Büschgen and Everling, 1996, p. 689)

These are the basic criteria for excluding a company from the rating or investment. As with the three previously discussed areas, more criteria can be used to make the model more specific and precise.

2.3   Other CSR Models and Their Differences

To include Corporate Social Responsibility (CSR) in investment decisions, you need a model by which you can make your decision. ESG is currently the most popular and widespread example of such a model. In this chapter I would like to briefly outline other models and show what differences there are to the ESG model.

Two-Dimensional Model (Quazi and O'Brien)   In the two-dimensional model, the extent of social responsibility and the cost perspective of CSR activities are taken into account on two axes. The former is located on the horizontal axis between the extremes of wide and narrow responsibility. On the vertical axis, the extreme costs and benefits as well as benefits from CSR activities contrast. The idea of subordinating a company's social responsibility to the costs incurred was taken up for the first time in this model (Quazi and O'Brien, 2000, p. 35)(Kaiser, 2014, p. 11). On the one hand, a responsibility is shown for generating short term profit, on the other hand a large degree of social responsibility is depicted, going beyond the scope of those restrictions enforced by law, these include environmental protection, social development and philanthropic initiatives (Quazi and O'Brien, 2000, p. 35). This results in four quadrants, according to which the corporate responsibility activity of companies can be systematised.
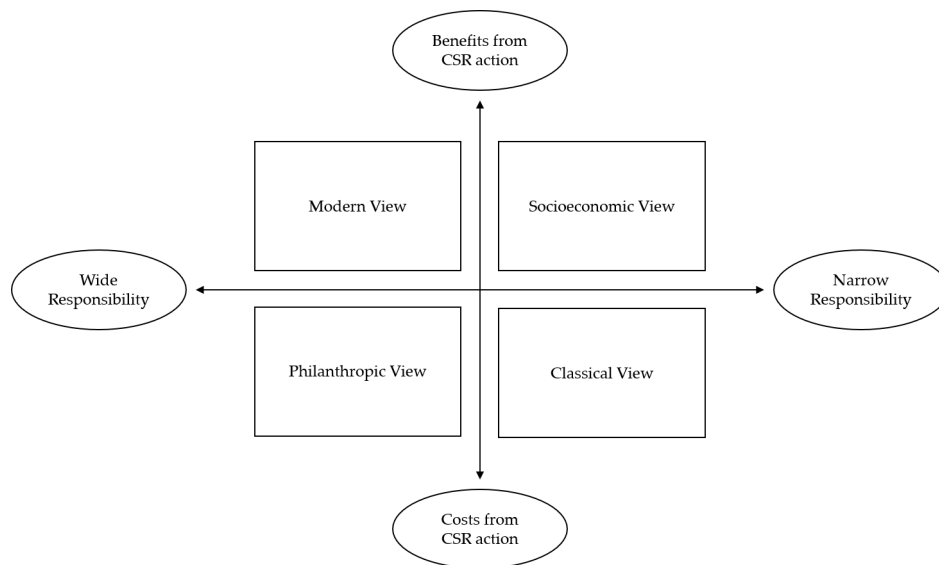
Figure 2.2: The two-dimensional CSR model

The classic view is characterised by a focus on maximising profit and CSR is perceived as an activity that causes net costs and brings no benefits. The socioeconomic perspective describes companies that accept that certain CSR measures can have a positive effect on company activity, for example on customer relationships. The modern perspective characterises companies that think long-term and accordingly implement corporate responsibility according to the stakeholder theory. From the philanthropic point of view, companies participate in charitable projects, although this is considered an extra cost factor. The motivation is based on altruistic and ethical-moral feelings towards society (Quazi and O'Brien, 2000, p. 36). The peculiarity of this model lies in the integration of the cost aspect in the implementation of corporate responsibility (Hadjeri, 2012, p. 36).

The Pyramid of CSR (Carroll)   What was possibly the first CSR model was circumscribed by Carroll in 1979. He considers the definition of CSR very general as the economic, legal, ethical and discretionary expectaitions that society has of organisations at a given point in time (Carroll, 1979, p. 500)(Wagner, 2016, p. 5). In 1991 he modified the model to the four dimensions of corporate social responsibility: economic, legal, ethical and philanthropic (Carroll, 1991, p. 40)
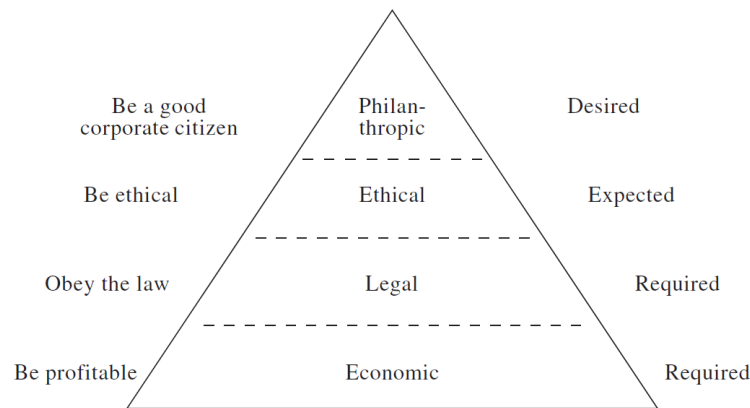
Figure 2.3: The Pyramid of Corporate Socially Responsibility

The model builds on a pyramid (see Figure 2.3) that is supposed to represent that the foundation for corporate responsibility is economic performance (Wagner, 2016, p. 6). "At the same time, business is expected to obey the law because the law is society's codification of acceptable and unacceptable behaviour. Next is the responsibility of businesses to be ethical. At its most fundamental level, this is the obligation to do what is right, just, and fair, and to avoid or minimise harm to stakeholders (employees, consumers, the environment, and others). Finally, business is expected to be a good corporate citizen. This is captured in the philanthropic responsibility, wherein business is expected to contribute financial and human resources to the community and the improve the quality of life" (Carroll, 1991, p. 42). According to Carroll, the fulfillment of the first three dimensions is required by society, while the exercise of 'philanthropic responsibility' is neither legally binding nor expected by society, though it is desirable (Wagner, 2016, p. 6). This is about concrete donations or support for projects that enable companies to fulfil their duty towards the community (good citizens in the community) (Kaiser, 2014, p. 10).

The model is often criticised because sustainability is only dependent on the company's profit and the economic aspect is the largest and most important. Furthermore, environmental and social aspects are not explicitly integrated in this model (Wagner, 2016, p. 7). These are also the most notable differences from the ESG model.

The Three-Domain Model of CSR (Schwartz and Carroll)   Since Carroll himself was of the opinion that the representation of his model from 1991 as a pyramid should be viewed critically because it induces a ranking, Schwartz and he revised the model in 2003. Furthermore, Schwartz and Carroll add that the theoretical design of the individual dimensions is incomplete and because of the lack of delimitation of the dimensions, they see no need for a separate philanthropic level (Secka, 2015, p. 44).
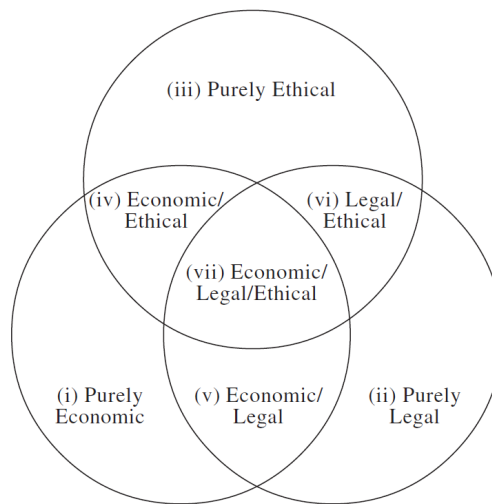
Figure 2.4: The Three-Domain Model of Corporate Social Responsibility

The selected display format (see Figure 2.4) is the basis for two new approaches. On the one hand, the core areas are no longer hierarchically structured, on the other hand, the philanthropic dimension depends on the underlying motivation of the economic or the ethical dimension (Kaiser, 2014, p. 12-13).

"The economic domain (i) captures those activities which are intended to have either a direct or indirect positive economic impact on the corporation in question. The positive impact is based on two distinct but related criteria, on the one hand the maximisation of profits and/or on the other hand the maximisation of share value" (Schwartz and Carroll, 2003, p. 508).

"The legal category (ii) of CSR pertains to the business firm's responsiveness to legal expectations mandated and expected by society in the form of federal, state, and local jurisdictions, or through legal principles as developed in case law. In this context, legality may be viewed in terms of three general categories" (Schwartz and Carroll, 2003, p. 509):

1. compliance,

2. avoidance of civil litigation, and

3. anticipation of the law (Schwartz and Carroll, 2003, p. 509).

"The ethical domain (iii) of the three-domain model refers to the ethical responsibilities of business as expected by the general population and relevant stakeholders. This domain includes responsiveness to both domestic and global ethical imperatives. Based on this general definition, the three-domain model both broadens and refines Carroll's concept of the ethical domain by including only three general ethical standards" (Schwartz and Carroll, 2003, p. 511):

1. conventional;

2. consequentialist; and

3. deontological (Schwartz and Carroll, 2003, p. 511).

The ideal overlap resides at the center of the model (see (vii) in Figure 2.4) where economic, legal, and ethical responsibilities are simultaneously fulfilled. The profit is maximised while maintaining a high standard and ethical norms, as well as actively protecting the rights of the law. The other pure and overlapping segments of the model represent situations that decision-makers may face in the business world (Schwartz and Carroll, 2003, p. 513).

Although the 'three domain model' tries to eliminate some shortcomings of the Pyramid of CSR(Carroll, 1991), this approach cannot escape certain criticism. It is thus questionable whether a clear classification and delimitation of purely economic, purely legal or purely ethical responsibility is possible at all. There is also the possibility that the model does not cover all relevant aspects and activities of corporate social responsibility (Secka, 2015, p. 48-49). For example, the ecological dimension of CSR is not explicitly mentioned again (Kaiser, 2014, p. 13).

Triple Bottom Line   "The phrase 'the triple bottom line' was first coined in 1994 by John Elkington, the founder of a British consultancy called SustainAbility. His argument was that companies should be preparing three different (and quite separate) bottom lines" (The Economist, 2009). "This concept includes a way of business accounting that factors in economic, environmental and social impact. John Elkington identifies the 'Triple Bottom Line' or 'Triple-P (People, Planet, Profit)' concept: Sustainability is about the balance or harmony between economic sustainability, social sustainability and environmental sustainability" (Dalibozhk and Krakovetskaya, 2018, p. 3). The following is an illustration of the first model which includes the environment as a factor which is equivalent to that of people and profit.

Figure 2.5: The interconnection of the elements of the Triple Bottom Line concept.

"'People' (or social dimension) focuses on the impacts organisations have on the communities in which they operate, also known as corporate responsibility.
'Planet'(or environmental dimension) focuses on direct impact on ecosystems, land, air, and water based on operational inputs and outputs.
'Profit' (or economic dimension) focuses on financial impact on a total Enterprise level,

usually expressed in monetary terms such as the efficient use of resources, sales/ profit (ROI), cost savings, job creation and product advantages" (Dalibozhk and Krakovetskaya, 2018, p. 3).

The TBL model is very similar to the ESG model and is also one of the most common models on the market. The 'Triple Bottom Line' approach "implies a close interconnection of environmental, social and economic goals, to which (as a whole) sustainable development is aimed. At the same time, this approach is applicable both to mankind as a whole and to communities of a lower level, such as individual nationalities, cities, organisations, etc." (Dalibozhk and Krakovetskaya, 2018, p. 4).

Tremmel analysed 60 definitions of sustainability and first examined how many dimensions (pillars) the authors attribute to their sustainability concepts. The range extends from one dimension to eight dimensions. The most common is the model that contains three pillars - ecological, economic, social. However, the relatively small number of entries (24) and the changing order of the columns show that it is by no means uncontroversial. The essence of the dispute does not concern the number of dimensions but that if one accepts the dimensions of sustainability whether they are considered to be equal or one takes priority. (Tremmel, 2004, p. 29).

2.4   ESG-Rating Market

"The ecosystem of organisations that provide ESG data is vast and products offered range from a wide variety of overall rating scores (sometimes including sub-dimensions), ratings on specific issue areas, overall rankings of companies based on specific scores, as well as tools providing evaluation of companies' ESG performances" (Eccles and Stroehle, 2018, p. 3). Besides many ESG ratings, there are about 500 rankings (in 2016), 170 different ESG related indices (in 2015), 100+ awards and at least 120 voluntary standards (in 2014). Additionally, there are think tanks, institutions, and other associations with their own interpretation of how to tackle the issue (Mooij, 2017, p. 1)

Unlike financial rating agencies, ESG rating firms are typically paid by investors and not by the rated entities. This type of rating is also referred to as a 'declarative rating', as opposed to a 'solicited rating', where the ESG audit is performed at the request and the expenses of a company or some other sponsor (Laermann, 2016, p. 9).

"As the comparability of these sources is low but the demand it is at an all-time high, meta-ratings services have emerged to 'Rate the Raters' and initiatives such as the 'ESG Ratings and Rankings Working Group' at the World Business Council on Sustainable Development (WBCSD), try to help companies understand and cope with the differences in ratings they receive" (Eccles and Stroehle, 2018, p. 6). "In fact, the Rate the Raters initiative by SustainAbility found in 2010 that out of 108 organisations, about 60% rely completely or partially on information submitted by companies" (Mooij, 2017, p. 1). The authors argued that "the financial non-viability of many ESG ratings and the then insufficient demand and funding for the number of ESG ratings contributed to the consolidation of the market" (Avetisyan and Hockerts, 2017, p. 7). Additionally, "a wide range of organisations use data from these ESG data vendors to create their own rankings

and aggregate index solutions. Mainstream data vendors like Bloomberg and Thomson
Reuters are distribution channels for these ratings, alongside a wider offering of financial
information, such as prices on stocks and other securities" (Eccles and Stroehle, 2018, p.
5).
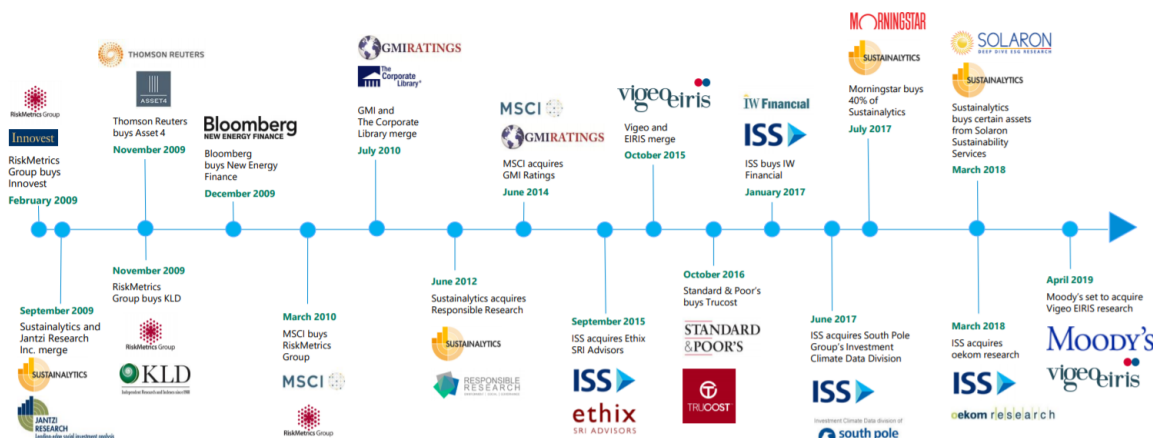
Figure 2.6: ESG Merger & Acquisition Activity

"Even though there has been substantial consolidation of rating agencies over the course
of the last 30 years (see Figure 2.6), the diversity of these data vendors remains impressive.
Some of these organisations are for profit, others are non-profit, and some have a subject
matter focus, such as climate (e.g., the former Carbon Disclosure Project, CDP) or human
rights (e.g., Corporate Human Rights Benchmark), while others focus on the entire range
of issues covered under ESG" (Eccles and Stroehle, 2018, p. 4-5).

Company	Methodology	Rating Scale	Target Market	Market Coverage	Indicators	Key Issues	Advisory Offered to Companies
Market[1]							
Bloomberg	Model[4]	100-0	Investors & Companies	>10000	700	120	No
FTSE Russell	Hybrid	5.0-1.0	Investors	4000	350	125	No
MSCI	Hybrid	AAA - CCC	Investors	6000	1000	37	Yes
Thomson Reuters	Hybrid	A+ - D-	Investors	6000	400	178	No
ESG Exclusive[2]							
Arabesque	Model	100-0	Investors	4000	200	NA	No
Covalence	Hybrid	ESG Rating 100-0; Reputation Index: A-D	Investors & Companies	3400	NA	50	Yes
CSR Hub	Model	100-0	Companies	17000	NA	NA	No
Ethos	Analyst		Investors	1650	NA	NA	No
Inrate	Hybrid	A+ - D-	Investors	2600	NA	NA	No
Oekom Research	Analyst	A+ - D-	Investors	3500	100	37	Yes
Robeco SAM	Hybrid	Gold, Silver, Bronze	Investors & Companies	2400	Survey	120	Yes
Sustainalytics	Analyst	100-0	Investors	6500	70	21	Yes
VigeoEIRIS	Hybrid	Double+ to double-	Investors & Companies	3200	330	38	Yes
Specialized[3]							
ISS/IW Financial							
CDP				2000	175	2	
RepRisk							

Notes: 1. All market data providers offer ESG research, ratings and indices as a subset of their product and service offerings. 2. Focus solely on ESG Research, Ratings and Analysis. 3. Focus solely on one or more aspects of ESG but *not* all three. 4. Ratings models vary from computer-drive models or algorithms, to analyst-based evaluations, to a hybrid of the two. *Source: Adapted from Elyse Douglas, Tracy Van Holt and Tensie Whelan, "Responsible Investing: Guide to ESG Data Providers and Relevant Trends," Journal of Environmental Investing, 8, No. 1 (2017). Information based on vendor disclosures.

Table 2.7: Major ESG Index Providers and Raters

Table 2.7 depicts some of the major ESG rating providers. Note that all of the big mar-

ket data-providers like Bloomberg and Thomson Reuters offer ESG research, ratings, and indices as a unit of their core global information and transaction services. The 'research only' or 'ESG exclusive' raters limit themselves to ESG scoring and analytics sold to the investor market and have no other businesses that might trigger conflicts of interest (Walter, 2019, p. 24).

Not all focus on all three ESG components or release both indices and ratings, as noted in Table 2.8. They in turn are joined by a small cohort of specialist raters (Walter, 2019, p. 24).

	Indeces				Ratings				Ranking
Providers	ESG	E	S	G	ESG	E	S	G	ESG
Market Data¹									
Bloomberg	x	x	x		x	x	x	x	
FTSE Russell	x	x			x	x	x	x	
MSCI	x	x	x		x	x	x	x	
Thomson Reuters	x	x	x	x	x	x	x	x	
ESG Exclusive²									
Arabesque					x	x	x	x	
Covalence	x				x	x	x	x	x
CSR Hub					x	x	x	x	
Ethos				x	x	x	x	x	
Inrate		x			x	x	x	x	
Oekom Research	x				x	x	x	x	x
Robeco SAM	x	x			x				x
Sustainalytics	x	x	x	x	x	x	x	x	x
VigeoEIRIS	x				x			x	x
Specialized³									
ISS/IW Financial					x			x	x
CDP		x				x			
RepRisk					x				x

Notes: 1. All market data providers offer ESG research, ratings and indices as a subset of their product and service offerings. 2. Focus solely on ESG Research, Ratings and Analysis. 3. Focus solely on one or more aspects of ESG but *not* all three. 4. Ratings models vary from computer-drive models or algorithms, to analyst-based evaluations, to a hybrid of the two. Source: Adapted from Elyse Douglas, Tracy Van Holt and Tensie Whelan, "Responsible Investing: Guide to ESG Data Providers and Relevant Trends," Journal of Environmental Investing, 8, No. 1 (2017). Information based on vendor disclosures.

Table 2.8: Coverage of Major ESG Index Providers and Raters

Most of major ESG raters cover thousands of entities using hundreds of indicators often grouped into 'key issues'. There is limited transparency in the indicators, algorithms, and qualitative proprietary assessment techniques applied. Presumably this is the competitive 'secret sauce' that provides value to ESG-sensitive investors. Approaches range from computer-driven models to analyst impressions and questionnaire-based evaluations. Hybrid approaches further erode transparency in the search for relevance. And artificial intelligence is on the horizon (Walter, 2019, p. 24).

2.5   International Implementation of Regulations

"Corporate social responsibility (CSR) and therefore ESG often involves the development of network relations as both private and government actors invest in and draw upon social capital. CSR necessitates legal compliance as well as 'customary ethics'. In this context, it seems that CSR may have been born out of necessity to offset the threat of regulation. Non-governmental organisations (NGOs) sought to step into the regulatory vacuum created by the inadequacies of both national government and international institutions to regulate multinational corporations by forging alliances with consumers, institutional

investors and the companies themselves. While they cannot replace the role of the state, these social movements have created new mechanisms of global business regulations" (Camilleri, 2017, p. 27).

"A number of bilateral and regional trade agreements were enforced in North American and European countries. They contained such provisions about the inclusion of labour, human rights and environmental standards in trade agreements. Nonetheless, the former General Agreement on Tariffs and Trade (GATT) and the World Trade Organisation (WTO) (which replaced GATT in 1995) never necessitated countries to conform to any product labelling standards which describe how products have been sourced and produced outside of their borders. In light of this, during the mid-1990s, Mr Robert Reich in his capacity as the American Secretary of Labour asked the International Labour Organisation (ILO) to develop a social label that would certify to consumers which products comply with the ILO standards. However, his proposal was denounced by the representatives of the emerging countries as it was considered to be a form of protectionism and was eventually abandoned. Surprisingly, this setback triggered the formation of private labour certification standards which now represent a critical demission of contemporary global corporate responsibility. The ILO has established a framework of minimum standards for working conditions and these have been agreed to by numerous governments. These standards were and still are entirely voluntary in nature as the ILO has no enforcement capacity. The growth of interest in the private regulation of global firms is a direct consequence of the lack of effective regulation of global firms" (Camilleri, 2017, p. 28).

Thus, "the regulation of transnational firms was denounced from the agenda of the United Nations' Commission on Environment and Development, while the creation of global codes of conduct for multinational corporations was not recommend by the UN, the Organisation for Economic Cooperation and Development (OECD) issued guiding lines for multinational corporations. These principles guide policy makers, regulators and market participants in improving their legal, institutional, and regulatory framework. These principles have served as the basis in various reform initiatives by different governments and have been taken up by the private sector in different countries" (Camilleri, 2017, p. 28-29).

The development of environmental, social and governance regulations on the part of private actors, NGOs, national governments and at international level started with the ILO standards and the principles of OECD. Since then, many regulations have been drafted that differ widely at the national level, so on the following pages I will try to record the status quo for the integration of ESG regulations in international organisations.

2.5.1   United Nations Organisation (UNO)

After the UN had long failed to set sustainability standards, the UN Global Compact 1999 was a big step in the right direction. Each member who joins the Global Compact commits to report their progress towards the ten principles. The communication should not be an end in itself, but a way for the members to demonstrate that the relevant principles apply in their own organisation, effects and results are measured and progress is made. Sharing this progress with stakeholders is just one step in the continuous cycle of practical implementation of values and ideas contained in the ten universal principles (Brownlie, 2005, p. 2).

The Ten Principles of the United Nations Global Compact are:

Human rights

1. Businesses should support and respect the protection of internationally proclaimed human rights; and

2. make sure that they are not complicit in human rights abuses.

Labour

3. Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;

4. the elimination of all forms of forced and compulsory labour;

5. the effective abolition of child labour; and

6. the elimination of discrimination in respect of employment and occupation.

Environment

7. Businesses should support a precautionary approach to environmental challenges;

8. undertake initiatives to promote greater environmental responsibility; and

9. encourage the development and diffusion of environmentally friendly technologies.

Anti-Corruption

10. Businesses should work against corruption in all its forms, including extortion and bribery (UN Global Compact, 2004).

"The Global Compact has grown rapidly since its launch in 1999. With more than 14,000 active members from over 160 countries (in 2020) - including companies, workers' organisations, civil society groups, governments and United Nations organisations - it is the largest corporate citizenship initiative in the world today. Companies from all sectors of the economy are represented, from the large multinationals of the industrialised world to small companies in emerging countries" (Brownlie, 2005, p. 2).

"The member institutions of the World Business Council for Sustainable Development (WBCSD) and the United Nations Environment Programme Finance Initiative (UNEP FI) believe that a company's management of ESG factors, as well as a company's leadership on sustainable development, are at the core of business today and therefore need to be considered by the capital markets. Both organisations believe that ESG factors can be financially material and can enhance long-term, sustainable company value. In 2008, the WBCSD and UNEP FI launched a series of workshops that provided a platform for institutional investors and companies to discuss how to facilitate the integration of ESG factors into key processes of the capital markets. At each workshop, one-on-one company-investor dialogues were used to formulate a common understanding of the financial materiality of ESG factors and forward-looking ESG and sustainability considerations in business value and investment decisions" (WBCSD and UNEP FI, 2010, p. 5).

"In a push to strengthen the quality of sustainability reporting in the corporate sector, the United Nations Global Compact and the GRI announced the agreement to align their work in advancing corporate responsibility and transparency, on the 28th May 2010. The agreement is intended to provide companies in the Global Compact with a clear set of reporting principles and indicators to meet the initiatives compulsory annual disclosure requirement, also known as the *Communication on Progress*. The GRI Reporting Framework is applicable to organisations of all sectors, sizes and regions and also offers a series of supplements developed to address sector-specific circumstances and challenges. In addition to creating a reporting framework that will be implemented universally, the new collaboration is also intended to provide a benchmark for financial analysts and other stakeholders to better analyse and identify risks and opportunities as they relate to ESG issues" (Hřebiček et al., 2011, p. 159).

Another big step was taken at the 2015 UN Summit. "The sustainable development goals for 2016-2030, imply the coherence of economic growth, human development, environmental protection. 17 Sustainable Development Goals (see Figure 2.7) and 169 objectives were unanimously adopted by 193 States Members of the United Nations at the historic Summit, held in New York in September 2015" (Dalibozhk and Krakovetskaya, 2018, p. 4).

Figure 2.7: The UN 2030 Agenda for Sustainable Development and the Sustainable Development Goals

"New goals and objectives for 2016 - 2030 cover a wider range of issues of social, economic and environmental development in their relationship, in comparison with the Millennium Development Goals. A significant requirement of the goals of sustainability is the capacity to work towards to the achievement of multiple goals simultaneously. The sustainable development goals, in contrast to the Millennium Development Goals, are more global. Their achievement requires joint efforts of governments, international organisations and world leaders" (Dalibozhk and Krakovetskaya, 2018, p. 4).

The last organisation that should be mentioned, which is supported by the UN, is founded in the early 2005. "The then United Nations Secretary-General Kofi Annan invited a group of the world's largest institutional investors to join a process to develop the Principles for Responsible Investment (UNPRI or PRI). A 20-person investor group drawn from institutions in 12 countries was supported by a 70-person group of experts from the investment industry, intergovernmental organisations and civil society. It works to understand the investment implications of environmental, social and governance (ESG) factors and to support its international network of investor signatories in incorporating these factors into their investment and ownership decisions. The PRI acts in the long-term interests of its signatories, of the financial markets and economies in which they operate and ultimately of the environment and society as a whole" (PRI, 2020a). The six Principles for Responsible Investment are a voluntary and aspirational set of investment principles that offer a menu of possible actions for incorporating ESG issues into investment practice:

1. Incorporate ESG issues into investment analysis and decision-making processes

2. Be active owners and incorporate ESG issues into ownership policies and practices

3. Seek appropriate disclosure on ESG issues by the entities in which they invest

4. Promote acceptance and implementation of the principles within the investment industry

5. Work together to enhance their effectiveness in implementing the Principles

6. Report on their activities and progress towards implementing the Principles (PRI, 2020a)

"Over 2700 investors representing some \$86 trillion (2019) in assets have signed the United Nations Principles for Responsible Investment (UNPRI) to integration ESG for equity investing" (Eccles et al., 2017, p. 2).

2.5.2   Organisation for Economic Cooperation and Development (OECD)

"On the 4th May 2010, the governments of the 42 OECD and non-OECD countries adhering to the OECD Declaration on International Investment and Multinational Enterprises and related decision started work on updating the guidelines to reflect changes in the landscape for international investment and multinational enterprises since the last review in 2000. The changes aim to ensure the continued role of the Guidelines as a leading international instrument for the promotion of responsible business conduct. The updated Guidelines and the related Decision were adopted by the 42 adhering governments on 25 May 2011 at the OECD's 50th Anniversary Ministerial Meeting" (OECD, 2011, p. 3). The following is a brief summary of the OECD Guidelines for Multinational Enterprises:

I. **General policies:** In their activities, multinational enterprises should comply with domestic laws and regulations. Enterprises should take into account, prevent and mitigate negative impacts in regard to human rights, workers' rights, the environment and corruption. The Guidelines concern both the operations of enterprises themselves and those of their supply chains.

II. **Disclosure of information on business activities:** Multinational enterprises are expected to publish information on their business activities and financial performance on a regular and transparent basis. This allows enterprises to demonstrate that they take the aims of the Guidelines seriously.

III. **Human rights:** Governments have an obligation to protect human rights, which are rights that apply equally to all people. Multinational enterprises should respect human rights. They are expected to find ways to prevent and mitigate negative impacts on human rights and to take corrective action in the case of negative impacts on human rights that have already occurred.

IV. **Employment and industrial relations:** Multinational enterprises should respect the rights of their workers and engage in cooperation with the workers' representatives. This means, for instance, that workers must have the right to join trade unions if they wish. Furthermore, enterprises are urged to combat discrimination, child labour and forced and compulsory labour.

V. **Environment:** Multinational enterprises are urged to prevent and mitigate negative impacts on the environment. Negative impacts on the environment can also be a risk to human health. Environmental protection can be seen as both an obligation and a business opportunity.

VI. **Combating bribery, bribe solicitation and extortion:** Multinational enterprises have a key role to play in the fight against corruption and bribery. This could take the form of, for example, action plans for internal control and ethical conduct.

VII. **Consumer interests:** Multinational enterprises should observe fair and honest marketing practices and ensure that their products and services are safe and of high quality.

VIII. **Science and technology:** Multinational enterprises have an impact on economic and social development by spreading new technologies around the world. They also have an important role in the development of innovations.

IX. **Competition:** Multinational enterprises must comply with the applicable competition laws and refrain from actions that restrict competition. This will promote the operation of the market and economic growth.

X. **Taxation:** It is essential that multinational enterprises contribute to the funding of general government finances in their host countries by paying their taxes promptly and appropriately. The Guidelines emphasise that enterprises should act in accordance with the spirit and letter of the tax regulations in their countries of operation (Ministry of Economic Affairs and Employment of Finland, 2017, p. 7-8).

"The UN Global Compact and the OECD Guidelines for Multinational Enterprises ('the OECD Guidelines') are based on complementary premises. The Guidelines are founded on the assumption that internationally agreed principles can help prevent misunderstandings and build an atmosphere of confidence and predictability among business, labour, governments and society as a whole. The Global Compact is based on the premise that business has an interest in sustainable and inclusive global markets underpinned by universal principles and that the UN's unique convening power can be used to build consensus

and promote substantive positive action and practical solution finding to the challenges of globalisation" (OECD, 2005, p. 3).

"The initiatives complement each other well in terms of the topics they address and their geographical coverage. Both initiatives are based on broad international consensus: both the OECD Guidelines and the UN Global Compact are deeply rooted in international conventions and declarations enjoying universal consensus. Since the OECD Guidelines' text is relatively long and detailed, it covers some areas that are not covered explicitly by the UN Global Compact. These include chapters on disclosure (which contain recommendations on both financial and non-financial disclosure), consumer interests, science and technology, competition and taxation. The following table maps the Global Compact principles with relevant chapters of the OECD Guidelines" (OECD, 2005, p. 4).

GLOBAL COMPACT PRINCIPLES	OECD GUIDELINES' CHAPTERS
Human Rights	
Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights;	Chapter II. General policies Chapter VII. Consumer interests
Principle 2: Make sure that they are not complicit in human rights abuses.	Chapter II. General policies
Labour	
Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;	Chapter IV. Employment and industrial relations
Principle 4: The elimination of all forms of forced and compulsory labour;	Chapter IV. Employment and industrial relations
Principle 5: The effective abolition of child labour;	Chapter IV. Employment and industrial relations
Principle 6 : The elimination of discrimination in respect of employment and occupation.	Chapter IV. Employment and industrial relations
Environment	
Principle 7: Businesses should support a precautionary approach to environmental challenges;	Chapter V. Environment
Principle 8: Undertake initiatives to promote greater environmental responsibility;	Chapter V. Environment
Principle 9: Encourage the development and diffusion of environmentally friendly technologies.	Chapter V. Environment
Anti-corruption	
Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.	Chapter VI. Combating bribery
Other issues	
	Chapter III. Disclosure Chapter VII. Consumer interests Chapter VIII. Science and technology Chapter IX. Competition Chapter X. Taxation

Table 2.9: A Comparison of the Coverage of the UN Global Compact Principles and Selected OECD Guidelines

"The Principle of UN PRI and OECD Guidelines for Multinational Enterprises also share a common goal, despite their different scope and orientation. This goal surrounds the positive contribution of the private sector to economic, social and ecological progress with a view to sustainable development" (OECD, 2007, p. 2) .

"In December 2010, GRI announced a partnership with the OECD to give companies worldwide greater guidance and support to conduct their business responsibly and to re-

port on their sustainability performance. The partnership aims to help companies make greater use of the OECD Guidelines for Multinational Enterprises (OECD, 2011) and the GRI Sustainability Reporting Framework, bringing increased coherence and consistency to their efforts to act more responsibly and be more transparent about their sustainability" (Hřebiček et al., 2011, p. 159-160).

2.5.3   European Union (EU)

The European Commission "renewed in the *EU strategy 2011-14 for Corporate Social Responsibility* a new definition of CSR as 'the responsibility of enterprises for their impacts on society'. Respect for applicable legislation and for collective agreements between social partners is a prerequisite for meeting that responsibility. To fully meet their corporate social responsibility, enterprises should have a process in place to integrate social, environmental, ethical, human rights and consumer concerns into their business operations and core strategy in close collaboration with their stakeholders, with the aim of" (EU Commission, 2011, p. 6):

- maximising the creation of shared value for their owners / shareholders and for their other stakeholders and society at large;

- identifying, preventing and mitigating their possible adverse impacts (EU Commission, 2011, p. 6).

The excessive definition assumes that CSR is sold on a voluntary basis, but gives national people the rights to set regulatory relationships, whatever and wherever (Secka, 2015, p. 37).

In 2014, "the Commission adopted the Non-Financial Reporting Directive, which aims to improve the quality and quantity of information reported by large listed companies on a range of ESG issues and updated the report in 2019" (Amariei, 2019, p. 9).

The European Commission established the provision of the new guidelines for climate-related disclosures because "companies and financial institutions have a critical role to play in the transition to a low-carbon and climate-resilient economy. Firstly, an additional annual investment of EUR 180 billion is already needed to meet the EU's energy and climate 2030 targets and further funds will be needed to achieve climate neutrality by 2050. Many of these investments represent significant business opportunities and much of the funding will need to come from private capital. Secondly, companies and financial institutions need to better understand and address the risks of a negative impact on the climate resulting from their business activities, as well as the risks that climate change poses to their business. Weather-related disasters caused a record EUR 283 billion in economic damages in 2017 and could affect up to two-thirds of the European population by 2100 compared with 5% in 2019. Better disclosure of climate-related information by companies can contribute to the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030, which calls for governments to evaluate, record, share, and publically account for disaster losses" (EU Commission, 2019a, p. 2). The commission also argues that "with better disclosure of climate-related information, benefits for the reporting company itself come up, such as" (EU Commission, 2019a, p. 2):

- increased awareness and understanding of climate-related risks and opportunities within the company, better risk management, and more informed decision-making and strategic planning;

- a more diverse investor base and a potentially lower cost of capital, resulting e.g. from inclusion in actively managed investment portfolios and in sustainability-focused indices, and from improved credit ratings for bond issuance and better credit worthiness assessments for bank loans;

- more constructive dialogue with stakeholders, in particular investors and shareholders;

- better corporate reputation and maintenance of social licence to operate (EU Commission, 2019a, p. 3).

