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SUSTAINABLE INVESTING
DOES ESG INDUCE A VIRTUOUS CIRCLE?

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PHD DISSERTATION

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You can't always get what you want
But if you try sometimes, well, you might find
You get what you need.
/The Rolling Stones

1. INTRODUCTION

What do oil, soybean, gold, and water have in common? The answer, at first, may sound surprising: in late 2020, water joined these well-known commodities on Wall Street as Californian farmers, hedge funds, and municipalities can now purchase water futures to hedge related risks (*Chipman, 2020*). Compared to water futures, weather derivatives have a more mature market. The Chicago Mercantile Exchange introduced the first exchange-traded weather futures contracts and corresponding options in 1999, mostly tracking cooling degree days or heating degree days. Some recent studies (*Liu et al., 2019*; *Xue et al., 2019*) have even gone further by designing and pricing air pollution derivatives. More importantly, these market developments and scientific initiatives on risk management draw attention to sustainability. Sustainability challenges are getting more severe as life-sustaining natural resources may become scarce worldwide. Consequently, the dissertation aims to analyse if it is possible to reconcile *sustainability* with the *financial objectives* of corporates and investors. However, a question arises, what does sustainability, in fact, connote? The following examples illustrate that sustainability challenges are much more diverse than one might first think.

The increase in CO_2 emissions was relatively slow until the mid-20th century. According to *Ritchie and Roser (2021)*, in the 1950s, the world emitted just over 5 billion tonnes of CO_2 – about the same as the US or half of China's annual emissions of today. By the 1990s, this figure had quadrupled to 22 billion tonnes. Emissions have continued to proliferate; societies around the globe now emits over 36 billion tonnes each year. Consequently, today's arctic ice area is 4.70 per cent smaller, while the global temperature is 0.79 degrees Celsius higher than the 20th-century average. These numbers frequently pop up in the press and everyday conversations; hence, raising concerns about *environmental* sustainability. Based on the above, it is almost selfevident that according to Oxford Languages, the word of the year in 2019 was climate emergency.

Decent working conditions greatly influence the well-being of citizens. However, *UNDP's (2021)* global statistics show some 700 million workers lived in extreme or moderate poverty in 2018, with around USD 3 income per day. Further, approximately 2 billion employees were in informal employment in 2016, accounting for 61 per cent of the world's workforce resulting in significant vulnerability towards employers. Then, fatal occupational injuries can be unexpectedly high even in some of the most prosperous countries: 2016 data show 5.24 cases of fatal injury per 100.000 employees in the US comparing with Germany's 0.97 figure. Social dialogue is among the principal means to promote satisfactory working conditions. It includes negotiations and consultations among different labour market actors, collective bargaining and dispute prevention. According to *International Labour Organisation (2021)* statistics, material differences exist in collective bargaining coverage rates between developed and the least developed countries. For instance, collective agreements cover 98.5 per cent of French employees, while barely 5 per cent of Bangladesh workers. All these examples are about the *social* dimension of sustainability.

Other well-known destructive factors are corruption, bribery, fraud and tax evasion. The estimated annual cost of these illegal actions in developing countries equals USD 1.26 trillion (*UNDP, 2021b*). Almost one in five firms worldwide have reported receiving at least one bribery payment request when involved in regulatory or utility transactions (*Cardoni et al., 2020*). Corruption can result in even more significant adverse consequences to the social and economic system, weakening efficiency and growth, exacerbating income inequalities and increasing poverty. These unacceptable activities provide cases of corporate governance and business ethics concerns that can significantly impact sustainable *economic* growth.

The cases and statistics presented above each underscore the need of fostering environmental, social, and economic dimensions of sustainability; hence, responding to urgent challenges of society. Global organisations have started elaborating standards and rules to enhance sustainable practices. The most prominent standard-setting framework is the Paris Agreement on climate change mitigation, adaptation, and finance, signed in 2016. The Agreement's long-term temperature goal is to limit global warming to 1.50 degree Celsius. The Sustainable Development Goals (SDGs) of the United Nations, established in 2015, define environmental and social challenges more broadly than focusing solely on climate change. SDGs cover themes such as clean water and sanitation (SDG6), end hunger and achieve food security (SDG2), sustainable cities and communities (SDG11), or responsible consumption and production (SDG12).

The Paris Agreement and the UN SDGs, however, are not mandatory to signatories. Nevertheless, both influenced the European Union's Taxonomy Regulation (TR) and Sustainable Finance Disclosure Regulation (SFDR). The Taxonomy Regulation introduces a classification system recognising sustainable business activities through which the asset management sector must classify investments. The SFDR requires investment firms to disclose the environmental sustainability of investments. According to *Matos (2020)*, Europe's ambitious regulatory system will likely affect the investment sector worldwide and be the major driver of growth in sustainable investments.

Further, the financial sector has taken steps to align business models with sustainability objectives. In a 2020 client letter, BlackRock management announced that sustainability should be their new standard for investing. They emphasise that "*because sustainable investment options have the potential to offer clients better outcomes, we are making sustainability integral to the way BlackRock manages risk, constructs portfolios*" (*BlackRock, 2020*). Some other recent examples – indicating shifts in business attitude – include UniCredit's declaration that it would exit thermal coal financing by 2023; in parallel, it would raise its exposure above USD 9 billion in the renewable energy sector. Then, Goldman Sachs announced in March 2021 that it would invest USD 10 billion in an initiative to support black women over the next ten years, focusing on areas of healthcare, job creation and education. In November 2012, Norges Bank Investment Management – asset manager of Norway's sovereign wealth fund – issued a discussion note requesting all its portfolio firms to meet new corporate governance expectations by focusing on board accountability and equal treatment of shareholders (*Aguilera et al., 2019*). The final example is about the world's largest pension fund, the Government Pension Investment Fund (GPIF) of Japan. GPIF revised its investment principles in 2017, incorporating environmental, social and governance (ESG) criteria into investment decisions. The fund's executive managing director asserts that "*Issues such as climate change or social disruption pose long-term systemic risks that ultimately affect our fund performance. (...) Companies that generate significant negative externalities in pursuit of short-term gains hinder our ability to fulfil our duty as fiduciary*" (*PRI, 2019, p. 7*).

Corporates often go ahead of regulatory expectations to meet sustainability requirements. The US oil giant Chevron acquired Blue Planet Systems, a start-up that manufactures and develops carbon capture technology to reduce carbon footprint. Apple invested USD 2.8 billion in 17 projects that will generate 1.2 gigawatts of renewable energy. The projects will avoid an average of 921,000 metric tons of CO_2 emissions each year, which equals removing nearly 200,000 cars from the road. Novartis, a Swiss drugmaker, raised 1.85 billion euros from the sale of a bond, increasing interest payments if the company fails to expand access to medicines against malaria in several developing countries.

Corporates' and asset managers' responsible behaviour outlined above cannot be independent of changing investor and customer preferences. A comprehensive survey of retail companies' customers found that nearly 80 per cent are aware of employees' fair treatment. Further, 66 per cent choose to purchase products and services based on their "environmental friendliness" (*Jacobs et al., 2020*). *Amel-Zadeh and Serafeim (2018)* surveyed mainstream investment organisations and concludes that one of the most critical professional motivation for using ESG factors is client demand.

This dissertation evaluates the consequences of promoting sustainability in a corporate context. The examples enumerated in the previous pages all underscore the inevitability of sustainability and the coherence with stakeholder theory. Stakeholder theory argues that maintaining stakeholder "satisfaction" – such as customers, employees, local communities, shareholders, and even the natural environment – is imperative for companies in fulfilling their mission. However, there is no light without shadow; therefore, advocates of the trade-off hypothesis assert that resource reallocation to sustainable activities does not pay off; instead, they induce higher operating costs due to the internalisation of externalities.

The examples also illustrated that alignment with sustainability goals might be assessed from as many angles as stakeholders recognised. The dissertation focuses on shareholder wealth; viz., examines sustainability from an asset owner perspective.

Hence, the research question is the following: is it possible to boost corporate profitability by implementing sustainable corporate practices? Put it another way, does the academic literature's "doing well while doing good" concept prevail? If so, as influential stakeholders, investors may drive and can "force" sustainable economic growth.

Studying the impact of sustainability on shareholder value-added may manifest in several forms. Firstly, the analysis might cover accounting profitability, then respond to how equity markets price sustainability, finally, identify the potential risk-adjusted excess returns for investors. The dissertation intends to explore the latter case.

In the investment literature and practice, ESG is a broad umbrella term for sustainability covering firms' environmental, social and governance attributes. A wide-scale of ESG-conscious investment strategies exist, from exclusionary screening to impact/community investing. The dissertation concentrates on two distinct strategies, the ESG integration approach and ESG-themed investing. ESG integration has exceptional popularity, with USD 17,500 billion total assets under management (AUM) in 2018, while thematic investing is the most rising strategy with a 1,200 per cent increase in AUM between 2012 and 2018.

The ESG integration strategy applies separate E, S, and G scores, and each stock belongs to one of the following portfolios: leaders, followers, loungers, laggards, and not rated. Thematic portfolios discover nine SDG-related challenges such as water scarcity, ageing population, cybersecurity concerns. Each thematic portfolio fits E, S, and G megatrends (MT) and encompasses firms with business models addressing critical ESG challenges.

Methodologically, the dissertation follows a factor portfolio construction procedure; consequently, stock weights and returns derive from an *extended* Fama-MacBeth cross-sectional regression technique. ESG portfolio compilation controls 100 different style, industry, and country exposures to filter out disturbing secondary factor effects. Altogether the database includes more than 15 million data points. The time-series analysis of ESG factor portfolio returns applies the Fama-French (FF) right-hand-side (RHS) approach, which simultaneously tests market performance and the validity of adding ESG factors to FF factor models.

The thesis contributes to the existing investment literature on sustainability in several ways. Firstly, it examines ESG investing from two distinct angles. ESG integration is rather consistent with the "organisational sustainability" concept, while ESG-themed investing corresponds more to the "global sustainability" idea. Furthermore, in ESG integration, portfolio construction adapts the valuation techniques of *external actors*, i.e., ESG rating agencies. In ESG-themed investments, stocks come from thematic ETFs; consequently, the relative amount of money inflows indicate professionals' belief that these firms can promote sustainability. This approach reflects a *pure market-oriented attitude*. Then, the dissertation emphasises the megatrend concept and integrates signalling theory into stock selection processes. It also creates a new mathematical formula for measuring megatrend exposures. Utilising the RHS approach in the ESG integration framework is a novelty as well. Further, ESG-themed investing is a relatively new strategy; hence, it is under-researched in the literature. Finally, the analysed database is unique and comprehensive that makes it suitable in measuring the *pure* performance of ESG factors.

The remainder of the dissertation is organised as follows. The second chapter introduces the theoretical framework. First, it defines sustainability in a general corporate context, then presents ESG, the manifestation of the sustainability concept in investments. A brief overview of the asset pricing literature follows as it provides the methodological backbone of the empirical analysis. Finally, the chapter summarises interviews conducted with market professionals and regulatory actors to determine new trends and motivations of ESG-conscious investing.

The third chapter presents the empirical findings. The first and second subchapters cover ESG-themed investing and ESG integration approach, respectively (based on *Naffa and Fain, 2020, 2021*). The third subchapter synthesises the previous two, including the effects of the COVID-19 pandemic on ESG resiliency. When designing the dissertation structure, it was a primary consideration to facilitate reading; hence individual subchapters should stand on their own. This structure allows the Reader to find the most important theoretical and methodological background within the given chapter; thus, it is unnecessary to revert to previous chapters to recall all information needed to interpret the results.