"According to the Non-Financial Reporting Directive, companies should disclose key performance indicators relevant to their particular business. They should consider using indicators to support their other climate-related disclosures, such as those related to outcomes or risks and their subsequent management, in addition to allowing for aggregation and comparability across companies and jurisdictions. Indicators should be integrated with other disclosures to support and explain the narrative. Subject to the company's materiality assessment and in order to facilitate greater comparability of disclosures of non-financial information by companies, companies should consider disclosing the indicators that were developed in the report" (EU Commission, 2019a, p. 12).

A special attempt was made "to address climate-related information and to integrate the TCFD recommendations. The technical expert group (TEG) on sustainable finance published its final report on climate-related disclosures in January 2019 (TEG, 2019c). In addition, the TEG released three new reports: a final report on the EU taxonomy (TEG, 2019d); a final report on the EU Green Bond Standard (TEG, 2019b); and an interim report on Climate Benchmarks and Benchmarks' ESG Disclosures (TEG, 2019a). Together, these developments mark an important step in the development of much needed common language, tools and instruments" (Amariei, 2019, p. 9-10).

In 2019, the EU Commission and all EU member states signed the European Green Deal. It describes "climate change and environmental degradation as an existential threat to Europe and the world. In order to meet these challenges, a new growth strategy is to be developed that will transform the Union into a modern, resource-efficient and competitive economy" (EU Commission, 2019b). The following major goals should be met by:

- there are no net emissions of greenhouse gases by 2050,

- economic growth is decoupled from resource use,

- no person and no place is left behind (EU Commission, 2019b).

3   Retail Investor Strategy and Sustainability Survey

The aim of this master's thesis is to identify the cost of sustainability. In Chapter 6 to Chapter 9 an analysis is carried out and a value is calculated. Assuming a portfolio with stocks that are restricted to sustainable stocks perform worse than a portfolio with all stocks, a rational investor or equity investor will always choose the portfolio with the better performance, depending on the risk. Nevertheless, in the previous chapters I explained that the investment market is increasingly focusing on sustainability, regardless of whether the performance is worse or better.

In order to find out whether shareholders really accept a poorer performance for sustainability, I created the following survey.

3.1   Structure of the Survey

The survey was created by me on the website <https://www.umfrageonline.com/>, and was active from 2020-06-31 until 2020-07-31. In the Exhibit you find the question of the survey in Figure 11.1. The survey was available in German and English and the participant was required to select their language preference. On the next two pages of the survey I explained the purpose of the survey and gave an introduction. Here I defined e.g. a sustainable portfolio and a traditional portfolio.

Then the survey starts with the first question deciding whether you continue into the body of the survey or are taken directly to the end. I asked if the participants had already invested private money in stocks or plan to do so in the near future. If the answer was 'yes', you would be taken to questions regarding retail investor strategies, in the answer was 'no' you came directly to the final questions regarding gender and year of birth since the other questions would not be relevant to you.

In question two, I ask about the criteria according to which private investors choose their stocks. There are also criteria that identify sustainable stocks. In questions three to five, I go specifically to the topic of sustainability, asking whether you are ready to be restricted to sustainable stocks. Furthermore, it is asked how much one is willing to give up for sustainable returns. The following is one such example:

Your traditional portfolio produces an excellent return. You are offered to switch to a sustainable portfolio, which brings less income. What percentage of your current return must the average return on the sustainable portfolio bring in order for you to switch anyway?

You could then enter between 0 and 100 percent, where, for example, entering 90 percent meant that you would get 10 percent less with the sustainable portfolio than with a traditional, i.e. an unrestricted, portfolio.

The fifth question asks whether sustainability of companies should be regulated internationally, nationally or not at all. The last question regarding sustainability asks in which areas you would buy stocks. Industries that are not sustainable are deliberately

included. Industries of atomic energy, coal, oil and gas, defence and army, genetic engineering, gambling, and drug are excluded in sustainable portfolios. The purpose of this question is to find out whether the investment behaviour on average across all participants is already leaning towards the area of sustainability.

The last two questions received by all survey participants are standard demographic questions, namely gender and age in order to be able to respond more specifically to these groups.

3.2   Analysing Results

A total of 222 people participated within the month that the survey was conducted online. Of all participants, 62.16% (n = 138) had invested their private money in shares before or plan to do so in the near future. When I speak of participants in the further course of the analysis of the survey, I refer to these 138 subjects.

The youngest participant was 23 and the oldest 77, the test persons divided into 49 women and 89 men. In order to better analyse the behaviour of the participants, they were divided into age groups. The groups are identified as follows: 20-29, 30-39, 40-49, 50-59, 60-69 and 70-79 year old participants. In the Figure 3.1 you see the distribution of the participants by age group and gender.
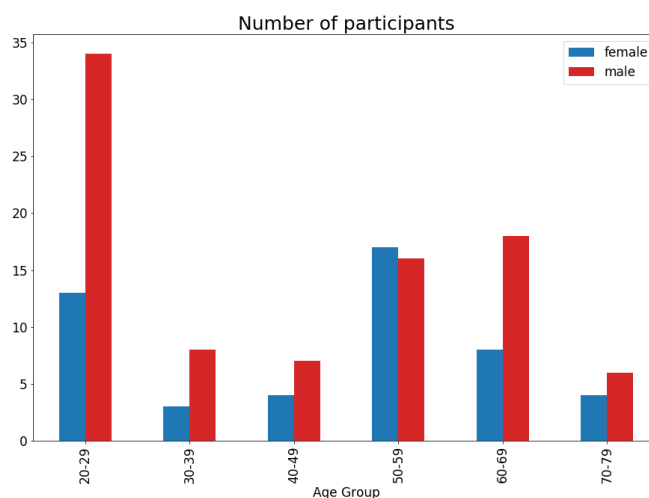
Figure 3.1: Distribution of participants

This distribution is not a random sample of the population and can therefore not be considered as representative. The aim of this survey was to find out whether the participating investors are ready for sustainability and whether this is desirable.

Now to the question of which criteria are important for shareholders when choosing their shares. A total of 38 criteria were mentioned, I would like to briefly list the top 10 criteria here, ranked according to importance (most important criterion begins at number 1):

  1. Stock price

2. Size of the company

3. High dividends

4. Sustainability of the company

5. Low debt company

6. Well-known company

7. Company with good employment relationships

8. Low volatility stocks

9. Sharpe ratio

10. Company that is involved in environmental projects

The top 3 of the list are typical criteria for stock selection, but the fact that sustainability comes fourth immediately after this came as a surprise to me. So the sustainability of companies is assigned a second, but still important value. It should also be noted that there are two other criteria in the top 10 that fit into ESG thinking, namely places 7 and 10.

The next question explicitly raised the issue of sustainability. We recognised earlier that sustainability is very important but you don't want to limit yourself to exclusively sustainable stocks. As an individual investor, only 60% of those surveyed wanted to limit themselves to just sustainable stocks. 40% of the 138 participants would be willing to be restricted.
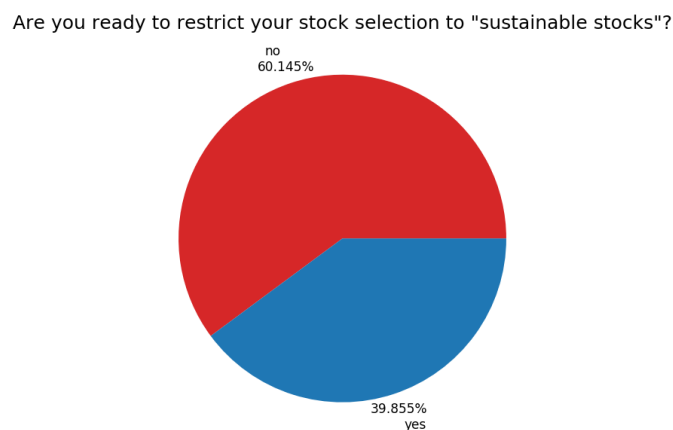
Figure 3.2: Percentage for and against restrictions

We will now skip the fourth question and come back to it later. As we will discuss in Chapter 4.1, both companies and investors want regulations for sustainability. The fifth question wanted to ask the opinion of the investors interviewed. More than two-thirds have spoken out in favour of regulating companies on the international level on the subject of sustainability.
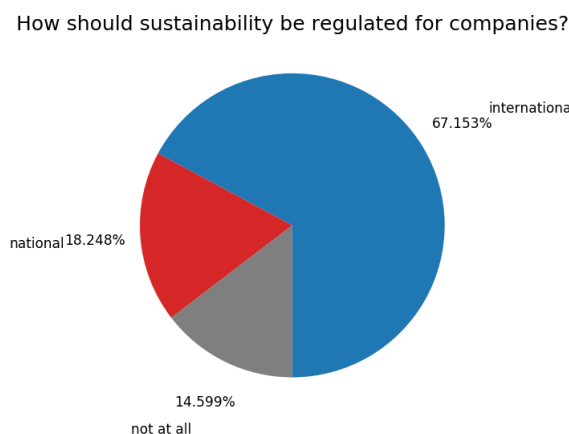
Figure 3.3: Regulated for companies

Almost 15% do not want any regulation in this area. Although this is a percentage that cannot be neglected, a qualified majority advocates regulation. In my view, it is also understandable that this should take place at the international level, since otherwise some companies are disadvantaged in the capital market compared to others. A difference already exists when considering company law which could be addressed e.g. if the EU introduced minimum standards. Even though corporate sustainability is regulated at this level, the international organisation is in favour with most investors.

Back to the most important question of this survey, namely the fourth. The aim of the work is to find out if and how much sustainability costs and so question 4 of this survey aims to identify whether participants would be willing to take on additional costs associated with sustainability, should they arise. The example mentioned on page 32 was used for this. The question was answered by entering a percentage of the return that you are willing to give up for sustainability. In the following Figure 3.4 you see a box plot of these percentages for each age group.
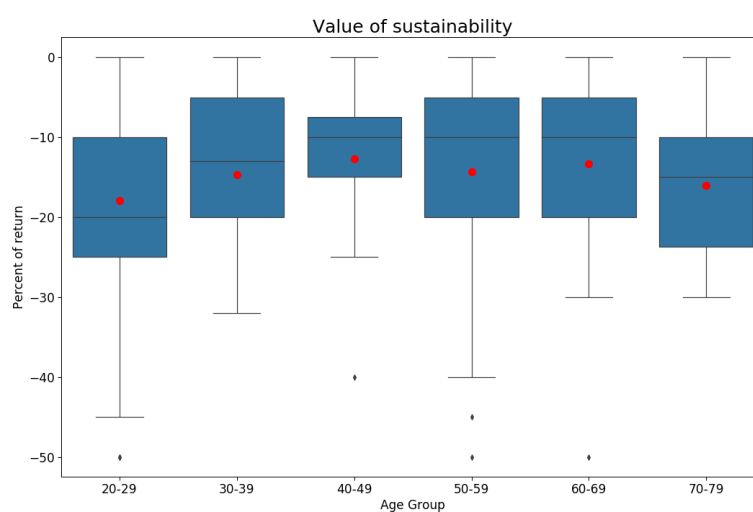
Figure 3.4: Average percentage of return willing to give up for sustainability

On average, all age groups are willing to give something from their return for sustainability.

The range among the participants is between 0% and 50%, although the 50% were three outliers among the 138 respondents. If you look at the mean values (red dot in the blue boxes), you clearly see a trend, namely that the younger the age group, the more the return is willing to give up for sustainability. When looking at the median (black line in the blue boxes), you see that half of the subjects in the age groups would give less percent of the return than the mean value, except for the age group of 20-29 years. Among them, half of the participants are willing to give more than the average of the group. The graphical representation of the groups has shown us a lot, but I would still like to refer to Table 3.1, which gives the exact percentages that those involved would give up for sustainability.

Age_Group	count	mean	std	min	25%	50%=median	75%	max
20-29	47	-17.906	12.889	-50	-25	-20	-10	0
30-39	11	-14.727	10.612	-32	-20	-13	-5	0
40-49	11	-12.727	11.697	-40	-15	-10	-7.5	0
50-59	33	-14.333	13.532	-50	-20	-10	-5	0
60-69	26	-13.346	11.757	-50	-20	-10	-5	0
70-79	10	-16.0	10.488	-30	-23.75	-15	-10	0

Table 3.1: Survey question 4 data description

Now to the last question regarding the topic regarding the industrial choices of the investors. The sectors that are mostly excluded by ESG criteria were marked in red in Figure 3.5.
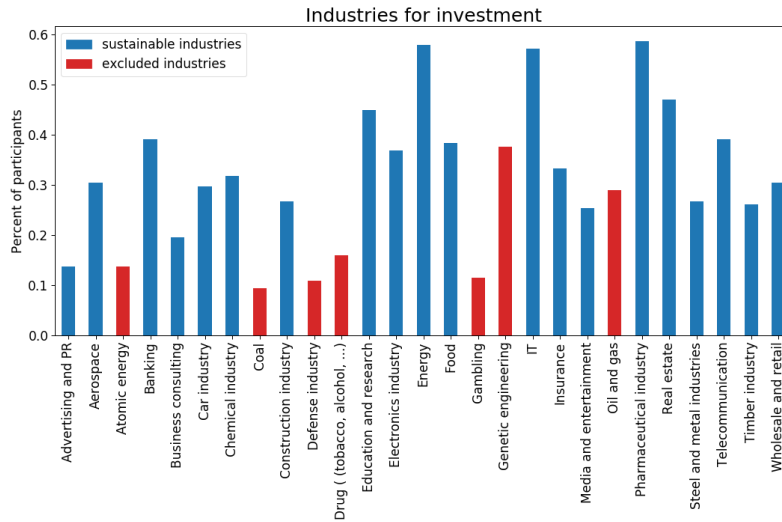
Figure 3.5: Sector distribution among the participants

The industries in the fields of atomic energy, coal mining, coal energy, defence, drug and gambling are no longer of great importance among the participants, because these sectors only address 9% to 16% of the participants. In contrast to this, 38% of those surveyed stated that they wanted to invest in genetic engineering and 29% of the participants in the oil and gas industry.

3.3 Survey Conclusion

Assuming that all retail investors behave in a similar way in terms of stock choice as those surveyed, this confirms that the sustainability of companies plays a major role and will play an even greater role in the future. The younger the investors, the more willing they are to pay for sustainability but there is also a trend towards sustainability beyond the age limit and, across the entire age group, they are willing to give 15% of the return for sustainability.

As previously established in the relevant literature, for example by State and Street (Eccles et al., 2017, p. 125), the majority of investors want regulation at the international level. This means that large organisations such as the UNO, the EU, etc. are required to continue to advance this topic. However, as long as no demands are made by governments or organisations to CEOs to convert their company and work structure to sustainability and to push back those companies that are not sustainable, there will still be investors buying the shares from them. When comparing Figure 3.2 and Figure 3.3, one realises that the individual investor does not want to limit himself alone but seeks a common ground for regulation and restriction.

4   Implementation of the ESG Criteria in Investment Decision Process

There are many options for socially responsible investment: The socially responsible investor can build up an ethical-ecological portfolio through targeted 'ESG investment'. When investing directly, he has the option of investing in fixed-income securities or shares. An alternative is to invest outside the capital market by participating in private or urban environmental projects such as the construction of a wind farm for hydropower plants or the development of innovative environmental technologies (Büschgen and Everling, 1996, p. 680).

For some companies, "ratings and rankings have become a benchmark and there is a sense of competition as they want to beat their peers. Some use DJSI or CDP to benchmark. Many use it to measure their progress and to work on their journey as they gradually try to increase their scores. The questions asked by ESG initiatives are used to put things on the agenda and to update policies. These are especially helpful for 'sustainability people' in gaining internal support for certain ESG projects. When they talk to the management team, it helps to show that there is interest from the 'outside world' in ESG. More than one respondent claims that it really helps in getting their superiors to sign off on certain projects. It also helps companies to understand the areas in which they need to be more transparent and it provides them with insight into trending topics. It simply sheds light on how they are perceived, including their potential points of improvement. Companies believe that ratings and rankings should focus on material and relevant issues. They must be transparent both with the methodology and the assessment" (Mooij, 2017, p. 20-21).

"The Center for Applied Research (CAR) at State Street Corporation conducted a global survey in late 2016 of 582 institutional investors that are either implementing ESG strategies or are planning to do so. The survey respondents were evenly split between asset managers and asset owners, and between fixed-income and equity investors, and were geographically dispersed across the Americas, Europe, the Middle East, Africa (EMEA), and Asia Pacific (APAC). All respondents were already or were planning to adopt ESG investing of some type and to some degree" (Eccles et al., 2017, p. 125-126).
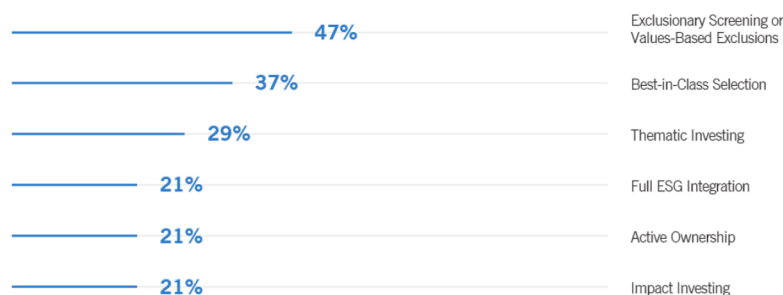
Figure 4.1: Choices of ESG investing strategies by international investors (Respondents can select more than one option, therefore percentages don't add to 100%)

Two strategies are most prominent among the surveyed investors: 47% of investors use exclusionary screening or values-based exclusions and 37% use best-in-class selection (see Figure 4.1). Investors identified the two greatest benefits of ESG investing as 'fostering

a long-term mindset' (62%), followed by 'cultivating better investment practices' (48%) (see Figure 4.2).
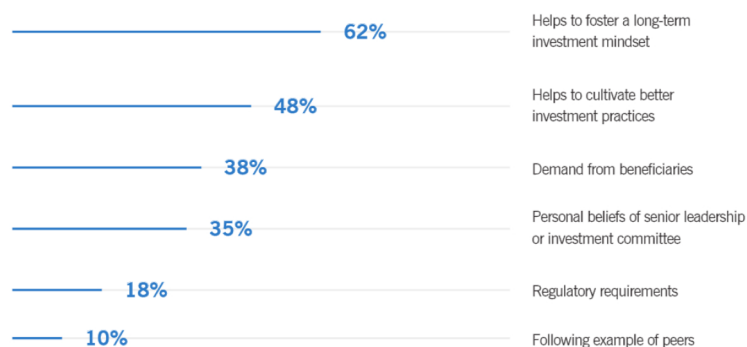
Figure 4.2: Reasons for ESG investing (Respondents can select more than one option, therefore percentage don't add to 100%)

"Investor interest in ESG is market-driven, with 38% citing demand from investment beneficiaries and 35% pointing to initiatives by executives. Only 18% said their interest is driven by regulatory requirements and 10% mentioned peer pressure as most relevant. There were no significant differences in perceived benefits by region, asset class, or asset owners vs. asset managers, suggesting that these benefits are truly global ones "(Eccles et al., 2017, p. 125-126).

"Like socially responsible investment (SRI), the narrower concept of ESG integration is also typically defined so widely that it loses much of its meaning. An increasing number of asset managers indicate that they integrate ESG into their investment processes. The more advanced players tend to have the following elements: signatory to UNPRI and similar initiatives, voting and engagement activities, screening and exclusion, dedicated ESG staff. However, true ESG integration goes much further. The European Sustainable Investment Forum defines ESG integration as follows" (Schramade, 2016, p. 2):

"This type (of strategy) covers explicit consideration of ESG factors alongside financial factors in the mainstream analysis of investments. The integration process focuses on the potential impact of ESG issues on company financials (positive and negative), which in turn may affect the investment decision." (Eurosif, 2012, p. 10)

"This definitely goes well beyond screening and engagement and implies the use of ESG information in all stages of the investment process, including the investment case and the valuation models used in investment decisions. Very few asset managers actually do this. There are several ways to fail at ESG integration including starting with the wrong objectives, lack of top management commitment (and bottom-up incentives), thinking it's already mainstream, buying the ratings and stopping there, treating all sustainability issues as material, not having a proper framework for linking ESG to decision making, and too much respect for the status quo. Often a combination of these mistakes is made and while lots of ESG efforts are being made, the connection to business models and valuation is missing. This typically means that the link to the investment case is missing as well. Even in the case of asset managers possessing a long history in ESG, what they call ESG integration is usually just some isolated ESG specialists throwing a lot of ESG data at

analysts and PMs who are not interested because it is not material to their investment cases. ESG analysts seem to be living in a different world than equity analysts and credit analysts. To bridge these disconnected worlds, one must ensure that the ESG analysts focus on the most material issues, so as to get the attention of their equity and credit counterparts; and ensure the latter have a clear framework for incorporating ESG issues into their models and investment decisions" (Schramade, 2016, p. 2-3).

"In the series of global workshops started by the WBCSD and UNEP FI between business, investors, and stakeholders about ESG and sustainability aspects of company performance evaluation, companies and investors do not agree on which ESG factors are material. The workshops revealed that there are many misconceptions between companies and investors on ESG factors and their financial materiality. Companies found that they have unique expertise on how and why ESG factors are material and core to their business - they understand their business best. Many asset managers generally find the information contained in sustainability reports difficult to use for the purposes of valuing a company. There is widespread acknowledgement among companies that ESG factors can have a material impact on their intrinsic value, and that ESG factors should have a corresponding impact on their market capitalisation. However, many investors continue to think that ESG is narrowly concerned with reputation and brand issues or strictly with matters of corporate governance. The expertise among mainstream asset managers and corporate investor relations departments about the systemic link between ESG factors and financial performance needs to be enhanced" (WBCSD and UNEP FI, 2010, p. 7).

4.1   What Companies and Investors Can Do

At the WBCDS and UNEP FI workshops, company managers and asset managers met to understand and discuss one another's points of view. Agreement should also be reached on how to make progress in assessing ESG factors and sustainability in investment decisions.

"The workshops revealed that there are many misconceptions between companies and investors on ESG factors and their financial materiality. Companies found that they have unique expertise on how and why ESG factors are material and core to their business - they understand their business best. Meanwhile, asset managers have not gained access to this information through current ESG questionnaires and desk research, and tend to focus on reputational issues" (WBCSD and UNEP FI, 2010, p. 7).

"Communication must be in a relative and comparable language, because if companies and investors can agree on an essential ESG factor, the management of this factor is often not explained by companies in equivalent terms, leading to issues with the capacity for comparison. Furthermore, ESG research needs to focus on financially material questions. The need for change is driven by company frustrations that ESG questionnaires from investors, rating agencies, indices and direct questions to companies at reporting times are not asking financially material questions, resulting in missed opportunities. The increasing volume of questionnaires in terms of both detail and frequency of requests is causing a major drain on corporate resources that might be used more effectively in direct dialogue with those seeking the assessments" (WBCSD and UNEP FI, 2010, p. 8).

There is a gap between companies and investors regarding agreement on ESG factors and the language in which the relevant data for these factors is transmitted. In the next two subsections (4.1.1 and 4.1.2), I take a look what investors and companies can do so that ESG criteria can flow into the investment decision process.

4.1.1   Companies

"The workshops revealed several areas where companies can draw 'quick wins' in terms of the orientation of corporate communications with the investment community on the financial materiality of ESG factors and sustainability" (WBCSD and UNEP FI, 2010, p. 10).

"Disclosure and communication from companies to the investment community currently lack clear links between ESG, sustainability and financial performance, and the way in which this can be generally linked to strategy. This is a relatively new area for many companies. Expertise among investors and investor relations managers alike is still evolving and needs to be accelerated. The workshops found that it is becoming more common for investor communications to focus on one element, so E, S, or G. However, it is less common for corporate managers to communicate a holistic view of ESG factors and sustainability in the context of their financial materiality. Corporate sustainability managers can provide valuable expertise on the materiality of ESG factors to support the corporate communication processes involving the investment community. The risk of doing nothing could result in long-term value destruction for companies that do not manage material ESG factors responsibly and are consequently unable to reap the rewards of new market opportunities that directly address global sustainability issues" (WBCSD and UNEP FI, 2010, p. 10).

"Building ESG expertise at management level and among investors requires clear and transparent investment language. Investors want quantitative ESG data to be:

- Material – where the relationship to financial performance is clear

- Standardised and comparable – across companies and sectors, and through time

Disclosure must include both data on past performance and forward-looking assessments. Such assessments can include forecasts on how ESG factors are projected to affect cash flows over a period of time. Investors say that insufficient forecasts in corporate disclosure are an impediment to pricing the long-term implications of ESG factors" (WBCSD and UNEP FI, 2010, p. 11).

"The difficulty with qualitative information is that it is not readily reducible for mathematical models and investor spreadsheets - it is not 'user-friendly' for asset managers. However, a review of the brand valuation journey demonstrates that qualitative data can be measured and valued. The workshops found that conversations are the real tool in allowing investors to better understand the intrinsic and long-term value of a company's business in a way that databases cannot. Currently, investor-company conversations are usually limited to asset managers and company investor relations managers who primarily focus on traditional factors such as earnings and growth prospects and put too much

emphasis on short-term gains without giving appropriate consideration to material ESG risks and opportunities associated with long-term value creation, resilience, and sustainable development" (WBCSD and UNEP FI, 2010, p. 11).

The most important takeaways for companies from the workshops were divided into three thematic areas:

1. Build expertise on ESG & sustainability fundamentals in company valuation:

   - Build knowledge and expertise on material ESG factors and sustainability in the context of their own companies and sectors

   - Systematically integrate financially material ESG factors and sustainability into corporate decision-making and disclosure

   - Communicate to investors the clear links between the management of financially material ESG factors and sustainability in the context of their own company's strategy and in comparison, to peer companies (i.e. within the sector)

2. Standardise disclosure of quantitative ESG data:

   - Form sector-wide agreements or principles on quantitative ESG factors and indicators perceived as financially material to businesses in their sector

   - Ensure that corporate and sustainability reports articulate financially material ESG factors and include both present data and forward-looking assessments

3. For delivering qualitative ESG data:

   - Proactively pursue one-on-one dialogues with investors to discuss qualitative ESG and sustainability issues with links to both past and forward-looking financial performance and strategy (WBCSD and UNEP FI, 2010, p. 27)

4.1.2 Investors

"The workshops revealed several areas where asset managers can draw 'quick wins' in terms of integrating financially material ESG factors into investment decision-making. An immediate roadmap for investors could follow three critical steps" (WBCSD and UNEP FI, 2010, p. 14).

"The first step for investors is to build expertise and knowledge on how ESG factors impact intrinsic company value. Some helpful starting places for building expertise are:

- Talking with companies themselves

- Approaching specialist investment research houses and brokers

- Direction from international initiatives (e.g. UNEP FI, WBCSD, Principles for Responsible Investment)

Companies strongly believe that ESG factors can drive long-term and sustainable value creation in their businesses. However, it is important to bear in mind that each company needs to be valued differently according to three variables:

- The regional geography of the company's operations

- The company's sector

- The particular ESG factors (the environment, social forces or corporate governance) to which the company is most exposed" (WBCSD and UNEP FI, 2010, p. 14)

In the second step, "both quantitative and qualitative data should be used for the investment analysis. Standard financial models in mainstream investment houses are almost entirely dependent on quantitative data inputs. However, these quantitative inputs often require qualitative judgements. The analyst must decide what assumptions to use to make the model forecast the best representation of the company's performance in the future. These judgement calls are where ESG factors play a crucial role for particular companies according to country, industry, and product line. A significant proportion of the value captured by ESG factors is through qualitative data. There is sizeable opportunity for asset managers to expand their valuation models to build a bridge between qualitative ESG factors and measurements of financial performance. Companies are uniquely qualified on how and why ESG factors are core to their business, but it is nevertheless recommended that companies that are financially material by sector and by region agree on common criteria. Investors should actively support and monitor this process so that data is standardised and comparable across companies within a given sector, as well as through time. Some of the world's most successful investment strategies are founded precisely on capturing qualitative information in valuation. This requires skills that can be developed with expertise, knowledge and business acumen rather than sophisticated modelling" (WBCSD and UNEP FI, 2010, p. 14-15).

The third step "is to formalise a process for gathering qualitative ESG data. The difficulty with qualitative information is that it is not 'user-friendly' for mathematical models and investor spreadsheets. Based on insights from company-investor dialogues, the report of the workshops recommends two approaches as a starting point to increase the flow of both qualitative and quantitative ESG data" (WBCSD and UNEP FI, 2010, p. 16):

- Standardised inputs for quantitative ESG data

- A formalised process for regular meetings and communications with companies to discuss the value and application of qualitative ESG data (WBCSD and UNEP FI, 2010, p. 16)

"The impetus for the first strategy must come from companies with the support of investors. The impetus for the second strategy must come from investors with the support of companies. The current investor method of using questionnaires has been criticised by companies as missing the mark" (WBCSD and UNEP FI, 2010, p. 16).

"Companies and capital market actors in emerging countries want to be included in the decision-making to ensure that global standardisation reflects the perspectives and needs of a diversity of regions. The WBCSD and UNEP FI may be ideal platforms for these inclusive dialogues" (WBCSD and UNEP FI, 2010, p. 16).

As before at the end of Chapter 4.1.1, the most important takeaways for investors from the workshops were divided into the same three thematic areas:

1. Build expertise on ESG & sustainability fundamentals in company valuation:

   - Build knowledge and expertise on ESG factors and sustainability across companies and sectors, and through time

   - Systematically integrate financially material ESG factors into fundamental analysis, company valuation and investment decision-making

   - Proactively ask companies about the management of material ESG factors and sustainability and their links to financial performance and strategy

2. Standardise disclosure of quantitative ESG data:

   - Price quantitative ESG data into their valuation models

   - Proactively support companies in the development of standardised ESG and sustainability data to ensure comparability. Use UNEP FI, the Principles for Responsible Investment and the WBCSD as platforms for these dialogues

3. For delivering qualitative ESG data:

   - Institute regular one-on-one dialogues with companies to discuss qualitative sustainability issues and links to companies' management of fi material ESG factors (WBCSD and UNEP FI, 2010, p. 27)

4.2   Requirements on ESG Reporting and Rating

In order to incorporate ESG data, reports and rankings into the investment decision process, these must first meet certain requirements and properties. The following synthesis of properties builds on a review of academic literature and practice-relevant publications on ratings, indices, and related assessments of corporate sustainability. It identifies the aspects which emerged as the common focus of several publications. This compilation does not claim to be complete but is intended to reflect the most important and most frequently mentioned requirements.
A brief description of each of these alphabetically ranked dimensions can be found below:

Accurate   "The reported information should be accurate enough to enable the company's stakeholders to evaluate the results of the company's activities" (Euronext N.V., 2020, p. 34).

Balanced   "The company should should provide an objective picture of their performance, presenting both favourable and unfavourable information clearly and in full to aid the reader's understanding" (London Stock Exchange Group, 2018, p. 21). Thus, "the report should describe both the positive and negative impacts of the company's activities" (Euronext N.V., 2020, p. 34). "Efforts to avoid or obscure certain information or aspects of performance will inevitably lead to questions from investors and may create an environment of mistrust. Data on more difficult subjects should be set out alongside explanations and commentary. Where influenced by unfavourable occurrences or market conditions, a full explanation detailing organisational learning and changes resulting from the experience will reassure investors" (London Stock Exchange Group, 2018, p. 21).

Comparable   I some respects, the increasing number of ratings with their own methods, weightings, and forms of representation pose a challenge. They increase complexity for companies and investors and simultaneously make the comparison of results quite difficult (Scalet and Kelly, 2010, p. 72)(Keller, 2015, p. 32). "The information should be presented in a manner that enables stakeholders to evaluate the company's performance over time and to compare it with that of other organisations where relevant" (Euronext N.V., 2020, p. 34).

"When seeking the optimal representation of the rating results, difficulties arise in regard to maintaining the integrity and informative value of the data while producing a scale which is comparable between industries and countries. The more detailed the results, the more precise the information is, making it quite performance specific and thus difficult for companies to compensate for poor performance in one area with good performance in another. A high level of detail, on the other hand, makes it difficult to compare the overall performance between different companies or to understand the individual services of the companies and to compare them with each other" (Windolph, 2011, p. 45). In addition, the question arises whether an identical catalogue of criteria can be used for different countries and industries and whether such an overarching comparability is generally possible or desirable. The comparison of absolute performance, e.g. the carbon dioxide emissions of a bank and a coal-fired power station lead to companies in an industry being deprived of the incentive to disclose this data or to improve in this area. The relative representation would be preferable in this regard, which in turn is disadvantageous for an investor who is explicitly looking for low-carbon industries (Keller, 2015, p. 32).

"In order to allow comparability between peers, it is important to use consistent global standards when reporting. Companies should use indicators and metrics that are widely used within their sector, aiming to gather data in line with common practice and to report in a similar manner to sector peers. Companies should consider using standard denominators when normalising data" (London Stock Exchange Group, 2018, p. 20).

Comprehensible   The comprehensibility of a rating, but not the complete verifiability, is not just a requirement from a financial theory perspective. The information should be clear to the reports users. In the area of comprehensibility, it should therefore be examined whether the individual analysis steps can be traced. It can be useful, for example, to describe the company's value chain in order to show where the company has the greatest impact on the environment (Keller, 2015, p. 30)(Euronext N.V., 2020, p. 34).

Consistent   "The methods used to collect and calculate data should remain consistent year-after-year. If data compilation methodologies or underlying assumptions change, issuers need to explain the changes that have been made. Where these changes have had a significant effect on results, data for previous years should be recalculated using the new methodology or assumptions to enable comparison" (London Stock Exchange Group, 2018, p. 20).

Free from any bias   "Another challenging aspect for CS ratings are biases. "Schäfer, Beer, Zenker, and Fernandes state that many sustainability ratings are biased, meaning that they put special emphasis either on the environmental, social, or economic dimension" (Schäfer et al., 2006, p. 160-164). However, overemphasising any one of the three

dimensions is inconsistent with the integrative character of sustainability. According to that, companies are required to simultaneously take account of and harmonise the environmental, social, and economic dimensions" (Diekmann, 2010, p. 44).

In addition, these different weightings allow a rated company to 'choose' or promote those ratings that focus on an area in which it has its strengths. Different weightings are not bad per se, but they do require rating agencies to explicitly communicate the purpose they pursue to the outside world (Keller, 2015, p. 30).

"Biases are also relevant for the type of companies to be rated. A lot of ratings, rankings, and indices aim at identifying sustainability leaders, for instance the DJSI. However, most ratings focus on larger companies and include neither small and medium enterprises nor companies from emerging countries. Consequently, sustainability leaders may not be identified by this procedure, since the raters possibly do not even include them in the sample or they do not take part in the rating. Another difference in the selection process is the usage of an existing index as 'underlying universe' versus actively screening for sustainability-oriented companies. For example, the Dow Jones Indexes (DJI) serve as parent indices for the DJSI and several MSCI indices for the MSCI ESG Indices, whereas the oekom universe also contains smaller companies and 'significant non-listed bond issuers'" (Diekmann, 2010, p. 44-45).

Granular   "Granularity pertains to the coverage or 'scale' of individual elements of a dataset. For example, does the dataset provide figures at the company or industry level? Granularity reflects the degree to which investors can make focused (versus generic) decisions based on a dataset" (In et al., 2019, p. 25).

Independent   According to Sönnichsen, independence is a basic requirement for the acceptance of a rating on the market (Büschgen and Everling, 1996, p. 441). This means that a rating process should be based exclusively on the requirements of the rating recipient, which among other things means that the rated companies are not financially connected to the rating creator (Keller, 2015, p. 27).

"The relationship between companies and raters established in order to get the necessary information raises the question whether ratings are independent. Research organisations increasingly depend on the personal interaction with companies. This is especially true when the rating process is carried out repeatedly over time, which is usually the case. For example, oekom emphasises the importance of the cooperation with companies during their rating and SAM describes to 'proactively engage with companies'. These aspects might create conflicts of interest. Another potential conflict brought up by Healy and Palepu is the personal interest of financial analysts in screening outcomes: 'analysts are rewarded for providing information that generates trading volume and investment banking fees for their brokerage houses' (Healy and Palepu, 2001, p. 417). This may encourage upward biases of rating results. One more relevant aspect in this context is the distinction between solicited and unsolicited ratings. Solicited ratings are carried out for a particular client and paid for. This fact also puts into question the independence of the ratings" (Windolph, 2011, p. 46).

The lack of independence between the rating agency and the rated company is one of the most frequently mentioned weaknesses in the ESG rating market (Windolph, 2011, p. 46). The criterion of independence also corresponds to one of the three mentioned from a financial theoretical point of view for a rating and the lack of this has sometimes led to

the regulation of the conventional credit rating (Büschgen and Everling, 1996, p. 441). In order to be independent, the rating agency must be aware of this danger and draw up appropriate guidelines to prevent conflicts of interest (Keller, 2015, p. 27).

Measurable   The operationalisation of the facts to be measured, i.e. the definition of directly observable, measurable variables, is associated with special challenges in the context of ESG ratings. This process is a difficult task, especially in the social area, where quantitative variables are often not directly apparent, e.g. when a company's dealings with its employees or other stakeholders have to be assessed. Furthermore, between quantitative and directly measurable variables, i.e. variables with qualitative character, and open questions can be distinguished, as mentioned in Chapter 2.1. The subdivision of variables in the form of closed questions takes place in multiple-choice questions, single-choice and hybrid questions, which have both closed and open answer options. Not only for questions with predefined answer specifications but in general, it should be possible for the respondent to also provide a 'non-substantial' answer, such as 'don't know' or 'not applicable' so as not to force the participant to give an answer that he does not know (Keller, 2015, p. 34).
Single-choice questions (SC questions) should also be rated as scaling since each possible answer represents a unique category. In this context, a distinction should also be made between quantitative, qualitative, and hybrid scales. A scale from the interval scale level is considered quantitative, otherwise it is classified as qualitative. A distinction is also made between dichotomous variables/scales and polytomous variables/scales, as well as hybrid SC questions that have both closed and open answer options (Diekmann, 2010, p. 118). Multiple choice questions are evaluated as a separate measurement technique, whereby a distinction can be made between normal MC questions and those with closed and open answer specifications, i.e. hybrid MC questions (Keller, 2015, p. 34).

Objective   According to Diekmann, "the extent of the objectivity of a measurement is measured according to whether there is a dependency between the result and the person performing the measurement. If the results of person A and B match perfectly, correlation 1 and thus the desired complete objectivity is given. If the measurement is based on an interview, the objectivity of the implementation can be used as a criterion in addition to the objectivity of the evaluation. If two different interviewers were to receive different answers from the same person, the implementation objectivity would be low" (Diekmann, 2010, p. 249)(Keller, 2015, p. 24).

Reliable   Reliability concerns "the accuracy, precision, and verifiability of data. Practically, a dataset being reliable means it is error-free, unbiased, and checkable. Reliability essentially captures the need for data to be trustworthy for supporting confident decision making by investors" (In et al., 2019, p. 25).
"Due to the lack of available data, it follows that in addition to that data which is made publicly available (such as company or media reports), raters are at least partially dependent of the self-disclosure of companies. A lot of companies acknowledge the signalling function of ratings and take part in surveys, for example through investor relations departments which communicate with analysts and investors (Healy and Palepu, 2001). For instance, inclusion in the DJSI requires companies to 'fill in a detailed questionnaire covering a wide range of weighted economic, environmental, and social factors'. Yet, the

credibility of company information may be questioned, 'because managers have incentives to make self-serving voluntary disclosures' that will not negatively affect their competitive position (Healy and Palepu, 2001, p. 425). That is one reason why many rating organisations additionally use publicly available data. For example, EIRIS refers to the information of 'government and regulatory agencies, industry organisations, trade publications, campaigning bodies, academic and specialists' reports, and the output of other research bodies' (Schäfer et al., 2006, p. 72). However, this information does not necessarily have to be credible either. The verification of information remains a 'significant challenge' for research organisations. Additionally, it was observed that companies are still 'by far the most important source of information' for research organisations. SAM states that their company questionnaire is 'the most important source of information for the assessment' leading to the Dow Jones Sustainability Index (DJSI)" (Windolph, 2011, p. 43).

"Another important argument for the increased inclusion of publicly available data is 'questionnaire fatigue' resulting from the intensive surveying of companies. Companies have to spend considerable resources to take part in surveys and to interact with research organisations. Besides the increasing unwillingness to participate in surveys, another possible negative sideeffect can be that inexperienced employees like interns accomplish the rating survey process. This questions the reliability of information even more" (Windolph, 2011, p. 43-44).

As part of the requirements for the credibility of the information, the following should therefore be examined:

- Which sources of information does the rating agency use, are they internal and/or external?

- Does the rating agency use primary data and/or secondary data?

- Is the data checked or are external certifications required? (Keller, 2015, p. 31-32)

Standardised   Although Corporate Sustainability ratings have spread, little standardisation has been achieved. Standardisation already poses a challenge in the reporting of companies due to the different ideas about corporate responsibility and the ESG concept (Keller, 2015, p. 29). "Beyond that, even those ratings that actually do address the same issues and interests apply varying measures and use their own methodology. The competing approaches have rarely been evaluated in academic research so far, although this is regarded as crucial for the construction of ratings and indices" (Windolph, 2011, p. 43).

"Ratings use publicly available information as well as data disclosed by companies. Yet, the ways that companies gather and communicate information are typically very different. Especially the measurement of social issues as well as the evaluation of the influence of Corporate Sustainability on the success of companies is difficult and not organised systematically. Therefore, the data that ratings build upon is not necessarily comparable and quality might differ. This fact can distort the rating result" (Windolph, 2011, p. 43). In the context of ratings, standardisation is a criterion insofar as the results can only be compared with one another if the rating agencies use uniform approaches. The criticism of the lack of a common understanding of the essential indicators and the measurement techniques of rating agencies moves in the same direction. Standardisation is therefore

not only a criterion for rating agencies, but also creates the basis for more quality and comparability of a rating on the company side. (Keller, 2015, p. 29).

Timely   Timeliness involves "the age of a dataset relative to the relevance of phenomena that it reflects. It is best practice to provide ESG data at the same time as the annual report and accounts are published, or as soon as possible afterwards. Timeliness is not simply equivalent to how old a dataset is; a dataset may have been produced many years ago and still be 'fresh' if it pertains to events of relevance" (In et al., 2019, p. 25). "A company may need to communicate sooner when a significant incident or controversy has taken place, or has been alleged. In these situations, investors do not expect to wait for the next annual reporting cycle" (London Stock Exchange Group, 2018, p. 21).

Transparent   A lack of transparency was sometimes one of the biggest criticisms that was voiced against credit rating agencies in the wake of the financial crisis and which ultimately resulted in their regulation. In the ESG literature, the lack of transparency is also often criticised, particularly with regard to rating results. Transparency with regard to the rating methodology is even mentioned as one of the most important drivers of the credibility of ESG ratings (Keller, 2015, p. 30).
"When discussing the lack of transparency, it has to be pointed out positively that most of the criteria accounted for in ratings are not determined by the raters alone but together with third parties like NGOs or academia. This first step in the direction of 'tripartism' serves to ensure that ratings are more balanced and accepted and increases transparency and accountability. Nonetheless, the research components leading to rating results are rarely made fully available, with the occasional exception for key clients. This refers to the way information is collected, the methodology, assumptions, calculations, weightings, threshold values, and the specific criteria of the analysis. Of course, this does not apply for all ratings to the same extent but generally academics as well as companies criticise these 'black box' approaches. For example, the general part of the questionnaire used for SAM's Corporate Sustainability Assessment rating is open to the public, while the sector-specific questions are not" (Windolph, 2011, p. 45-46).
Although the credibility of ESG rating agencies has increased in the meantime and some already have a high degree of transparency, much of the criticism of the ESG rating market still relates to this fact (Keller, 2015, p. 30).

Valid   Even if objectivity and reliability are given as necessary quality criteria, a measurement does not have to be valid, i.e. at all meaningful (Diekmann, 2010, p. 256). According to Schnell et al. the most important quality feature of validity is given when a 'measuring instrument actually measures what it should measure', which is of interest (Schnell et al., 2013, p. 144).
In view of the numerous varying approaches in the ESG rating area, the evaluation and review of a rating methodology by third parties, e.g. academics, seen not only as drivers of legitimation but also of quality (Windolph, 2011, p. 43). This was shown, among other things, by a detailed analysis of 21 ESG ratings carried out in 2011, according to which rating agencies with systematic inclusion of stakeholder groups were the overall stronger organisations (Sadowski et al., 2011, p. 14).
The validity or representativeness "is mentioned by various sides as a normative requirement for an indicator and for a rating in general. Representativeness is a fundamental

criterion for the quality of an indicator and in this context means that the indicator measures what is to be shown with the result. This, in turn, is comparable to the 'significance' or 'adequacy' required in ESG literature and also on the financial theoretical side, which is given when the desired aspect is also measured with the rating. In the context of sustainability ratings, the assessment of this requirement is made more difficult by the lack of a common understanding of corporate sustainability, CSR, and ESG-relevant topics. This is due to the fact that the understanding of the essential aspects in the area of ESG varies depending on the initial situation or stakeholder group (e.g. NGOs, investors, employees, etc.)" (Windolph, 2011, p. 43). Due to the different demands and interests mentioned, external stakeholders should be included in the development of the evaluation methodology and evaluation criteria. This not only increases the validity of a rating (Windolph, 2011, p. 43), but also the credibility of the rating agency by not only measuring the required dialogue with stakeholders in their ratings, but also executing it itself (Keller, 2015, p. 25-26, 35-36).

4.3   Strategies of Implementation

Unfortunately, the concept of ESG integration is usually so broad that "it loses much of its meaning. An increasing number of asset managers indicate that they integrate ESG into their investment processes" (Schramade, 2016, p. 2). But there are different levels of integration that are more or less based on one another.
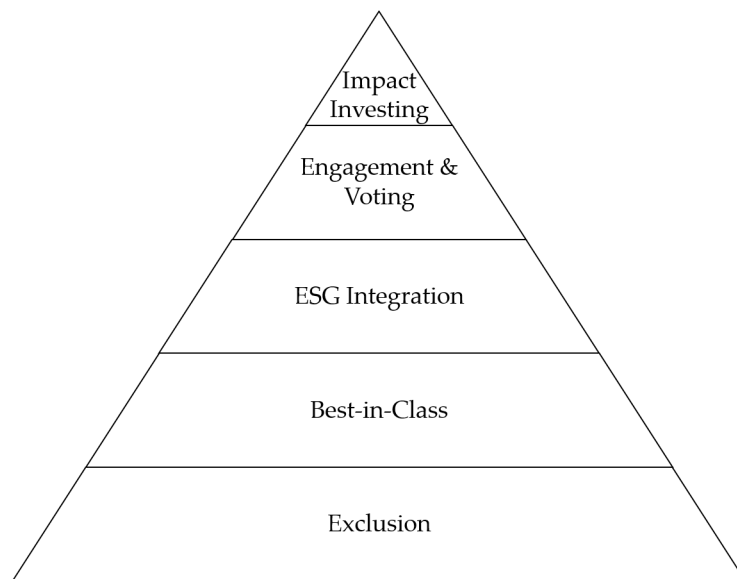
Figure 4.3: Levels of strategies for ESG implementation

The more advanced players tend to implement all of the elements into their investment decision process. In order to be able to incorporate ESG data, ratings and ranking into your decision, we assume that you have access to them and that they approximately meet the characteristics of Chapter 4.2. Let us now elaborate on each one, starting with the level of exclusion, as this approach is the simplest.

4.3.1   Exclusion

In the first step, "certain 'exclusion criteria' are applied, resulting in the exclusion of firms operating in particular industries, the so-called 'sin industries'" (Clark and Viehs, 2014, p. 7). "Companies that breach certain standards are rejected outright from the investment universe. This also signals to companies that their access to the capital market will be severely hampered if they disregard the principles of sustainable corporate governance" (Metzler Asset Management GmbH, 2016, p. 14-15). Such exclusion criteria were discussed in Chapter 2.2.4.

Furthermore, companies can be excluded from the investment universe if they do not meet important global principles and observe catalogues of fundamental value concepts. The list includes the protection of human rights, compliance with labour standards, proactive environmental protection and compliance with quality standards for products and customer rights. Another principle is the fight against all forms of corruption (Metzler Asset Management GmbH, 2016, p. 14-15).

"Most of the criteria are based on the principles of the UN Global Compact (see Chapter 2.5.1) and the provisions of the International Labour Organisation. In addition, other international standards and conventions, including the OECD Guidelines for Multinational Enterprises (see Chapter 2.5.2) and the UN Conventions against Corruption can also be taken into account" (Metzler Asset Management GmbH, 2016, p. 14-15).

Finally, "exclusions can be applied at individual fund or mandate level but increasingly also at asset manager or asset owner level, across the entire product range of assets" (Eurosif, 2020).

"For some investors, this is their only form of practising sustainable investing, which is a shame, because they are missing out on the benefits of using the other styles" (RobecoSAM, 2019, p. 6).

4.3.2   Best-in-Class

Companies in a universe are rated based on ESG criteria and then placed in a ranking. "The best-in-class approach to Sustainable Investing means investing in companies that are leaders in their sector in terms of meeting environmental, social, and governance criteria" (Robeco, 2020). In the next step after the ranking, just the 'top performers' within a single criterion are selected for investment, leaving the inferior corporations aside (Clark and Viehs, 2014, p. 7).

"The most sustainable companies in a sector are used as a benchmark to be equalled or surpassed. The Dow Jones Sustainability Indices follow the best-in-class principle" (Robeco, 2020).

This strategy can of course also be pursued without the first strategy of exclusion. In this case, the sectors or industries such as tobacco and mining are not excluded but rather companies are invested in which strive the most to meet the environmental, social, and governance criteria according to their respective industries (Robeco, 2020).

"The 'best-in-class' strategy can be quite successful in financial terms. For example, research has found that this approach can lead to abnormal returns by going long in the top performing stocks regarding eco-efficiency, and shorting the inferior counterparts" (Clark and Viehs, 2014, p. 7).

4.3.3   ESG Integration

The European Sustainable Investment Forum (Eurosif) defines ESG integration as follows:

"The explicit inclusion by asset managers of ESG risks and opportunities into traditional financial analysis and investment decisions based on a systematic process and appropriate research sources. This type covers explicit consideration of ESG factors alongside financial factors in the mainstream analysis of investments. The integration process focuses on the potential impact of ESG issues on company financials (positive and negative), which in turn may affect the investment decision." (Eurosif, 2020)(Schramade, 2016, p. 2-3)

"This level of implementation is a less common, but much more comprehensive, approach of systematically integrating environmental, social and governance factors (ESG) into portfolio construction" (RobecoSAM, 2019, p. 6). "For a comprehensive analysis of qualitative and quantitative data of the highest quality, it is crucial to use highly structured, rule-based processes. This applies to both data screening and the exchange between the portfolio management team and the ESG experts" (Metzler Asset Management GmbH, 2016, p. 16-19).

"The high quality of the data ensures that the conclusions drawn from the ESG factors and the potential sustainability risks and opportunities of companies are reliably based on sound judgments. The evaluation and interpretation of all available detailed data is the task of the portfolio manager, who coordinates his activities with the ESG experts. However, true success ultimately depends on the competence of the decisions and judgments of the portfolio manager who is responsible for the investments. The investment depends on his discretion" (Metzler Asset Management GmbH, 2016, p. 16-19).

"A strict and rule-based system for analysing and evaluating potential investments is required. In a first step, the ESG controversies will be assessed by specifically highlighting the controversial behaviour of companies and sectors and thus uncovering the potential risks for the business model. In a second step - that of the ESG screenings - factors such as the development of specific sustainability indicators for companies are measured over time. This assessment provides initial indications of investment opportunities and risks. In a third step, the most important ESG criteria are examined in more detail. Companies that have overcome these hurdles and finally made it into the portfolio are subject to strict and continuous ESG control and reporting" (Metzler Asset Management GmbH, 2016, p. 16-19).

ESG ratings, ESG scores, and ESG controversies are used as supplemental criteria to provide an information advantage over traditional models used in the selection of companies for equity and bond investments. "The portfolio managers review the portfolio's ESG

profile using performance and risk control tools. This gives them constant insight into the ESG risks of the portfolios and enables them to react accordingly. These instruments can also be used to assess the sustainability performance of a portfolio manager in relation to his investment universe - a point of discussion for the performance review with the CIO" (Metzler Asset Management GmbH, 2016, p. 16-19).

The Principles for Responsible Investing (PRI) define ESG integration as the "systematic and explicit inclusion of key ESG factors in investment analysis and investment decisions" (PRI, 2016, p. 12-13). Their integration model consists of four stages (see Figure 4.4), which is the same as the three disputes described above.
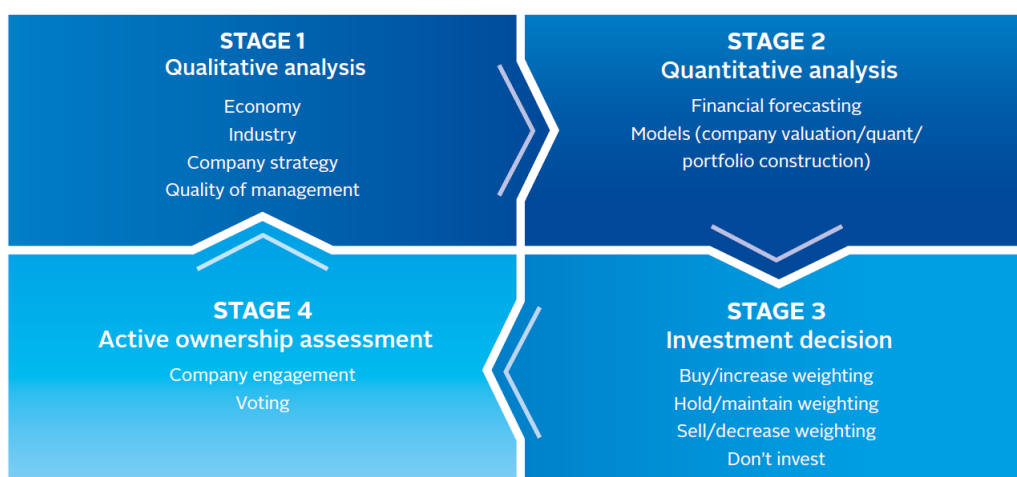
Figure 4.4: PRI model for ESG integration

Stage 1: Qualitative analysis – Investors will gather relevant information from multiple sources (including but not limited to company reports and third-party investment research) and identify material factors affecting the company.

Stage 2: Quantitative analysis – Investors will assess the impact of material financial factors on securities in their portfolio(s) and investment universe and adjust their financial forecasts and/or valuation models appropriately.

Stage 3: Investment decision – The analysis performed in stage 1 and stage 2 will lead to a decision to buy (or increase weighting), hold (or maintain weighting) or sell (or decrease weighting).

Stage 4: Active ownership assessment – The identification of material financial factors, the investment analysis and an investment decision can initiate or support company engagements and/or inform voting. The additional information gathered and the outcome from engagement and voting activities will feed back into future investment analysis and hence have an impact of subsequent investment decisions (PRI, 2016, p. 12-13).

The fourth stage of the PRI integration model already integrates another possibility of implementing ESG in the investment decision process. I will explain this approach in the following subsection.

4.3.4   Engagement & Voting

"Engagement is one of the most powerful instruments for investors. The goal is to give investors a say in the management of the companies included in our portfolios – through proxy voting at Annual General Meetings (AGMs) and through direct dialogue - in order to meet our responsibility as owners and investors. The objective is to enable clients to exert direct influence to ensure that the ecological, economic and socially ethical aspects of corporate governance appear regularly on companies' agendas. This continuous process is also termed 'responsible engagement overlay'" (Metzler Asset Management GmbH, 2016, p. 20-22).

ASIC prepared a report, which provides an overview of the annual general meeting season in 2018 for S&P/ASX 200 listed entities (Australia). "The 2018 AGM season saw a strong display of shareholder engagement. Environmental, social, and governance (ESG) issues continued to attract shareholder attention, with climate change risk and sustainability emerging as the most frequently raised ESG issue. ESG issues received a broader level of support from shareholders in season 2018, suggesting such issues may continue to be raised in years to come. As shown in Figure 4.5, the 2018 AGM season saw an increase in the level of shareholder support for a number of these resolutions" (ASIC, 2019, p. 3,8).
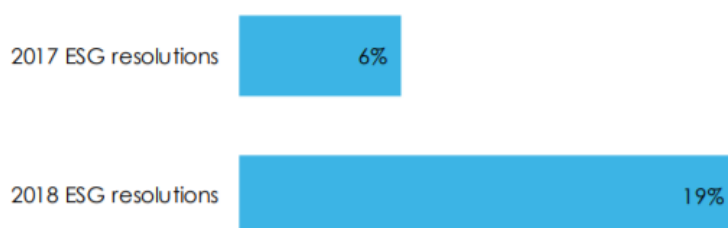
Figure 4.5: Percentage of votes cast 'for' shareholder-requisitioned resolutions on ESG issues (2017 and 2018 AGM seasons)

This trend is not only noticeable in Australia but also in Europe and North America.

However, "proxy voting at company AGMs is not sufficient of itself, due to the fact that many environmental and social themes are underrepresented at AGMs from an ESG perspective" (Metzler Asset Management GmbH, 2016, p. 20-22).

"The additional information gathered and the outcome from engagement and voting activities will feed back into future investment analysis and hence have an impact on subsequent investment decisions" (PRI, 2016, p. 12).

4.3.5   Impact Investing

Impact Investments are "investments made into companies, organisations and funds with the aim of creating a measurable beneficial impact on the environment or society, as well as earning a positive financial return. This could mean investing in a fund that aims to bring telecommunications services to remote areas in emerging markets or to improve nutritional standards in food by investing in organic farming" (RobecoSAM, 2019, p. 16).

"Investments are often project-specific and distinct from philanthropy, as the investor retains ownership of the asset and expects a positive financial return. Impact investment includes microfinance, community investing, social business/entrepreneurship funds, etc." (Eurosif, 2020).

"Impact investing has three key components. First, there must be intent: an investor is making a deliberate, targeted effort to exert a positive impact. This could be because he or she wants to have a feelgood factor in making a difference, with an underlying business motivation. Second, it should generate a positive return on investment; this is the key differentiator between investing and descending into charity or philanthropy, where no return is expected. And third, the financial, social and environmental benefits of impact investment should be measurable and transparent" (RobecoSAM, 2019, p. 16).

"This style of investing is growing in popularity because it acts as a neat bridge between pure capitalism and philanthropy. Specifically targeting investing in renewable energy, for example, helps the fight against global warming while also making a financial return from the sale of the electricity generated. It allows the best of both worlds and is becoming increasingly popular for that reason" (RobecoSAM, 2019, p. 16).

5   Why Are There No Standardised Criteria?

As already stated in chapter 2, there are no generally valid standardised criteria for the areas of the ESG model. While the disclosure of financial information by companies is well defined by national and international accounting standards, the disclosure of non-financial data remains largely disorganised (Eccles and Stroehle, 2018, p. 1) because every company wants to convey the uniqueness of their business models by 'customising' their reporting practices to some degree. However, most companies should be able to accept and work within a reasonable baseline for reporting standards (Kotsantonis and Serafeim, 2019, p. 12).

Most investors want ESG data to be standardised and comparable – across companies and sectors, and through time (WBCSD and UNEP FI, 2010, p. 11). The companies comply with the request for sustainability reports. A study by KPMG in 2017 revealed that 93% (see Figure 5.1) of the 250 largest companies in the world in terms of turnover (based on the Fortune 500 ranking from 2016) actually report on their sustainability performance. The N100 includes the top 100 companies by sales in each of the 49 countries that participated in this study. Thus, the sample includes a total of 4,900 companies (KPMG, 2017, p. 9).
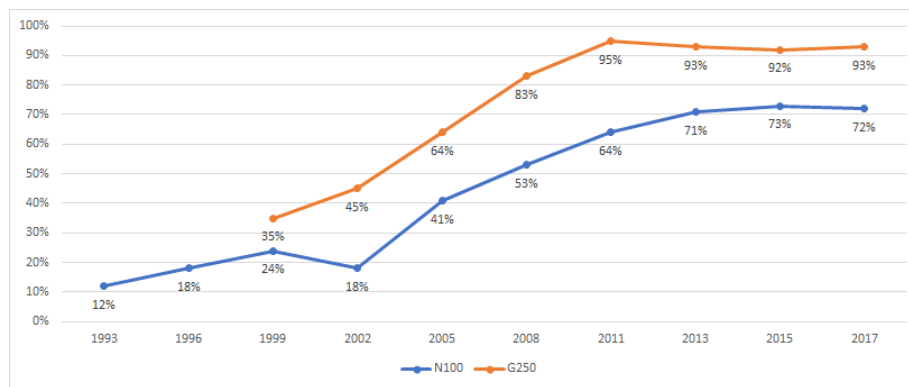
Figure 5.1: Growth in global corporate responsibility reporting rates since 1993

However, it should not be forgotten that some stakeholders do not want standardisation due to their different perceptions and interests in corporate sustainability (CS). "Another cause for the lack of rating standardisation is company-internal CS accounting and reporting. Ratings use publicly available information as well as data disclosed by companies. Yet, the ways that companies gather and communicate information are typically very different" (Windolph, 2011, p. 8). Windolph said that "especially the measurement of social issues as well as the evaluation of the influence of CS on companies' success is difficult and not organised systematically. Therefore, the data that ratings build upon is not necessarily comparable and quality might differ" (Windolph, 2011, p. 8). In order to remove these differences, in the last two decades a lot of effort has been made to develop key criteria with standard specifications (mostly in SI units).

After the first publication of the ESG key criteria 'ESG Key Performance Indicators' (KPIs) by the German Association for Financial Analysis and Asset Management (DVFA) in 2007, the latest version from 2010 was also adopted by the European Federation of Fi-

nancial Analysts Societies (EFFAS). As a motivation for the development of the KPIs, they claim that previous reports have not satisfied the requirements of investors, financial analysts and lenders. The ESG KPIs were geared solely towards the interests of the target group of investors. The basic idea is certainly in the interest of all stakeholders. However, it is questionable whether a sole focus on the needs of investors can be justified and whether it is in the interests of sustainable investments because the inclusion of various stakeholder groups can be described as a basic idea of the ESG and CSR topic (Keller, 2015, p. 20).

With the Global Reporting Initiative (GRI), a voluntary standard has been set that is recognised and applied on a global level. The non-profit organisation GRI endeavours to consider the interests of both the reporter and the user of reports. The GRI standards represent public reporting on a range of economic, ecological and social impacts. The GRI Sustainability Reporting Standards (GRI Standards) are the first and most widely used global standards for sustainability reporting. Since GRI was founded in 1997, almost 15,000 companies have uploaded their sustainability reports to the GRI platform. Approximately 38,000 GRI reports and 63,000 sustainability reports were submitted (Status 2020-08-20). All of them can be downloaded from the GRI database (GRI, 2020).

Companies around the world can also use SASB standards to identify, manage, and pass on to their investors financially significant sustainability information. In November 2018, SASB developed and published a complete set of 77 industry standards. A complete set of globally applicable industry-specific standards is provided, in which the minimum financially significant sustainability issues and the associated key figures for the typical company in an industry are listed (SASB, 2020).

5.1   Correlation in Rating Industry

"An estimated \$30 trillion of assets are invested relying in some way on ESG ratings. However, ratings from different providers disagree dramatically" (Chatterji et al., 2016)(Berg et al., 2019, p. 1-5). According to academic evidence, there is little correlation between the ESG ratings. This sheds doubt on the reliability of ESG scores (Chatterji et al., 2016)(Mooij, 2017, p. 2). "Projects such as the MIT 'Aggregate Confusion' from Berg et al. (2019) or studies such as Chatterji et al. (2016) and Gibson et al. (2019) attempt to document the alignment of social ratings from diverse sources. Using different methods and assessing diverse cases, they all arrive at the common conclusion that comparability within the ESG universe is low" (Eccles and Stroehle, 2018, p. 6-7). We shall shortly take a closer look at the project of Berg et al. and the study of Gibson et al.

Gibson et al. collected ESG ratings from six prominent ESG ratings providers for a sample of S&P 500 firms between 2013 and 2017 (see Table 5.1), as policy think tanks, the financial press, and academics have emphasised that there can be significant disagreements about a company's non-financial or ESG performance. In other words, it was pointed out that company-level correlations between ESG ratings produced by different providers (e.g. MSCI, Thomson Reuters, Bloomberg, FTSE, Sustainalytics) can be relatively small (Gibson et al., 2019, p. 1-4).

Data provider	Legal origin	Origin	Rating scale	Number of stocks (sample)	Pillars
	(1)	(2)	(3)	(4)	(5)
Asset4	Civil law	CH	0 – 100	436	E, S, G, Total
Sustainalytics	Civil law	NL	0 – 100	454	E, S, G, Total
Inrate	Civil law	CH	1 – 12	360	E, L, S, G, Total
Bloomberg	Common law	US	0 – 100	450	E, S, G, Total
MSCI KLD	Common law	US	-1 – +1	451	E, S, G, Total
MSCI IVA	Common law	US	0 – 10	451	E, S, G, Total

Table 5.1: ESG data providers for analysis (Gibson et al.)

They started by documenting some very basic empirical facts (see Table 5.2). For example, they showed that the average correlation between the overall ESG ratings of six rating providers is about 0.46. Surprisingly, by taking a look on the ESG specific rating areas, the average correlation is lowest for the governance (0.20) and highest for the environmental dimension (0.43) (Gibson et al., 2019, p. 1-4).

	N	Mean	Median	StdDev	Pearson correlations				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					Asset4	Sust.	Inrate	Bloom.	KLD
Panel A: Total rating									
Asset4	31424	0.501	0.501	0.289					
Sustainalytics	32703	0.501	0.499	0.289	0.762				
Inrate	25945	0.501	0.534	0.284	0.233	0.303			
Bloomberg	32410	0.501	0.501	0.289	0.749	0.708	0.122		
KLD	32485	0.501	0.507	0.288	0.584	0.619	0.290	0.538	
MSCI IVA	32450	0.501	0.502	0.289	0.418	0.460	0.319	0.308	0.452
Average correlation							**0.458**		
Panel B: Environmental Pillar									
Asset4	31261	0.501	0.501	0.289					
Sustainalytics	32532	0.501	0.501	0.289	0.710				
Inrate	25880	0.501	0.518	0.286	0.305	0.488			
Bloomberg	28258	0.501	0.501	0.289	0.651	0.566	0.206		
KLD	32403	0.501	0.498	0.281	0.629	0.654	0.422	0.472	
MSCI IVA	32361	0.501	0.502	0.289	0.174	0.325	0.403	0.140	0.284
Average correlation							**0.429**		
Panel C: Social Pillar									
Asset4	31424	0.501	0.501	0.289					
Sustainalytics	32703	0.501	0.504	0.289	0.617				
Inrate	25945	0.501	0.522	0.288	0.133	0.143			
Bloomberg	32322	0.501	0.507	0.288	0.682	0.530	0.061		
KLD	32485	0.501	0.505	0.288	0.397	0.423	0.128	0.302	
MSCI IVA	32450	0.501	0.500	0.289	0.282	0.323	0.236	0.207	0.351
Average correlation							**0.321**		
Panel D: Governance Pillar									
Asset4	31424	0.501	0.501	0.289					
Sustainalytics	32703	0.501	0.504	0.289	0.312				
Inrate	25945	0.501	0.502	0.283	0.297	0.401			
Bloomberg	32410	0.501	0.487	0.283	0.421	0.340	0.343		
KLD	32485	0.501	0.489	0.237	0.059	0.034	0.083	0.095	
MSCI IVA	32450	0.501	0.501	0.288	0.141	0.129	0.144	0.045	0.152
Overall correlation							**0.200**		

Table 5.2: Descriptive statistics and correlations (Gibson et al.)

Gibson et al. also showed in their paper that disagreement is higher for larger and less profitable firms as well as for firms that do not have a credit rating (Gibson et al., 2019, p. 19-20).

The paper of Berg et al. also "investigates the divergence of environmental, social, and governance (ESG) ratings. First, the paper documents the disagreement between the ESG ratings of five prominent rating agencies (see Table 5.3). The paper proceeds to trace the disagreement to the most granular level of ESG categories that is available and decomposes the overall divergence into sources" (Berg et al., 2019, p. 1-5).

Descriptive Statistics of full sample in 2014.

	Sustainalytics	RobecoSAM	Vigeo-Eiris	KLD	Asset4
Observations	4551	1668	2319	4295	4025
Mean	56.38	47.17	32.19	1.11	50.87
Standard Deviation	9.44	21.05	11.78	1.72	30.95
Minimum	29	13	5	-6	2.78
Median	55	40	31	1	53.13
Maximum	89	94	67	9	97.11

Descriptive Statistics of common sample in 2014.

	Sustainalytics	RobecoSAM	Vigeo-Eiris	KLD	Asset4
Observations	823	823	823	823	823
Mean	61.36	49.61	33.91	2.44	72.12
Standard Deviation	9.52	20.91	11.46	2.28	24.12
Minimum	36	13	6	-4	3.26
Median	61	46	33	2	80.47
Maximum	89	94	67	9	97.11

Table 5.3: ESG data providers for analysis (Berg et al.)

In principle, "there are two reasons why ratings diverge. They might diverge because rating agencies adopt different definitions of ESG performance, or they can differ because these agencies adopt different approaches to measuring ESG performance. *Scope divergence* refers to the situation where different sets of attributes are used as a basis to form different ratings. For instance, attributes such as greenhouse gas emissions, employee turnover, human rights, and lobbying, etc. may be included in the scope of a rating. *Weight divergence* refers to the situation where rating agencies take different views on the relative importance of attributes and whether performance in one attribute compensates for another. For example, the human rights indicator may enter the final rating with greater weight than the lobbying indicator. Indeed, the scope and weight divergence could also be subsumed under Aggregation divergence, since excluding an attribute from a rating's scope is equivalent to including it with a weight of zero. Finally, *Measurement divergence* refers to the situation where rating agencies measure the same attribute using different indicators. For example, a firm's labour practices could be evaluated on the basis of workforce turnover, or by the number of labour cases against the firm. Both capture aspects of the attribute labour practices but they are likely to lead to different assessments. Indicators can focus on processes such as the existence of a code of conduct or outcomes such as the frequency of incidents. The data can come from various sources such as company reports, public data sources, surveys, or media reports, for example. The final aggregate rating contains all three sources of divergence intertwined into one number. The goal of Berg et al. is to estimate to what extent to which each of the three sources drives the overall divergence" (Berg et al., 2019, p. 1-5).

"Returning to the topic of correlations between the ESG ratings of different rating agencies, Table 5.4 shows the correlations between the aggregate ESG ratings, as well as the ratings in the separate environmental, social, and governance dimensions. Correlations of the ESG ratings are on average 0.61, and range from 0.42 to 0.73. The correlations of the environmental ratings are slightly higher than the overall correlations with an average of

0.64. The social and governance ratings have the lowest correlations with an average of 0.49 and 0.43, respectively" (Berg et al., 2019, p. 6-7).

| | SA-VI | SA-KL | SA-RS | SA-A4 | VI-KL | VI-RS | VI-A4 | KL-RS | KL-A4 | RS-A4 | Correlation | | | |
											Average	Min	Median	Max
ESG	0.73	0.53	0.68	0.67	0.48	0.71	0.71	0.49	0.42	0.64	0.61	0.42	0.66	0.73
E	0.70	0.61	0.66	0.65	0.55	0.74	0.66	0.58	0.55	0.70	0.64	0.55	0.66	0.74
S	0.61	0.28	0.55	0.58	0.33	0.70	0.68	0.24	0.24	0.66	0.49	0.24	0.57	0.70
G	0.55	0.08	0.53	0.51	0.04	0.78	0.77	0.24	-0.01	0.81	0.43	-0.01	0.52	0.81

Table 5.4: Correlation at aggregate ESG level and at E, S, and G level (Berg et al.)