Chapter four summarises the most important results and concludes. It compares the findings with some relevant studies in the literature. Further, the results have several practical implications, which are also covered in this final chapter. Practical implications are closely linked with the information provided by interviewees presented in the qualitative research. Besides articulating the key messages of the thesis, chapter four outlines and identifies possible future research directions.

2. THEORETICAL FRAMEWORK

This chapter first describes the link between sustainability and corporate (financial) objectives (Subchapter 2.1.), then presents the terminology and recent developments of ESG-conscious investment strategies representing the sustainability concept in the investment literature and practice (Subchapter 2.2.). After ESG, a brief overview of empirical asset pricing follows (Subchapter 2.3.). Finally, the chapter summarises interviews conducted with market professionals and regulatory actors to determine new trends and challenges ESG faces (Subchapter 2.4.).

2.1. SUSTAINABILITY AND CORPORATE OBJECTIVES

The dissertation examines how shareholder value creation shifts when corporate managers consider the needs of other related parties than shareholders. Accordingly, the following pages present the theoretical underpinnings of the thesis. The first subchapter below covers stakeholder theory (2.1.1 – Stakeholder theory). Then, the connection between traditional stakeholder theory and sustainability concept is established (2.1.2. – Stakeholder theory and sustainability). Finally, sustainability and stakeholder theory is linked with distinct ESG-conscious investment strategies (2.13. – Shareholder interests and sustainability).

2.1.1. STAKEHOLDER THEORY

Before "reconciling" corporate objectives with sustainability, it is worth defining the primary goal of businesses. According to *Chikán (2005)*, the primary objective of business organisations is to satisfy consumer needs and, concurrently, make profits. However, corporates, while trying to accomplish their goals interact with many other parties, called stakeholders.

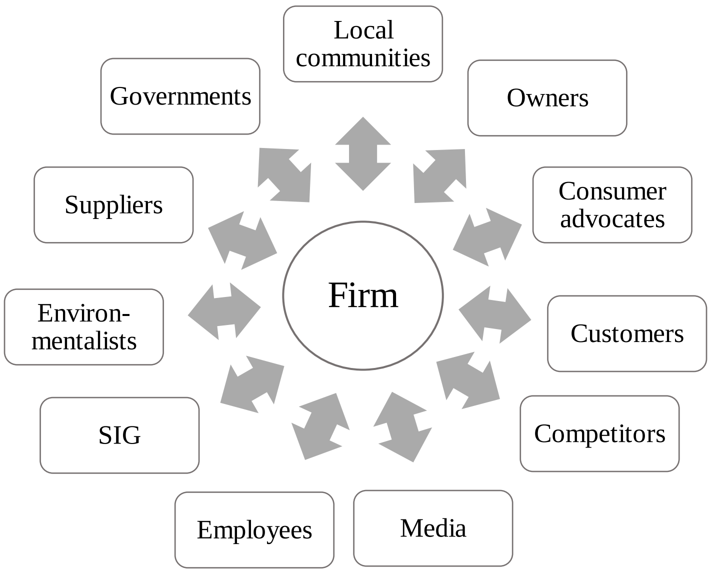
The introduction of the stakeholder concept into academic discourse is often credited to Edward Freeman[1], who described stakeholders as "*any group or individual who can*

[1] Nevertheless, the idea of a stakeholder-like approach was already discussed by Mary Parker Follett in the 1910s-1920s (see *Follett, 1942*).

affect or is affected by the achievement of the firm's objectives" (Freeman, 1984, p. 25). Figure 1 is from Freeman's 1984 book Strategic Management. Although it is an oversimplified mapping of the theory as each stakeholder group can be broken down into several smaller categories, it gives an idea about the most critical stakeholders. According to the figure, stakeholders who can affect or can be affected by the achievement of the firm's objectives include, among others, customers, employees, governments, owners, suppliers, local communities, and environmentalists.

In line with Figure 1, *Freeman et al. (2010)* argue that stakeholder theory enlarges company activities and objectives by assuming broader societal embeddedness than traditional economic theories; hence, it postulates that companies aim to create value for all stakeholders[2].

Figure 1. Stakeholder view of firms



This figure enumerates the most common examples of corporate stakeholders. According to *Freeman (1984, p. 25)* "*stakeholders are any groups or individuals who can affect or are affected by the firm's objectives*". The figure is from *Freeman (1984, p. 25)*. SIG stands for Special Interest Groups.

[2] Stakeholder theory, not surprisingly, has opponents as well as proponents. Without being exhaustive, many of these theories are in the publications of *Friedman (1970), Jensen (2002), Porter (1980), Williamson (1984)*. In his book, *Freeman et al. (2010)* compare the concepts of these scholars with stakeholder theory and concludes that there are almost in each case some common insight.

Past decades' stakeholder literature reveals that many different versions of the theory have been developed. *Donaldson and Preston (1995)* categorise these different versions as descriptive/empirical stakeholder theory, instrumental stakeholder theory, and normative stakeholder theory. *Freeman et al. (2010)* add a fourth category of integrative stakeholder theory.

Kaler (2003) details the four alternatives. Descriptive/empirical stakeholder theory helps in describing how companies are managed or, more specifically, detects relevant stakeholders. Instrumental stakeholder theory analyses the effects of stakeholder management on the realisation of traditional corporate goals (e.g., increasing corporate profitability) or related objectives (e.g., creating social capital, acquiring knowledge). Normative stakeholder theory assumes that traditional corporate goals embody moral decisions. According to *Freeman (1994, p. 414)*, *"one normative core of a stakeholder theory might be a feminist standpoint. (…) Another would be an ecological (or several ecological) normative cores"*. The integrative version of stakeholder theory considers an interlink between descriptive and instrumental as well as normative roots. Table 1 summarises the four types of stakeholder theory and their focal points.

Table 1. Different types of stakeholder theory

Stakeholder theory	Focus
Descriptive/empirical ST	Description of how companies are managed; identification of relevant stakeholders
Instrumental ST	Effects of stakeholder management on the achievement of corporate objectives
Normative ST	Discussion of the purpose of business; moral justifications of stakeholder theory
Integrative ST	Considers the descriptive, instrumental, and normative aspects of stakeholder theory to be inextricably linked

This table presents four types of stakeholder theory (ST). The first three theories are from the categorisation of *Donaldson and Preston (1995)*; the fourth is from *Freeman et al. (2010)*. An extended version of the table can be found in *Hörisch et al. (2014, p. 330)*.

2.1.2. STAKEHOLDER THEORY AND SUSTAINABILITY

Turning to sustainability, it has several competing definitions in the literature (e.g., *Darnall et al., 2010*; *Starik and Rands, 1995*; *Welcomer, 2010*). However, the dissertation applies the well-known terminology of *WCED (1987, p. 43)* articulated in Our Common Future[3]: *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." WCED (1987)* underscores that it is essential to simultaneously consider the demands of the world's poor and the environmental and socioeconomic constraints to meet present and future needs. Overall, the argument asserts that economic and social development goals must be consistent with sustainability in all countries.

According to *Garvare and Johansson (2010)*, there is a dedicated strain in the management literature for integrating sustainability directly into corporate decisions. Although this approach is not entirely new, *Starik and Kanashiro*, in their 2013 study "Toward a Theory of Sustainability Management: Uncovering and Integrating the Nearly Obvious", set up the *sustainability management* framework drawing on the previous works of *Bell and Morse (2008)*, *Dunphy et al. (2000)*, *Elkington (1998)*, *Laszlo (2003)*, and *Stead and Stead (2013)*. Based on Starik and Kanashiro's definition (p. 12), sustainability management is "*the formulation, implementation, and evaluation of both environmental and socioeconomic sustainability-related decisions and actions*" embedded in corporate strategy.

The relationship between stakeholder theory and sustainability management seems straightforward; however, besides the numerous similarities, there exist some differences. *Hörisch et al. (2014)* compare the two approaches and review similarities and dissimilarities (Table 2 summarises their findings). Among the similarities, probably the most fundamental one is that both concepts broaden the perception of companies beyond simply maximising short-term shareholder value or accounting profitability and believes in interconnectedness with other dimensions of society. It

[3] World Commission on Environment and Development (WCED), also known as the Brundtland Commission, was founded in 1983 under the leadership of former Prime Minister of Norway, Gro Harlem Brundtland, to promote sustainable development. The Brundtland Commission officially finished its operation in December 1987 after releasing the publication "Our Common Future", which defined and popularised the term "sustainable development".

follows directly that both theories have a long-term perspective, thus requiring strategic thinking.

Increasing accounting profitability and shareholder wealth is still an essential requirement in both theories but not the sole goal. More precisely, *Schaltegger et al. (2019)* contend that there is no hierarchy between the different environmental, socioeconomic parties and shareholders; hence, their needs cannot be inferior to the profit maximisation goals of investors. Managers should pursue business models that create economic success by considering as many stakeholder needs as possible. In line with dual optimisation, both concepts reject simplistic, conventional management approaches. Instead, the incorporation of further criteria to management decisions makes both theories complex.

Another common aspect is the refusal of the separation of ethical and business considerations. Put another way, business objectives and ethical concerns do not conflict but somewhat interlinked[4]. Further, the ideas of "compensating" and "philanthropy" are firmly rejected, consistently with the "opposition to residual CSR[5]" concept of *Freeman et al. (2010)*. Equivalently, the task of corporate managers is to integrate responsibility into core business practices.

Table 2. The comparison of stakeholder theory and sustainability management

Similarities	
Purpose of business	Both concepts extend the view on the purpose of business beyond maximising short-term shareholder value.
Separation fallacy	Refusal of the idea that ethical issues can be separated from business. Business and ethics are not perceived as conflicting but as fundamentally interlinked.
Opposition to residual CSR	The ideas of compensating and philanthropy are rejected. Companies are challenged to integrate responsibility into their core business.
Profit-making	Profit-making is not regarded as immoral. Creating synergies and mutuality between different interests as one of the core challenges.

[4] A well-known related term is the "separation fallacy" of *Freeman et al. (2010)*. It is a ubiquitous but misleading belief that business decisions should be made independent of ethical considerations.

[5] CSR stands for Corporate Social Responsibility.

Table 2. *(Continued)*

Similarities	
Ties to strategic management	The short-term view is complemented by a long-term perspective.
Complexity	Refusal of simplistic, conventional management approaches. Incorporation of further criteria to management challenges.
Bridging normative, empirical, and instrumental approaches	Both concepts embody and link descriptive, prescriptive, and instrumental elements.
Dissimilarities	
Linking social, environmental, and economic aspects	Sustainability management emphasises the links between societal, ecological, and economic goals more explicitly.
Role of nature	Sustainability management highlights that organisations act within ecological systems.
Sustainable development	While stakeholder theory is open about the outcome of stakeholder interactions, sustainability management challenges companies to contribute to and shape sustainable development.
Time and durability	Sustainability management addresses questions of durability and keeping (environmental) systems working more explicitly.

This table derives from the study of *Hörisch et al. (2014, p. 332)* and summarises the similarities and differences between stakeholder theory and sustainability management.

According to *Hörisch et al. (2014)*, the stakeholder concept is a theoretical framework with pragmatic origins; thus, suitable for applying in numerous different fields of interest. Sustainability management is not just a concept but also a field of interest itself; therefore, it is an inherent motivation to explore how the stakeholder concept could be related to sustainability management. Consequently, the dissimilarities are primarily due to the particular focus of sustainability management.

According to Table 2, although stakeholder management intends to create shared interests and value for each stakeholder, sustainability management points out the links between environmental, social, and economic objectives more explicitly. It, therefore, takes a different perspective to analyse business behaviours, new products, and business processes.

Sustainability management better articulates the role of nature, which, given its name, is not at all surprising. However, the stakeholder theory also considers environmental concerns. For instance, *Freeman (1984)* mentioned environmentalists as stakeholders (see Table 1), and *Clarkson (1995)* underscore the importance of incorporating environmental principles into capital project appraisal.

According to *Schaltegger and Wagner (2011)*, sustainability management emphasises the responsibility of companies to contribute to the sustainable development of the economy and society. In contrast, stakeholder theory does not require the pursuit of this normative goal per se. However, if corporate managers consider broader stakeholder needs in decision making, they might contribute to sustainable development involuntarily (*Hörisch et al., 2014*).

Finally, sustainability management explicitly adds a different time dimension to the stakeholder approach. Even if stakeholder management has dealt with intertemporal challenges too (e.g., *Anderson et al., 2012; Zsolnai*, *2006*), sustainability management more clearly addresses the questions of maintaining the operations of systems in the (very) long run (*Starik and Kanashiro, 2013*).

In the academic literature, two general approaches exist to integrate the sustainability concept into stakeholder theory (*Hörisch et al., 2014*). The first approach considers sustainability-related parties (e.g., the environment) as particular stakeholders (*Starik, 1995; Stead and Stead, 2009; Waddock, 2011*), while the second considers individuals, groups, and organisations as stakeholders who analyse, interpret, adjust, and adapt to developments in sustainability[6] (*Freeman et al., 2000*; *Phillips et al., 2003*; *Phillips and Reichart, 2000*).

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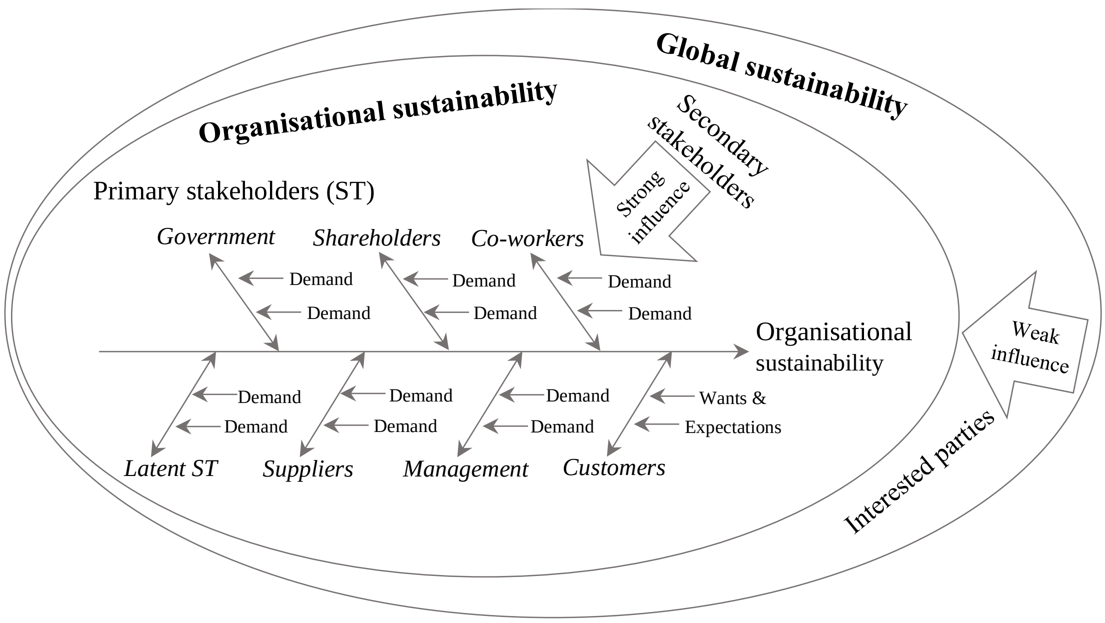
[6] This latter interpretation is more complex than considering sustainability-related parties (especially the environment) as independent stakeholders. *Phillips et al. (2003)* criticise attempts to ascribe stakeholder status to the nonhuman environment. However, the authors demonstrate how the environment is accounted for on a fairness-based approach through legitimate (human) organisational stakeholders. They list several examples, one of which is as follows (p. 192): *"A firm's managers must be sensitive to these interests due to stakeholder obligations. If among the interests of these legitimate stakeholders is a concern for nonhuman nature, then the firm has obligations to consider the impacts of its operations upon the environment in its decision making."*

The concept developed by *Garvare and Johansson (2010)* is a mixture of the two approaches presented above. The authors differentiate *organisational* and *global sustainability* and connect *stakeholders* and *interested parties* to the two forms of sustainability. Corporates can reach organisational sustainability if they satisfy the demands of their stakeholders. According to the authors, stakeholders can be either primary and secondary or overt and latent; nevertheless, they are analogous to *Freeman's (1984)* classification presented in Figure 1. Furthermore, stakeholders have the following characteristics: (1) they provide the essential support expected by corporates, but, on the other hand, (2) can revoke this support if their wants are not satisfied, thereby causing a loss to the corporate.

Following the definition of *Garvare and Johansson (2010)*, global sustainability is attained if corporates achieve organisational sustainability without compromising the ability of interested parties to meet their own needs. Interested parties are actors with enquiry in the corporate activities but do not possess the direct power or ability to control and influence corporates or their stakeholders. Interested parties might include, among others, nature and future generations.

Figure 2. Actors influencing global sustainability and organisational sustainability



This figure presents the relationship between two levels of sustainability, organisational and global sustainability (*Garvare and Johansson, 2010, p. 741*).

Based on the arguments of *Garvare and Johansson (2010)*, organisational sustainability does not necessarily indicate the complete alignment of business models with global sustainability goals since the timeframes are different and because different parties' needs are involved (Figure 2 in the previous page depicts the concept of the authors). Global sustainability assumes business models with a time horizon measured in long decades, whereas corporations tend to dedicate their resources to the near future. Furthermore, actions to reach global sustainability reflect the needs of interested parties such as future generations and the natural environment, whereas organisational sustainability is likely to involve "only" primary and secondary stakeholders[7].

2.1.3. SHAREHOLDER INTERESTS AND SUSTAINABILITY

The dissertation focuses on the relationship between sustainability and shareholder wealth; viz. examines sustainability from an investor perspective. In the investment literature (e.g., *van Duuren et al., 2016*) and among practitioners (e.g., *GSIA, 2018*), ESG is a broad umbrella term for sustainability covering corporates' environmental (E), social (S), and governance (G) attributes – i.e., from now on, ESG is a synonym for sustainability.

As underscored previously, investors are one of the most critical actors, regardless of management theories[8]. Due to their privileged role in the capitalist economic system[9],

[7] *Meadows et al. (1972)* suggest that the priority of various dimensions of sustainability is determined by the actors' speed of feedback and personal closeness. If given actors' feedback speed and closeness is comparatively delayed and distant, they have a relatively weaker influence on corporates resulting in that actor remain an interested party. However, this status can change if the speed of feedback and personal closeness improve significantly. *Matos (2020)* presents market developments showing that universal moral principles (based on negative screening investment strategies) and the acceptance of stewardship can increase the influence of interested parties, thus becoming stakeholders.

[8] Stakeholder theory classifies asset owners as primary stakeholders; hence, their role is beyond doubt. According to trade-off theory, the "antagonist" concept of stakeholder management, the sole purpose of businesses is to maximise profits for the benefit of shareholders (*Friedman, 1962*).

[9] One fundamental of market economies is that individuals possess capital. As *Samuelson and Nordhaus* contend in Economics (*2010, p. 34*) "*the ability of individuals to own and profit from capital is what gives capitalism its name*".

asset owners can promote sustainability goals under certain conditions. What are these conditions? In line with the primary objective of corporates, firm executives manage businesses they oversee with asset owners' interests in mind and simultaneously can deal with ESG challenges. The crucial question is whether ESG-conscious corporate behaviour pays off to investors. If the answer is yes, investors should recognise sustainability as a better way to invest since they can attain adequate financial performance and address ESG concerns. In this case, ESG delivers extra added value: investors acquire both financial and sustainability gains. The interacting activities between corporate managers and investors regarding sustainability might create a *virtuous circle* (*Revelli and Viviani, 2015*): responsible corporate behaviour triggers an increase in financial performance; consequently, investors signal to less conscious corporates to improve ESG performance by shifting their savings to more sustainable companies. In response, ESG lagging companies may start improving their operations to meet sustainability standards, which results in superior financial performance.

The dissertation asks if there is a chance to take the first step, thus starting the virtuous circle. Put in another way: is it possible for asset owners to realise *superior financial performance* by investing in firms that adapt *ESG-conscious business models*? Under this reading, the thesis follows, at least, the approach of an instrumental stakeholder theorist (see Table 1) that concomitantly incorporates sustainability management aspects (see Table 2).

Although the dissertation's theoretical framework is straightforward from a stakeholder theory point of view, some financial and investment aspects must be still clarified. Firstly, several forms of ESG-conscious business models exists on which different investment strategies can be based. Secondly, the term "financial performance" alone can be interpreted and measured in many ways.

In the empirical analysis of the dissertation, the financial performance of two distinct ESG strategies is evaluated[10]. The first one, the ESG integration strategy, applies separate E, S, and G scores, and each stock analysed belongs to one of the following portfolios: leaders, followers, loungers, laggards, not rated. The second one, the ESG-themed strategy, discover nine UN Sustainable Development Goals-related (SDG)

[10] The next subchapter gives a detailed description of how these strategies are embedded in the ESG investment universe.

challenges such as water scarcity, ageing population, cybersecurity concerns. Each thematic portfolio fits E, S, and G megatrends (MT) and encompasses firms with business models addressing critical ESG challenges. In line with *Garvare and Johansson (2010)*, ESG integration is rather consistent with the "organisational sustainability" concept, while ESG-themed investing corresponds more to the "global sustainability" idea (see Figure 2).

However, there is not always such a sharp borderline between the two strategies. For instance, companies with high ESG scores can also support SDGs. Then, companies that do not belong to the leader ESG portfolios but do promote global sustainability could also satisfy organisational sustainability goals since, either in theory or in practice, it is not easy to specify the level below which organisational sustainability objectives are not fulfilled[11].

Furthermore, according to *Garvare and Johansson (2010)*, organisational sustainability is a prerequisite of global sustainability. In the dissertation, however, no such precondition is employed, i.e., companies with possibly low ESG scores can still promote global sustainability. In other words, the empirical chapters about ESG-themed investments do not consider ESG scores of portfolio firms but emphasise the SDG-related business models. In this respect, the ESG-themed investment strategy is closely related to the "shared value" concept of *Porter et al. (2019)*[12].

Regarding the specification of financial performance metrics, *Cornell and Damodaran (2020)* suggest three fundamental yes-no questions for researchers to answer, which they can use to decide what sort of financial performance they wish to measure. If the researcher ought to answer the question "Do good companies create more value than bad companies?" then she or he is inquiring about corporate growth, profits, and risk. Measuring the relationship between accounting profitability and ESG performance is a common practice in the academic literature; some highly cited studies are as follows:

[11] *Garvare and Johansson (2010)* did not specify these levels either.