"The disagreement between ESG ratings is far larger than between credit ratings. Credit rating agencies use different data sources and procedures to evaluate the ability to pay as well as the willingness to pay of firms, governments, and individuals. These procedures and the data sources are not free of judgement. Nevertheless, they found a correlation of 98.6 percent between credit ratings from Moody's and Standard & Poor's. Since credit ratings are expressed on an ordinal scale, researchers usually do not report correlations. However, for the sake of illustration they used the data from Jewell and Livingston (1998), and calculated a Pearson correlation by replacing the categories with integers. The degree of disagreement between ESG ratings from different providers is thus far more pronounced. While credit rating agencies occasionally differ in their assessment one category upwards or downwards, ESG ratings disagree significantly more" (Berg et al., 2019, p. 6-7).

In their further analysis, Berg et al. found that "53 percent of the difference of the ratings stems from measurement divergence, while scope divergence explains 44 percent and weight divergence another 3 percent. In other words, 53 percent of the discrepancy comes from the fact that the rating agencies are measuring the same categories differently and 47 percent of the discrepancy stems from aggregating common data using different rules. This means that for users of this data – financial institutions for instance – a sizeable proportion of the discrepancy could be resolved by sharing the data on the indicator level and having a common procedure for aggregation. On the other hand, these results also suggest that different sustainability ratings cannot be made congruent simply by taking into account scope and weight differences. Therefore, standardisations of the measurement procedures are required" (Berg et al., 2019, p. 1-5).

Berg et al. showed that "this divergence is not merely noise. Since half of the divergence in ratings is coming from aggregation rules instead of using aggregate data as it is provided, researchers may consider and construct their own measures" (Berg et al., 2019, p. 32-33).

"The divergence thwarts companies' efforts to improve their ESG performance as they receive mixed signals from rating agencies about what actions are expected and what the market will rate. In addition, the divergence of ratings presents a challenge to empirical research, as the use of one assessor over another can alter the results and conclusions of a study. Overall, the ambiguity of ESG ratings is an obstacle to prudent decision-making that would contribute to a green and socially just economy" (Berg et al., 2019, p. 1-5).

Nevertheless, "until there are more standardised and easily accessible indicators available, investors will be exposed to diverging ESG ratings. For companies, the results highlight that there is substantial disagreement about ESG performance. The divergence

happens not only at the aggregate level but also in relatively specific subcategories of ESG performance, such as human rights or energy. This situation might frustrate attempts by companies to improve because the chance that their efforts are recognised consistently by ESG rating providers is small. In many cases, improving scores with one rating provider is unlikely to result in improved scores at another. Thus, in their current form, ESG ratings do not play a role as important as potentially possible in guiding companies towards improvement. To change the situation, companies should work with rating agencies to establish open and transparent disclosure standards and ensure that the data is publicly accessible. If companies fail to do so, the demand for ESG information will push rating agencies to base the creation of the data on other sources prone to divergence" (Berg et al., 2019, p. 32-33).

5.2   Difference to Credit Rating

In the last subsection it became clear that the ESG ratings of different agencies are only half correlated. Nevertheless, Berg et al. find a correlation of 98.6 percent between credit ratings from Moody's and Standard & Poor's (Berg et al., 2019, p. 6-7). I will now describe where this difference comes from.

"The push toward ESG scoring has added a new element to the global investment ratings industry, which is already well served by credit rating agencies in the debt space and by equity analysts competing for investor insights. Perhaps the most useful benchmark for the ESG ratings industry is the credit rating agencies (CRAs), today dominated by Moodys, S&P Global and Fitch Ratings. They trace their histories back to the 1890s and have endured multiple economic and credit cycles. Additionally, they deal with narrower and more tractable set of issues – advising lenders and investors on the likelihood that borrowers will be willing and able to service their debts in full and on time" (Walter, 2019, p. 25-27).

ESG ratings try to adapt to the structure of the CRAs, as they both have the same purpose, namely to convert a rating into a user-friendly form with scores or letters. A similarity is, for example, that "the input information is often public and that this type of intermediary does not solve information asymmetries. Rating agencies thus have a sorting function. Similarly, the goal of ESG agencies is to process a large volume of information instead of creating information. The aim is to enable more efficient ESG screening" (Mooij, 2017, p. 16-17).

Another similarity is that "of the change from research into ratings during the initial development stage. The credit rating industry has its roots in 1841, when a merchant started gathering and selling information on the credit worthiness of companies in the US. It had been collecting this information on its own clients and spotted a gap in the market. The first commercial rating book was published in 1857 and Moody's Investors Service joined in 1909 with their bond ratings. About 10 years later, U.S state and local government bonds were rated. Interesting is that there was a first boom in the use of bond ratings from the introduction in 1909 until the 1930s and then again from the 1970s till the 1990s. The second boom was driven by a new business model whereby issuers pay for their own rating. This is different from ESG ratings as they are unsolicited, al-

though a few companies offer ratings to companies for a fee. This kind of service is more
of an assessment and consultancy for companies to improve their rating. Most though,
are paid for by the users and unsolicited" (Mooij, 2017, p. 16-17). Credit ratings help to
send signals to investors about the quality of securities and they help to reduce regulatory
costs. All the way back in 1936, the comptroller of the currency prohibited national banks
from investing in bonds that were not investment grade. In case of any doubt about the
rating, guarantees from at least two rating agencies had to be secured. Later, in 1975,
the SEC stepped in as they introduced the 'Nationally Recognised Statistical Ratings
Organisations' (NRSROs) (Mooij, 2017, p. 16-17).

From time to time, "the CRAs' purely analytical role has been conflated with their role
as highly profitable investor-owned businesses. Managing potential conflicts of interest
depends on rigorous and credible controls and compliance and the CRAs have sometimes
been found wanting. In the time since the 2008 financial crisis, the CRAs - heavily sanc-
tioned for their catalytic role in the disaster - have taken great care to explain what they
do, how their business model works, who pays for the ratings, what methodologies are
used, and in backtesting the models to see how history has played-out. All of this does not
prevent over-reliance from investors on credit ratings to short-cut the time and expense of
forming their own judgements. Still, the CRA world seems rock-solid compared to what
has emerged so far in the ESG ratings space" (Walter, 2019, p. 25-27).

The following criteria show how, in combination, form a credible descriptor of today's
dominant global CRAs:

1. A well-defined and clearly bounded core mandate – the likelihood of contractual
   debt service in full and on time – adaptable to changes in financial instruments and
   markets.

2. A transparent rating model covering a broad range of risk based on credible quan-
   titative and qualitative inputs.

3. Credible public certification (e.g., US SEC NRSRO status).

4. Ratings comparability across regulatory jurisdictions and asset classes.

5. Model replicability, backtesting and development of analytics such as transition
   matrices reflecting correlations between historical ratings and defaults.

6. Meaningful interaction with issuers on information sourcing and rating signalling
   (e.g., watch lists, criteria for ratings revision).

7. Ability to distinguish changes in creditworthiness fundamentals from market senti-
   ment and momentum.

8. Large cohort of rated issues.

9. Successful conflict management in separating the analytics from business issues.

10. Acceptance by institutional investors and regulators, including rating breaks (e.g.,
    'investment grad')

11. Ability to attract, develop and retain skilled analysts.

12. Constrained competition (due to industrial economics or regulatory barriers) to sustain franchise and margins (Walter, 2019, p. 25-27).

"This can generally be put forward as a sustainable 'gold standard' of financial ratings. Any rating system that impacts financial valuations and capital allocation decisions should incorporate, in one form or another, a defensible cluster of these criteria. If a CRA does its job well, it improves the efficiency of capital allocation. If it does its job poorly, it is simply selling a regulatory license" (Walter, 2019, p. 25-27).

"CRAs need to make sure that their own policies and processes meet the high standards of impartiality set by the regulator. Their methodologies should provide a clear overview of what and how risks are incorporated into the rating. However, credit ratings cannot guarantee credit worthiness and do not constitute investment advice or recommendations (buy, sell, hold) or a measure of liquidity or pricing" (Amariei, 2019, p. 2-4).

Credit ratings provide the market with a signal and the earlier the signal comes the more useful it is. Signals that anticipate market movements are obviously more helpful than those that trail market movements. Comparability of ratings across asset classes is an important public good and encourages the creation of efficient portfolios (Walter, 2019, p. 25-27). Undoubtedly, "certain sustainability factors can play a role in the ability of borrowers to pay back their debt and therefore merit integration into credit ratings. However, there is a broader perspective of ESG that goes beyond concrete, visible, material aspects reflected in credit ratings. For example, the impact of physical climate risk is very difficult to integrate in credit ratings but can be reflected in sustainability ratings" (Amariei, 2019, p. 2-4).

"Some CRAs also started to provide separate ESG evaluations/scores that take a more holistic, stakeholder view of the company. There are factors that may not be impacting its credit quality at present but will ultimately lead to a company's ability to thrive in the medium term (5Y) and this could be captured in ESG evaluations. The ESG score is different to the credit rating but one could inform the other to a certain extent. The monitoring of the impact of ESG factors is expected to evolve as more up-to-date information on the company becomes available, e.g. overall ESG exposure, preparedness to manage those risks and adjusting its corporate strategy" (Amariei, 2019, p. 2-4).

6   Investment World for Analysis

In this chapter I want to explain the basic structure on which the analysis is then built. In the following subchapters I will describe how the portfolios are structured for the comparison and what the data structure is.

For the analysis I will assume the Efficient Market Hypothesis (EMH). I.e. it is impossible to make economic gains by trading on the information available in the financial market. The information available on an asset is therefore reflected in the price of the asset. *Paul A. Samuelson* said that in an efficient market, prices will change only when there is new and unanticipated information (Gaunersdorfer, 2019, p. 56).

In addition, for the sake of simplicity, I assume in this master's thesis that there are no transaction costs or taxes if you change the allocation of the portfolio. But now to the structure of the portfolios.

6.1   Regional Assumptions

The area addressed in this thesis includes the German language countries Germany, Austria, and Liechtenstein. This is first defined by the state language set out in the constitution. In Germany this happens through §23 paragraph (1) of the Verwaltungsverfahrensgesetz (Deutschland, 2020), in Austria through Article 8 Paragraph (1) of the Bundes-Verfassungsgesetz (Österreich, 2005) and in Liechtenstein through Article 6 of the Verfassung des Fürstentums Liechtenstein (Fürstentums Liechtenstein, 2019).
In Switzerland, Article 4 of the Bundesverfassung der Schweizerischen Eidgenossenschaft also specifies German as an official language (Schweizerischen Eidgenossenschaft, 1999), but not as the only official language. There are many other countries that set German as their official language, but only minorities speak German in these areas. In 2018, the Swiss Federal Statistical Office found that 62.2% of Swiss speak German (Bundesamt für Statistik, 2018). Therefore I include Switzerland as another country in the area under consideration.
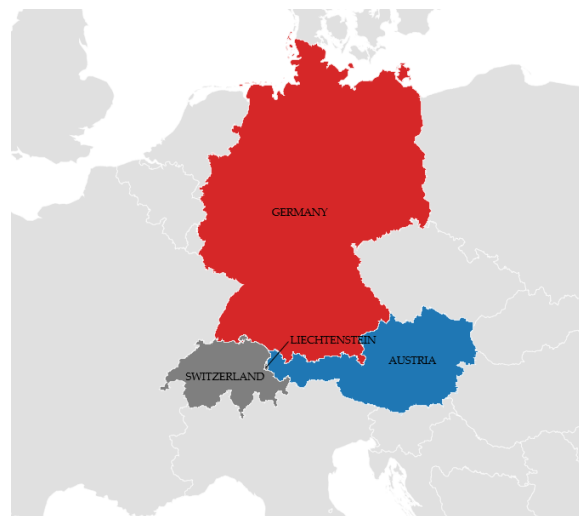
Figure 6.1: Map with the German-speaking area

For the portfolio composition, I consider the composition of the leading indices of the German-speaking countries. Since all listed companies from Liechtenstein are listed on the Swiss stock exchange, Liechtenstein is included in the leading index of Switzerland.The German-speaking area is therefore defined in this paper by the countries: Germany, Austria, Switzerland and Liechtenstein, with Liechtenstein data being included in the Swiss data.

6.2   Overview

As mentioned at the beginning, I will use the leading indices to build the two portfolios. The traditional portfolio consists of the HDAX, ATX Prime and SMI Expanded. I will go into more detail on the portfolio in Chapter 6.3. Sustainability indices are also calculated by the stock exchanges in Germany, Austria and Switzerland. In doing so, the previously mentioned traditional indices are restricted to ESG criteria. These are the DAX 50 ESG, VÖNIX and SXI Switzerland Sustainability 25 indices. The components of these indices are combined in the sustainable portfolio. I will also look at these indices and the portfolio in more detail in Chapter 6.4. Additionally, I consider which ESG criteria are used to restrict.

It is also important to emphasise that the Swiss and German financial markets are roughly the same size, but the Austrian is a small financial market in comparison. Whether or not this is taken into account depends on the asset allocation strategy which is described in Chapter 7.
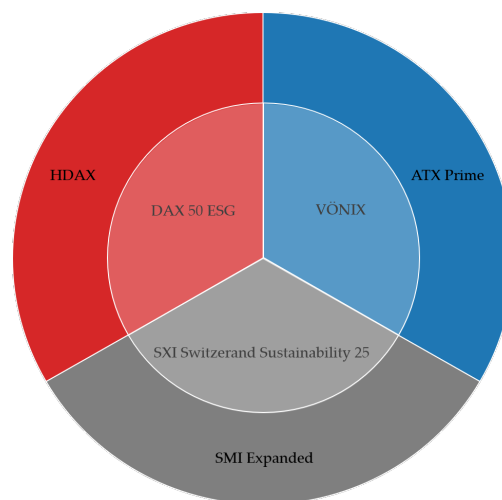
Figure 6.2: Traditional (sustainable) Portfolio in outer (inner) circle

Figure 6.2 is intended to visually illustrate how the two portfolios of the constellation are structured. The traditional portfolio includes all companies in the indices and a subset in the sustainable portfolio, limited by ESG criteria. For the analysis, the price time series of all companies included via Bloomberg are used. This data contains dividend information. The time horizon is from 2014-07-01 to 2020-03-31.

6.3   Traditional Portfolio Indices

The components of the traditional portfolio are adjusted quarterly to the components of the following three indices:

HDAX   The HDAX is a stock index that is calculated by Deutsche Börse as a total return index (ISIN: DE0008469016) and as a price index (ISIN: DE0008469974). In September 2018 it became the successor to the DAX 100 index, therefore its historical development was supplemented by this. HDAX combines the stocks of all components belonging to DAX, MDAX and TecDAX selection indices. Which of the companies is included in the DAX and MDAX depends solely on the order book turnover and the market capitalisation of the free float shares.

The DAX comprises the 30 most actively traded stocks (blue chips), and represents approximately 75% of the aggregate capital stock of listed German stock corporations. The MDAX contains the 60 largest companies below the DAX values in terms of market capitalisation and stock exchange turnover. Since September 2018, the TecDAX has included the largest technology stocks (Deutsche Börse Group, 2020b).

The composition of HDAX changes in tandem with the underlying indices. The index date occurs four times per year, on the third working day in March, June, September, and December. The upcoming changes are then published after the US market closes. The underlying ranking of the companies is based on the closing prices from the Friday prior. The changes decided will take effect around three weeks later (Börse Frankfurt, 2020). Depending on whether a TecDAX company is also included in the DAX or not, between 100 and 110 companies are always included in the HDAX. Table 11.3 provides an example of the composition of the HDAX per quarter from 2014-07-01 to 2020-03-31.

ATX Prime   The ATX Prime is "designed by Wiener Börse as an all-share price index (ISIN: AT0000999925) and consists of all securities traded in the prime market segment of Austria. The prime market segment includes stocks admitted to listing on the Official Market of Wiener Börse which meet the special additional requirements of this segment such as stricter disclosure and reporting obligations and minimum capitalisation. The ATX Prime has been calculated since 2 January 2002. As the direct successor to the ATX50, it is linked to the closing price on 28 December and serves as a benchmark for institutional investors" (Wiener Börse, 2020a).

In principle, only shares from issuers with legal and operational headquarters in Austria can be included in the ATX Prime. If an issuer does not have its legal seat in Austria, its shares can still be included in the ATX Prime if its operating seat is in Austria and the shares have their main listing on the Vienna Stock Exchange. The main listing is measured by trading money turnover compared to other stock exchanges (Wiener Börse, 2020b, p. 4).

The number of stocks contained in the ATX Prime is not limited. The index composition is checked every six months on the third Friday in March and September and carried out after close of trading (Wiener Börse, 2016, p. 13). In the Exhibit in Table 11.4 you see

the composition of the ATX Prime per quarter from 2014-07-01 to 2020-03-31.

SMI Expanded   The SMI Expanded was introduced on November 15, 2004. It is a stock index that is calculated by SIX Swiss Exchange as a total return index (ISIN: CH0019399853) and as a price index (ISIN: CH0019399861). It combines the SMI and SMIM indices and contains the 50 highest capitalised stocks on the Swiss stock market. It covers around 95% of the capitalisation in freely tradable shares of the Swiss stock market (SIX Swiss Exchange, 2020).

During the regular index review, the adjustments to the index composition and the weighting of the index components are implemented on the 3rd Friday of March, June, September and December based on the last available selection list. (SIX Swiss Exchange, 2019, p. 18, 27).

As in Austria, shares that are listed on more than one stock exchange and generate less than 50% of their total turnover at SIX must also meet a liquidity criterion in order to be selected for the SMI Expanded (SIX Swiss Exchange, 2019, p. 27). In the Exhibit in Table 11.5 you see the composition of the SMI Expanded per quarter from 2014-07-01 to 2020-03-31.

6.4   Sustainable Portfolio Indices

The components of the sustainable portfolio are adjusted quarterly to the components of the following three indices. This solves the problem of generating an ESG rating for each company from the traditional indices, as the three sustainability indices do just that. The following inidies limit exactly the three traditional indices according to ESG criteria.

DAX 50 ESG   In March 2020, the Deutsche Börse Group launched the DAX 50 ESG (ISIN: DE000A0Z3NB0), which "tracks the performance of the 50 largest, most liquid German market stocks that have comparably good performance based on their Environmental, Social and Governance criteria. Further, the stocks must have passed standardised ESG screens related to Global Standards Screening, as well as the involvement in controversial weapons, tobacco production, thermal coal, nuclear power and military contracting. The base universe of the index is the HDAX universe" (DAX, 2020). The index is offered as a price, total return, and net return index.

The index creation uses norm-based exclusion criteria that follow the UN Global Compact principles, as well as product-based exclusion criteria, including "controversial weapons, tobacco, coal, nuclear power and military contracts. A ranking list is created from the resulting values, according to market capitalisation, stock exchange turnover and ESG rating from Sustainalytics, one of the leading global providers of ESG research, ratings and data. The top 50 stocks for the index are selected from this list. The index is reviewed every three months" (Deutsche Börse Group, 2020a).

Since the index was not brought into being until March 2020, but my analysis starts with 2020-07-01, I had to calculate the index regression. The Deutsche Bröse Group also calculated it back, but unfortunately the data was not made available to me. Revinitiv

has rated the HDAX companies since 2003 and made the relevant data publicly available. The historical ESG scores can be downloaded in Excel using the Datastream tool from Thomson Reuters Eikon. The ESG Combined Score can be downloaded with the DS Datatype 'TRESGCS'. The companies were then ranked according to their score and the top 50, similar to the current DAX 50 ESG, were included in the index. Thus, the index for the period from 2014-07-01 to 2020-03-31 could also be created for the German financial market (see Table 11.6).

VÖNIX   In 2005 the VÖNIX (ISIN: AT0000496906) was launched as one of the world's first national sustainability indexes. It is the sustainability benchmark for the domestic stock market and includes those Austrian companies listed on the Vienna Stock Exchange that are leaders in ecological and social terms. VÖNIX stands for VBV Österreichischer Nachhaltigkeitsindex and thus contains the name of the largest pension fund in the country (Sihn-Weber and Fischler, 2019, p. 507-508).

The basis of the VÖNIX is the measurement of corporate sustainability. This requires a complex model with extensive ecological and social exclusion and positive criteria. The results of the annual analysis process are sustainability ratings, whereby those companies that achieve a correspondingly good rating are included in the VÖNIX. The recomposition takes place in mid-June and the composition is valid for one year. The number of index members is not fixed, but is usually between 20 and 25. The universe for VÖNIX is basically all domestic companies whose shares are listed in the upper market segments of the Vienna Stock Exchange (rfu, 2019).

Renowned players in the Austrian capital market enable ongoing index management and sustainability research through their skills and contributions. These partners are the VBV-Vorsorgekasse, the Raiffeisen Nachhaltigkeits-Initiative, and the Security KAG as well as the technical partner rfu (responsible for sustainability analysis) and the Vienna Stock Exchange - responsible for index management and ongoing calculation and publication (rfu, 2019). In the Exhibit in Table 11.7 you see the composition of the VÖNIX per quarter from 2014-07-01 to 2020-03-31.

SXI Switzerland Sustainability 25   The index universe of the SXI Switzerland Sustainability 25 Index (ISIN: CH0235574404) is the SMI Expanded. The index components that do not meet the sustainability criteria defined by Sustainalytics are excluded from the index universe. For example, companies that violate the guiding principles of the Global Compact are excluded. The remaining instruments are then evaluated using a catalog of criteria and given a sustainability score. The 25 instruments with the highest sustainability scores are included in the index composition. If an issuer has more than one instrument on the selection list, the instrument with the larger free float market capitalisation is selected (SIX Swiss Exchange, 2019, p. 37).

The sustainability index was launched on 2014-06-17, which is also the reason why my observation period begins on 2014-07-01. This index is also provided as a price and total return index. In the Exhibit in Table 11.8 you see the composition of the SXI Switzerland Sustainability 25 per quarter from 2014-07-01 to 2020-03-31.

6.4.1 Restriction Criteria

The DAX 50 ESG and the SXI Switzerland Sustainability 25 are both supplied with the ESG scores by the rating agency Sustainalytics. The structure of the exclusion criteria of both indices are therefore almost the same. Unfortunately, it is not possible to see the Sustainalytics rating system and the methodology behind it.

In Austria, as already mentioned, the companies of the ATX Prime are rated by the Austrian company rfu. No fixed number of companies is included in the index. They must achieve a certain rating in order to be included in the VÖNIX. The rfu sustainability model, which is used for the ecological and social analysis of potential VÖNIX members, combines exclusion and positive criteria. Companies that violate one or more of the criteria listed on page 16 cannot be included in the index. Are several criteria affected - e.g. deliveries for the military and for the nuclear industry - but below the tolerance limit in each case, the sales shares are added up according to the cumulation rule, which can also lead to exclusion overall (Sihn-Weber and Fischler, 2019, p. 509).

Positive criteria can be recorded with the help of the so-called stakeholder and product criteria, in this case all relevant dimensions and aspects of the sustainability of a company are recorded and assessed. The basic structure of the model is a matrix with six stakeholder groups and four management levels. Each intersection of the six-by-four matrix forms an evaluation field to which criteria are assigned. In total, the sustainability model contains almost 100 individual criteria, operationalised by around 400 quantitative and qualitative indicators.

The management levels include:

- principles and strategies

- management systems and organisation

- Programs, activities and results

- as well as the products and services

Stakeholder groups are:

- Employee

- Society

- Customers

- Market partner

- Investors

- Environment (Sihn-Weber and Fischler, 2019, p. 510-511)

The weighting of the matrix dimensions and evaluation fields with their criteria is based on relevance for the respective company. For example, procurement and the associated ecological and social rucksack of the supply chain are more important for a trading company than for a fully integrated producer. The following factors determine the relevance of the individual criteria:

- Industry affiliation (based on the most important business areas)

- Employee intensity and geographical structure of the locations

- Geographical structure of the sales markets

- Position in and depth of the value chain ('upstream', 'downstream' or integrated)

- Scope and structure of the procurement portfolio

- Customer structure ('consumer' or 'commercial clients')

- Company-specific factors (Sihn-Weber and Fischler, 2019, p. 512)

Ultimately, each analysed company receives an individual weighting mix. The scale described below is shown in Figure 6.3. Each relevant criterion is rated in the range of -10 to +10 points and is included with its specific weighting in the assessments at the level of the stakeholder groups and management levels as well as in the overall assessment. The aggregated score (core score) is transformed into a rating on a nine-point scale from A+ (innovative) to C- (regressive) (Sihn-Weber and Fischler, 2019, p. 512-513).
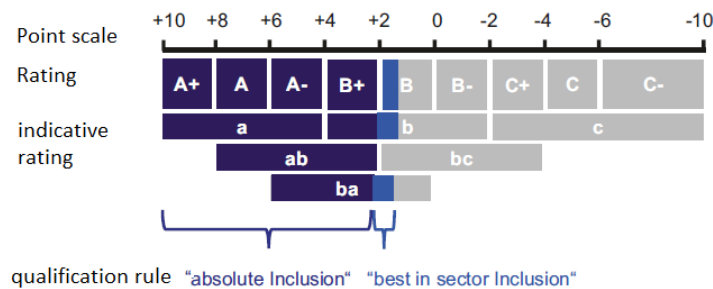
Figure 6.3: Scoring and rating scale as well as qualification rules for the VÖNIX

In parallel to the assessment of the content of a criterion, there is also an assessment of the data situation, on the basis of which the assessment was made. This makes the blurring of the results visible. At the level of each stakeholder group, the overall data situation and the remaining information gap are calculated. This is filled with a realistic positive case score and a realistic negative case score so that the range of fluctuation in the result becomes visible. If this is wider than a rating class, a so-called indicative rating, represented by lowercase letters (a, ab, etc.), is generated. However, if the realistic range of fluctuation is outside an indicative rating class due to poor overall data, this leads to a 'no rating' (Sihn-Weber and Fischler, 2019, p. 513). So much for a brief overview of rfu's rating for the VÖNIX index. Now let's take a look at the data of the portfolio before doing the allocation.

6.5   Data

A total of 261 companies were included in the traditional portfolio in at least one quarter. For the sustainable portfolio, there were 173 in the period from 2014-07-01 to 2020-03-31 (23 quarters). The price data from Bloomberg for each company, which also included dividend information, covers exactly 2780 business days from 2009-07-01 to 2020-03-31. As you have probably noticed, an additional 5 years of price data have been included in order to be able to calculate the allocation B - but more on this in the next chapter.

7 Asset Allocation Strategies and Optimisation

The previous chapter it was defined which companies can be included in the traditional and sustainable portfolio. In this chapter I would like to define the proportions to which the companies are represented in the portfolios, the so-called portfolio strategy. Each investor has his own preferences and accordingly includes different companies with different weightings in his portfolio. Since I don't want to restrict myself to any individual preferences or individual risk aversion and want to keep it as general as possible, I use asset allocation strategies that are also used by stock exchanges to weight their indices. I would also like to include an allocation theory from which a portfolio weighting also follows. In total, I consider three allocations, which I describe in the following three subsections. In order to be able to calculate the allocations, daily price data containing dividend information and the market capitalisation were downloaded from Bloomberg. There will be rebalancing for every quarter, so I have to calculate a total of 23 allocations per strategy for the period from 2014-07-01 to 2020-03-31. I will then use these three variants to calculate the costs of sustainability.

7.1 Value Weighted Portfolio (Allocation A)

A market value-weighted portfolio "is also known as a capitalisation-weighted portfolio. This weighted portfolio includes components, or securities, weighted according to their total market capitalisation. Market capitalisation uses the total market value of a firm's outstanding shares. The components with a higher market cap carry a higher weighting percentage in the index. Conversely, the components with smaller market caps have lower weightings in the index. Most stock market indices are cap-weighted indices, including the Standard and Poor's (S&P) 500 Index, the Wilshire 5000 Total Market Index (TMWX) and the Nasdaq Composite Index (IXIC)" (Investopedia, 2019b).

"Market capitalisation remains immensely popular as the incumbent and theoretically efficient choice, despite doubts about whether its core theoretical underpinnings, the Efficient Market Hypothesis (EMH) and CAPM are precisely correct. Cap Weight tacitly assumes that share-price-implied consensus expectations regarding the net present value of each company's future growth prospects, are an unbiased view of the future. Furthermore, Cap Weight offers very low turnover, trading costs, and tax consequences" (Arnott et al., 2010, p. 4).

"Critics of the cap-weighted indices might argue that the overweighting toward the larger companies give a distorted view of the market. However, since large companies with numerous outstanding shares tend to be more stable revenue producers, they can provide steady growth for the portfolio. On the other hand, small companies tend to have a lower weighting, which can reduce risk if the companies don't perform well" (Investopedia, 2019b).

Since this asset allocation strategy is still very widespread and plays a major role in the index weighting on the stock exchanges, I will use this strategy as the first allocation ('Allocation A') for the traditional and sustainable portfolio.

7.2 Maximum Sharpe Portfolio (Allocation B)

The second strategy for asset allocation is the maximum Sharpe ratio portfolio. This portfolio has been optimised to provide the highest Sharpe ratio. This is a metric that compares the level of return with the level of risk based on historical data. Maximum Sharpe portfolio or tangency portfolio is a portfolio on the efficient frontier at the point where the line drawn by the point (0, risk-free interest rate) touches the efficient frontier. To get to this point, I first need to optimise the efficient frontier out of the historical data from the last 5 years and then calculate the tangent portfolio using the risk-free interest rate (EURIBOR). I will optimise using the python programming language. In order to have an almost good risk-free rate, I will use the EURIBOR with maturity 3 month, since I also rebalance every third month. However, first I turn to the theory according to which I optimise.

7.2.1 Modern Portfolio Theory - Markowitz

Harry M. Markowitz was born in Chicago, United States, in 1927. He studied economics at the University of Chicago and wrote his doctoral thesis on mathematical methods in the securities market. In 1952 Markowitz started working for RAND Corporation. During this time, the only 25-year-old Markowitz met *William F. Sharpe*, who was very interested in Markowitz's theories and at the time was writing his doctoral thesis. Markowitz started a new joint project with Sharpe called 'the portfolio theory'. With the 14-page article 'Portfolio Selection', which appeared in 1952 in the renowned 'Journal of Finance', Markowitz set a milestone in modern capital market theory. The article became one of the most important economic publications. In 1990, at the age of 63, Markowitz, along with William F. Sharpe and Merton Howard Miller, received the Nobel Prize in Economics for his work in portfolio selection theory (Deutsche Gesellschaft für Finanzanalyse mbH).

In his theory, an investor wants to invest a certain amount for a certain time. The length of the period and the amount of money available for investment are optional. A certain number of assets are available for the investment, such as fixed-income securities with different maturities, currencies and credit ratings, domestic and foreign shares, all kinds of funds, etc. The question now is which assets to invest should be used. This question is called the portfolio selection problem (Hausmann et al., 2002, p. 7).

In order to be able to compare assets with one another, the individual types of investment must be assessed. I assume that the period is equal to a time interval $[t_0, T]$. The assets are also numbered with $A_1, A_2, ..., A_m$. A rational investor will endeavour to increase his assets as much as possible, therefore he strives for a high return. The performance or rate of return r_i for an asset A_i is defined as follows:

$$r_i = \frac{A_i(T) - A_i(t_0)}{A_i(t_0)} \tag{1}$$

Here $A_i(t_0)$ is the price of a unit A_i at the beginning of the period and $A_i(T)$ is the price at the end of the period. However, since I cannot assume that the rate of return will remain the same in the future, an idea of the return for the asset A_i must be specified,

this is achieved with the expected value $\mu_i = \mathbb{E}(r_i) = \overline{r_i}$. The expected value equals:

$$\mu_i = \mathbb{E}(r_i) = p_1 \cdot r_{i,1} + p_2 \cdot r_{i,2} + \cdots + p_N \cdot r_{i,N} = \sum_{j=1}^{N} p_j \cdot r_{i,j} \tag{2}$$

I assumed that $r_{i,j}$ arrives with probability p_j for all $j \in [1, N]$ and the sum of all p_j equals 1. The second value that is essential for the valuation of the assets is the risk. This is specified by the standard deviation σ_i in Makrowitz's theory (Markowitz, 1952, p. 81-82)(Hausmann et al., 2002, p. 7).

The standard deviation is the square root of the variance $\mathbb{V}(r_i) = \sigma_i^2$ and this is defined as:

$$\mathbb{V}(r_i) = \sigma_i^2 = p_1 \cdot (r_{i,1} - \mu_i)^2 + p_2 \cdot (r_{i,2} - \mu_i)^2 + \cdots + p_N \cdot (r_{i,N} - \mu_i)^2 = \sum_{j=1}^{N} p_j \cdot (r_{i,j} - \mu_i)^2 \tag{3}$$

And as mentioned before, the standard deviation equals:

$$\sigma_i = \sqrt{\sigma_i^2} = \sqrt{\left(\sum_{j=1}^{N} p_j \cdot (r_{i,j} - \mu_i)^2 \right)} \tag{4}$$

Thus, in Markowitz's theory, each asset A_i is described by only two values, namely the expected value μ_i and the standard deviation σ_i. Back to the initial problem, namely the problem of which assets are included in the portfolio. I can now draw and compare each asset A_i by (μ_i, σ_i) in a $\mu\sigma$-diagram. To illustrate this, I would like to go through a small example.

Example   A stock trader offers us assets from three different companies, namely the companies 'Evotec SE' (A_E), 'UBM Development AG' (A_U) and 'Adecco Group AG' (A_A). I receive the quarterly time series at stock prices from 2009-12-31 to 2019-12-31 (see Exhibit Table 11.1). The trader is an experienced trader and reveals to us that the annual returns of the past will have the following probabilities in the coming year:
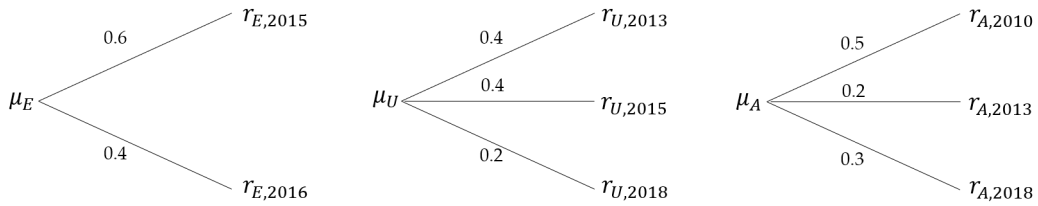
Figure 7.1: Probabilities to the annual returns

The number in the index indicates the year, e.g. the return for the interval 2014-12-31 to 2015-12-31 is meant for $r_{E,2015}$. By inserting the stock prices in the formula (1) I get the annual return, for example:

$$r_{E,2015} = \frac{A_E(2015 - 12 - 31) - A_E(2014 - 12 - 31)}{A_E(2014 - 12 - 31)}$$

$$r_{E,2015} = \frac{4.17 - 3.675}{3.675}$$

$$r_{E,2015} = 0.135$$

The other annual returns can be calculated in the same way and you get the following results: $r_{E,2016} = 0.785$, $r_{U,2013} = 0.188$, $r_{U,2015} = 0.59$, $r_{U,2018} = -0.142$, $r_{A,2010} = 0.088$, $r_{A,2013} = 0.523$, $r_{A,2018} = -0.36$

Now that I have the returns and the probabilities, I can use the formula (2) to calculate the expected values μ_i for each asset.

$$\mu_E = 0.6 \cdot 0.135 + 0.4 \cdot 0.785$$
$$\mu_E = 0.395$$

The other results for the expected value are $\mu_U = 0.283$ and $\mu_A = 0.041$. By equations (3) and (4) I can calculate the standard deviation, also called volatility.

$$\sigma_E = \sqrt{0.6 \cdot (r_{E,2015} - \mu_E)^2 + 0.4 \cdot (r_{E,2016} - \mu_E)^2}$$
$$\sigma_E = \sqrt{0.6 \cdot (0.135 - 0.395)^2 + 0.4 \cdot (0.785 - 0.395)^2}$$
$$\sigma_E = 0.101$$

The volatility for the other assets is $\sigma_U = 0.077$ and $\sigma_A = 0.096$. Now I have the expected value μ_i and the volatility σ_i for each asset A_i and I can visualise them in the $\mu\sigma$-diagram (see Figure 7.2).
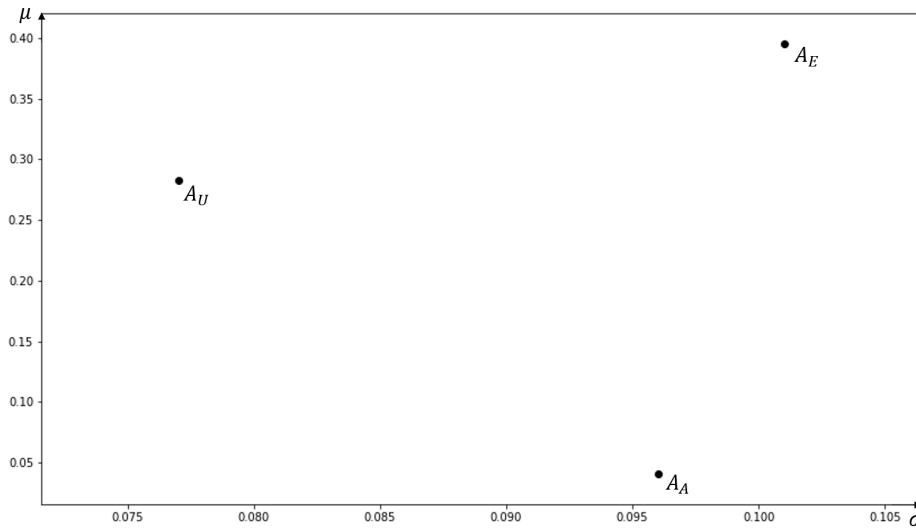
Figure 7.2: Assets of example in the $\mu\sigma$-diagram

The diagram shows the risk with the standard deviation on the x-axis and the expected return on the y-axis. By entering the assets in the diagram, I can see that the 'UBM Development AG' stocks has the least risk, but also gives the less return than the asset of 'Evotec SE'. The 'Evotec SE' stocks has a greater return, but also a much greater risk. The 'Adecco Group AG' has more risk that the asset of 'UBM Development AG'

but no more return. Therefore, it is domiated by the asset of 'UBM Development AG'. Depending on the risk aversion of the investor, he will choose one of the two other assets. The goal of every investor will be to take as little risk as possible and get as much return as possible. For two assets with the same risk, the one that delivers more return is chosen and for two assets with the same return, the one that carries less risk. Thus, a rational investor chooses assets in the upper left corner of the $\mu\sigma$-diagram.

In the example and in equations (2) and (4) I assumed that the probabilities are known. This is not usually the case, so the probabilities $p_j \forall j \in [1, N]$ are equally weighted for the returns in the past. Therefore, I take the average of the returns to fix the expected value and do the same for the standard deviation. The number of returns r_i depends on the length of the time series of the price data and the frequency with which the returns are calculated. Previously I calculated annual returns but of course you can also calculate daily, monthly, etc. returns. This results in the general equations for the expected value (5) and the standard deviation (6) for all assets A_i.

$$\mu_i = \sum_{j=1}^{N} \frac{r_{i,j}}{N} \tag{5}$$

$$\sigma_i = \sqrt{\left(\sum_{j=1}^{N} \frac{(r_{i,j} - \mu_i)^2}{N}\right)} \tag{6}$$

So far I have only considered individual types of assets but of course you can also combine several. So the question is how to calculate the expected return μ_P and the volatility of the return σ_P for a composite portfolio P. From probability theory it follows that

$$\mathbb{E}(A_s + A_t) = \mathbb{E}(A_s) + \mathbb{E}(A_t), \tag{7}$$

$$\mathbb{V}(A_s + A_t) = \mathbb{V}(A_s) + \mathbb{V}(A_t) + 2 \cdot Cov(A_s, A_t), \tag{8}$$

where the covariance of A_s and A_t equals

$$Cov(A_s, A_t) = \mathbb{E}(A_s + A_t) - \mathbb{E}(A_s) \cdot \mathbb{E}(A_t). \tag{9}$$

The correlation coefficient of A_s and A_t is:

$$\rho_{A_s, A_t} = \frac{Cov(A_s, A_t)}{\sqrt{\mathbb{V}(A_s) \cdot \mathbb{V}(A_t)}} \tag{10}$$

The variances of A_s and A_t must be positive and it applies that $-1 \leq \rho_{A_s, A_t} \leq 1$.

Linear combinations from the various assets can also be combined to form a portfolio, whereby the asset A_i is weighted with α_i, therefore $P = \alpha_1 \cdot A_1 + \cdots + \alpha_m \cdot A_m$ with $\alpha_i \in \mathbb{R} \forall i \in [1, m]$ and $\sum_{i=1}^{m} \alpha_i = 1$. If I now set $\sigma_{i,j} = Cov(A_s, A_t)$ if $i \neq j$ and $\sigma_{i,i} = \mathbb{V}(A_i)$, then equations (7) and (8) can be generalised by (taking into account that $Cov(A_s, A_t) = Cov(A_t, A_s)$):

$$\mathbb{E}(\alpha_1 \cdot A_1 + \cdots + \alpha_m \cdot A_m) = \sum_{i=1}^{m} \alpha_i \cdot \mathbb{E}(A_i) \tag{11}$$

$$\mathbb{V}(\alpha_1 \cdot A_1 + \cdots + \alpha_m \cdot A_m) = \sum_{i=1}^{m} \sum_{j=1}^{m} \alpha_i \alpha_j \sigma_{i,j} \tag{12}$$

The equation (12) for variance can also be written in matrix form:

$$\mathbb{V}(\alpha_1 \cdot A_1 + \cdots + \alpha_m \cdot A_m) = (\alpha_1, \cdots, \alpha_m) \begin{pmatrix} \sigma_{1,1} & \cdots & \sigma_{1,m} \\ \vdots & \ddots & \vdots \\ \sigma_{m,1} & \cdots & \sigma_{m,m} \end{pmatrix} \begin{pmatrix} \alpha_1 \\ \vdots \\ \alpha_m \end{pmatrix} \tag{13}$$

The quadratic matrix is the so-called variance-covariance matrix. It is symmetrical and positive semi-definite, which means that equation (13) cannot be negative.

Example Continued   The previous example can now be continued with the equations (5) and (6). First, I calculate the expected value and the volatility in order to be able to plot the assets in the $\mu\sigma$-diagram, the following results come out: $\mu_E = 0.304$, $\mu_U = 0.204$, $\mu_A = 0.076$, $\sigma_E = 0.318$, $\sigma_U = 0.299$, $\sigma_A = 0.284$. It can be seen that the assets shown in Figure 7.3 have different expected values and standard deviations than the assets with the given probabilities in Figure 7.2.

When combining two of the three assets, the position of the portfolio in the $\mu\sigma$-diagram depends on how the weighting α_i is. Using the combination of the assets A_E and A_A, I would like to show how to get to the positions of the portfolio in the $\mu\sigma$-diagram and how the portfolio curve is created.

At first I fix the weight $\alpha_E = 0.4$ for example. Then I can calculate the expected value μ_P with the equation (11).

$$\mu_P = \alpha_E \cdot \mu_E + (1 - \alpha_E) \cdot \mu_A$$
$$\mu_P = 0.4 \cdot 0.304 + 0.6 \cdot 0.076$$
$$\mu_P = 0.167$$

In order to calculate the standard deviation using equation (13), I first have to calculate the variance-covariance matrix. A computer program such as Excel or Python helps with this, of course this can also be calculated with other programs. The variance-covariance matrix for the two assets A_E and A_A looks as follows:

$$\begin{pmatrix} \sigma_{E,E} & \sigma_{E,A} \\ \sigma_{A,E} & \sigma_{A,A} \end{pmatrix} = \begin{pmatrix} 0.101 & 0.03 \\ 0.03 & 0.081 \end{pmatrix}$$

Now let's put this in equation (13) to establish the variance for the portfolio P of

$$\sigma_P^2 = (0.4, 0.6) \begin{pmatrix} 0.101 & 0.03 \\ 0.03 & 0.081 \end{pmatrix} \begin{pmatrix} 0.4 \\ 0.6 \end{pmatrix}$$

$$\sigma_P^2 = 0.06$$

It follows that the volatility of the portfolio P is $\sigma_P = \sqrt{\sigma_P^2} = \sqrt{0.06} = 0.244$. If I now take these steps for several $\alpha \in [0, 1]$, I get a curve between the two assets that are included in the portfolio. In Figure 7.3 you see these curves for the three combination of assets.
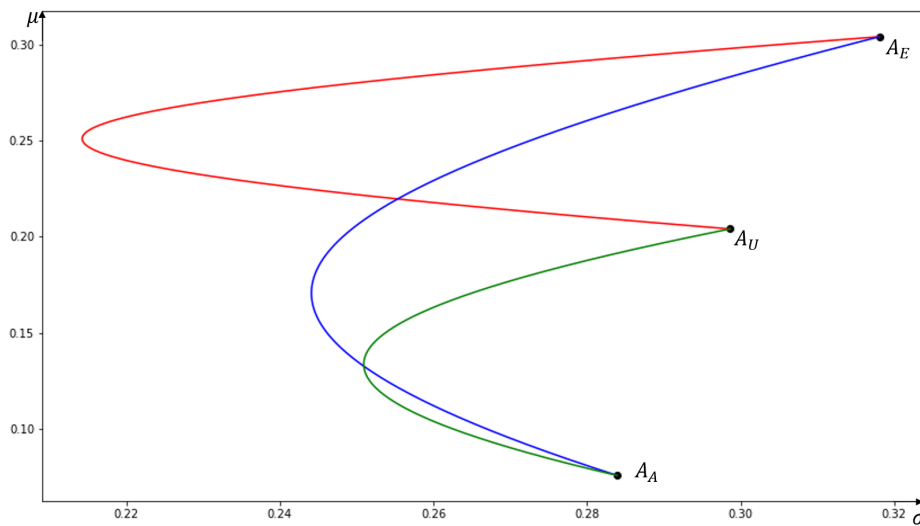
Figure 7.3: Assets of example with combination curves

What can be seen impressively from the combination of only two assets in the portfolio (for example when combining assets from company 'Evotec SE' and company 'UBM Development AG', i.e. on the red line) is that the combination can minimise the risk and still one receives higher returns than holding assets from company 'UBM Development AG' alone. Berk and DeMarzo say "a portfolio is an *inefficient portfolio* whenever it is possible to find another portfolio that is better in terms of both expected return and volatility" (Berk and DeMarzo, 2016, p. 403). Looking at Figure 7.4, a portfolio is inefficient if there are other portfolios above and to the left of it.
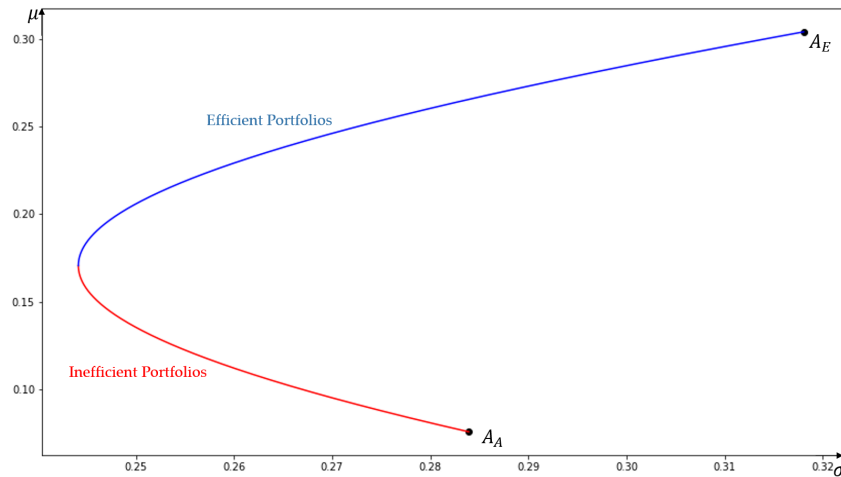
Figure 7.4: Efficient and inefficient Portfolios

There is no other portfolio of the two stocks that offers a higher expected return with lower volatility, than the Portfolio were the blue and red line are connected. But while I can rule out inefficient portfolios as inferior investment choices, I cannot easily rank the efficient ones - investors will choose among them based on their own preferences for return versus risk. For example, an extremely conservative investor who cares only about minimising risk would choose the lowest-volatility portfolio. An aggressive investor might choose to invest 100% in 'Evotec SE' stock - even though that approach is riskier, the investor may be willing to take that chance to earn a higher expected return" (Berk and DeMarzo, 2016, p. 403).

If I now want to construct a portfolio from all existing assets, a cloud of portfolios is created that show all different allocations. Suppose that the set of all obtainable (μ, σ) combinations were as in Figure 7.5. The investor would (or should) want to select one of those portfolios which gives rise to the (μ, σ) combinations indicated as efficient in the figure; i.e., those with minimum σ for given μ or more and maximum μ for given σ or less (Markowitz, 1952, p. 82).
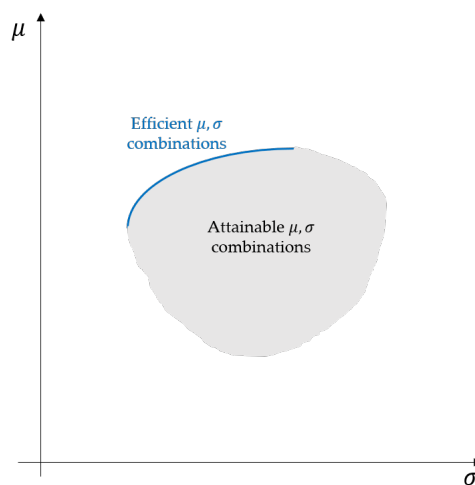
Figure 7.5: Cloud of possible portfolios

There are techniques by which I can compute the set of efficient portfolios lying on the so-called efficient frontier and efficient (μ, σ) combinations associated with given μ and and σ (Markowitz, 1952, p. 82). Many programming languages already offer these optimisation algorithms in finished packages. For example, python in the package,*'pypfopt.efficient_frontier'*, which I will also use in the rest of this master's thesis to be able to generate the efficient frontier. If I allow for short sales as well, I get an entire region of risk and return possibilities rather than just a single curve. I will not allow short sales in this thesis. The portfolio with the highest return is therefore the limit on the upper right side of the efficient frontier.

Example Continued   If I use the data from the exhibit (see Table 11.1) and feed an algorithm (more about the algorithm in Chapter 7.2.3) with it, I get the efficient frontier for our three assets (see Figure 7.6) on which the efficient portfolios lie if short sales are not allowed. This curve only tells us which portfolios are efficient, not which one to take. As mentioned before, this depends on the risk aversion of the investor.
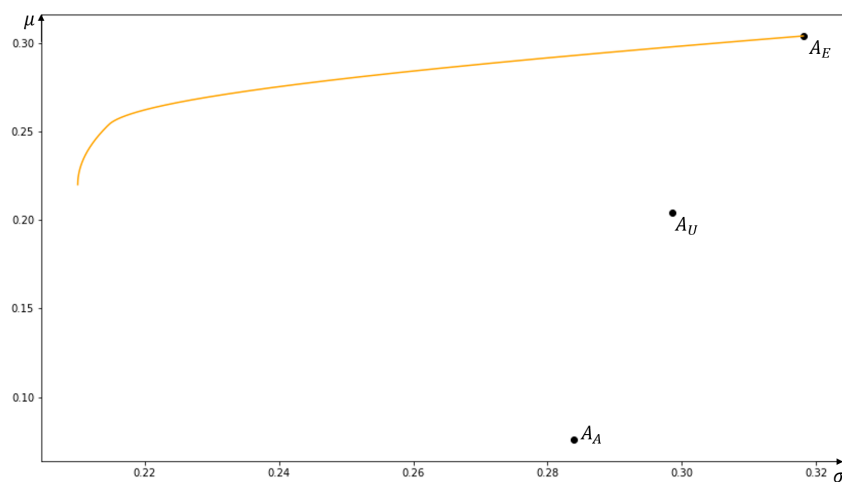
Figure 7.6: Efficient frontier of the assets of example

"While Markowitz assumed that investors might choose any portfolio on the efficient frontier of risky investments, *James Tobin* furthered this theory by considering the implications of allowing investors to combine risky securities with a risk-free investment. As you will see later, in that case I can identify a unique optimal portfolio of risky securities that does not depend on an investor's tolerance for risk. In his article 'Liquidity Preference as Behaviour Toward Risk' published in the Review of Economic Studies in 1958, Tobin proved a *Separation Theorem*, which applied Markowitz's techniques to find this optimal risky portfolio. The Separation Theorem showed that investors could choose their ideal exposure to risk by varying their investments in the optimal portfolio and the risk-free investment. Tobin was awarded the Nobel Prize for economics in 1981 for his contributions to finance and economics" (Berk and DeMarzo, 2016, p. 407).

First of all, I have to consider what a risk-free asset A_f is. I call the return on this asset r_f. Immediately you think of fixed-income securities but they are not necessarily completely risk-free. If they are securities in a foreign currency, they are subject to the exchange rate risk. Fixed-income securities must therefore be in the investor's currency.

In addition, they have to expire exactly at the end of the period, otherwise their price would be dependent on the interest rate level then applicable. But even if both of these conditions are met, a fixed income investment opportunity is not necessarily risk free. There is a possibility that the debtor will become insolvent and all safeguards such as guarantees would also be wholly or at least partially cancelled. This risk is most pronounced for government bonds or other bonds for which the state is responsible. These are viewed as risk-free, although of course this is also not true in an absolute sense.

In practice, for short terms, it is customary to consider the risk-free return to be the return that results from the interest rates at which the banks are willing to lend money to one another. Such reference interest rates are the EURIBOR (= EURopean InterBank Offered Rate) quoted by large numbers of well-known European banks and the EURO-LIBOR (= EURO-London InterBank Offered Rate) (Hausmann et al., 2002, p. 25-26). More about the EURIBOR in the next chapter 7.2.2.

If there is such a risk-free asset, it lies on the μ-axis in the $\mu\sigma$-diagram. Of course, money can then be invested in A_f and in risky portfolio P_r. The entire portfolio then consists of $P = \alpha_f \cdot A_f + \alpha_r \cdot P_r$. The expected value and the standard deviation of the portfolio can be calculated using the following equations:

$$\mu_P = \alpha_f \cdot r_f + \alpha_r \cdot \mu_r \tag{14}$$

$$\sigma_P = \alpha_r \cdot \sigma_r \tag{15}$$

The volatility of A_f is completely eliminated, since it is risk-free and therefore the variance is 0. Since the covariance of r_f and μ_r is also zero, the expected return equation of the portfolio can be expanded to:

$$\mu_P = r_f + \frac{\mu_r - r_f}{\sigma_r}\sigma_P \tag{16}$$

Equation (16) shows that each portfolio P from the combination of the risk-free asset A_f and the risky portfolio P_r lies on a straight line that has a slope of $\frac{\mu_r - r_f}{\sigma_r}$ and a constant therm of r_f. This straight line goes from $(r_f, 0)$ to (μ_r, σ_r) in the $\mu\sigma$-diagram (see Figure 7.7).
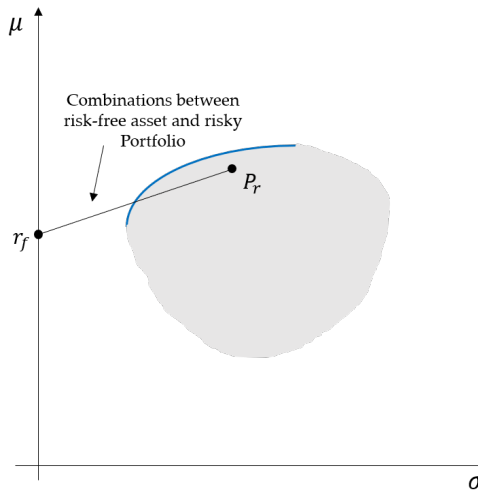
Figure 7.7: Straight line with combinations of A_f and P_r

So far, I've taken a risky portfolio out of the crowd in the cloud (see Figure 7.7). It becomes more efficient if I choose a portfolio at the efficient frontier. For a fixed risk-free rate there is only one portfolio on the curve, namely that at the point where the straight line touches the efficient frontier. A tangent is created from the straight line. The portfolio on this point is called the efficient portfolio or tangent portfolio P_T. The tangent equation is a new version of equation (16) where μ_T is the expected return and σ_T the volatility of the tangent portfolio.

$$\mu_P = r_f + \frac{\mu_T - r_f}{\sigma_T}\sigma_P \tag{17}$$
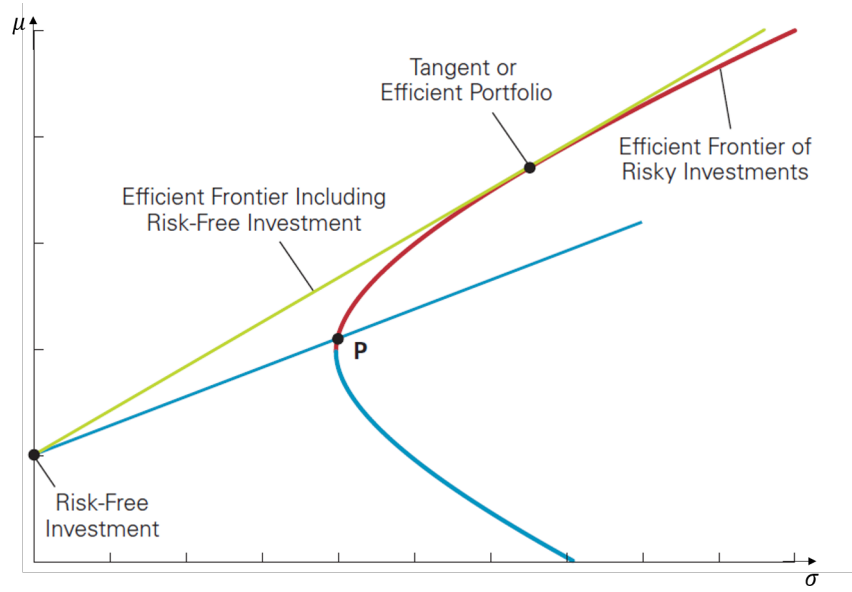
Figure 7.8: The Tangent or Efficient Portfolio

To calculate the values of equation (17) I need the expected value and the standard deviation of the tangent portfolio. To earn the highest possible expected return for any level of volatility I must find the portfolio that generates the steepest possible line when combined with the risk-free investment. The slope of the line through a given portfolio P_r is often referred to as the *Sharpe ratio* of the portfolio developed by William F. Sharpe:

$$\text{Sharpe ratio} = \frac{\mu_{P_r} - r_f}{\sigma_{P_r}} \tag{18}$$

The Sharpe ratio measures the ratio of reward-to-volatility provided by a portfolio. It can be also interpreted as the number of standard deviations the portfolio's return must fall to underperform the risk-free investment. The tangent portfolio is the portfolio with the highest Sharpe ratio. Thus, if returns are normally distributed, the tangent portfolio is the portfolio with the greatest chance of earning a return above the risk-free rate (Berk and DeMarzo, 2016, p. 411-412). In order to calculate the values for the tangent portfolio, I have to maximise the Sharper ratio across all risky portfolios on the efficient frontier.

$$\max_{P_r} \frac{\mu_{P_r} - r_f}{\sigma_{P_r}} \quad \forall P_r \text{ on efficient frontier} \tag{19}$$

"The combinations of the risk-free asset A_f and the tangent portfolio P_T provide the best risk and return trade-off available to an investor. This observation has a striking consequence, which James Tobin summarises in his Separation Theorem: The tangent portfolio is efficient and, once I include the risk-free investment, all efficient portfolios are combinations of the risk-free investment and the tangent portfolio. Therefore, the optimal portfolio of risky investments no longer depends on how conservative or aggressive the investor is; every investor should invest in the tangent portfolio independent of his or her taste for risk. The investor's preferences will determine only how much to invest in the tangent portfolio versus the risk-free investment. Conservative investors will invest a small amount, choosing a portfolio on the line near the risk-free investment. Aggressive investors will invest more, choosing a portfolio that is near the tangent portfolio or even beyond it by buying stocks on margin. But both types of investors will choose to hold the same portfolio of risky assets, the tangent portfolio" (Berk and DeMarzo, 2016, p. 412).

Example Continued   I would now like to conclude the example that accompanied us in this chapter with the new knowledge by calculating the tangent portfolio. The efficient frontier has already been calculated for us and can be seen in Figure 7.6. I assume that a risk-free asset exists with a risk-free rate of 0.13. In Table 11.2 in the exhibit you see fifty efficient portfolios that are on the curve. The table shows the volatility, the return, the weights of the three assets A_E, A_U, A_A, and the Sharpe ratio. For the first line in the table, the calculation of the Sharpe ratio with the formula (18) is once again utilised. The portfolio P_1 has an allocation of $(\alpha_E, \alpha_U, \alpha_A) = (0.394, 0.423, 0.183)$ and with the equations (11) and (12) I get the expected return and the standard deviation which you can also see in the Table 11.2. For the calculation with these equations I needed the variance-covariance matrix, which looks like this:

$$
\begin{pmatrix}
0.101 & -0.003 & 0.030 \\
-0.003 & 0.089 & 0.041 \\
0.030 & 0.041 & 0.081
\end{pmatrix}
$$

Thus, I have the volatility $\sigma_{P_1} = 0.21$ and the expected return $\mu_{P_1} = 0.22$. By inserting into equation (18) I get the Sharpe ratio:

$$
\begin{aligned}
\text{Sharpe ratio}(P_1) &= \frac{\mu_{P_1} - r_f}{\sigma_{P_1}} \\
&= \frac{0.22 - 0.13}{0.21} \\
&= 0.429
\end{aligned}
$$

If you now take these steps for all portfolios on the efficient Frontier, you get a Sharpe ratio for each of them. The portfolio with the maximal Sharpe ratio is the tangent portfolio

(see Table 11.2 the bold line). The linear equation of the tangent can still be calculated by using the values of the tangent portfolio:

$$\mu_P = r_f + \frac{\mu_T - r_f}{\sigma_T}\sigma_P$$
$$\mu_P = 0.13 + \frac{0.27 - 0.13}{0.23}\sigma_P$$
$$\mu_P = 0.13 + 0.609\sigma_P$$

I will close this example with Figure 7.9, in which I have described all the necessary steps and theory that I will need for Allocation B.
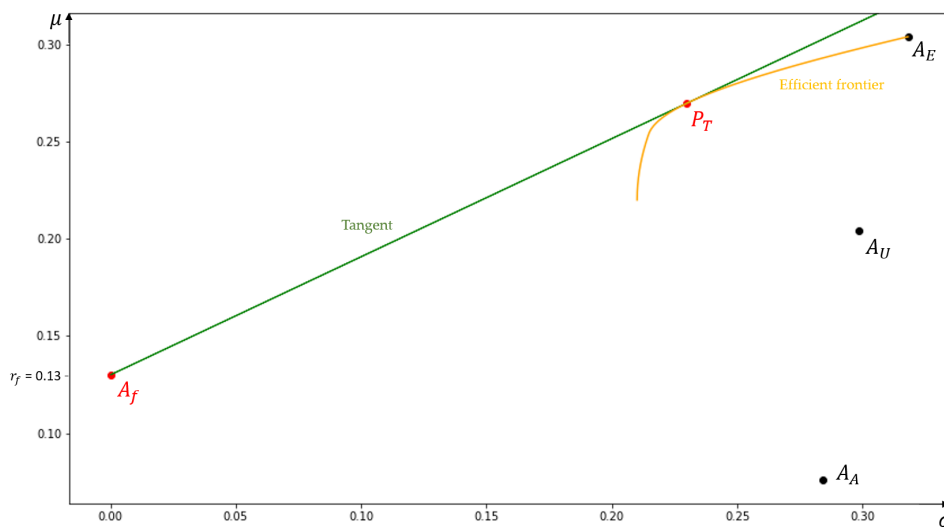
Figure 7.9: Optimal portfolio P_T at the point of contact of the curve and the tangent

Tobin's Separations Theorem now says that the optimal combination of an investor's risky securities is the same for all investors and can therefore be calculated without knowing the investor's risk preference. However, a perfect capital market is assumed, that means:

- For all investors, the expected value and standard deviation of the return are the only relevant parameters of a portfolio.

- All investors want maximum returns with the lowest possible risk but may have different individual risk preferences.

- All investors are fully informed and have the same assessments regarding the values μ_i, A_i and the variance-covariance matrix.

- All investors plan for the same period.

- All investors have the same risk-free rate r_f at which they can borrow and lend money.

- Each security can be purchased in any size.

- Taxes and transaction costs do not exist or are at least insignificant for the investment strategy of the investors (Hausmann et al., 2002, p. 39).

This is of course a very idealistic world, but such conditions can be approximate.

7.2.2   EURIBOR 3M

EURIBOR "is short for Euro Interbank Offered Rate. The EURIBOR rates are based on the interest rates at which a panel of European banks borrow funds from one another. The panel banks are the banks with the highest volume of business in the Euro zone money markets. The panel consists of banks with a first class credit standing, high ethical standards and an excellent reputation. In the calculation, the highest and lowest 15% of all the quotes collected are eliminated. The remaining rates will be averaged and rounded to three decimal places. EURIBOR is determined and published at about 11:00 am each day, Central European Time" (Euribor, 2020).

EURIBOR "was first published on 30 December 1998 (value 4 January 1999). 1 January 1999 was the day that the Euro as a currency was introduced. In the years before, a lot of domestic reference rates like PIBOR (France) and Fibor (Germany) existed. When EURIBOR is being mentioned it is often referred to as THE EURIBOR, suggesting that there is only one EURIBOR interest rate. This is not correct, since there are in fact 5 different EURIBOR rates, all with different maturities" (Euribor, 2020).

"Since the EURIBOR rates are based upon agreements between many European banks, the level of the rates is determined by supply and demand in the first place. However there are some external factors, like economic growth and inflation which do influence the level of the rates as well" (Euribor, 2020).

The EURIBOR rates "are important because these rates provide the basis for the price or interest rate of all kinds of financial products, like interest rate swaps, interest rate futures, saving accounts, and mortgages" (Euribor, 2020).

As mentioned at the beginning of the chapter, I will use the EURIBOR 3M as a risk-free rate to optimise the tangent portfolio. The data is available on Bloomberg as well as at https://www.euribor-rates.eu/.

7.2.3   Optimisation with Python

As noted several times, I use python to optimise the tangent portfolio on the efficient frontier. There is also the *'pypfopt.efficient_frontier'* package. Included in this is the *EfficientFrontier* function, which is fed with the average return and the variance-covariance matrix. On the next page you will find the script with which I have calculated all 23 quarterly allocations of the portfolio. It is written so that it always works. I have fed it with the Bloomberg data from the data going back 5 years from the date of the rebalancing. The function getData downloads this from my excel file whose path I have passed. If you run the program without an excel file, the program will automatically download the price data via Yahoo from Apple, Microsoft, Facebook and Twitter of the last 10 years.

```python
# -*- coding: utf-8 -*-
"""
@title: Main_efficient_frontier.py
@date: Thu May 14 14:07:34 2020
@version: 0.01
@description:    The script receives price data either via pandas_datareader.data
                or via an excel. To ensure that the program runs in any case, the
                download of test data from Yahoo was implemented. Furthermore, you
                have to specify the risk-free rate and the frequency of the returns.
                With the data, the maximum sharp portfolio is optimised and saved in
                the dictionary.
@key variables: fileIN, rf, freq
@external sources: excel or webdata
"""

import pandas as pd
import pandas_datareader.data as web
from pypfopt.efficient_frontier import EfficientFrontier

def getData(fileIN=None):
    if fileIN == None: #testdata
        dataDict = {"Apple" : web.DataReader("AAPL", 'yahoo', start='2010', end='2021'),
        "Microsoft" : web.DataReader("MSFT", 'yahoo', start='2010', end='2021'),
        "Facebook" : web.DataReader("FB", 'yahoo', start='2010', end='2021'),
        "Twitter" : web.DataReader("TWTR", 'yahoo', start='2010', end='2021')}

        lengths = pd.DataFrame([len(v) for v in dataDict.values()],
                                columns=['observations']).T
        lengths.columns=dataDict.keys()
        Stocks = list()

        for key in dataDict.keys():
            df = pd.DataFrame(dataDict[key]['Close'])
            df.columns = [key]
            Stocks.append(df)

        data = pd.concat(Stocks, axis=1, sort=False)
    else:
        data=pd.read_excel(fileIN)
        data['date'] = pd.to_datetime(data['date'])
        data = data.set_index('date')

    return data

#set frequenzy, risk-free rate and fileIN
data = getData(fileIN=None)
freq = 'Y'
rf = 0.13

data = data.resample(freq).last()
returns = data.pct_change().fillna(0)

# calculate expected returns and sample covariance matrix
avg_returns = returns.mean()
cov_mat = returns.cov()

# get weights maximising the Sharpe ratio
ef = EfficientFrontier(expected_returns=avg_returns, cov_matrix=cov_mat)
weights = ef.max_sharpe(risk_free_rate=rf)
weights = pd.DataFrame(ef.clean_weights(), columns=ef.clean_weights().keys(),index=[0])
weightsnp = weights.to_numpy()
opt_return = (returns*weightsnp).sum(axis=1).mean()
opt_vola = (float((weightsnp@cov_mat.to_numpy()@weightsnp.T)))**(1/2)

tangenPortfolio = {'weights':weights,'return':opt_return,'volatility':opt_vola}
```

Once the data has been downloaded by whichever method, after entering the risk-free rate and the frequency, the average return and the variance-covariance matrix are calculated and transferred to the *EfficientFrontier* function. An object 'ef' is created which has the function *max_ sharpe*. By transferring the risk-free rate to this function, the allocation of the tangent portfolio is obtained. Finally, I calculate the expected return and volatility of this portfolio and pack everything into a dictionary.
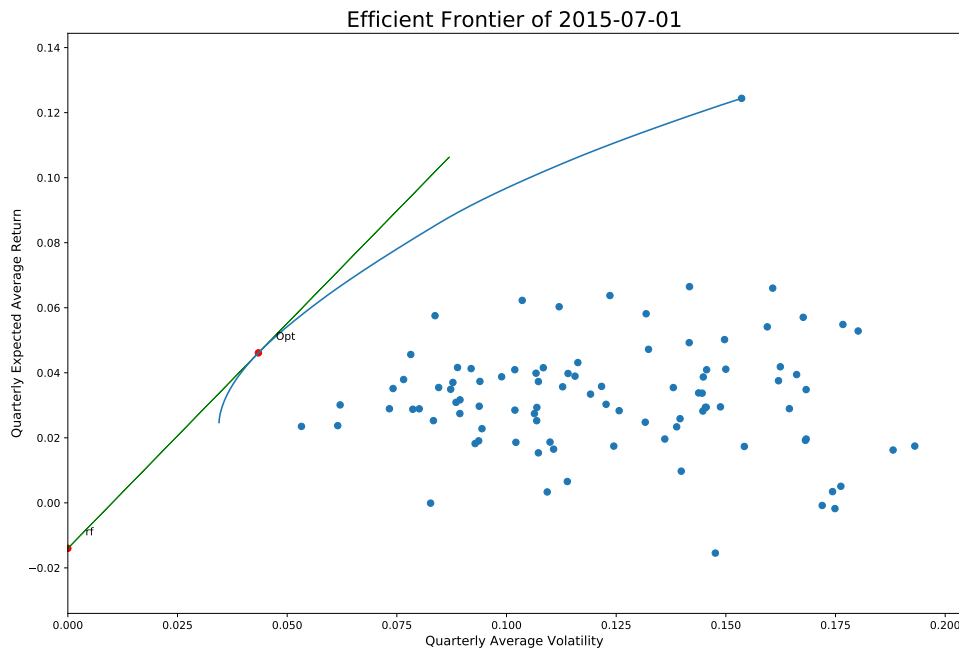
Figure 7.10: Efficient Frontier

In Figure 7.10 you see the efficient frontier with the tangent and the optimal portfolio for the reporting date 2015-07-01. I would also like to point out that the components of the two portfolios are listed in the exhibit. The constituents of the traditional portfolio are shown in Table 11.9 and those of the sustainable portfolio in Table 11.10.