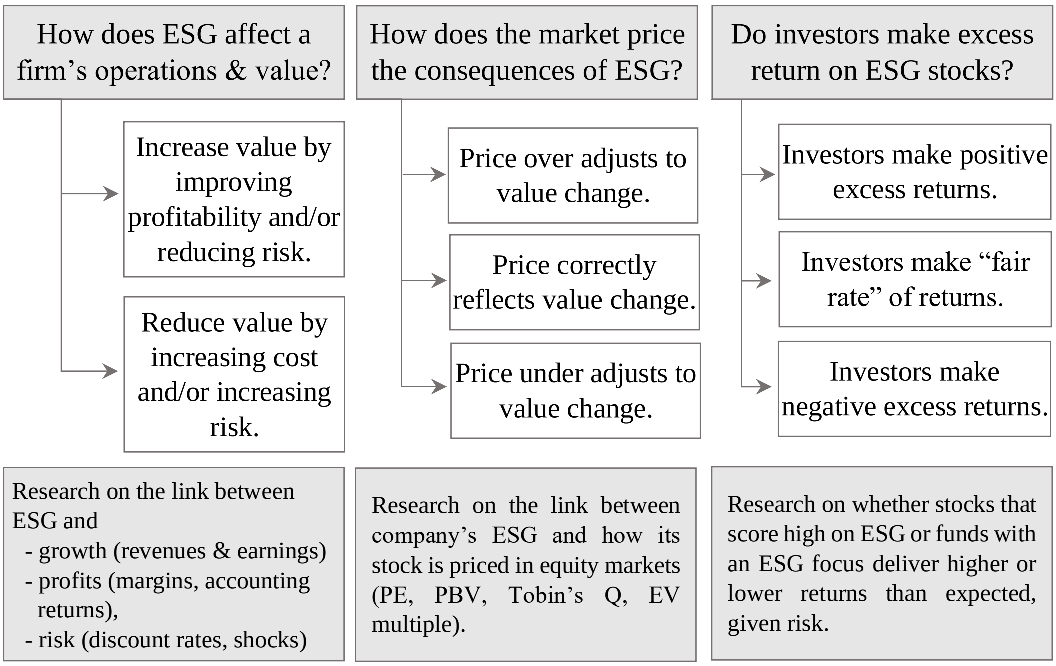
[12] *Portel et al. (2019)* term profit-driven social impact as "shared value". In their article, the authors enumerate several illustrative examples of the concept. One of these examples highlights corporates from Fortune magazine's annual "Change the World" list that generate shared value. Many of them do not achieve the top ESG rankings in their industries. However, companies on the list from 2015 through 2017 outperformed the MSCI World Index by an average of 3.90 per cent in the year after publication.

Albuquerque et al. (2018), McWilliams and Siegel (2000), Russo and Fouts (1997), and *Waddock and Graves (1998)*. The author of the present dissertation also conducted research in this area, see *Fain (2020a, 2020b*).

Alternatively, to answer the question of "Do markets price good companies higher than bad companies?" researchers should focus on the link between ESG performance and multiples such as P/E, P/BV, Tobin's Q or EV/EBITDA. For instance, *Klassen and McLaughlin (1996)* analysed the market valuation impact of corporates environmental performance and found that the first-time award announcements were associated with a greater increase in market valuation. The study of *Dowell et al. (2000)* suggests that firms adopting stringent global environmental standards have much higher market values, as measured by Tobin's Q.

Lastly, the question of "Do investors make excess returns by investing in good companies?" is about analysing stock market returns after correcting for risk (e.g., Jensen's alpha, Sharpe ratio). Some well-known related studies are *Edmans (2011), Hong and Kacperczyk (2009), Renneboog et al. (2008a)*. *Naffa and Fain (2021, 2020)* also analysed the market-relative performance of ESG. The figure below summarises the three questions and the possible effects of ESG on "financial performance".

Figure 3. The three approaches of measuring financial performance



This figure summarises (1) three general research questions regarding ESG, then (2) how should financial performance be measured based on these questions, and finally (3) the possible relationship between ESG and financial performance. The figure is from *Cornell and Damodaran (2020, p. 11)*.

The thesis intends to answer the third question, i.e., whether it is possible to realise positive risk-adjusted[13] excess returns with the two distinct ESG-conscious investment strategies introduced previously. The risk-adjusted returns are the CAPM and the Fama-French factor model alphas, and the Sharpe ratio[14]. The hypothesis on a positive alpha (and benchmark-adjusted Sharpe ratio) might indicate that ESG increases corporate value (first question); however, markets underreact, so prices go up too little (second question), resulting in positive excess returns for investors allocating resources to ESG-conscious investment strategies (third question)[15]. Obtaining statistically significant positive risk-adjusted returns is contrary to the efficient market hypothesis (EMH) often attributed to *Fama (1970)*, meaning that the dissertation's empirical chapter can be considered a test of the EMH as well.

In summary, the thesis looks at corporates from a shareholder perspective. Consequently, it has an instrumental stakeholder theory foundation that incorporates sustainability management aspects into analysing the risk-adjusted returns of two distinct ESG investment strategies. The ESG integration strategy is consistent with the "organisational sustainability" concept, while ESG-themed investing corresponds more to the "global sustainability" idea.

2.2. INTRODUCING ESG

The upcoming pages first cover the most common ESG investment strategies (2.2.1. – ESG strategies), then the latest market trends (2.2.2. – ESG in global financial markets). Regarding ESG strategies, the focus is on the two approaches analysed in the thesis. Subchapter 2.2.2. summarises the current status of sustainable and responsible investing in global financial markets.

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[13] Subchapter 3.3. also analyses returns without correcting risk, terming them deltas or nominal returns.

[14] Both nominal returns and Sharpe ratios are netted with the benchmark return (hence the term delta for nominal returns). The applied benchmark is the MSCI All Country World Index (MSCI ACWI), which plays the role of the theoretical market portfolio too.

[15] There is another possible way to obtain positive risk-adjusted returns: ESG might decrease value; however, markets overreact, pushing down prices too much, delivering positive risk-adjusted returns to investors.

2.2.1. ESG STRATEGIES

Hypothetically, there is no upper limit to the number of ESG-based investment strategies that investors may develop and implement. However, *Global Sustainable Investment Alliance's*[16] *(GSIA) 2012* classification system, which categorises ESG strategies based on seven different philosophies, is a good starting point. Today, this grouping scheme has become a global standard both in academia and among professionals. Table 3 specifies these strategies and summarises essential features.

Table 3. Classification of ESG investment strategies

	Strategy	Basic features
1	Negative/exclusionary screening	The exclusion from a fund or portfolio of certain sectors, companies or practices based on specific ESG criteria.
2	Positive/best-in-class screening	Investment in sectors, companies or projects selected for positive ESG performance relative to industry peers.
3	Norms-based screening	Screening of investments against minimum standards of business practises based on international norms, such as those issued by the OECD, ILO, UN and UNICEF.
4	ESG integration	The systematic and explicit inclusion by investment managers of environmental, social and governance factors into financial analysis.
5	Sustainability-themed investing	Investment in themes or assets specifically related to sustainability (e.g., clean energy, green technology, or sustainable agriculture).
6	Impact/community investing	Targeted investments aimed at solving social or environmental problems, and including community investing, where capital is specifically directed to traditionally underserved individuals or communities, as well as financing that is provided to businesses with a clear social or environmental purpose.
7	Corporate engagement and shareholder action	The use of shareholder power to influence corporate behaviour, including through direct corporate engagement (i.e., communicating with senior management and/or boards of companies), filing or co-filing shareholder proposals, and proxy voting guided by comprehensive ESG guidelines.

This table introduces seven different ESG investment strategies based on the original 2012 classification scheme of the Global Sustainable Investment Alliance (*GSIA, 2018 p. 7*).

[16] GSIA is a collaboration of membership-based sustainable investment organisations around the world. The GSIA's mission is to deepen the impact and visibility of sustainable investment organisations globally. The alliance members are such important organisations as the Eurosif, US SIF, or JSIF.

According to *GSIA (2018)*, the ESG integration approach is the systematic and explicit inclusion of environmental, social, and governance factors into the stock selection processes. *Nagy et al. (2016)* show that ESG ratings are the standard proxies for corporate ESG factors in a traditional quantitative portfolio construction framework. Consequently, ESG scores are routinely applied to create ESG-conscious equity portfolios and measure portfolio ESG tilts. ESG ratings typically derive from third-party rating agencies: *Melas et al. (2017)* used the scores of MSCI, while Auer (2016) used Sustainalytics ratings to construct portfolios[17]. The dissertation utilises Sustainalytics's E, S, and G scores separately.

What kind of ESG issues do these scores measure? According to *Lopez et al. (2020)*, ESG factors include a wide range of topics, and the relevant issues are likely to depend on the examined company, the industry in which it operates, and, ultimately, on investor preferences. Hence, the authors contend that it is not surprising that a conclusive catalogue of ESG factors does not exist. Table 4 displays some of the well-known ESG factors.

Matos (2020) lists several examples for E, S, and G factors. The environmental dimension evaluates a company's impact on nature, which covers its emissions (e.g., CO_2), the use of natural resources (e.g., energy efficiency, water management), pollution and waste (e.g., spills), threats to biodiversity (e.g., conversion of natural habitats such as forests and wetlands) and efforts to eco-design products (e.g., recycling plastic).

The social dimension covers a company's interactions with its labour force, customers, and society. It includes efforts to maintain loyal employees (e.g., employment quality,

[17] The role of ESG rating agencies and their methodology have often been the subject of debate. For instance, *Gibson et al. (2019)* found that in their sample, the average correlation between the overall ESG ratings of the six rating providers is relatively low, about 0.46 (compared to a 0.99 correlation of credit ratings). The paper of *Escrig-Olmedo et al. (2019)* studies how the ESG rating agency industry and the criteria they use in the assessment process evolved over 2008 and 2018 and examines whether ESG rating agencies are now contributing to more sustainable development by the inclusion of sustainability principles into their assessment processes and practices. They argue that ESG rating agencies' bargaining power has grown exponentially. This could force companies to improve their ESG performance; however, it could also imply a biased concept of sustainability if sustainability principles are not guaranteed in the assessment process of ESG agencies.

health and safety, training, and development), respond to customer needs (e.g., producing quality goods and services that keep customers safe), behaving responsibly in the communities where it operates.

The governance dimension describes the management actions that intend to meet the best interests of long-term shareholders. Governance factors include, among others, the protection of shareholder rights, maintenance of a functioning board, development of well-designed executive compensation policies, management of cybersecurity challenges, and the avoidance of illegal practices, such as fraud and bribery.

Table 4. Main ESG issues

Environmental	Social	Governance
• Climate change policies, plans, and disclosure practices • Air and water pollution • Carbon emissions • Biodiversity impact • Water stress • Waste and hazardous materials anagement • Usage of renewable energy • Ecodesign and innovation	• Community engagement • Human rights • Labour practices • Workforce health and safety and training • Product safety • Data security and customer privacy • Diversity and inclusion • Customer relations • Ethical supply chain	• Management structure • Executive compensation • Board composition • Business integrity • Transparency • Bribery and corruption • Lobbying • Whistleblower schemes • Shareholder relations

The table lists the most frequently cited ESG factors *Lopez et al. (2020, p. 13) and Matos (2020, p. 7)*.