7.3   Equally Weighted Portfolio (Allocation C)

"The Equal Weight approach assigns an equal weight to each company in the portfolio, thereby tacitly assigning zero information value to all public and private information about a company except for its inclusion in the portfolio" (Arnott et al., 2010, p. 6).

This means that the portfolio reacts completely identically to changes in companies of the same percentage (Wiener Börse, 2020c).

In the case that "it is impossible for any investor to predict a security's risk or return, or the covariance matrix, it follows that holding an equal amount of each investable security results in the portfolio with the lowest predicted risk, at no sacrifice to our expected

return. Put another way, if the Value Weight portfolio reflects the view that the aggregate investor universe fully incorporates return and risk forecasts, then Equal Weight assumes that the aggregate investor universe has zero ability to forecast anything. For practitioners, the elegant simplicity of an equally weighted portfolio is compromised by implementation issues. Because Equal Weight means that I hold small companies on the same scale as large ones, the strategy results in higher transaction costs and lower capacity than Value Weight. Regardless, absent trading costs and any view on forecasting return or risk, equal weighting has considerable appeal on a risk-return basis" (Arnott et al., 2010, p. 6).

"For instance, the S&P 500 Equal Weight Index (S&P EWI) tacitly assigns value to a stock's inclusion or exclusion from the S&P 500 Index. Besides, equal weighting was the basis for the first index futures. You should note that no one has built a portfolio based on equally weighted Index, but I think it's a very interesting idea. It has similar merits and demerits, when compared with the now-widely-accepted equal weight portfolios based on value-weighted indexes such as the S&P 500" (Arnott et al., 2010, p. 6-7).

8   Portfolio Performance

Chapters 6 and 7 described which assets are included in the portfolios and which allocation strategies are followed and how these are then rebalanced every quarter. This means that the price trend of the two portfolios with the allocations A, B and C can now be calculated for the period 2014-07-01 to 2020-03-31. This chapter takes a close look at the performance, its course and the structure of these portfolios. During the analysis, common statistical measures are considered as well as descriptive statistics in subchapter 8.2, such as the Sharpe ratio and the Value at Risk. This analysis should help to calculate the costs of sustainability in Chapter 9.

8.1   Technical Analysis

In the first step, the time series of the portfolio performance is considered in the technical analysis. In Figure 8.1 we see the performance of the portfolios for the three different allocations. At first glance, you can see that the sustainable portfolio has a positive outperformance in all allocations. I will go into these outperformances in more detail in Chapter 9 as they will be used to calculate the value of sustainability.
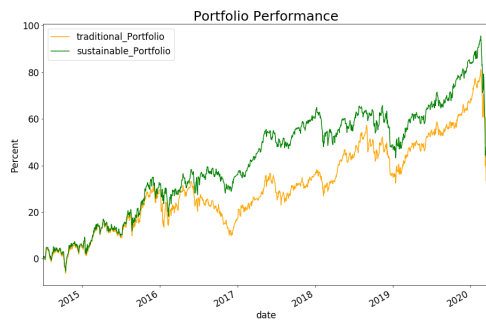
(a) Allocation A
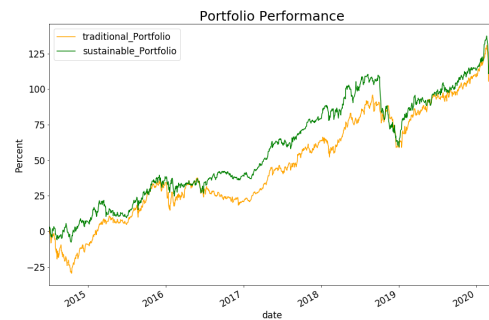
(b) Allocation B
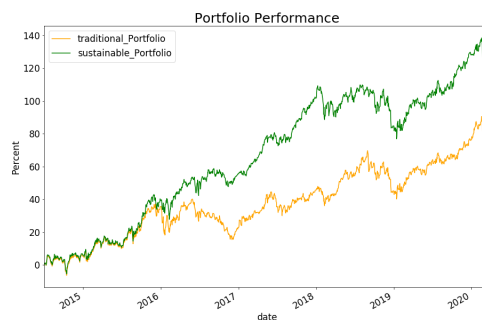
(c) Allocation C

Figure 8.1: Performance of Portfolios from 2014-07-01 to 2020-03-31

The portfolios in all allocations clearly have an upward trend until the beginning of 2020. There was an economic slump caused by the global coronavirus pandemic that broke out

in Wuhan (China) in December 2019 (more on this in Chapter 8.4). A seasonal component can be recognised, as there is a small price drop at every turn of the year.

Now to the returns of the portfolios that can be seen in Figure 8.2.

(a) Allocation A

(b) Allocation B
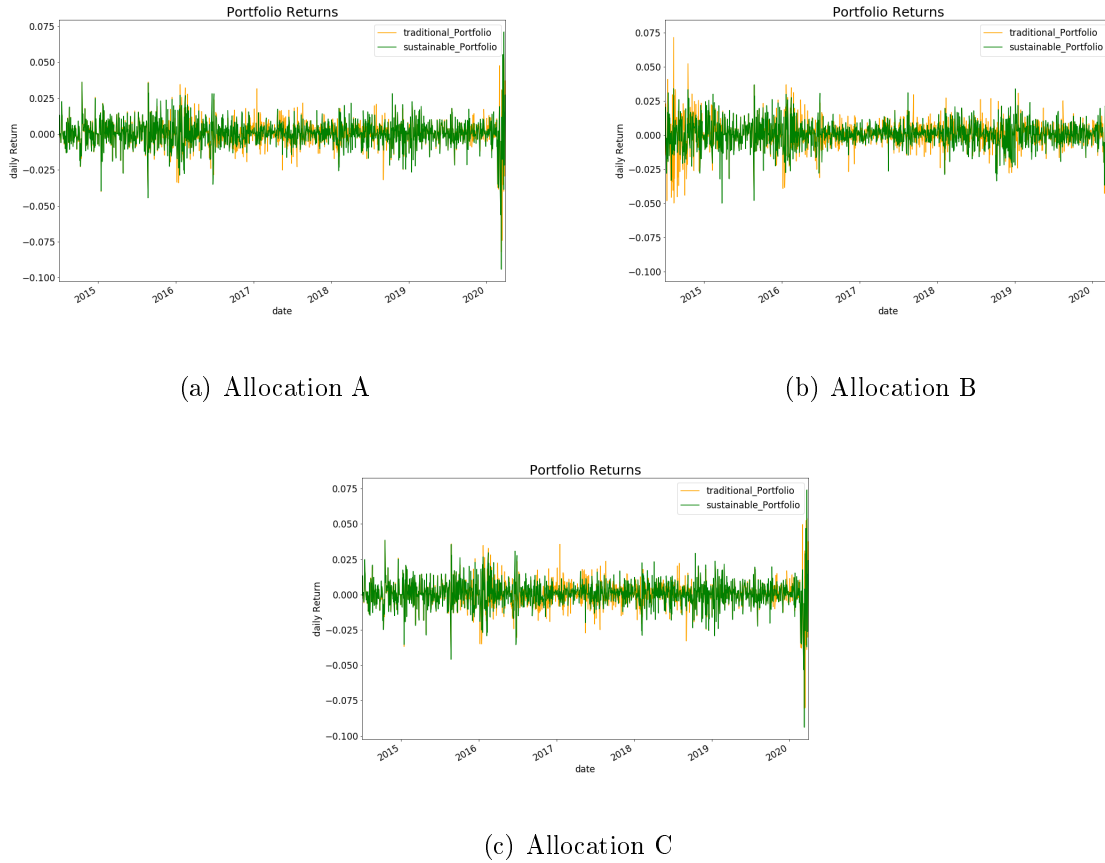
(c) Allocation C

Figure 8.2: Daily returns of portfolios from 2014-07-01 to 2020-03-31

Table 8.1 summarises the most important statistical measures of returns and the better results per allocation are marked in blue. With all allocations A, B and C, the sustainable portfolio performs better than the traditional one.

Allocation	A		B		C	
Portfolio	traditional	sustainable	traditional	sustainable	traditional	sustainable
count	1488	1488	1488	1488	1488	1488
mean (arithmetic)	0.0361%	0.0374%	0.0460%	0.0550%	0.0397%	0.0496%
std	0.9818%	0.9388%	1.1442%	1.0148%	1.0045%	0.9470%
min	-8.2081%	-9.4283%	-9.8496%	-7.7526%	-8.0683%	-9.3979%
25%	-0.4157%	-0.3962%	-0.4244%	-0.4266%	-0.4254%	-0.4097%
50%	0.0438%	0.0424%	0.0716%	0.0570%	0.0451%	0.0642%
75%	0.5352%	0.4970%	0.5851%	0.5241%	0.5300%	0.5205%
max	5.3931%	7.1029%	7.1455%	7.5408%	5.3764%	7.4025%

Table 8.1: Summary statistics of daily returns

With an average daily return of 0.0374% (A), 0.0550% (B) and 0.0496% (C), the sustainable portfolios perform better, and their standard deviation is also lower (0.9388%,

1.0148% and 0.9470%). A look at both Table 8.1 and Figure 8.3 shows that the daily returns of all three allocations are distributed similarly. The distributions are very similar to a normal distribution, with the smaller volatility visible in the distribution of sustainable returns in all three allocations.

(a) Allocation A

(b) Allocation B

(c) Allocation C
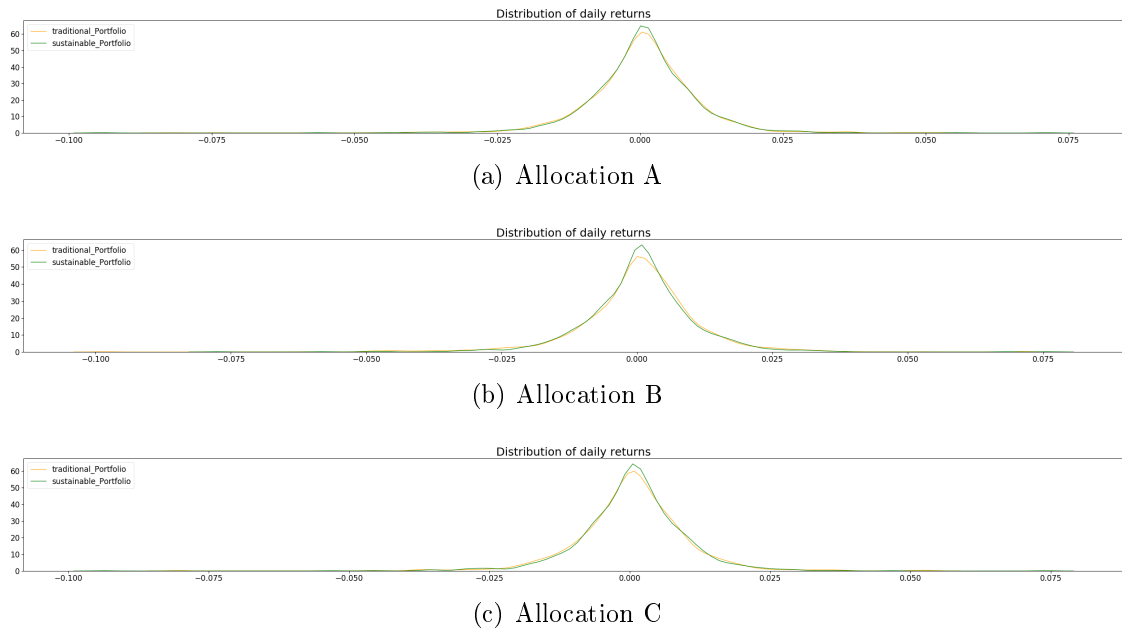
Figure 8.3: Distribution of daily returns

(a) Allocation A

(b) Allocation B

(c) Allocation C
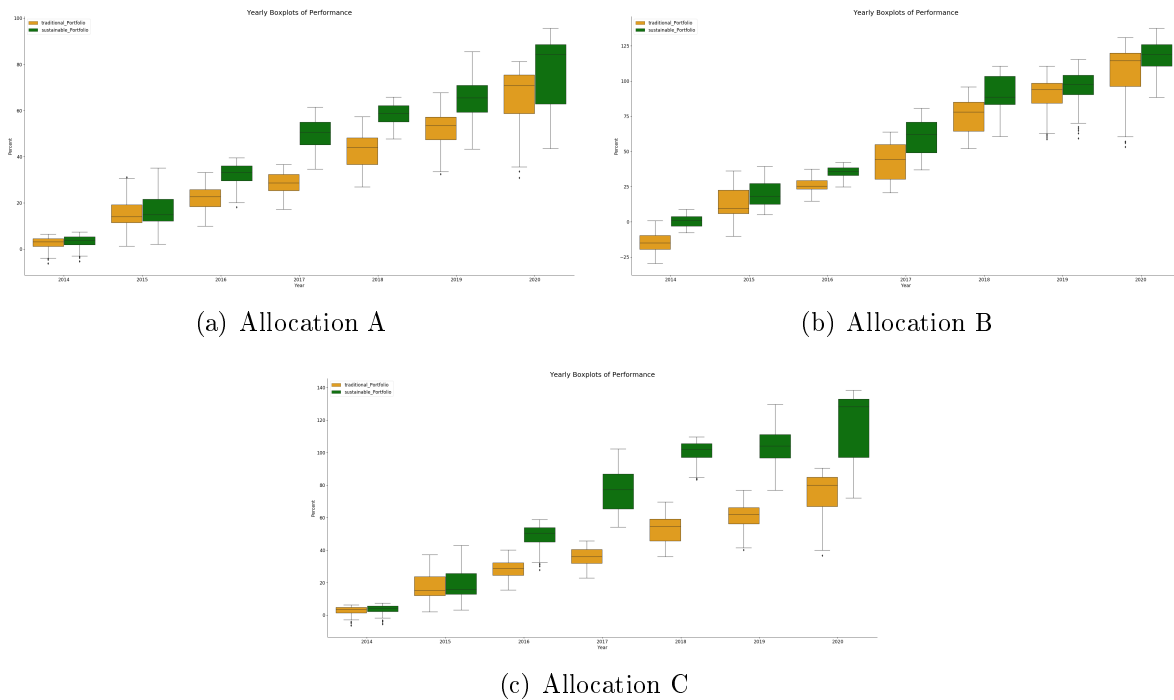
Figure 8.4: Yearly Boxplots of Performance of Portfolios

Before I get to the descriptive statistics, I would like to briefly refer to Figure 8.4. In this figure you can see boxplots across the annual performance. The upward trend that I have already described can be seen even more clearly in this figure. Another finding is that the traditional portfolio is more stable in all allocations and therefore less volatile. While the boxplots of the traditional portfolios in 2020 is average, those of the sustainable portfolio have shifted sharply downwards in allocations A and C.

8.2   Descriptive Statistics

In this chapter, I'll take a closer look at performance and use descriptive statistics to describe it. In the first step, I will explain and define these measures.

Total Return   The annualised total return is the geometric average amount of money earned by an investment each year over a given time period. The higher the value, the better. The annualised return formula is calculated as a geometric average to show what an investor would earn over a period of time if the annual return was compounded (Investopedia, 2020a).

$$\text{Annualised return} = \left((1 + r_1) \cdot (1 + r_2) \cdot \ldots \cdot (1 + r_n)\right)^{\frac{1}{n}} - 1, \tag{20}$$

with r_i returns and n the number of years.

Volatility   Volatility is a statistical measure of the dispersion of returns for the given portfolio. The higher the volatility, the riskier the portfolio (Investopedia, 2020d). To make a comparison with the annualised total return, the annualised volatility must also be calculated. Whereby we have already defined the formula for the volatility in equation (6).

$$\text{Annualised volatility} = \sigma \cdot \sqrt{250} \tag{21}$$

Volatility is multiplied by the square root of 250 based on 250 business days per year.

Sharpe ratio   The Sharpe ratio compares the return with the risk of the portfolio. This was previously established in Chapter 7.2.1.

$$\text{Sharpe ratio} = \frac{\text{Annualised return}}{\text{Annualised volatility}} \tag{22}$$

Value at Risk   The Value at Risk determines the loss potential and the probability of occurrence. Here for the quantile of α =1%. Risk managers use VaR to measure and control the level of risk exposure (Investopedia, 2019a).

Conditional VaR   The conditional Value at Risk, also known as 'expected shortfall', quantifies the amount of tail risk. Here with quantile of α =1% as well. Generally speaking, if an investment has shown stability over time, then the value at risk may be sufficient for risk management in a portfolio containing that investment. However, the less stable the investment, the greater the chance that VaR will not give a full picture of the risks, as it is indifferent to anything beyond its own threshold. Conditional Value at Risk (CVaR)

attempts to address the shortcomings of the VaR model, which is a statistical technique used to measure the level of financial risk within a firm or an investment portfolio over a specific time frame (Investopedia, 2020b).

Maximum Drawdown   The maximum drawdown is a specific measure of drawdown that looks for the greatest movement from a high point to a low point, before a new peak is achieved. Maximum drawdown is an indicator of downside risk over a specified time period (Investopedia, 2020c).

Since the measures with which I interpret the performance are explained and defined, I can compare the portfolios on the basis of these numbers. Table 8.2 shows these for the three allocations and each of the two portfolios. The better results per measure per allocation are again marked in blue.

Allocation	A		B		C	
Portfolio	traditional	sustainable	traditional	sustainable	traditional	sustainable
Total return (geometric)	8.4259%	8.8970%	10.7186%	13.7439%	9.3602%	12.3580%
Volatility	15.5296%	14.8490%	18.0975%	16.0514%	15.8872%	14.9791%
Sharpe ratio	54.2571%	59.9165%	59.2270%	85.6239%	58.9168%	82.5019%
Value at Risk (VaR)	-2.9384%	-2.5682%	-3.7424%	-2.8080%	-3.0211%	-2.8280%
Conditional VaR	-4.1876%	-3.8781%	-4.8869%	-3.9600%	-4.2260%	-3.8270%
Maximum drawdown	-50.3632%	-51.9791%	-77.5565%	-51.2087%	-53.8911%	-66.3094%
Date	2020-03-18	2020-03-16	2020-03-18	2019-01-03	2020-03-18	2020-03-16

Table 8.2: Descriptive Statistics of Portfolios (annualised)

As can be seen from Table 8.2, all allocations A, B and C have a similar structure in terms of performance to that previously described in subchapter 8.1. With an annualised total return of 8.879%, 13.7439% and 12.358%, the sustainable portfolios outperform their benchmarks (traditional portfolios) for all allocations.

All risk indicators also give the sustainable portfolio a better rating. The sustainable portfolios are less volatile than their traditional benchmarks. It follows that for allocations B and C, the excess return of the sustainable portfolio is much higher than that of the traditional one. In the portfolio weighted according to market capitalisation (allocation A), the Sharpe ratios are similar but the sustainable portfolio also performs better here. Both the value at risk and the conditional value at risk prescribe a lower loss rate for the sustainable portfolios with a probability of 99% (since $\alpha = 1$).

In the period from 2014-07-01 to 2020-03-31, the sustainable portfolio for allocation A and C had a higher maximum drawdown than the traditional one. These maximum drawdowns were in mid-March during the coronavirus pandemic. It is interesting, however, that in the Maximum Sharpe Portfolio (Allocation B), the traditional portfolio had a higher maximum drawdown than the sustainable one.

In summary, an investor would prefer the sustainable portfolio in any of the three allocations when summarising the technical analysis and the descriptive statistics.

8.3   Analysis of the Portfolio Composition

In order to complete the analysis of the portfolios and their performance, the composition of each portfolio is analysed in relation to sectors and countries. The difference between the traditional and sustainable portfolios within the three allocations is intended to provide information on the consequences of sustainability for certain countries and industry sectors.

8.3.1   Country-Specific Composition

In order to be able to recognise the difference between the portfolios, the average over the 23 quarters was calculated. The weights per quarter for the countries can be seen in the Exhibit in Figures 11.2, 11.3 and 11.4.

In Figure 8.5 you can see the proportion of stocks in the portfolios for allocation A. At first glance you can see that the German and Swiss financial markets are several times larger than the Austrian. In both portfolios, 90% of the components are from Germany and Switzerland. Austrian companies can be found on average between 3.3% and 2.6% in the portfolios. The other countries represented are negligible. The difference between the traditional and sustainable portfolio is that the fifty-fifty split in the traditional portfolio of the 90% in the sustainable portfolio results in a decline on the part of Swiss companies and a loss for German companies. The sustainable portfolio in allocation A holds 56.8% in Swiss companies and 38.8% in German companies. In the traditional portfolio there is this fifty-fifty split where 45.3% of the assets are Swiss stocks and 47.8% German stocks.

(a) traditional Portfolio   (b) sustainable Portfolio
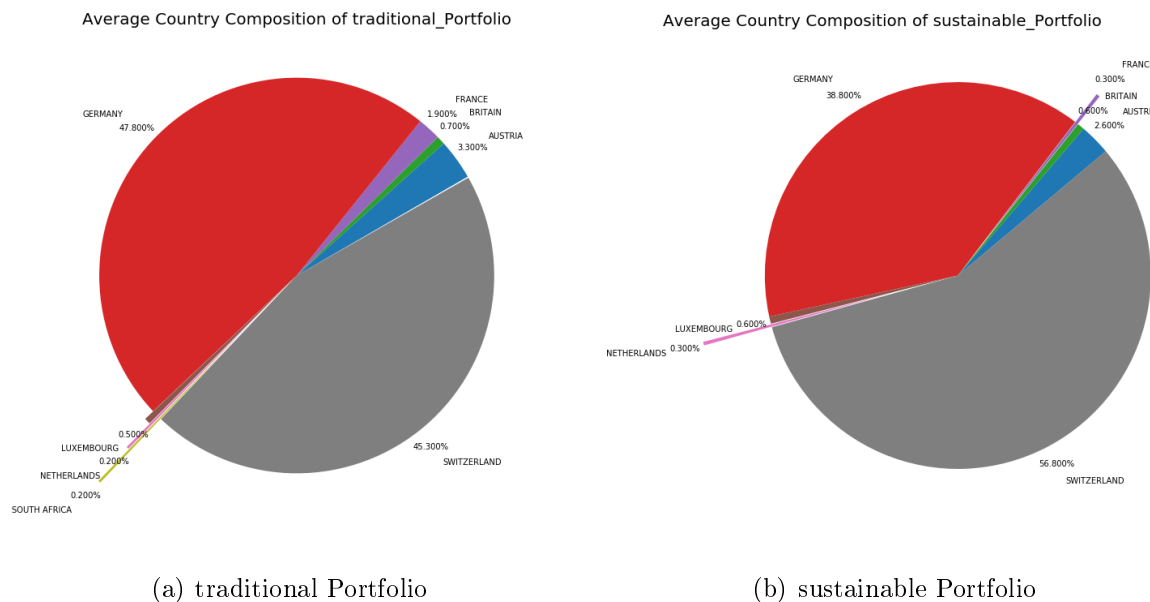
Figure 8.5: Average Country Compositions of Portfolios (Allocation A)

This difference between the two portfolios in this allocation does not change significantly over time, as can be seen in Figure 11.2 in the Exhibit. I interpret this difference to mean

that among the companies with a large market capitalisation, more sustainable ones are located in Switzerland than in Germany.

In allocation B (Maximum Sharpe) the picture of the allocation is completely different from the first one. The percentage of companies in the traditional portfolio can be divided into 40.2% German, 43.2% Swiss, and 16.1% Austrian companies on average over the quarters. This reflects that among all listed companies in Germany, Switzerland and Austria, those for the creation of efficient portfolios according to Markowitz also have a similarly good Sharpe ratio to their market capitalisation, whereby it should be noted that the share of Austrian companies is five times as large as before, in the traditional portfolio for allocation A.

We now consider the biggest difference in the sustainable portfolio. The percentage of Austrian companies in the sustainable portfolio increases from the benchmark 16.1% to 47.8%. The proportion of German and Swiss companies decreased by around 10% and 20%.

(a) traditional Portfolio   (b) sustainable Portfolio
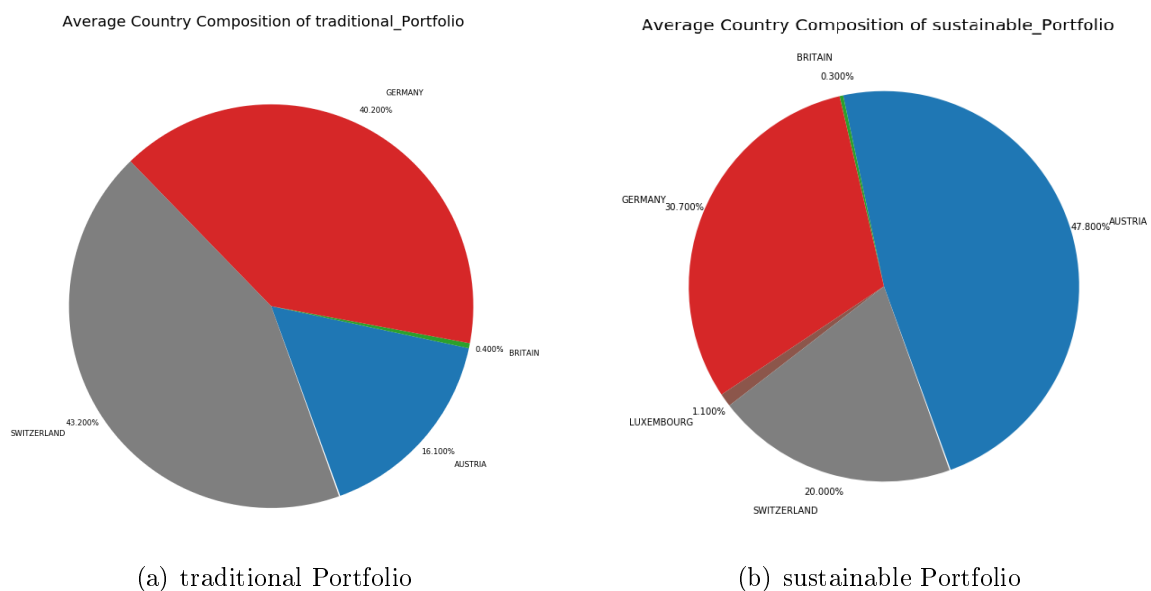
Figure 8.6: Average Country Compositions of Portfolios (Allocation B)

If we look at the exact temporal course of the allocation, which is broken down into the countries in Figure 11.3 (Exhibit), you can see that the proportion of Austrian companies only increased so significantly from the 3rd quarter of 2016. Euribor 3 Months explains, why the proportion is so large from this point on. This rate is used in the Markowitz model as the risk-free interest rate. On April 21, 2015 it was negative for the first time. At the beginning of the 3rd quarter of 2016 (2016-07-01), the risk-free interest rate is already strongly negative at -0.29. For this reason, portfolios closer to the bottom left are selected as optimal, i.e. in the south-west of the $\mu\sigma$-diagram on the curve. Previously, portfolios were selected that were more in the north-west on the efficient frontier. From the 3rd quarter of 2016, portfolios will therefore be selected that have less risk but also less return. Some Austrian companies are in the $\mu\sigma$-diagram in the south-west, including

the asset of BKS Bank AK. The optimised portfolio consists to a large extent of these assets, namely with a total weighting in the portfolio of 40% to 90%, which leads to this increase for Austria.

The last breakdown (Figure 8.7) of the countries in allocation C has no meaning at all because on the one hand, the two portfolios are similar and on the other hand, the composition of the portfolios contains the number of companies in the indices. Since the German indices always have twice as many components as the Swiss and Austrian indices, these also have 50% and the other two 25% in the country breakdown.

(a) traditional Portfolio   (b) sustainable Portfolio
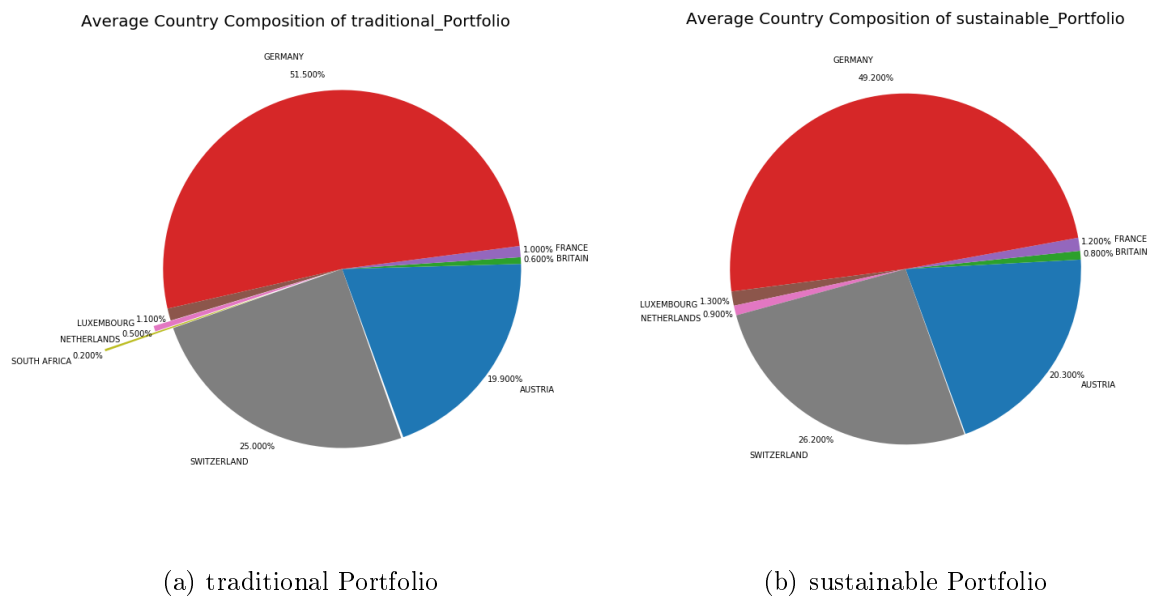
Figure 8.7: Average Country Compositions of Portfolios (Allocation C)

8.3.2   Sector-Specific Composition

Whether sustainability and the restriction to ESG-compliant companies and an associated ranking also have an impact on the various sectors is to be considered in this subchapter. The weights per quarter for the sectors can be seen in the Exhibit in Figures 11.5, 11.6 and 11.7.

First, the allocation A (value weighted) and its portfolios are analysed again. If you look at the division into the industry sectors in Figure 8.8, you can see that there are four larger industries. The Consumer cyclical, Financial, and Industrial sectors are roughly the same size of around 15%. The fourth and largest part of the companies is active in the customary non-cyclical sector with 35%. The remaining sectors all have only parts below 10%. The difference in allocation between the traditional and sustainable portfolio lies in the increase to 44% in the already large consumer non-cyclical sector. The remaining sectors each lose a few percent in this increase. The customary non-cyclical sector consists of companies engaged in agriculture, food and beverage processing and manufacturing, household and personal product manufacturers, and personal service providers. I

attribute the 10% increase in this area in the sustainable portfolio to consumers in the German-speaking area paying attention to the sustainability of goods and services and therefore creating a demand within the sector. The customary non-cyclical sector is also trying to comply with that.

If you look at the time course of the portfolios in Figure 11.5, you can see that the distribution across the sectors remains roughly constant.

(a) traditional Portfolio   (b) sustainable Portfolio
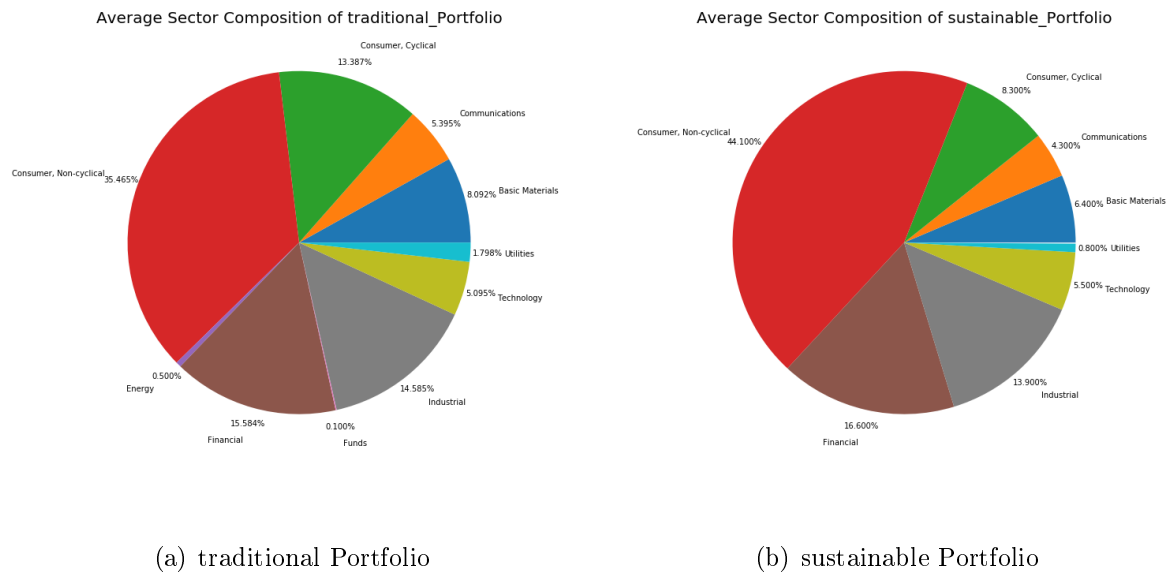
Figure 8.8: Average Sector Compositions of Portfolios (Allocation A)

(a) traditional Portfolio   (b) sustainable Portfolio
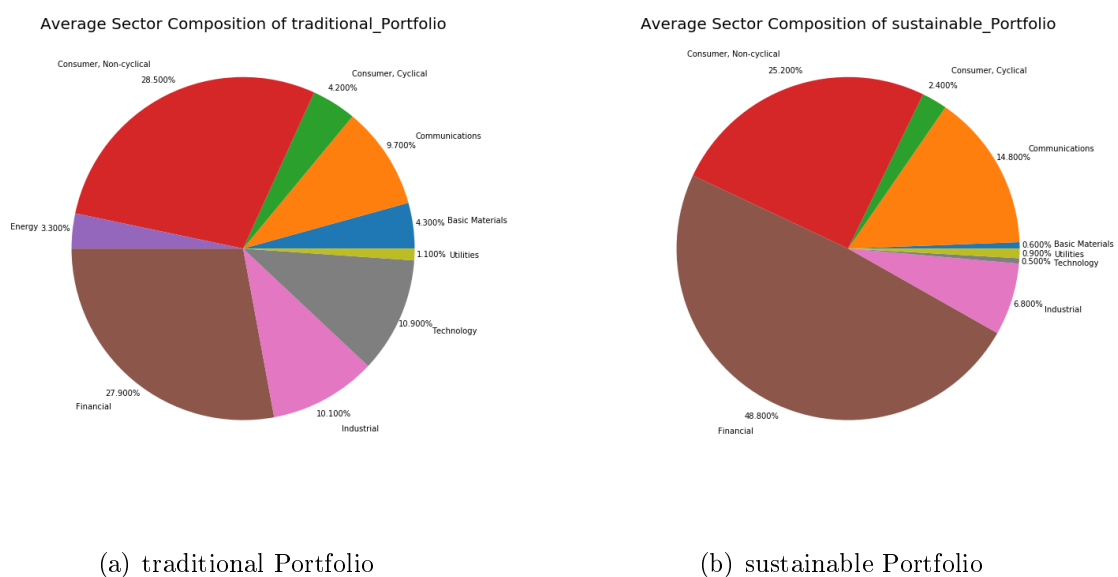
Figure 8.9: Average Sector Compositions of Portfolios (Allocation B)

In allocation B, the composition of the sectors is again strongly affected by the customary non-cyclical sector but this time also by the financial sector (see Figure 8.9). The fact that the percentage in the sustainable portfolio of the financial sector almost doubles is due to the weighting of the asset BKS Bank AK with 40%-90% in the portfolio, as was previously the case in the country-specific composition.

The last pie diagram in this chapter shows the division of the sectors for the allocation C (equally weighted). It is evident that the composition of the traditional and sustainable portfolio are very similar and that all areas are therefore equally affected by ESG regulation.

(a) traditional Portfolio   (b) sustainable Portfolio
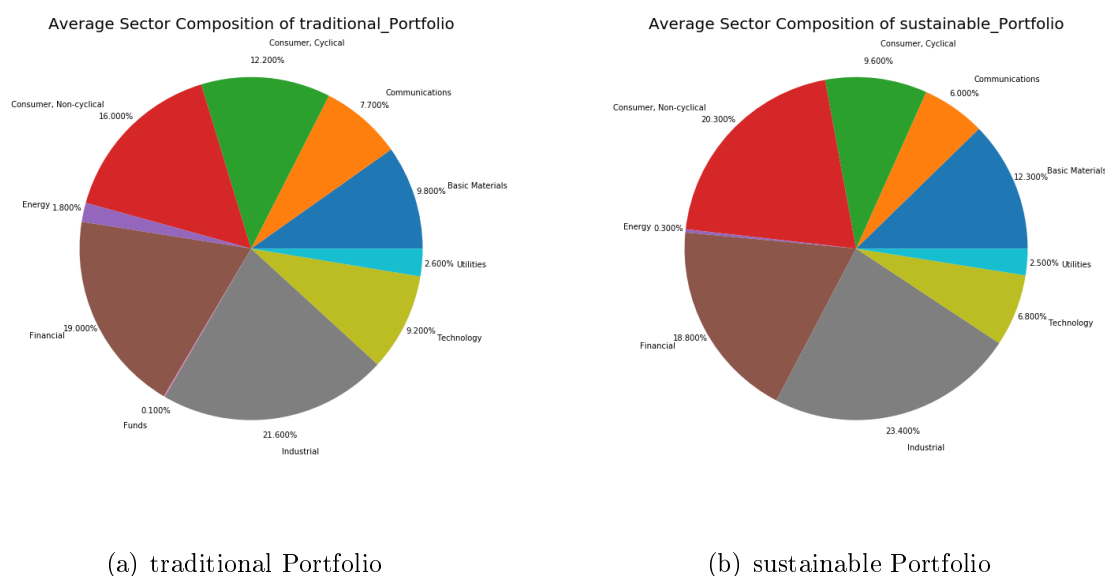
Figure 8.10: Average Sector Compositions of Portfolios (Allocation C)

8.4   Excursus - Coronavirus Pandemic (2019)

Since the coronavirus pandemic (COVID-19) broke out during the writing and research analysis of this master's thesis, I would like to briefly report on the economic consequences in the analysed portfolios and use this current economic crisis to show, as in the recently published papers by Broadstock et al. (Broadstock et al., 2020) and Morningstar (Morningstar, 2020), that portfolios that are ESG-compliant and ESG funds perform better than their traditional peers even in times of crisis and survive this phase better.

Several crises shocked the financial market in the last 20 years. The largest were the Dot-com bubble (2000), the Financial crisis (2007), the European debt crisis (2010), and in this year the COVID-19 recession (2020). The financial markets collapse sharply in such phases, lead to sharp falls in share prices and put one or the other company so hard that it has to go into bankruptcy.

I have already mentioned that the collapse in portfolio performance and most of the maximum drawdowns occurred during the financial crisis, triggered by the coronavirus

pandemic (see Table 8.2). From the previous performance analysis in this thesis it can be seen, despite the economic crisis, that the sustainable portfolios, regardless of the allocation, perform better than the traditional ones.

In a series of interviews by Expert Investor and its author Kenway, Guillaume Mascotto, head of ESG and investment stewardship at American Century Investments said:

"We believe that an investment-led and materiality-focused ESG integration program can help minimise downside risk otherwise not captured by traditional financial analysis. Investments with systematic ESG integration (not an ESG product per se) could offer exposure to higher-quality issuers with strong ESG risk management practices, and ultimately help investors during a period of uncertainty." (Kenway, 2020)

Additionally, "M&G's head of sustainable and impact investing, Ben Constable-Maxwell, said investing with an ESG lens was essentially a risk management mechanism as managers take a more holistic approach in their company analysis" (Kenway, 2020) and added:

"We tend to scrutinise companies in a deeper way. This should help make better informed decisions on the durability and sustainably of companies. ESG on its own is not a safe haven but good risk management aligned with companies that are more sustainably oriented - that is a powerful combination." (Kenway, 2020)

Research from the data provider Morningstar examining the long-term performance of 745 Europe-based sustainable funds shows that the majority of strategies have done better than non-ESG funds over one, three, five, and ten years. However, "this doesn't mean that all ESG funds have had equal odds of success and that outperformance will persist. They showed that success rates vary by investment horizon" (Morningstar, 2020, p. 13-14). However, one of the key takeaways from this study was that "sustainable funds held up better than their traditional counterparts during the COVID-19 sell-off, delivering superior returns in all but one category" (Morningstar, 2020, p. 1).

Therefore, I would now like to use the COVID-19 recession to show that sustainable portfolios perform better than traditional portfolios, but that this depends on the investment horizon. Therefore, the two portfolios are compared across all allocations, with a maturity of 5 years and 1 year. Investments were made in the portfolios with maturity of one year on 2019-04-01 and in those with maturity of 5 years on 2015-04-01. Thus, at the end of their term, the portfolios will go through the recession that began in February 2020.

In Figure 8.11 you can see the performance of the portfolios with allocation A for the respective maturities.
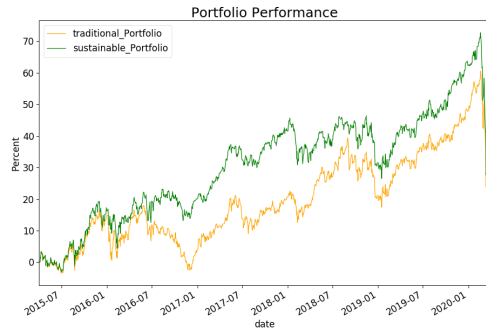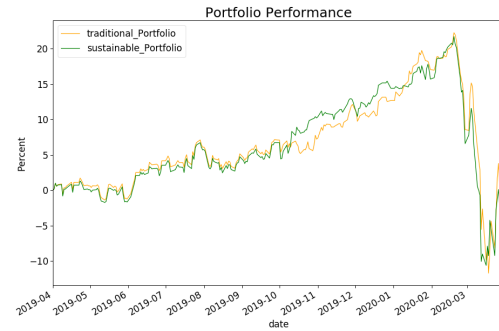
(a) Started on 2015-04-01 (5Y)   (b) Started on 2019-04-01 (1Y)

Figure 8.11: Performance of Portfolios until 2019-03-31 (Allocation A)

In Table 8.3, as before in Chapter 8.2, the figures for the performance comparison were calculated and the better results per measure per maturity are marked in blue.

Maturity	5Y (Long-Term)		1Y (Short-Term)	
Portfolio	traditional	sustainable	traditional	sustainable
Total return (geometirc)	7.1260%	7.5874%	7.4718%	1.6202%
Volatility	15.6939%	14.8888%	21.1378%	19.7540%
Sharpe ratio	45.4061%	50.9604%	35.3481%	8.2021%
Value at Risk (VaR)	-2.9698%	-2.6633%	-4.7634%	-3.8692%
Conditional VaR	-4.2972%	-3.9711%	-6.7954%	-6.3118%
Maximum Drawdown	-44.6205%	-45.8939%	-33.9838%	-32.3475%
Date	2020-03-18	2020-03-16	2020-03-18	2020-03-16

Table 8.3: Descriptive Statistics of Portfolios (annualised)(Allocation A)

In this allocation for portfolios with a maturity of 5 years, the sustainable portfolio is clearly chosen if one neglects the small difference in the maximum drawdown. However, for portfolios with only one year of maturity, the risk figures speak for the sustainable portfolio but the return figures (i.e. the total return and the Sharpe ratio) represent the traditional portfolio better. It is therefore not possible to make a clear choice between the two portfolios based on these measures.
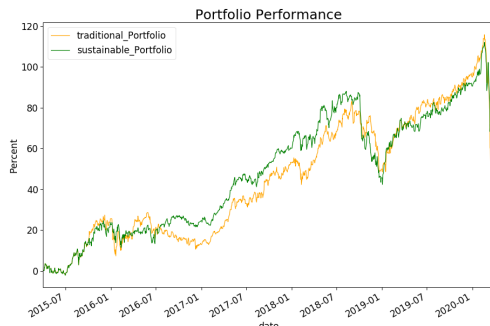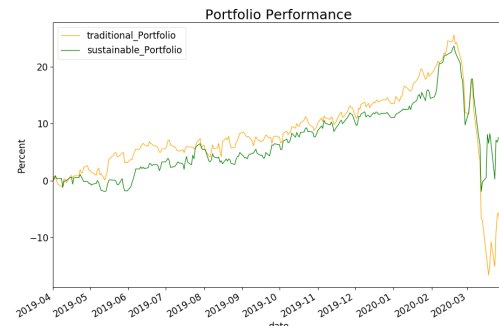
(a) Started on 2015-04-01 (5Y)   (b) Started on 2019-04-01 (1Y)

Figure 8.12: Performance of Portfolios until 2019-03-31 (Allocation B)

Maturity	5Y (Long-Term)		1Y (Short-Term)	
Portfolio	traditional	sustainable	traditional	sustainable
Total return (geometirc)	10.9204%	13.3794%	-2.2568%	9.2243%
Volatility	16.1505%	15.2600%	20.9944%	19.5930%
Sharpe ratio	67.6167%	87.6761%	-10.7496%	47.0794%
Value at Risk (VaR)	-2.8044%	-2.7644%	-4.8838%	-4.6807%
Conditional VaR	-4.5095%	-3.8899%	-6.9671%	-6.0908%
Maximum Drawdown	-72.5069%	-45.7495%	-42.1973%	-25.5368%
Date	2020-03-18	2019-01-03	2020-03-18	2020-03-12

Table 8.4: Descriptive Statistics of Portfolios (annualised)(Allocation B)

Under allocation B, the sustainable portfolios perform better in both the long-term and the short-term. All of the indicators give the sustainable portfolio a better rating. The crisis is thus coped better with portfolios that are restricted in both maturities with ESG than with non-ESG compliant portfolios.
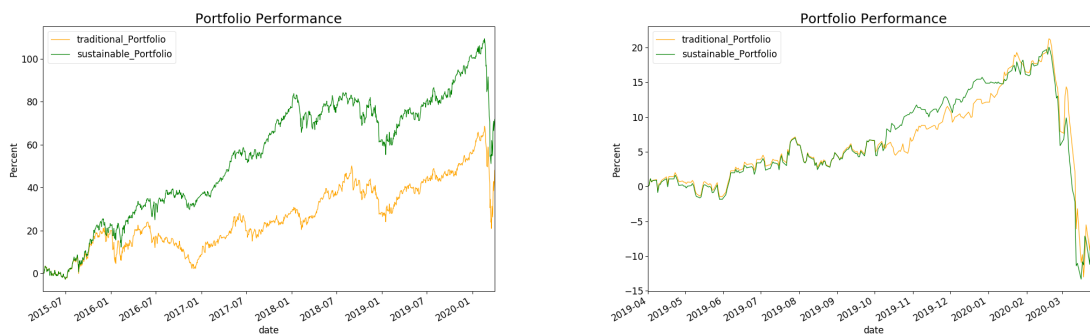
(a) Started on 2015-04-01 (5Y)

(b) Started on 2019-04-01 (1Y)

Figure 8.13: Performance of Portfolios until 2019-03-31 (Allocation C)

Maturity	5Y (Long-Term)		1Y (Short-Term)	
Portfolio	traditional	sustainable	traditional	sustainable
Total return (geometirc)	8.1597%	11.4170%	6.5168%	-1.5149%
Volatility	16.0278%	14.9312%	21.5178%	19.3848%
Sharpe ratio	50.9100%	76.4637%	30.2858%	-7.8146%
Value at Risk (VaR)	-3.0467%	-2.8722%	-4.6684%	-3.7098%
Conditional VaR	-4.3609%	-3.9266%	-6.9153%	-6.1451%
Maximum Drawdown	-47.6830%	-58.2523%	-34.3053%	-33.4040%
Date	2020-03-18	2020-03-16	2020-03-18	2020-03-16

Table 8.5: Descriptive Statistics of Portfolios (annualised)(Allocation C)

Allocation C gives a similar picture to Allocation A. In the long-term, the sustainable portfolio performs better, although the maximum drawdown was larger. In the case of portfolios with a one-year maturity, no clear decision can be made on the basis of the figures (see Table 8.5).

In summary, an economic crisis is easier to survive with a sustainable long-term portfolio than with its traditional benchmark. This is not clear in the area of short-term

portfolios. A Morgan Stanley report recognised that ESG was one of the strongest ways to generate long-term returns, with an emphasis on long-term returns (Stanley, 2019).

ESG integration in investment analysis and portfolio management has gained increasing acceptance in recent years as investors recognised the profound effects of environmental and social changes on long-term portfolios. MSCI has identified ESG traits as a potential way to mitigate systematic and idiosyncratic risk. The COVID-19 pandemic was the first real test of this hypothesis. Companies with strong ESG traits saw relatively smaller drawdowns. An attribution analysis by MSCI showed that much of this relative outperformance came from ESG and was not just a substitute for other defenses such as quality and low volatility (MSCI, 2020).

Broadstock et al. only recently examined "the role of ESG performance during the market-wide financial crisis that emerged in response to physical and economic blockades caused by the global COVID-19 pandemic. They used the special circumstances to question whether investors interpret ESG performance as a signal for future stock performance and/or risk reduction. Using a novel dataset covering China's CSI300 constituents, they illustrate that high ESG portfolios tend to outperform low ESG portfolios, that ESG performance mitigates financial risk during financial crisis, and the role of ESG performance is attenuated in 'normal' times, confirming their incremental importance during crisis" (Broadstock et al., 2020, p. 1).

The Morningstar paper showed that "sustainable funds held up better than their traditional counterparts during the COVID-19 sell-off. In all but one category considered in the study, sustainable funds outperformed, with average excess returns in the first quarter of 2020 ranging between 0.09% and 1.83% across categories. The overall outperformance of sustainable funds during the COVID-19 sell-off in the first quarter can be explained by a combination of factors. First, being underweight in less ESG-friendly sectors like oil and gas and overweight in technology and healthcare would have benefitted many ESG-aligned portfolios. Traditional factors such as quality and low volatility would also have played a role. Companies that score high on ESG tend to enjoy more conservative balance sheets and competitive advantages, and these are attributes that make companies more resilient during market downturns. Finally, companies that score high on ESG also tend to be well-run businesses that treat all their stakeholders fairly, address their environmental challenges, and have lower levels of controversies. Many such companies are better equipped to weather periods of uncertainty" (Morningstar, 2020, p. 12-13).

The COVID-19 pandemic and its economic consequences can thus help to empirically prove the resilience of stocks with high ESG performance in times of a market-wide financial crisis. This, in turn, is in line with the view that investors could use ESG performance as a signal for future stock performance and/or interpret risk mitigation in times of crisis (Broadstock et al., 2020, p. 8).

9   Costs of Sustainability

In this master's thesis, the concept of sustainability was explored and many insights were provided. In my survey, it was also asked whether the retail investor feels ready to invest sustainably instead of traditionally and wants to be restricted in the process. In addition, the participants were asked how much return they would give up for sustainability. On average and across all age groups, individuals are willing to give up 15% of the return of a traditional portfolio in order to be sustainable (see Chapter 3.3). The cost of sustainability will be calculated in the following chapter.

In order to calculate the costs for sustainable goals, we consider the outperformance of the sustainable portfolio compared to the traditional portfolio.

(a) Outperformance   (b) Boxplot of daily outperformance
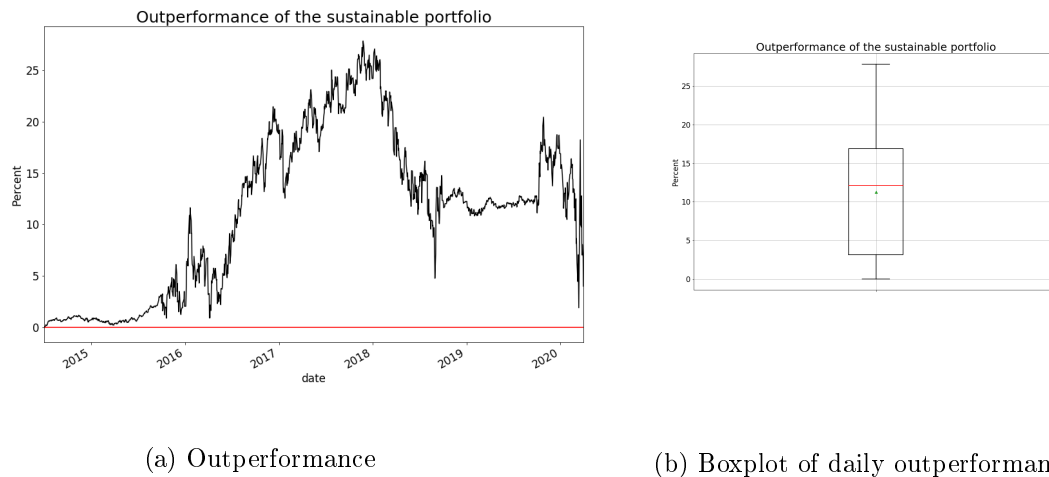
Figure 9.1: Outperformance of the sustainable portfolio (Allocation A) and Boxplot

For allocation A, the outperformance is almost always positive, only in 2015 it was -0.0256%. It reached the maximum at the end of the year from 2017 to 2018 with 27.8162%. The sustainable portfolio with allocation A goes beyond the entire time horizon from 2014-07-01 to 2020-03-31 with an outperformance of 4.0226%. With this allocation, you don't have to pay for sustainability, you get even more.

In contrast to allocation A, the outperformance in allocation B (see Figure 9.2) has several negative outliers, i.e. it performed worse than the traditional portfolio. The worst outperformance here is -8.8319%. Especially in the COVID-19 recession, the strongest outperformance is at 51.3460%. When the time horizon expires on 2020-03-31, the sustainable portfolio has a positive outperformance of 30.1392% and therefore does not generate any costs for sustainability either.

(a) Outperformance

(b) Boxplot of daily outperformance
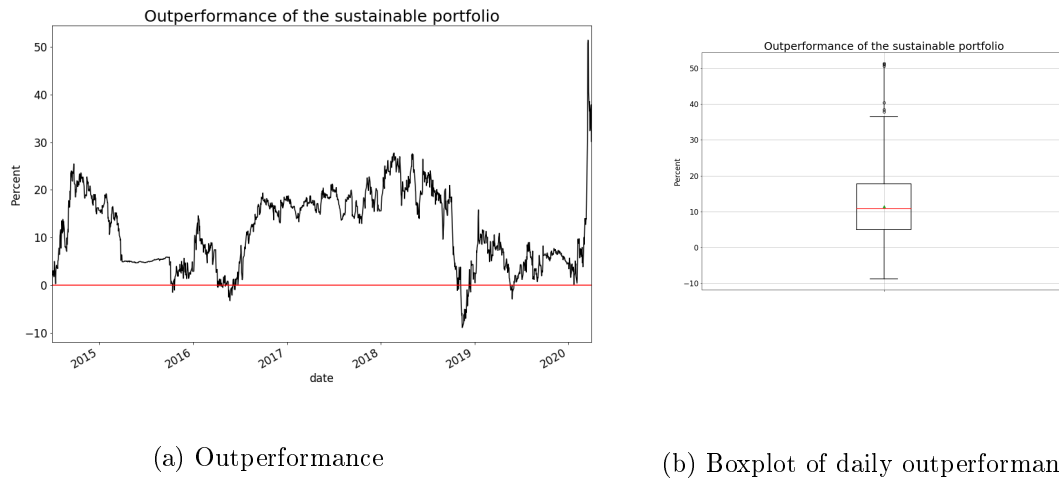
Figure 9.2: Outperformance of the sustainable portfolio (Allocation B) and Boxplot

Allocation C, similar to Allocation A, has a minimal negative outperformance of -0.0780% compared to the traditional portfolio in the first year. From 2016, the outperformance increases sharply and reaches its maximum of 62.1321% at the end of 2018. The sustainable portfolio closes on 2020-03-31 with 28.1700% outperformance. This means that even the last allocation does not bear any costs for sustainability.

(a) Outperformance

(b) Boxplot of daily outperformance
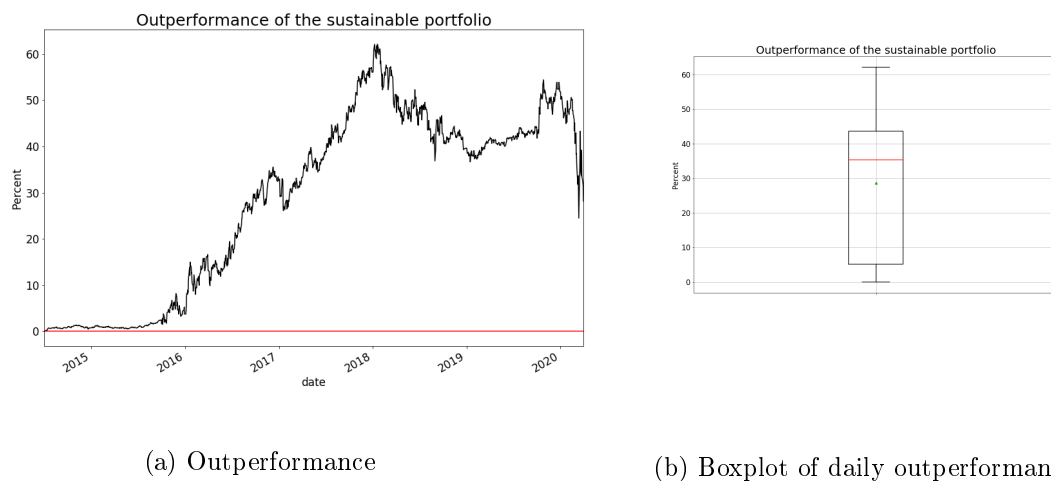
Figure 9.3: Outperformance of the sustainable portfolio (Allocation C) and Boxplot

Holding these portfolios in all three allocations over the period from 2014-07-01 to 2020-03-31 does not result in any disadvantages compared to the traditional portfolio. On the contrary, the outperformance is positive.

The Mornigstar research group also came to this conclusion in June 2020. "Average returns and success rates for sustainable funds across seven Morningstar Categories suggest that there is no performance trade-off associated with sustainable funds. In fact, a majority of sustainable funds have outperformed their traditional peers over multiple time horizons" (Morningstar, 2020, p. 1).

In order to make my results comparable, the annual outperformance of the sustainable portfolio compared to its traditional peers is calculated (see Table 9.1).

Allocation	A	B	C
Outperformance from 2014-07-01 to 2020-03-31	4.0226%	30.1392%	28.1700%
Outperformance (annualised)	0.4711%	3.0252%	2.9978%

Table 9.1: Outperformance of the sustainable portfolio

The outperformance of the sustainable portfolios is between 0.47% and 3.03% annually. This result is in line with the outperformance of the VÖNIX in Austria compared to its traditional benchmark, the ATX Prime, which is 1.32% pa (Sihn-Weber and Fischler, 2019, p. 518).

This master's thesis shows that investing in sustainable assets does not result in any disadvantage for the investor. On the contrary, by adhering to the ESG criteria of the companies and their pursuit of improvement, one experiences the advantages of a positive impact on the environment, the employees, and much more. And last but not least, this strategy of investment decision makes long-term profits and also minimises the risk (see Table 8.2).

10   Conclusion

For more than 20 years, the areas of environmental, social, and governance as sustainability areas have influenced the investment decision-making process and it is increasing every day. For many years this influence was seen as a restriction on investment decisions and a deterioration in performance. However, some studies have proven otherwise, including this master's thesis. Corporate financial performance also have positive effects through the implementation of ESG issues in the company, according to the study by Friede et al., which summarised 2200 studies and reports and their statements. The results showed that "roughly 90% of studies find a non-negative ESG – CFP relation. More importantly, the large majority of studies reports positive findings. They highlighted that the positive ESG impact on CFP appears stable over time" (Friede et al., 2015, p. 1).

In addition to the positive effects in the areas of environmental, social, and governance, ESG also has positive effects for the company, but much more important for this paper also for investors and shareholders.

The ESG model is still in the development phase. A wide variety of organisations (UN, EU, OECD, PRI, etc.) and forums are promoting standardisation at the international level. This should help to collect ESG data qualitatively and quantitatively, to be able to compare them with one another.

The survey that I created and analysed for my master's thesis showed that private investors are ready for international standards and guidelines in the ESG area. In addition, the subject would give up an average of 15% of the return on a traditional portfolio for sustainability. Furthermore, it has been shown that the younger the investor, the more likely it is that they want to invest sustainably. The implementation of ESG topics in the investment decision-making process has its difficulties but can be realised in stages. Qualitative ESG data are important for this.

A comparison of traditional and sustainable portfolios in the German-speaking area (Germany, Austria, Switzerland and Liechtenstein) was sought using three different allocation strategies. The comparison of the long-term sustainable portfolios with traditional portfolios (benchmarks) gave the sustainable portfolios a better rating in terms of performance. The risk was reduced by the ESG restriction, as you can see from several risk figures (volatility, value at risk, conditional value at risk) (see Table 8.2) and more return was generated.

The economic crisis, triggered by the coronavirus pandemic 2020, was a first test for the ESG investment strategy. The stormy seas of the economic crisis were overcome better on an ESG-compliant ship than on a traditional one. However, one important finding showed that an ESG investment strategy is suitable for long-term investment and does not necessarily perform better for short-term investments.

The portfolio comparison in German-speaking countries over the period from 2014-07-01 to 2020-03-31 showed a positive outperformance for the sustainable portfolios and this also across the crisis.

As a result of this master's thesis, the costs should be calculated that arise when investments are restricted by sustainability criteria. However, there was no such cost. On the contrary, there was an outperformance with higher returns than their traditional peer. On average, the sustainable portfolio outperforms with an annual return of 0.47% to 3.03%.

In the broad literature on sustainability in the investment market, this master's thesis is one of the studies that gives positive testimony to socially responsible investment (SRI) and the integration of ESG models into the investment decision-making process. Long-term and ESG-compliant investments generate more return. Risk get minimised, because the ESG reports take a closer look at the behaviour of the company towards their employees and the environment etc., so that fewer events occur that cause the risk of a price collapse. Therefore "ESG integration in the investment process can lead to better risk-adjusted returns and long-term value creation" (Cappucci, 2017, p. 2). Last but not least, standards and guidelines in the ESG areas have positive effects on our planet Earth and protect it, which is their primary goal and purpose.

11 Exhibit

Retail investor strategy and sustainability

0 %

Dear participant,

My name is Jakob König, I'm studying Banking and Finance and I'm currently writing my master's thesis. During this work, I designed this survey and would be delighted if you would take part.

It is often said that the desire to include the areas of environment, social affairs and corporate governance in the decision-making process for capital investments increases. In my work I would like to document how much sustainability costs. And the survey should show how much you are willing to invest for it.

Answering takes less than 5 minutes and all data is collected anonymously. The answers cannot be assigned to you personally and will be treated as strictly confidential.

Thank you for your participation.

———————————————— Next page ————————————————

By "traditional stocks" I mean all stocks traded on the world market.

Under "sustainable stocks" I define the subset of those stocks that are not from the
• Defense,
• Addictive,
• Gambling,
• Nuclear power and
• Coal power industry.
The company also undertakes to act sustainably in the areas of environmental, social and government.

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Next

Have you already invested your private money in stocks or do you plan to do so in the near future? *

◯ yes

◯ no

Next

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(a) Explanation and question 1

How decisive are the following criteria for you when choosing a stocks?

Choice of criteria is optional

	not at all	rarely	to some degree	important	very important
Size of the company	○	○	○	○	○
Well-known company	○	○	○	○	○
Stock price	○	○	○	○	○
Sustainability of the company	○	○	○	○	○
High dividends	○	○	○	○	○
Company based in my home country	○	○	○	○	○
Companies that are involved in environmetal projects	○	○	○	○	○
Companies with good employment relationships	○	○	○	○	○
Low volatility stocks	○	○	○	○	○
Sharpe-Ratio	○	○	○	○	○
Stocks with strong price rises recently	○	○	○	○	○
Low debt companies	○	○	○	○	○
Another criterion:	○	○	○	○	○

↓ +1

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Are you ready to restrict your stock selection to "sustainable stocks"? *

○ yes

○ no

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Your traditional portfolio produces an excellent return. You are offered to switch to a sustainable portfolio, which brings less income. What percentage of your current return must the average return on the sustainable portfolio bring in order for you to switch anyway? *

Enter the percentage between 0 and 100 percent. (e.g. 90, then you get 10% less than before)

[   ] %

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(b) Question 2-4

How should sustainability be regulated for companies?

○   international

○   national

○   not at all

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In which of these industries would you invest?

Multiple selection is possible

☐ Media and entertainment	☐ Coal	☐ Oil and gas
☐ Banking	☐ Drug ((tobacco, alcohol, ...)	☐ Advertising and PR
☐ Gambling	☐ Timber industry	☐ Pharmaceutical industry
☐ IT	☐ Telecommunication	☐ Business consulting
☐ Aerospace	☐ Chemical industry	☐ Genetic engineering
☐ Steel and metal industries	☐ Construction industry	☐ Education and research
☐ Car industry	☐ Energy	☐ Wholesale and retail
☐ Insurance	☐ Real estate	☐ Atomic energy
☐ Defense industry	☐ Electronics industry	☐ Food

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Gender: *

○   female

○   male

○   other

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Choose your year of birth: *

[2020 ⌄]

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Thank you for your participation! Do you want to complete the survey?

If you know interested participants, please transmit the survey link (https://www.umfrageonline.com/s/f327b0d).