The GSIA definition in Table 3 for sustainability-themed investing or ESG-themed investments is as follows: "*Investment in themes or assets specifically related to sustainability (e.g., clean energy, green technology, or sustainable agriculture).*" The terminology developed by *UNCTAD (2020)* is more detailed than the one formulated by GSIA: ESG-themed investment strategy might cover specific sustainability themes (for instance, gender equality or low carbon), it might focus on only one ESG pillar, or track a "quasi sector", such as renewable energy or water. The latter description well corresponds to UN SDGs. Table 5 summarises numerous themes, investment opportunities and compliance with SDGs.

Table 5. The relation between ESG-themed investment strategy and UN SDGs

Theme	Associated UN SDGs	Investment Opportunity
Water scarcity Ensuring supply of clean water and efficient use of water	(2.) Zero hunger (6.) Clean water & sanitation	Water infrastructure, agricultural technology (e.g., enhanced irrigation)
Waste management and recycling Reducing, reusing, recycling and disposing of the increasing amounts of waste	(6.) Clean water & sanitation (12.) Responsible consumption & production	Waste management, with particular focus on emerging markets
Agricultural yield Improving yields in order to provide food for the growing world population	(2.) Zero hunger (15.) Life on land	Agricultural equipment, biotech, irrigation technology, fertiliser producers
Clean air and carbon reduction Reducing our carbon footprint and improving local air quality	(11.) Sustainable cities and communities (13.) Climate action	Renewable energy, energy efficiency & storage, clean fuels, emission control
Emerging market infrastructure Providing a sustainable infrastructure that enables productivity and competitiveness	(9.) Industry, innovation and infrastructure (11.) Sustainable cities and communities	Transportation infrastructure, water supplies, sanitation services, affordable housing
Energy efficiency Saving resources and cutting CO_2 missions with energy efficiency, the “cheapest fuel”.	(7.) Affordable and clean energy (12.) Responsible consumption & production	Building systems, industrial processes, transportation infrastructure, software
Renew able energy Providing renewable and clean alternatives to fossil fuel to satisfy energy needs	(7.) Affordable and clean energy (13.) Climate action	Renewable energy project developers, wind turbine and solar PV manufacturers, utilities
Mass transit rail Saving land resources, combatting congestion and rising CO_2 emissions in rapidly growing Asian cities	(9.) Industry, innovation and infrastructure (11.) Sustainable cities and communities	Companies with exposure to mass transit rail (capital equipment suppliers, operators, developers)
Automation and robotics Addressing rising wages and challenging demographic developments with automation	(12.) Responsible consumption & production	Industrial automation/robotics technology/industrial software
Educational services Expanding the reach and improving quality of education through private sector initiatives	(5.) Gender equality (10.) Reduced inequalities	Education service companies
Emerging market healthcare Improving access to health care services, with a focus on emerging markets	(3.) Good health and well-being	Healthcare equipment & supplies, healthcare providers & services, pharmaceuticals
Generics Saving costs and broadening access to vital drugs through generics	(3.) Good health and well-being	Generics manufacturers

Table 5. *(Continued)*

Theme	Associated UN SDGs	Investment Opportunity
Medical devices Improving the quality of life and enabling people to better contribute to the economy	(3.) Good health and well-being	Manufacturers of medical devices such as orthopaedic implants, cardiovascular devices
Obesity Preventing and treating obesity to improve quality of life and reduce healthcare costs	(3.) Good health and well-being	Consumer (healthy food, fitness & sportswear), healthcare (treatment obesity-related diseases)
Retirement homes Satisfying the demand for increased assisted living and care facilities	(10.) Reduced inequalities	Real estate firms with exposure to senior housing, companies specialised in nursing homes
Retirement planning Addressing looming pension gaps through private savings schemes	(10.) Reduced inequalities	Companies with exposure to asset & wealth management, and life insurance.
Safety and security Protecting data and physical assets, ensuring security and safety	(16.) Peace, justice and strong institutions	Products and services that focus on cybersecurity, testing, inspection & certification, life science tools

This table summarises numerous ESG themes and related investment opportunities as well as compliance with United Nations Sustainable Development Goals (SDGs) (*Whittaker et al., 2018, p. 3*). The number of SDGs is in brackets. The list of UN SDGs can be found in Appendix 1.

The dissertation covers most of these themes, albeit, in some cases, under slightly different names: Energy efficiency, Food security, Water scarcity, Ageing, Millennials, Urbanisation, Cybersecurity, Disruptive technologies, and Robotics.

Regarding the quasi-sector clause of the UNCTAD definition, the dissertation wishes to introduce and promote, in line with *Naffa and Fain (2020)*, the megatrend concept (MT). The themes presented in Table 5 each corresponds to either environmental, social, or technology-related governance MTs. The MT concept is an alternative and more comprehensive classification system of corporates than the traditional sector or industry taxonomy such as GICS[18] or ICB[19].

One of the drawbacks of traditional industry classification is that each company belongs to a predetermined group, i.e. it is an "either/or system". For instance, Apple should be either a technology company or a consumer discretionary company; but it is

[18] Global Industry Classification Standard – developed in 1999 by MSCI and S&P.

[19] Industry Classification Benchmark – launched by Dow Jones and FTSE in 2005 and now used by FTSE International and STOXX.

impossible to be both. The next shortcoming of a sector-based classification approach is that it is static: industry classifications cannot capture all the potential forces driving the market. For instance, there is no "agriculture" sector or subsector within GICS. Instead, it is scattered throughout auxiliary sectors: consumer staples (agricultural products subindustry), industrials (farm machinery and heavy trucks subindustry), and materials (fertilisers and agricultural chemicals subindustry). In contrast, the megatrend concept and thematic classification are inherently more flexible because they do not require completeness or exclusivity (requisition of being non-overlapping).

2.2.2. ESG IN GLOBAL FINANCIAL MARKETS

The impact of sustainability has increased tremendously over the past decade. According to *GSIA (2018)*[20] data, in 2018, the volume of ESG-aligned assets reached USD 30,683 billion (assets under management, AUM), while in 2012, it was "only" USD 13,261 billion, i.e. ESG-conscious assets more than doubled in these six years. This impressive expansion is equivalent to a 15 per cent compound annual growth rate (CAGR)[21]. The 33 per cent market share in 2018 makes the importance of ESG even more apparent in contrast to the 21 per cent figure in 2012, indicating that ESG AUM increased at a higher rate than global AUM (15 per cent vs 7 per cent CAGR). Furthermore, the number of PRI[22] signatories has also skyrocketed since 2006 (the

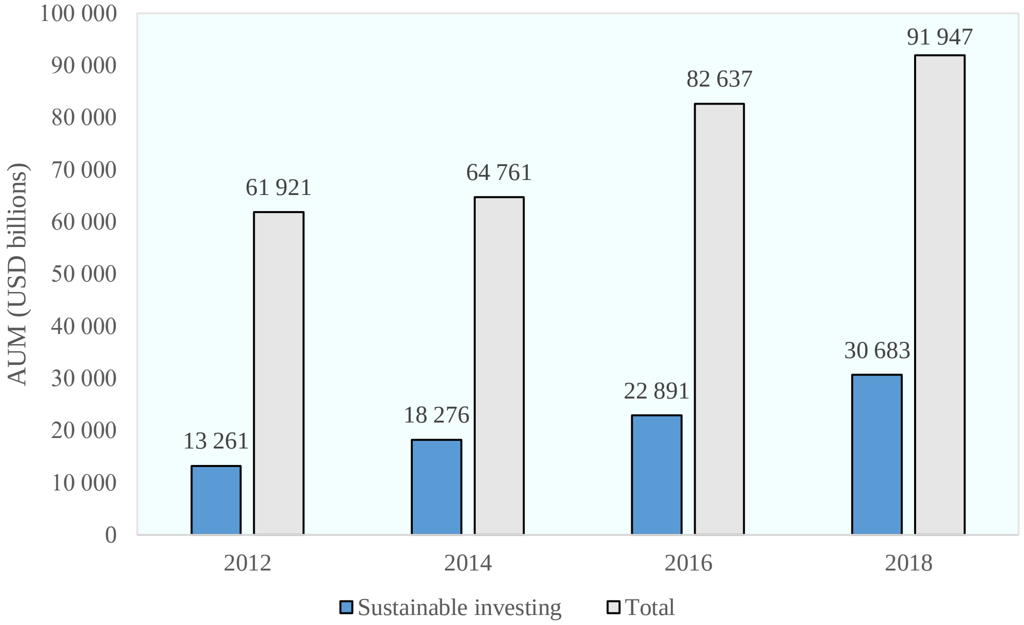
[20] When writing this dissertation (May 2021), the latest GSIA data are from 2018 (information for 2020 is expected to be available in mid-2021). Of course, it would have been possible to work from other data sources with more recent data. Nevertheless, due to the lack of rigorous, consequent data collection with a longer history on the global level, it is not easy to obtain market information that is comprehensive and reliable. The GSIA framework, however, satisfies these particular requirements. Furthermore, the data are appropriate to interpret global trends.

[21] Nevertheless, all that glitters is not gold: greenwashing is a well-known phenomenon. According to *Delmas and Burbano (2011)*, greenwashing is a corporate practice when firms mislead customers about their environmental performance or the environmental benefits of products or services. Furthermore, it can be interpreted at both the corporate and asset management levels. *Delmas and Burbano (2011)* argue that mitigating this problem is particularly challenging in a context of limited and uncertain regulation. The figures in the present chapter are also certainly biased due to some degree of greenwashing.

[22] Principles for Responsible Investment is a UN-supported network of investors working together to implement sustainability principles into their investment decision-making and ownership practices.

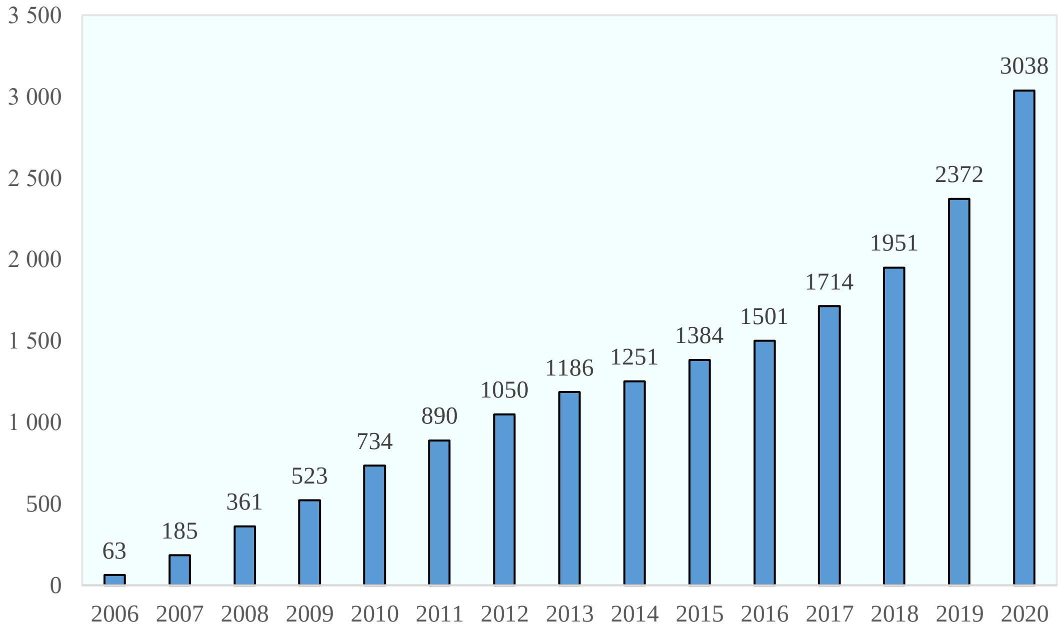
introduction of the Principles). In 2006, there were 63, while in 2020, more than 3,000 signatories. Figure 4 and 5 summarises the above information.