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[Done]

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(c) Question 5-8 and end

Figure 11.1: Questions of the survey

</div>

Company Name	EVOTEC SE	UBM DEVELOPMENT AG	ADECCO GROUP AG
ISIN	**DE0005664809**	**AT0000815402**	**CH0012138605**
Country	**GERMANY**	**AUSTRIA**	**SWITZERLAND**
2009-12-31	2.13	14.859	57.05
2010-03-31	2.003	14.894	59.85
2010-06-30	2.03	13.398	52.43
2010-09-30	2.32	13.964	52.03
2010-12-31	2.92	16.494	62.06
2011-03-31	2.967	14.686	61.19
2011-06-30	2.543	14.957	55.6
2011-09-30	2.274	14.37	37.31
2011-12-31	2.337	13.355	40.59
2012-03-31	2.832	13.889	48.79
2012-06-30	2.135	12.256	45.22
2012-09-30	2.728	13.822	48.19
2012-12-31	2.626	15.042	51.72
2013-03-31	2.252	15.878	55.98
2013-06-30	2.713	20.123	60.08
2013-09-30	3.297	16.885	71.85
2013-12-31	3.665	17.868	78.77
2014-03-31	3.863	18.047	82.06
2014-06-30	3.585	23.411	83.68
2014-09-30	3.099	28.381	74.34
2014-12-31	3.675	28.501	78.93
2015-03-31	3.76	49.098	92.86
2015-06-30	3.55	46.32	89.37
2015-09-30	3.975	42.594	83.9
2015-12-31	4.17	45.314	81.13
2016-03-31	3.168	40.223	73.77
2016-06-30	3.8	38.549	59.81
2016-09-30	5.023	43.123	66.91
2016-12-31	7.442	40.509	81.53
2017-03-31	9.149	42.339	87.04
2017-06-30	13.99	51.047	90.99
2017-09-30	20.09	52.775	95.28
2017-12-31	13.5	55.732	94.2
2018-03-31	15.9	55.869	85.93
2018-06-30	14.735	58.386	77.11
2018-09-30	18.34	57.671	67.64
2018-12-31	17.365	47.796	60.27
2019-03-31	23.69	51.803	69.71
2019-06-30	24.58	58.268	80.29
2019-09-30	20.42	63.716	75.58
2019-12-31	23.05	71.435	83.79

Table 11.1: Quarterly stock data of the companies 'Evotec SE', 'UBM Development AG' and 'Adecco Group AG'

Volatility	Expected Return	Sharpe ratio	weigth of A_E	weigth of A_U	weigth of A_A
0.21	0.22	0.429	0.394	0.423	0.183
0.21	0.222	0.438	0.4	0.427	0.174
0.21	0.223	0.443	0.405	0.431	0.164
0.21	0.225	0.452	0.41	0.435	0.155
0.21	0.227	0.462	0.415	0.439	0.146
0.21	0.229	0.471	0.421	0.443	0.137
0.21	0.23	0.476	0.426	0.447	0.127
0.211	0.232	0.483	0.431	0.451	0.118
0.211	0.234	0.493	0.437	0.455	0.109
0.211	0.235	0.498	0.442	0.458	0.1
0.211	0.237	0.507	0.447	0.462	0.09
0.211	0.239	0.517	0.452	0.466	0.081
0.212	0.241	0.524	0.458	0.47	0.072
0.212	0.242	0.528	0.463	0.474	0.063
0.212	0.244	0.538	0.468	0.478	0.053
0.213	0.246	0.545	0.474	0.482	0.044
0.213	0.247	0.549	0.479	0.486	0.035
0.213	0.249	0.559	0.484	0.49	0.026
0.214	0.251	0.565	0.49	0.494	0.016
0.214	0.253	0.575	0.495	0.498	0.007
0.215	0.254	0.577	0.503	0.497	0
0.215	0.256	0.586	0.52	0.48	0
0.216	0.258	0.593	0.537	0.463	0
0.218	0.259	0.592	0.554	0.446	0
0.219	0.261	0.598	0.571	0.429	0
0.221	0.263	0.602	0.589	0.411	0
0.223	0.265	0.605	0.606	0.394	0
0.225	0.266	0.604	0.623	0.377	0
0.227	0.268	0.608	0.64	0.36	0
0.23	**0.27**	**0.609**	**0.657**	**0.343**	**0**
0.233	0.271	0.605	0.674	0.326	0
0.236	0.273	0.606	0.691	0.309	0
0.239	0.275	0.607	0.709	0.291	0
0.243	0.277	0.605	0.726	0.274	0
0.246	0.278	0.602	0.743	0.257	0
0.25	0.28	0.6	0.76	0.24	0
0.254	0.282	0.598	0.777	0.223	0
0.258	0.283	0.593	0.794	0.206	0
0.262	0.285	0.592	0.812	0.188	0
0.267	0.287	0.588	0.829	0.171	0
0.272	0.289	0.585	0.846	0.154	0
0.276	0.29	0.58	0.863	0.137	0
0.281	0.292	0.577	0.88	0.12	0
0.286	0.294	0.573	0.897	0.103	0
0.291	0.295	0.567	0.914	0.086	0
0.296	0.297	0.564	0.932	0.068	0
0.302	0.299	0.56	0.949	0.051	0
0.307	0.301	0.557	0.966	0.034	0
0.313	0.302	0.55	0.983	0.017	0
0.318	0.304	0.547	1	0	0

Table 11.2: Volatility, Return, Sharpe ratio and assets weights of the portfolio on the efficient frontier

	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1	2018 Q2	2018 Q3	2018 Q4	2019 Q1	2019 Q2	2019 Q3	2019 Q4	2020 Q1
1&1 DRILLISCH AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
AAREAL BANK AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ADIDAS AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ADVA OPTICAL NETWORKING SE				X	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X
AIRBUS SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
AIXTRON SE	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
ALLIANZ SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ALSTRIA OFFICE REIT-AG								X	X	X	X	X	X	X		X							
AROUNDTOWN SA								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
AUMANN AG																	X	X	X	X			
AURUBIS AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
AXEL SPRINGER SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
BASF SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BAYER AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BAYERISCHE MOTOREN WERKE AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BB BIOTECH AG	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BECHTLE AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BEIERSDORF AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BERTRANDT AG				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BILFINGER SE	X	X	X	X	X	X	X	X	X	X	X	X	X										
BRENNTAG AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CANCOM SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CARL ZEISS MEDITEC AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CECONOMY AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X
COMMERZBANK AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
COMPUGROUP MEDICAL SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CONTINENTAL AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
COVESTRO AG					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CTS EVENTIM AG & CO KGAA				X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X
DAIMLER AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DELIVERY HERO SE														X	X	X	X		X	X	X	X	X
DEUTSCHE BANK AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DEUTSCHE BOERSE AG	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X
DEUTSCHE EUROSHOP AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X
DEUTSCHE LUFTHANSA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DEUTSCHE PFANDBRIEFBANK AG					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DEUTSCHE POST AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DEUTSCHE TELEKOM AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DEUTSCHE WOHNEN SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DIALOG SEMICONDUCTOR PLC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DIEBOLD NIXDORF AG	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X
DMG MORI AG	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X
DRAEGERWERK AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
DUERR AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
E.ON SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ELRINGKLINGER AG	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
EVONIK INDUSTRIES AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
EVOTEC SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FIELMANN AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
FRAPORT AG FRANKFURT AIRPORT	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FREENET AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FRESENIUS MEDICAL CARE AG &CO KGAA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FRESENIUS SE & CO KGAA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FUCHS PETROLUB SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
GAGFAH SA	X	X	X																				
GEA GROUP AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
GERRESHEIMER AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
GERRY WEBER INTL AG	X	X	X	X	X																		
GFT TECHNOLOGIES SE				X	X	X	X	X	X	X	X	X	X										
GRAND CITY PROPERTIES												X	X	X	X	X	X	X	X	X	X	X	X
GRENKE AG															X	X	X	X	X		X	X	X
HANNOVER RUECK SE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HEIDELBERGCEMENT AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HELLA GMBH & CO KGAA	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HENKEL AG & CO KGAA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HOCHTIEF AG	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Company
HUGO BOSS AG
INFINEON TECHNOLOGIES AG
INNOGY SE
ISRA VISION AG
JENOPTIK AG
JUNGHEINRICH
K+S AG
KABEL DEUTSCHLAND HOLDING AG
KBC GROUP NV
KION GROUP AG
KLOECKNER & CO SE
KNORR-BREMSE AG
KRONES AG
KUKA AG
LANXESS AG
LEG IMMOBILIEN AG
LEONI AG
LINDE AG
LINDE PLC
LPKF LASER & ELECTRONICS
MAN AG
MANZ AG
MCKESSON EUROPE AG
MEDIGENE AG
MERCK KGAA
METRO AG
MORPHOSYS AG
MTU AERO ENGINES AG
MUENCHENER RUECKVER AG
NEMETSCHEK SE
NEW WORK SE
NORDEX SE
NORMA GROUP SE
OSRAM LICHT AG
PFEIFFER VACUUM TECHNOLOGY
PROSIEBENSAT.1 MEDIA SE
PSI SOFTWARE AG
PUMA SE
QIAGEN NV
QSC AG
RATIONAL AG
RHEINMETALL AG
RHOEN-KLINIKUM AG
RIB SOFTWARE SE
ROCKET INTERNET SE
RTL GROUP
RWE AG
S&T AG
SALZGITTER AG
SAP SE
SARTORIUS AG
SCHAEFFLER AG
SCOUT24 AG
SGL CARBON SE
SIEMENS AG
SIEMENS HEALTHINEERS AG
SILTRONIC AG
SKY DEUTSCHLAND AG
SLM SOLUTIONS GROUP AG
SMA SOLAR TECHNOLOGY AG
SOFTWARE AG
STADA ARZNEIMITTEL AG
STEINHOFF INTERNATIONAL H NV
STRATEC SE
STROEER SE & CO KGAA
SUEDZUCKER AG
SUESS MICROTEC SE
SYMRISE AG
TAG IMMOBILIEN AG
TALANX AG

TEAMVIEWER AG
TELEFONICA DEUTSCHLAND HOLDING
THYSSENKRUPP AG
TUI AG
UNIPER SE
UNITED INTERNET AG
VARTA AG
VOLKSWAGEN AG
VONOVIA SE
WACKER CHEMIE AG
WINCOR NIXDORF AG
WIRECARD AG
X CAC 40
ZALANDO SE

Table 11.3: Composition of HDAX from 2014-07-01 to 2020-03-31

	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1	2018 Q2	2018 Q3	2018 Q4	2019 Q1	2019 Q2	2019 Q3	2019 Q4	2020 Q1
ADDIKO BANK AG																							
AGRANA BETEILIGUNGS AG																							
AMAG AUSTRIA METALL AG																							
ANDRITZ AG																							
AUSTRIA TECHNOLOGIE & SYSTEM																							
BAWAG GROUP AG																							
BUWOG AG																							
CA IMMOBILIEN ANLAGEN AG																							
CENTURY CASINOS INC																							
CONWERT IMMOBILIEN INVEST GM																							
DO & CO AG																							
ERSTE GROUP BANK AG																							
EVN AG																							
FACC AG																							
FLUGHAFEN WIEN AG																							
FRAUENTHAL HOLDING AG																							
FREQUENTIS AG																							
IMMOFINANZ AG																							
KAPSCH TRAFFICCOM AG																							
LENZING AG																							
MARINOMED BIOTECH AG																							
MAYR-MELNHOF KARTON AG																							
OESTERREICHISCHE POST AG																							
OMV AG																							
PALFINGER AG																							
PIERER MOBILITY AG																							
POLYTEC HOLDING AG																							
PORR AG																							
RAIFFEISEN BANK INTERNATIONAL AG																							
RHI AG																							
ROSENBAUER INTERNATIONAL AG																							
S IMMO AG																							
SCHOELLER-BLECKMANN OILFIELD																							
SEMPERIT AG HOLDING																							
STRABAG SE																							
TELEKOM AUSTRIA AG																							
UBM DEVELOPMENT AG																							
UNIQA INSURANCE GROUP AG																							
VALNEVA SE																							
VERBUND AG																							
VIENNA INSURANCE GROUP AG																							
VOESTALPINE AG																							
WARIMPEX FINANZ- UND BETEILIGUNGS AG																							
WIENERBERGER AG																							
WOLFORD AG																							
ZUMTOBEL GROUP AG																							

Table 11.4: Composition of ATX Prime from 2014-07-01 to 2020-03-31

Company	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1	2018 Q2	2018 Q3	2018 Q4	2019 Q1	2019 Q2	2019 Q3	2019 Q4	2020 Q1
ABB LTD	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ACTELION LTD	■	■	■	■	■	■	■	■	■	■	■												
ADECCO GROUP AG		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ALCON INC																				■	■	■	■
AMS AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ARYZTA AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
BALOISE HOLDING AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BARRY CALLEBAUT AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BB BIOTECH AG																	■	■	■	■	■	■	■
BUCHER INDUSTRIES AG																	■	■	■				
CHOCOLADEFABRIKEN LINDT	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CIE FINANCIERE RICHEMONT	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CLARIANT AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CREDIT SUISSE GROUP AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
DKSH HOLDING AG	■	■	■	■	■	■	■	■				■	■	■	■								
DORMAKABA HOLDING AG		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
DUFRY AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
EMS-CHEMIE HOLDING AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
FISCHER (GEORG)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
FLUGHAFEN ZURICH AG					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
GALENICA AG	■	■	■	■	■	■	■	■	■	■		■	■	■	■			■	■	■		■	■
GAM HOLDING AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■
GEBERIT AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
GIVAUDAN	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
HELVETIA HOLDING AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
JULIUS BAER GROUP LTD	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
KUEHNE + NAGEL INTL AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LAFARGEHOLCIM LTD	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LOGITECH INTERNATIONAL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LONZA GROUP AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
MEYER BURGER TECHNOLOGY AG		■	■	■	■																		
NESTLE SA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
NOBEL BIOCARE HOLDING AG	■	■																					
NOVARTIS AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
OC OERLIKON CORP AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PARTNERS GROUP HOLDING AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PSP SWISS PROPERTY AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
ROCHE HOLDING AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SCHINDLER HOLDING AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SGS SA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SIKA AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SONOVA HOLDING AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
STRAUMANN HOLDING AG	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SULZER AG	■	■	■	■	■	■	■	■	■	■	■	■	■										
SUNRISE COMMUNICATIONS GROUP					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SWATCH GROUP AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SWISS LIFE HOLDING AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SWISS PRIME SITE	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SWISS RE AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SWISSCOM AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SYNGENTA AG	■	■	■	■	■	■	■	■	■	■	■												
TEMENOS AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
TRANSOCEAN LTD	■	■	■	■	■	■	■	■															
UBS GROUP AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
VAT GROUP AG											■	■	■	■	■	■	■	■	■	■	■	■	■
VIFOR PHARMA AG											■	■	■	■	■	■	■	■	■	■	■	■	■
ZURICH INSURANCE GROUP AG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Table 11.5: Composition of SMI Expanded from 2014-07-01 to 2020-03-31

	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1	2018 Q2	2018 Q3	2018 Q4	2019 Q1	2019 Q2	2019 Q3	2019 Q4	2020 Q1
AAREAL BANK AG																							
ADIDAS AG																							
ADVA OPTICAL NETWORKING SE																							
AIRBUS SE																							
AIXTRON SE																							
ALLIANZ SE																							
ALSTRIA OFFICE REIT-AG																							
AROUNDTOWN SA																							
AURUBIS AG																							
AXEL SPRINGER SE																							
BASF SE																							
BAYER AG																							
BAYERISCHE MOTOREN WERKE AG																							
BECHTLE AG																							
BEIERSDORF AG																							
BILFINGER SE																							
BRENNTAG AG																							
CANCOM SE																							
CARL ZEISS MEDITEC AG																							
CECONOMY AG																							
COMMERZBANK AG																							
CONTINENTAL AG																							
COVESTRO AG																							
DAIMLER AG																							
DEUTSCHE BANK AG																							
DEUTSCHE BOERSE AG																							
DEUTSCHE LUFTHANSA																							
DEUTSCHE PFANDBRIEFBANK AG																							
DEUTSCHE POST AG																							
DEUTSCHE TELEKOM AG																							
DEUTSCHE WOHNEN SE																							
DIALOG SEMICONDUCTOR PLC																							
DIEBOLD NIXDORF AG																							
DRAEGERWERK AG																							
DUERR AG																							
E.ON SE																							
ELRINGKLINGER AG																							
EVONIK INDUSTRIES AG																							
EVOTEC SE																							
FIELMANN AG																							
FRAPORT AG FRANKFURT AIRPORT																							
FRESENIUS MEDICAL CARE AG & CO KGAA																							
FRESENIUS SE & CO KGAA																							
FUCHS PETROLUB SE																							
GEA GROUP AG																							
GERRESHEIMER AG																							
GFT TECHNOLOGIES SE																							
HANNOVER RUECK SE																							
HEIDELBERGCEMENT AG																							
HELLA GMBH & CO KGAA																							
HENKEL AG & CO KGAA																							
HOCHTIEF AG																							
HUGO BOSS AG																							
INFINEON TECHNOLOGIES AG																							
JENOPTIK AG																							
JUNGHEINRICH																							
K+S AG																							
KION GROUP AG																							
KLOECKNER & CO SE																							
KNORR-BREMSE AG																							
KRONES AG																							
LANXESS AG																							
LEG IMMOBILIEN AG																							
LEONI AG																							
LINDE AG																							
LINDE PLC																							
MAN AG																							
MERCK KGAA																							
METRO AG																							
MORPHOSYS AG																							
MTU AERO ENGINES AG																							
MUENCHENER RUECKVER AG																							

Table 11.6 (continued): Company rows

- NEW WORK SE
- NORDEX SE
- NORMA GROUP SE
- OSRAM LICHT AG
- PROSIEBENSAT.1 MEDIA SE
- PUMA SE
- QIAGEN NV
- RATIONAL AG
- RHEINMETALL AG
- RTL GROUP
- SALZGITTER AG
- SAP SE
- SARTORIUS AG
- SCHAEFFLER AG
- SCOUT24 AG
- SGL CARBON SE
- SIEMENS AG
- SIEMENS HEALTHINEERS AG
- SILTRONIC AG
- SMA SOLAR TECHNOLOGY AG
- SOFTWARE AG
- STADA ARZNEIMITTEL AG
- SUEDZUCKER AG
- SYMRISE AG
- TAG IMMOBILIEN AG
- TELEFONICA DEUTSCHLAND HOLDING
- THYSSENKRUPP AG
- TUI AG
- UNIPER SE
- UNITED INTERNET AG
- VONOVIA SE
- WACKER CHEMIE AG
- WIRECARD AG
- X CAC 40
- ZALANDO SE

Table 11.6: Composition of DAX 50 ESG from 2014-07-01 to 2020-03-31

Table 11.7 column headers: 2014 Q3, 2014 Q4, 2015 Q1, 2015 Q2, 2015 Q3, 2015 Q4, 2016 Q1, 2016 Q2, 2016 Q3, 2016 Q4, 2017 Q1, 2017 Q2, 2017 Q3, 2017 Q4, 2018 Q1, 2018 Q2, 2018 Q3, 2018 Q4, 2019 Q1, 2019 Q2, 2019 Q3, 2019 Q4, 2020 Q1

Company rows:

- AGRANA BETEILIGUNGS AG
- AMAG AUSTRIA METALL AG
- AUSTRIA TECHNOLOGIE & SYSTEM
- ATHOS IMMOBILIEN AG
- BENE AG
- BKS BANK AG
- BURGENLAND HOLDING AG
- BUWOG AG
- BWT AG
- CA IMMOBILIEN ANLAGEN AG
- ERSTE GROUP BANK AG
- EVN AG
- KAPSCH TRAFFICCOM AG
- LENZING AG
- OESTERREICHISCHE POST AG
- PALFINGER AG
- RAIFFEISEN BANK INTERNATIONAL AG
- RHI AG
- ROSENBAUER INTERNATIONAL AG
- TEAK HOLZ INTERNATIONAL AG
- TELEKOM AUSTRIA AG
- UNIQA INSURANCE GROUP AG
- VALNEVA SE
- VERBUND AG
- VIENNA INSURANCE GROUP AG
- WIENERBERGER AG
- ZUMTOBEL GROUP AG

Table 11.7: Composition of VÖNIX from 2014-07-01 to 2020-03-31

	2014_Q3	2014_Q4	2015_Q1	2015_Q2	2015_Q3	2015_Q4	2016_Q1	2016_Q2	2016_Q3	2016_Q4	2017_Q1	2017_Q2	2017_Q3	2017_Q4	2018_Q1	2018_Q2	2018_Q3	2018_Q4	2019_Q1	2019_Q2	2019_Q3	2019_Q4	2020_Q1
ABB LTD																							
ADECCO GROUP AG																							
ALCON INC																							
BARRY CALLEBAUT AG																							
CHOCOLADEFABRIKEN LINDT																							
CIE FINANCIERE RICHEMONT																							
CLARIANT AG																							
CREDIT SUISSE GROUP AG																							
FISCHER (GEORG)																							
GALENICA AG																							
GEBERIT AG																							
GIVAUDAN																							
HELVETIA HOLDING AG																							
JULIUS BAER GROUP LTD																							
KUEHNE + NAGEL INTL AG																							
LAFARGEHOLCIM LTD																							
LOGITECH INTERNATIONAL																							
LONZA GROUP AG																							
NESTLE SA																							
NOBEL BIOCARE HOLDING AG																							
NOVARTIS AG																							
ROCHE HOLDING AG																							
SCHINDLER HOLDING AG																							
SCHINDLER HOLDING																							
SGS SA																							
SIKA AG																							
SONOVA HOLDING AG																							
STRAUMANN HOLDING AG																							
SULZER AG																							
SWISS RE AG																							
SWISSCOM AG																							
SYNGENTA AG																							
TEMENOS AG																							
UBS GROUP AG																							
VIFOR PHARMA AG																							
ZURICH INSURANCE GROUP AG																							

Table 11.8: Composition of SXI Switzerland Sustainability 25 from 2014-07-01 to 2020-03-31

	2014_Q3	2014_Q4	2015_Q1	2015_Q2	2015_Q3	2015_Q4	2016_Q1	2016_Q2	2016_Q3	2016_Q4	2017_Q1	2017_Q2	2017_Q3	2017_Q4	2018_Q1	2018_Q2	2018_Q3	2018_Q4	2019_Q1	2019_Q2	2019_Q3	2019_Q4	2020_Q1
1&1 DRILLISCH AG																							
AAREAL BANK AG																							
ACTELION LTD																							
ADIDAS AG																							
ADVA OPTICAL NETWORKING SE																							
AIXTRON SE																							
AMS AG																							
AURUBIS AG																							
BALOISE HOLDING AG																							
CA IMMOBILIEN ANLAGEN AG																							
CANCOM SE																							
CHOCOLADEFABRIKEN LINDT-PC																							
CHOCOLADEFABRIKEN LINDT																							
CONWERT IMMOBILIEN INVEST GM																							
DEUTSCHE WOHNEN SE																							
DIALOG SEMICONDUCTOR PLC																							
DO & CO AG																							
DUERR AG																							
EMS-CHEMIE HOLDING AG																							
EVOTEC SE																							

FLUGHAFEN WIEN AG
FLUGHAFEN ZURICH AG
FREENET AG
FRESENIUS MEDICAL CARE AG
GALENICA AG
GERRESHEIMER AG
HELVETIA HOLDING AG
JULIUS BAER GROUP LTD
K+S AG
KABEL DEUTSCHLAND HOLDING AG
LEG IMMOBILIEN AG
LENZING AG
LOGITECH INTERNATIONAL
LONZA GROUP AG
MORPHOSYS AG
NEW WORK SE
NOVARTIS AG
OC OERLIKON CORP AG
PARTNERS GROUP HOLDING AG
PFEIFFER VACUUM TECHNOLOGY
PIERER MOBILITY AG
PORR AG
PSP SWISS PROPERTY AG
PUMA SE
RAIFFEISEN BANK INTERNATIONAL AG
RATIONAL AG
RHOEN-KLINIKUM AG
ROCHE HOLDING AG
SARTORIUS AG
SCHOELLER-BLECKMANN OILFIELD
SMA SOLAR TECHNOLOGY AG
SONOVA HOLDING AG
STRABAG SE
STRATEC SE
STRAUMANN HOLDING AG
STROEER SE & CO KGAA
SUEDZUCKER AG
SWISS LIFE HOLDING AG
SWISS PRIME SITE
SWISS RE AG
SWISSCOM AG
TALANX AG
TELEFONICA DEUTSCHLAND HOLDING
TELEKOM AUSTRIA AG
UNIQA INSURANCE GROUP AG
VERBUND AG
VIFOR PHARMA AG
VOESTALPINE AG
VONOVIA SE
WIRECARD AG
WOLFORD AG

Table 11.9: Composition of traditional Portfolio (Allocation B)
from 2014-07-01 to 2020-03-31

	2014_Q3	2014_Q4	2015_Q1	2015_Q2	2015_Q3	2015_Q4	2016_Q1	2016_Q2	2016_Q3	2016_Q4	2017_Q1	2017_Q2	2017_Q3	2017_Q4	2018_Q1	2018_Q2	2018_Q3	2018_Q4	2019_Q1	2019_Q2	2019_Q3	2019_Q4	2020_Q1
AAREAL BANK AG												X					X	X					
ABB LTD																X	X						
AGRANA BETEILIGUNGS AG					X	X					X	X	X	X	X	X	X						
AIXTRON SE															X	X							
ALSTRIA OFFICE REIT-AG											X												
AMAG AUSTRIA METALL AG																							
BARRY CALLEBAUT AG									X														
BECHTLE AG										X													
BKS BANK AG								X	X	X	X	X	X	X	X	X	X	X	X	X			
CARL ZEISS MEDITEC AG									X	X										X			X
CHOCOLADEFABRIKEN LINDT			X	X																			
DEUTSCHE TELEKOM AG				X																			
DEUTSCHE WOHNEN SE						X				X	X	X			X	X			X	X	X	X	
DIALOG SEMICONDUCTOR PLC					X	X										X	X	X	X				
EVN AG									X	X													
FISCHER (GEORG)																	X						
FRESENIUS MEDICAL CARE AG			X	X	X	X	X	X		X	X												
FRESENIUS SE & CO KGAA													X	X									
GEA GROUP AG														X	X								
GERRESHEIMER AG						X	X	X		X	X		X	X	X	X							
HANNOVER RUECK SE																							
HUGO BOSS AG	X	X	X																				
K+S AG-REG															X					X			
KAPSCH TRAFFICCOM AG						X		X															
LENZING AG					X		X	X								X	X						
LONZA GROUP AG									X	X													
MORPHOSYS AG		X	X	X	X	X	X		X	X	X	X				X	X						
NESTLE SA				X																			
OESTERREICHISCHE POST AG			X	X																			
PROSIEBENSAT.1 MEDIA SE	X	X																					
PUMA SE																						X	X
RAIFFEISEN BANK INTERNATIONAL AG												X											
RATIONAL AG											X	X											
ROCHE HOLDING AG				X	X	X		X								X	X						
RTL GROUP			X	X	X		X	X															
SARTORIUS AG		X	X	X	X	X	X											X	X	X		X	
SGS SA																							
SMA SOLAR TECHNOLOGY AG																							
SONOVA HOLDING AG						X	X									X	X						
STRAUMANN HOLDING AG						X	X						X	X	X			X					
SUEDZUCKER AG					X	X	X	X	X				X										
SWISS RE AG					X	X	X												X	X	X	X	
SWISSCOM AG					X	X	X				X	X	X						X	X	X	X	
SYNGENTA AG					X																		
TELEFONICA DEUTSCHLAND HOLDINIG																			X	X	X	X	
TELEKOM AUSTRIA AG					X	X			X	X	X												
TEMENOS AG																			X				
UBS GROUP AG											X												
VERBUND AG							X	X		X	X	X	X	X	X	X		X	X	X	X	X	
VIFOR PHARMA AG														X	X	X							
VONOVIA SE												X	X				X	X	X				
WACKER CHEMIE AG																							
WIRECARD AG					X	X																	
ZURICH INSURANCE GROUP AG													X	X	X	X	X						

Table 11.10: Composition of sustainable Portfolio (Allocation B)
from 2014-07-01 to 2020-03-31

(a) traditional Portfolio   (b) sustainable Portfolio
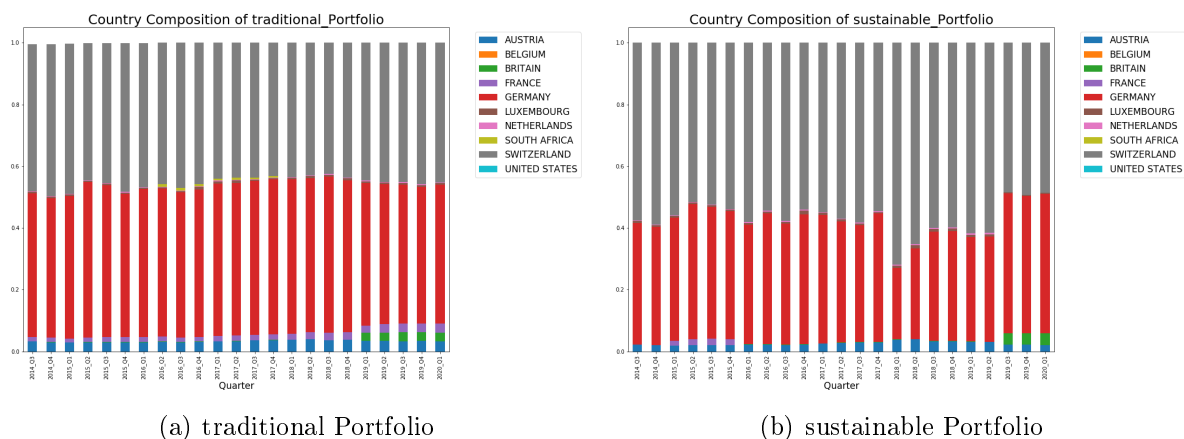
Figure 11.2: Quarterly Country Composition of Portfolio (Allocation A)

(a) traditional Portfolio   (b) sustainable Portfolio
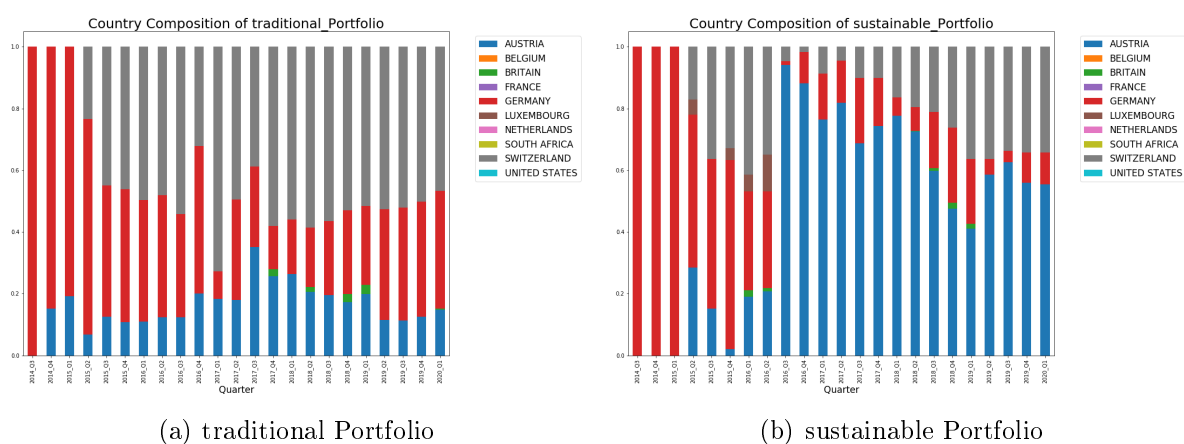
Figure 11.3: Quarterly Country Composition of Portfolio (Allocation B)

(a) traditional Portfolio   (b) sustainable Portfolio
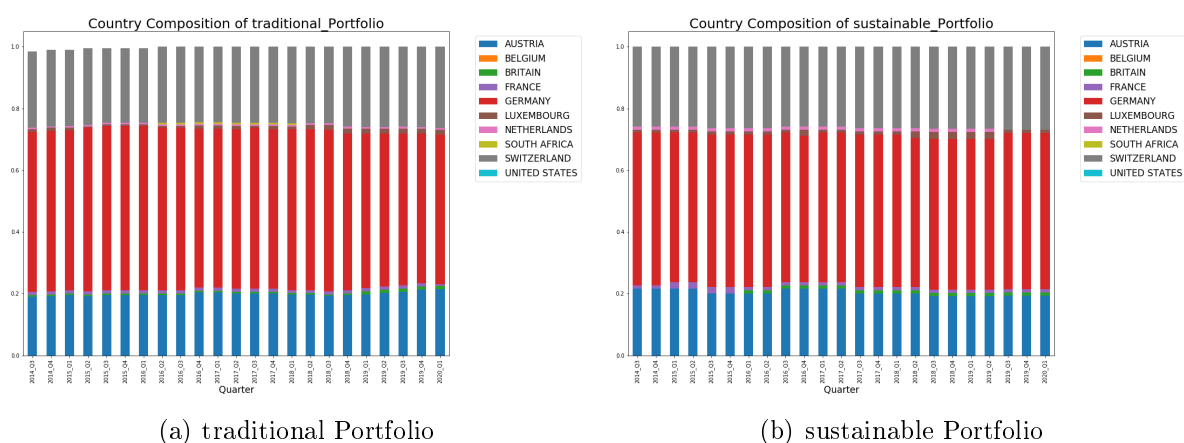
Figure 11.4: Quarterly Country Composition of Portfolio (Allocation C)

(a) traditional Portfolio   (b) sustainable Portfolio
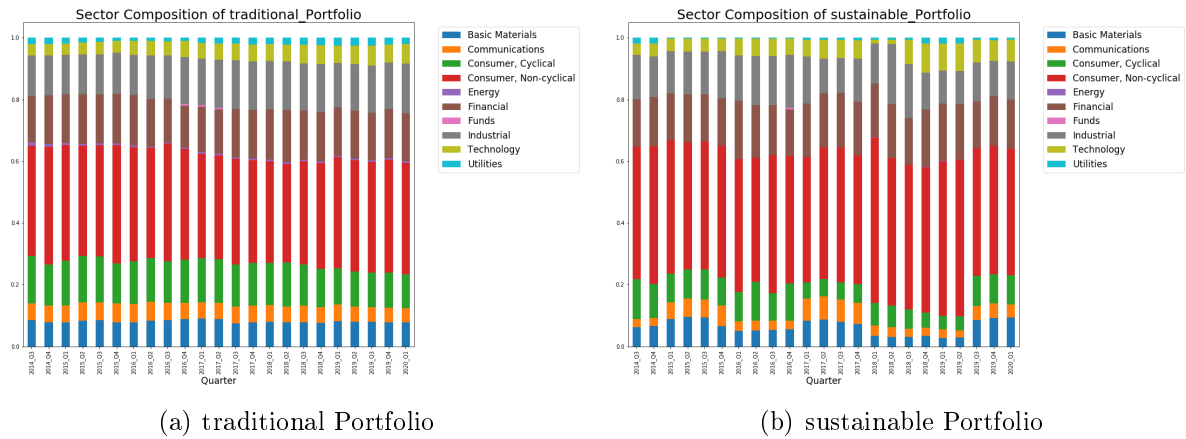
Figure 11.5: Quarterly Sector Composition of Portfolio (Allocation A)

(a) traditional Portfolio   (b) sustainable Portfolio
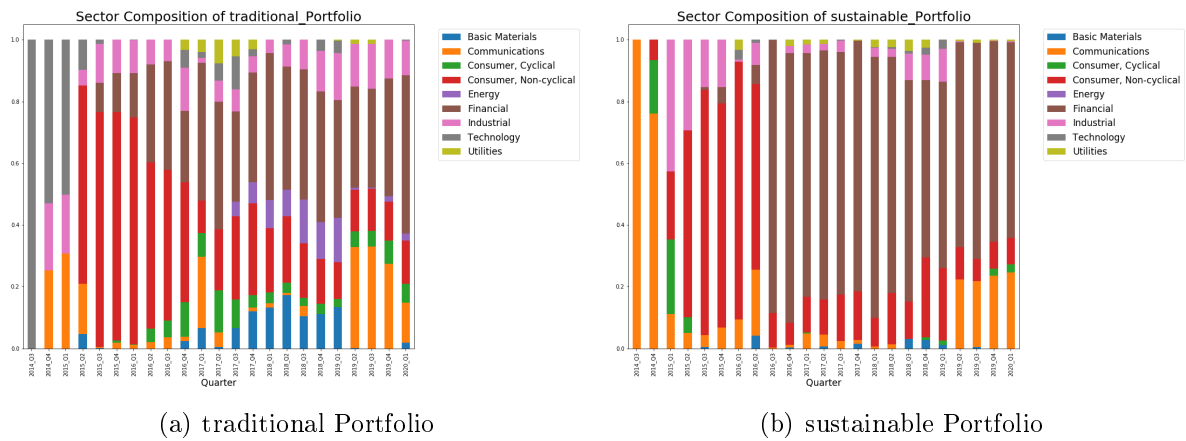
Figure 11.6: Quarterly Sector Composition of Portfolio (Allocation B)

(a) traditional Portfolio   (b) sustainable Portfolio
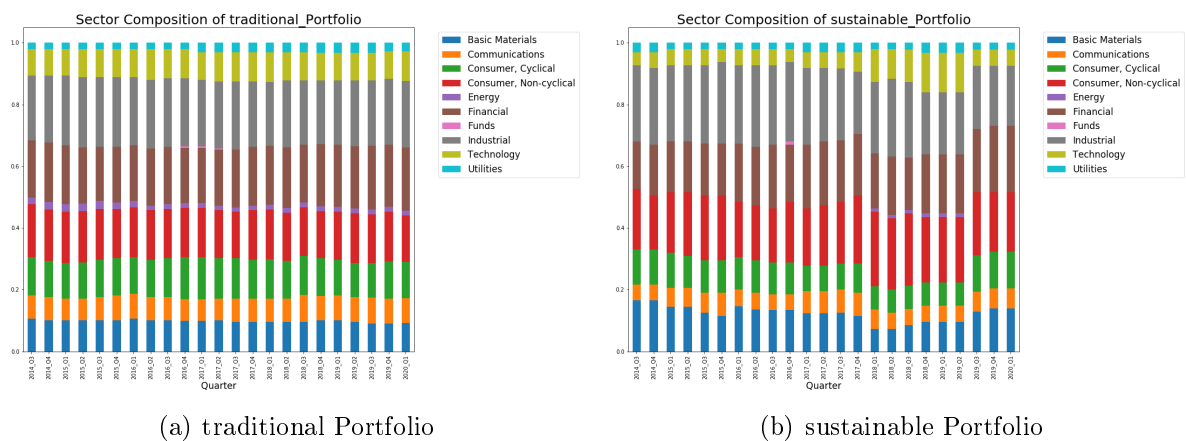
Figure 11.7: Quarterly Sector Composition of Portfolio (Allocation C)

Abstract in German

Seit mehr als 20 Jahren beeinflussen die Bereiche Umwelt, Soziales und Governance (ESG) als Nachhaltigkeitsbereiche den Investitionsentscheidungsprozess. Über viele Jahre wurde dieser Einfluss als Einschränkung der Investitionsentscheidung und als Verschlechterung der Performance verstanden. Einige Studien bewiesen das Gegenteil, einschließlich dieser Masterarbeit.

Das ESG-Modell befindet sich noch in der Entwicklungsphase. Eine Vielzahl von Organisationen (UNO, EU, OECD, PRI, usw.) und Foren fördern die Standardisierung auf internationaler Ebene. Dies soll helfen ESG-Daten qualitativ und quantitativ zu erfassen, um sie anschließend miteinander vergleichen zu können.

Die Umfrage, die ich für meine Masterarbeit erstellt und analysiert habe, hat gezeigt, dass der Privatanleger für internationale Standards und Richtlinien im ESG-Bereich bereit ist. Außerdem würde der Proband durchschnittlich 15% der Rendite eines traditionellen Portfolios für Nachhaltigkeit aufgeben. Des Weiteren hat sich gezeigt, dass je jünger der Investor ist, desto wahrscheinlicher ist es, dass er nachhaltig investieren möchte.

Ein Vergleich traditioneller und nachhaltiger Portfolios im deutschsprachigen Raum (Deutschland, Österreich, Schweiz und Liechtenstein) wurde mit drei verschiedenen Allokationsstrategien angestrebt. Der Vergleich der langfristig nachhaltigen Portfolios mit traditionellen Portfolios (Benchmarks) zeichnete das nachhaltige Portfolio mit einem besseren Zeugnis in Bezug auf die Performance aus.

Die Analyse im Zeitraum vom 01.07.2014 bis zum 31.03.2020 zeigte für das nachhaltige Portfolio eine positive Outperformance mit höheren Renditen und einem geringeren Risiko, gegenüber ihrem traditionellen Pendant. Im Durchschnitt übertrifft das nachhaltige Portfolio mit einer jährlichen Rendite von 0,47% bis 3,03%. "Daher kann die Integration der ESG in den Anlageprozess zu besseren risikobereinigten Renditen und langfristiger Wertschöpfung führen" (Cappucci, 2017, p. 2).

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