Figure 4. The size of assets under management based on ESG principles



This chart depicts the share of sustainable investments within total assets under management (AUM) globally. The numbers rest on GSIA 2012-2018 data.

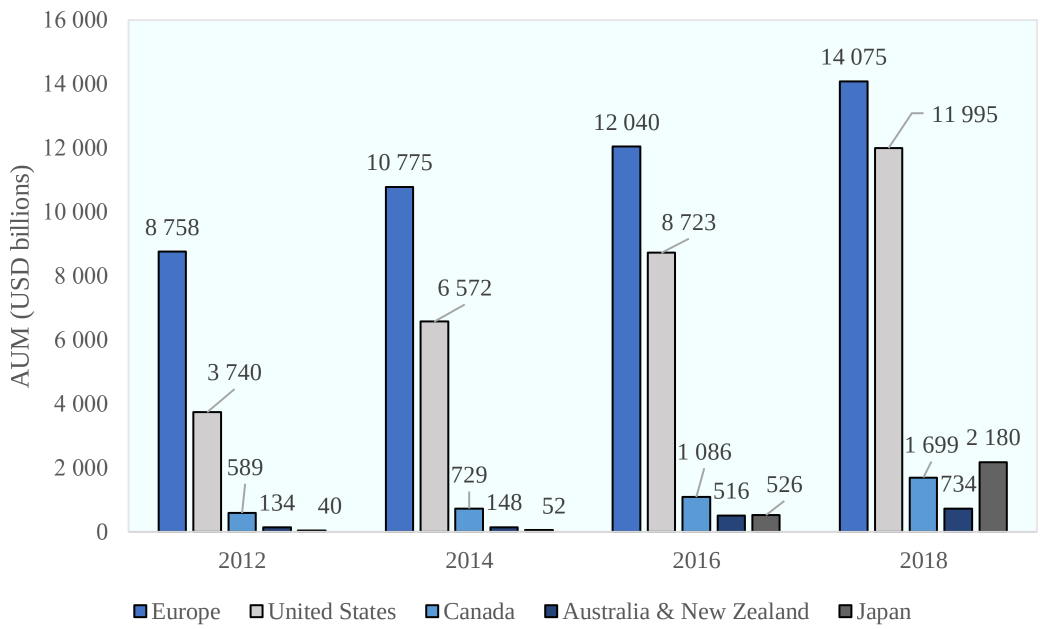
Figure 5. Increase of PRI signatories



This figure shows the number of PRI signatories from 2006 until 2020 (the Principles were launched in 2006). The data are available at PRI's webpage: https://www.unpri.org/pri/about-the-pri.

Based on Figure 6, one remarkable conclusion is that the distribution of ESG investments is not homogeneous. The most prominent market players continue to operate in the European and US markets: the 2018 AUM was USD 14,075 billion for the former, while it was USD 11,995 billion for the latter. In any case, the growth rate of responsibly managed assets was slower in Europe (8.22 per cent) than in the United States (21.43 per cent). However, from 2016 onwards, Japan emerged at a great pace. Japan was already in third place in 2018 (AUM USD 2,180 billion) thanks to an extraordinarily dynamic growth: the value of financial assets managed on an ESG basis approximately doubled each year between 2012 and 2016.

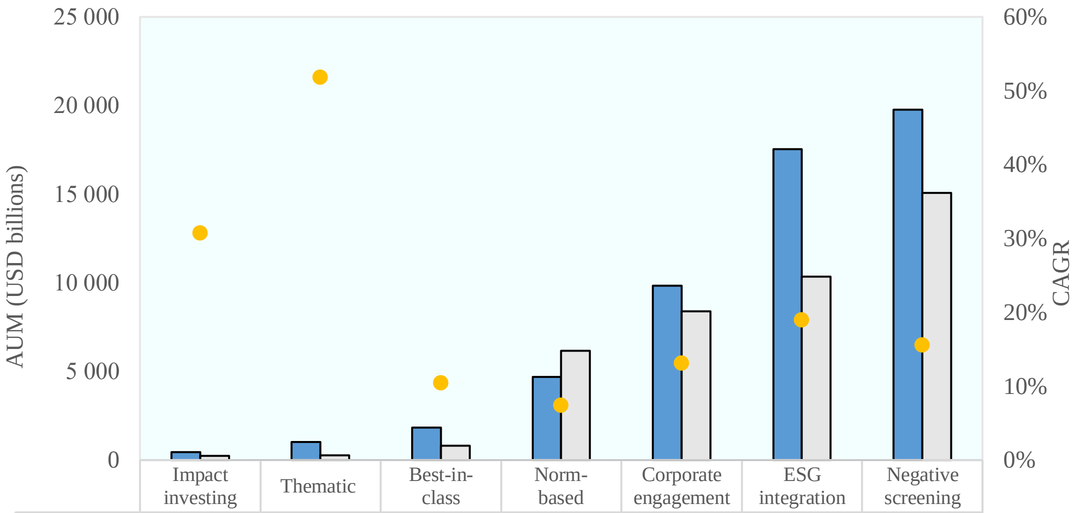
Figure 6. Growth of ESG investing assets by region



This chart summarises the market development of ESG investing by countries and regions. The two most prominent market players are still Europe and the US; however, Japan showed an imposing growth. The numbers rest on GSIA 2012-2018 data.

Figure 7 outlines the market development of sustainable investing strategies, from impact/community investing to negative/exclusionary screening. In terms of AUM, negative screening was the most popular strategy among investors: in 2018, nearly USD 20,000 billion was managed according to this strategy. Between 2012 and 2018, exclusionary screening achieved a CAGR of 16 per cent, which is a high figure, but it is not particularly outstanding compared to other strategies. In 2018, ESG integration got close to exclusive screening (USD 17.544 billion AUM) due to an average annual growth rate of nearly 20 per cent. Only the two strategies with the smallest AUM, impact investments and thematic investments, achieved higher growth during the period. However, sustainability-themed investing showed outstanding growth from 2012 to 2018 as the AUM increased by 1,126 per cent, which corresponds to a 52 per cent CAGR (the 31 per cent CAGR of impact investing is not negligible either). Norm-based investing was the only strategy that recorded a decline in AUM from 2016 to 2018.

Figure 7. Global growth of sustainable investing strategies



	Impact investing	Thematic	Best-in-class	Norm-based	Corporate engagement	ESG integration	Negative screening
AUM - 2018	444	1 018	1 842	4 679	9 835	17 544	19 771
AUM - 2016	248	276	818	6 159	8 385	10 353	15 064
Growth 12-18	399%	1126%	82%	54%	110%	184%	139%
CAGR 12-18	31%	52%	10%	7%	13%	19%	16%

AUM - 2018 AUM - 2016 CAGR 12-18

The figure presents – based on GSIA classification – the market development of seven sustainable investing strategies, from impact investing to negative screening. Regarding total AUM, negative/exclusionary screen and ESG integration are the most prominent, while concerning asset growth (CAGR), impact investing and ESG-themed investing show the most impressive figures. The numbers derived from GSIA biennial reports (2012-2018).

In summary, the dissertation examines two strategies that are currently quite different in market embeddedness. Nevertheless, the current market data show that their future role is unquestionable. Firstly, ESG integration, which promotes rather organisational sustainability, is already a well-established approach due to its second-highest AUM. Secondly, although thematic investing, which focuses more on global sustainability, is still in its infancy in absolute terms but produced by far the highest AUM growth between 2012 and 2018.

2.3. EMPIRICAL ASSET PRICING – LITERATURE REVIEW[23]

Professionals and scholars in the field of financial investments have always been keen on the question of how to forecast and interpret the fair expected return of securities reflecting risk[24], or, in other words, to predict equity prices[25]. The various capital market theories and applications devised in past decades focused on identifying various factors influencing returns and establishing a relationship, viz., a trade-off between expected return and risk.

How has financial and investment thinking changed over the last roughly 100 years? The methodological works of Graham – Dodd and Williams in the 1930s laid down the foundations of intrinsic value calculation (*Graham and Dodd, 1934; Williams, 1938*). Modern finance was born and consolidated in the 1950s and 1960s. This period was characterised by economists and their theories, such as the modern portfolio theory (MPT) of *Markowitz (1952)* or the capital asset pricing model (CAPM) of *Lintner (1965)*, *Mossin (1966)*, and *Sharpe (1964)*. Contemporary thinking featured rational investors: efficient markets (efficient market hypothesis, EMH) from an information perspective (see *Fama, 1970*) and approaches that interpreted the development of returns as a random walk.

Around the 1970s, the belief that markets are probably not "that" efficient as previously supposed and investors do not always behave rationally slowly became accepted in financial thinking[26]. The assumptions and conclusions of the CAPM were increasingly questioned; in response, multifactor models started to dominate (for instance, see the Arbitrage Pricing Theory by *Ross, 1976*). The literature usually attributes the spread and popularisation of the multifactor models to *Fama and French*

[23] For the most part, this subchapter rests on the work of *Fain and Naffa (2019)*. (Fain, M., Naffa, H., 2019. Performance Measurement of Active Investment Strategies Using Pure Factor Portfolios. Financial and Economic Review 18, 52–86. https://doi.org/10.33893/FER.18.2.5286)

[24] There is a major difference between the concept of expected return and required rate of return, which should be borne in mind (see *Fernandez (2015)* and *Fernandez and Fernández Acín, 2019*).

[25] More precisely, investors are interested in total return, comprising the sum of dividend yield and percentage price changes. In the dissertation, return always means total return.

[26] This is the period of the emergence of behavioural finance, established by *Kahneman and Tversky* with their seminal work published in *1979* (*Prospect Theory*).

(2015, 1996, 1992). By now, researchers in the field have identified a plethora of factors that could explain returns. In any case, it is not easy to decide which of these factors can be deemed significant in this universe of factors, both statistically and from the perspective of practical interpretability. *Cochrane (2011, p. 1063)* aptly referred to this multitude as a "*factor zoo*". It is not easy "*taming the factor zoo*", as the imaginative title of the study of *Feng et al. (2020)* emphasises. However, the authors propose a model selection method to evaluate the contribution of new factors. The well-known publication of *Harvey et al. (2016)* suggests that a new factor should obtain t-statistics greater than 3.0 to prove its raison d'etre. In the empirical section, the dissertation follows the hints of *Harvey et al. (2016)*.

The following paragraphs summarise the academic literature of how the research field of empirical asset pricing and market anomalies have evolved during the past 70 years. Many of these anomaly factors are utilised as explanatory variables of portfolio returns in the empirical analysis; therefore, introducing them is critical. Before starting with a detailed discussion of market anomalies, it must be stressed that testing market efficiency and quantifying the risk-adjusted abnormal rate of return of equity investments is identical to testing the widely used pricing models (primarily the CAPM).

According to *Chien-Ting (1999)*, the anomalies related to CAPM as a benchmark may have three main explanations: 1) measurement errors, 2) unrealistic assumptions of the model, and 3) model specification errors. The measurement errors, alternatively errors-in-variables, include inaccurate measurement of the model variables, such as the risk-free return, the beta and the market risk premium, since the theoretical CAPM does not provide practical guidance for their calculation[27]. The most often cited flawed assumptions include the efficient market hypothesis. Model specification errors are grounded in statistics just as errors-in-variables. They include, for example, the omitted variables bias. The presence of these statistical problems does not necessarily mean that markets are not efficient, "merely" that not all the explanatory factors have been considered or the measured factors contain errors (or both).

Errors-in-variables and omitted variables are well-known forms of endogeneity bias. *Campbell et al. (1997)* and *Cochrane (2005)* also articulate the measurement errors

[27] The assumption that the beta and the market risk premium are constant over time is also untenable.

regarding asset pricing models and emphasise measurement errors related to the Fama-MacBeth procedure. The dissertation handles endogeneity by applying a generalised method of moments (GMM) estimator with robust distance instrumental variables (GMM-IV_d).

It follows from the above that one of the critical conditions of the CAPM is the existence of perfect (competitive) markets (see *Lintner, 1965*). However, perfect markets assume market efficiency. At the same time, efficient markets do not necessarily have to be perfect (*Kasper, 1997, p. 325*). In practical terms, if the conditions of the efficient market theory are violated, the presumptions of the CAPM regarding perfect markets do not hold either. In recent decades, several studies have been conducted on market anomalies that seem, at first glance, to violate the assumptions on market efficiency. Some of these market anomalies are highlighted below without the ambition to be exhaustive. After introducing the anomaly literature, multifactor models that use some of these factors to explain returns are presented. Everyday trading and portfolio optimisation (searching for alpha) based on the anomalies described here can be regarded as different types of "style investing".

The *momentum* effect is as follows: the current good performance will be followed by good performance, while the current poor performance will be followed by poor performance. Statistically speaking, positive autocorrelation can be observed between subsequent returns. The actual question concerning the anomaly is about the time horizon: how long does the momentum last? *Fama and Blume (1966)* examined positive autocorrelation on daily returns, integrating the filter technique of *Alexander (1964, 1961)*. *Lo and MacKinlay (1988)* and *Conrad and Kaul (1988)* analysed weekly returns. The essence of their conclusion is that although there is some positive autocorrelation, it is not enough to generate significant profits. The paper by *Jegadeesh and Titman (1993)* used a more extended period. The authors found the momentum factor to be significant over a time horizon of 3-12 months. The authors 2001 article confirms their observations from 1993 (*Jegadeesh and Titman, 2001*).

One phenomenon closely linked to momentum is the *reversal (adjustment) effect*, which assumes negative autocorrelation, meaning that the capital markets tend to penalise former "winner" stocks and reward "loser" stocks after a certain time. Equivalently, markets tend to overreact. Among others, *Brown and Harlow (1988)*, *De*

Bondt and Thaler (1985, 1987), and *Howe (1986)* examined market overreactions and concluded that reversal could be seen in the long run over the years. According to the findings of *De Bondt and Thaler*, the originally "loser" portfolio outperformed the earlier "winner" 36 months later, by approximately 25 per cent. *Howe* found that stocks that achieved significant gains performed below the market by 30 per cent one year after the good news. Overall, the momentum factor seems to be relevant in the short run, and the reversal effect seems to exist in the long term[28].

The *size effect*, which is also referred to as the *small-firm effect*, was initially described by *Banz (1981)*. The essence of this anomaly is that the return that small firms can achieve is significantly higher than the risk-adjusted fair (CAPM) return. *Banz* performed the analysis on a large sample: the database contained the companies listed on the New York Stock Exchange for at least five years between 1926 and 1975. His research shows that the most considerable difference was seen in the case of the smallest firms (hence the name "small-firm effect"). Several papers have attempted to explain the reasons for excess returns. Some of these treat small enterprises as companies neglected by large portfolio managers ("*neglected firm effect*"), which allows them to achieve higher risk-adjusted returns (*Arbel et al., 1983*; *Carvell and Strebel, 1987*). However, a study from *Beard and Sias (1997)* concluded that the neglected firm effect did not exist anymore. Other studies (see *Reinganum, 1983*; and *Ritter, 1988*) emphasised tax considerations at the beginning and end of the year, which led to the finding that the size effect exists "only" in January (hence the name "*January effect*").

The *value* factor helps identify corporate fundamentals that can significantly determine value, making it possible to recognise undervalued and overvalued stocks. Widely used value factors include the price/earnings ratio (P/E), its inverse, the earnings yield ratio (E/P), the price to book ratio (P/BV). The empirical findings of *Basu (1983, 1977)* confirmed the belief widely held among investors that securities with a low P/E ratio (or high E/P ratio) are undervalued and may generate excess returns. *Fama and French (1992)* showed that firms listed on the NYSE, the AMEX, and the NASDAQ with a high BV/P ratio between 1963 and 1990 generated substantial excess returns compared

[28] "*Mean reversion*" is a concept closely linked to momentum and the reversal effect. See *De Bondt and Thaler (1989).*

to the companies with low BV/P ratios. *Capaul et al. (1993), Chan et al. (1991)* and *Rosenberg et al. (1985)* have the same conclusions for different periods and markets.

Besides the value factor, the study of *Novy-Marx (2013)* also comes to an exciting conclusion. The author argues for the explanatory power of a somewhat different *profitability factor*. According to *Novy-Marx*, the gross margin[29] is an appropriate alternative to BV/P, as the criticism against the explanatory power of the BV/P ratio is not relevant here. He justifies this by stating that profitable firms have low operating leverage, and therefore positive corporate cash flows are more stable and sustainable in the long run.

Another relatively new theme is the *low volatility* or *low beta* anomaly. The essence of this anomaly is that companies with high volatility (beta) significantly underperform low-risk (beta) investments. *Baker et al. (2011)* underline that the results are not entirely new, but earlier authors have not emphasised the importance of this phenomenon enough. Others came to a similar conclusion (e.g., *Ang et al., 2009, 2006*; *Bali et al., 2011*; *Blitz and Vliet, 2007*; *Frazzini and Pedersen, 2014*).

From now, in a few paragraphs, some prominent studies that applied the anomalies mentioned above as explanatory factors of the cross-section of stock returns are introduced. The *multifactor models* most often cited in the literature are associated with the works of *Fama and French* (*FF*)[30]. Indeed, there are other influential studies in the literature, not just those of FF. One should mention *Barr Rosenberg*, who was one of the first researchers to focus on factor models, both on a theoretical and a practical implementation level. *Rosenberg (1974)* laid down the statistical foundations of multifactor models. Later, together with his colleagues, he also performed empirical analyses, dedicating special attention to industries and financial statement data (e.g.,

[29] The difference between net sales and the cost of goods sold (COGS).

[30] The methodological background to the early works by FF is provided by *Fama – MacBeth* (*1973*) (FM). The paper's most important methodological messages should be briefly summarised, particularly because several subsequent analyses used this technique, including the study of *Chen et al. (1986)* presented on the next page. First, the returns of the selected stocks should be explained by the chosen risk factors, which yields the beta parameter associated with the risk factors. Second, the returns should be regressed again, but this time on the betas derived in the first step. The result of the second regression is the sensitivities towards the factors. The empirical part of the thesis also applies the FM procedure (for further methodological details, see those chapters).

Rosenberg and Guy, 1976; *Rosenberg and McKibben, 1973*). Another often quoted work is *Carhart* (*1997*), which expands the three-factor model of *FF* (*1996*) with the momentum factor. From the Central and Eastern European region, one could mention the study of *Naffa (2009)*, *Walter and Berlinger (1999)*, and *Zaremba and Czapkiewicz (2017)*.

Chen et al. (*1986*) identified several macroeconomic factors, such as industrial production, expected and unexpected inflation changes, unexpected changes in bond risk premia and term premia, which may influence expected return. Using the two-stage Fama – MacBeth regression technique, they found that industrial production, unexpected inflation and the excess return on bonds have significant explanatory power.

Fama and French (*1992*) explained returns by making two statements, which caused massive turmoil among scholars and practitioners. First, the authors found that stock returns on NYSE, AMEX, and NASDAQ between 1963 and 1990 were considerably influenced by two variables: size and the BV/P ratio. According to the relationship between returns and explanatory factors, the investments with a high BV/P ratio and relatively small size performed better, yielding higher returns than it would have been expected based on the traditional asset pricing models. The authors' second conclusion, which sparked greater confusion, was the lack of a significant relationship between systematic risk, i.e. the beta and returns, which was worrying news concerning the applicability of the CAPM.

In an article published a few years later, in 1996, *Fama and French* introduced an asset pricing technique to the academic community that later became known as the three-factor model. The paper title (*Multifactor Explanations of Asset Pricing Anomalies*) is "talkative" in the sense that the authors were looking for explanations on the risk-adjusted excess returns that the CAPM cannot explain. They argued that besides the market[31], two other explanatory variables should be used to capture the observed

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[31] Identifying the market as the first factor is not that straightforward as it would seem at first glance. *Clarke et al. (2014, p. 13)* ask the following question. *"What are the three factors in the well-known Fama–French model? Some analysts will say the market, size, and value, whereas others will say beta, size, and value. So, is it the return on the capitalization-weighted market portfolio or the return on the beta of the capital asset pricing model?"* The authors examine this issue comprehensively.

anomalies: the difference between the return on a portfolio of small and large stocks (size factor: small minus big, SMB) and the difference between the return on a portfolio with a high BV/P value and a low BV/P value (value factor: high minus low, HML). Comparing the two seminal Fama and French studies, *FF (1992)* is a study of cross-sectional regressions used to calculate monthly factor return, while *FF (1996)* is a paper of time-series regressions used to estimate stock and portfolio alphas and sensitivity to a previously determined set of factors (*Clarke et al., 2014*).

The authors have recently (*Fama and French, 2015*) augmented the three-factor model with two further factors, profitability (citing *Novy-Marx, 2013*) and investment. The financial rationale of the FF 5-factors derives from a modified dividend discount model incorporating profitability and investment factor effects explicitly. The new variables are consistent with the approach used in the three-factor model. Consequently, the profitability factor was represented by the difference between the returns on diversified portfolios of stocks with robust and weak profitability (robust minus weak, RMW). The investment factor expressed the return differences on equity portfolios with conservative and aggressive investment strategies (conservative minus aggressive, CMA). One of the key findings is that with the addition of profitability and investment factors, the value factor of the FF three-factor model becomes redundant for describing average returns in the sample the authors examined.

2.4. TRENDS AND CHALLENGES OF ESG – QUALITATIVE RESEARCH

In the discipline of financial economics, most empirical studies have a purely quantitative approach: large samples of numerical data are collected and analysed statistically to test various hypotheses[32]. However, conducting qualitative research is desirable since it might reveal aspects for which quantitative research is not

[32] Regarding ESG, however, several important qualitative research studies have been published recently. Most of them surveyed or interviewed investment professional (e.g., *Amel-Zadeh and Serafeim, 2018; Khemir, 2019; Krueger et al., 2020; van Duuren et al., 2016*), though there are few examples with corporate executives as well (e.g., *Clementino and Perkins, 2020*).

appropriate[33]. Firstly, qualitative research may help to interpret the quantitative results obtained and can provide further practical implications. Secondly, by asking professionals, researchers can discover the leading motivations shaping actors' behaviour operating in the area. The chapter has the following structure. First, in a nutshell, the methodological background of the qualitative research is presented, followed by a summary of the interviews.

2.4.1. METHODOLOGY

The aim of conducting qualitative research is twofold. Firstly, it helps explore the dominant trends and challenges that ESG investing already faces or will soon. Secondly, it can explain the empirical results and establish practical implications and applications of the findings obtained.

Overall, seven in-depth, semi-structured interviews were undertaken during November-December 2020, which lasted between 30-60 minutes. Among the seven interviewees, two were from the asset management sector, two from ESG rating agencies, two from rated corporates, and one from the regulatory side[34]. The involvement of other critical stakeholders besides investors and Hungarian organisations was an explicit goal to understand the complexity of ESG.

Furthermore, according to *Seidman (2006)*, reaching representativeness is a crucial requirement not just in quantitative but qualitative researches. As collecting large and random samples is generally not feasible for interviews, *Seidman (2006, p. 52)* suggest *maximum variation sampling* and contends that this method provides the most effective strategy in achieving representativeness. In the dissertation, maximum variation sampling refers to both sectors and geographic locations: choosing

[33] The inherent nature of quantitative analysis is that it cannot always answer *why* the researcher ended up with the particular finding (*Agee, 2009*).

[34] The author of the dissertation is grateful to each interviewee for their flexibility and availability even in the middle of the COVID-19 pandemic. With their valuable insights, they contributed greatly to the author's research and the completion of the present dissertation. The author would like to give thanks to Zsombor Bene (K&H), Péter Csárdás (Sustainalytics, Netherlands), Gábor Gyura (MNB), Gergely Jancsár (MOL), Zsolt Kardos (Aegon), Zoltán Nagy (MSCI), and Jyrki Talvitie (Magnit, Russia).

participants from different sectors, and distinct regions can enhance representativeness[35].

Interviews began with contacting professionals, which took two forms. Firstly, the supervisor of the author has several associates[36] who are authentic in ESG investing. To exclude validity threats during the preparation phases[37], the author contacted the interviewees, as he did not know them personally. The second way of making contact was utilising business and employment-oriented databases on the internet (i.e., LinkedIn)[38]. The interview invitation e-mails, in line with *Seidman (2006)*, introduced the nature of the empirical study as broadly as possible and discussed what would be expected from the interviewees.

The research applied two techniques to get valid results: 1.) in-depth, semi-structured Skype interviews; 2.) researcher reflection notes recorded immediately after interviews. The methods of interviewing could incorporate validity issues as well. According to the relevant literature (e.g., *Bryman, 2012; McCoyd and Kerson, 2006*), the traditional view is that face-to-face interviews are superior to other interview techniques. However, some recent publications underscore the advantages of VoIP (Voice over Internet Protocol) technologies such as Skype (*Deakin and Wakefield, 2014; Lo Iacono et al., 2016*). Scholars argue that these technologies can overcome

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[35] To attain proper inference, the higher the number of "observations", the better. However, due to limited resources and time constraints, the author had to accept the relatively low number of participants. Nevertheless, *Eisenhardt (1989, p. 545)* suggests between four and ten cases: *"With fewer than four cases, it is often difficult to generate theory (…) with more than ten cases, it quickly becomes difficult to cope with the complexity and volume of the data"*.

[36] These potential interviewees were at the same hierarchy level as the supervisor (i.e., there were no authority issues). The term "associates" is defined broadly: they are not just current colleagues (portfolio managers) but former local and foreign clients.

[37] The first steps included all the necessary preparation phases, such as the first contact e-mail or telephoning, which introduced the empirical research topic.

[38] Getting contact via LinkedIn was greatly facilitated by the online forum of the Budapest Stock Exchange held on July 16, 2020, where the author listened to some of the interviewees (www.bet.hu).

logistical issues, save time and financial resources. However, shortcoming such as the potential lack of rapport is admitted (*Rowley, 2012, p. 265*)[39].

Thematic analysis was conducted within each case and across cases using data storage, coding, and theme development. Thematic analysis is a general method of studying qualitative data; further, it is also widely applied to a set of texts, such as interview transcripts (*Seidman, 2006*).

2.4.2. SUMMARY OF INTERVIEWS

Asset managers

According to asset managers, the "*doing well while doing good*" concept is becoming more popular among asset owners, especially in the millennial generation[40]. However, the perception of the "doing well" part is context-depending: if bull market conditions prevail, hence the returns are soaring steadily, then returns comparable to (market) benchmarks alone are considered "doing well". Equivalently, in hausse markets, it is not necessary to generate substantial excess returns. One interviewee, albeit with some exaggeration, gave the following imaginative example:

> "W*ith a 30 per cent market return, it matters less from an investor's point of view whether the portfolio yielded 29 or 31 per cent.*"

He also added that when optimism reigns, risks are also less relevant. Interviewee insights are in line with the literature's finding that past returns positively impact return expectations and are positively related to fund flows, while past risk has moderate or sometimes no impact, except for sophisticated investors *(Hoffmann and Post, 2017;*

[39] An important note: due to the COVID-19 pandemic, personal interviews were not possible. Furthermore, the epidemic is an extreme, outlier event that may have resulted in bias in the interviews (during this period, the coronavirus may have affected the interviewees' beliefs regarding ESG).

[40] One interviewee noted that "investor motivations are not homogenous". For instance, a wealthy individual investor insisted on returns without considering "doing good" in investment decision making. He contended that the fiduciary duty of asset managers is to generate returns, and after that, he would decide on social responsibility independently. The portfolio manager quoted the following from this investor: *"Your task is to make me money, and then I will decide what to do with it afterwards. Perhaps, I will keep social interests in mind as well"*.

Sirri and Tufano, 1998). This stylised fact of capital markets underscores the practicality of examining returns unadjusted for risks besides alphas or Sharpe ratios.

Both respondents believed that ESG investing would pay off in the long term: markets need time to recognise genuinely material processes; that is, it is conceivable that markets overreact, pushing up prices too much or underreact, with prices going up too little. The possibility of mispricing in both directions can be traced to that market participants do not assess transition risks well. As one asset manager remarked:

> *"ESG makes sense in 3-5 years or even in a longer investment horizon. It usually takes 2-3 years for markets to discover and really get familiar with global material, value-driving trends and another 3-4 years for these effects to be well priced."*

Asset manager insights are consistent with what *Bebchuk et al. (2013), Cornell and Damodaran (2020),* or *Matos (2020)* found. *Cornell and Damodaran (2020)* argue that highly-rated ESG stocks might outperform the low ESG stocks during the transition period, but that is a one-time effect as markets adjust. *Matos (2020)* suggests that investor preferences shift toward ESG-friendly companies over time (not necessarily because of financial reasons), and this shift is reflected in that these firms experience higher returns in the transition years. *Bebchuk et al. (2013)* examined different periods and showed that the return premium associated with highly rated corporate governance recently disappeared compared to earlier periods.

Another common point among the interviewees relates to transaction costs. They agreed that expense ratios significantly determine investors' bottom line. Although they have seen remarkable high expense ratios (even higher than 100 basis points per annum), both expect decreasing fees. However, they disagreed on the exact figures, which should be around 25-50 basis points considering an asset management firm's actual cost structure. In the words of one asset manager:

> *"Today, I do not see the reason for very high costs. ESG is a dynamically developing, mainstream segment of the asset management sector, meaning intense competition. Market mechanisms will simply force cost cuts."*

Finally, both portfolio managers had mixed feelings concerning the resilience of ESG investments during the COVID-19 pandemic. Although they found in their everyday practice and the financial press that ESG investments performed relatively well during the pandemic, they believed the situation had been a bit more complex. For instance, both interviewees highlighted that good ESG stocks belonged to the tech sector; thus, the performance is partly due to industries. They concluded that it would be worthwhile to see ESG indices that filter out these secondary effects.

Corporates

Corporate representatives first stressed that sustainability-conscious corporate behaviour is not an entirely new concept; the ESG approach became more widely accepted and required from investors in the second half of the last decade. Before that, companies' ESG performance depended much more on corporate executives' personal beliefs. Although the importance of this aspect has not diminished to this day, executives' role is no longer exclusive. Corporate greenwashing practices are still challenging for stakeholders to detect; nevertheless, in the past, it was a much more complicated issue due to a lack of comprehensive ESG information[41].

Based on the interviewees' arguments, it was clear that companies look at ESG ratings more as an issue of organisational sustainability than a driver of global sustainability. The interviewee from an oil company emphasised:

> "*It is important to see sustainability for what it is: the emphasis should be on strategic thinking rather than at the overly operational level, which is often inherent in ESG ratings.*"

The interviewee from the retail sector was implicit in terms of strategic and operational sustainability:

> *"We have recognised that addressing the challenges of waste management and packaging is paramount to our company-branded products. If our customers are willing to pay for recycling, this results in increased expenditures for us, but on the other hand, we can also achieve higher margins."*

[41] As one interviewee noted: *"Several companies only dealt with ESG because of brand building, marketing, image considerations. Around 2008, however, there was a setback in this practice due to the crisis: those who did ESG just because of greenwashing stopped it because it also had massive marketing costs, i.e., it was expensive to create and maintain the fiction"*.

It is clear cut from his words that he envisions sustainability much more within a company framework. Nevertheless, this corporation is one of Russia's largest groceries and general merchandise retailers; hence, its everyday practices have country-level effects. Furthermore, belonging to a sector can also significantly determine thinking: an oil company is much more exposed to transition risks than a retailer; therefore, executives must look beyond company boundaries and think about other, more sustainable business models.

Corporate representatives also underscored that ESG performance is not independent of industries and countries. Dirty industries are highly exposed to environmental and social issues. The interviewee from the oil company described this as follows:

> *"Exploring oil in rainforests is a tough job: building roads without cutting certain protected trees and paying attention to the natives is not an everyday challenge."*

As stated by the corporate sustainability officer (CSO) of the Russian retailer:

> *"In some parts of Russia, the condition of the roads is not satisfactory enough, resulting in higher fuel and maintenance costs for trucks, which in turn poses environmental challenges for the company. Waste management is also fraught with challenges, which makes it complicated to achieve environmentally friendly operations. Ultimately, all of these affect the company's ESG ratings."*

The examples each underpin that ESG performance measurement should consider secondary industry and country effects.

ESG rating agencies

Interviewees working for ESG rating firms shared thoughts about challenges in their work. However, this is not surprising, as ESG rating agencies attract an increased number of stakeholders who use their ESG scores. One interviewee highlighted that the sector had developed exceptionally much in recent years and had become significantly more professional and sophisticated. He shared a somewhat odd story:

> *"In the early stages, the technical background was elementally simple. Data collection procedures used Excel workbooks, and*

everyday practices were heavily administrative. Nowadays, everything has changed: data feeds and APIs are applied, and users can easily access modern, user-friendly client interfaces on the internet."

As one respondent argued, the greatest challenge has been to collect reliable, good quality data. Originally, ESG rating agencies typically obtained raw data from company financial reports, but more recently, an increasing number of public companies publishes annual sustainability reports[42]. Concerning sustainability reports, both interviewees drew attention to potential greenwashing issues and possible solutions:

"Approximately 50 per cent of data cannot come from the company itself; it must come from an independent source. We need to check the authenticity of the data from several sources, so we do cross-validation."

Furthermore, it is not sufficient what the CEO says or what the sustainability report states about protecting rainforests, local native communities or other stakeholders. For instance, Sustainalytics first examine whether corporates have a documented set of policies on managing risks associated with each relevant stakeholder. In the second phase, they verify if corporates align their everyday practices with the formal policies. To execute the second phase, Sustainalytics carry out the so-called "controversy research", which has a discounting effect: they identify corporate behaviour that violates written policies, and a controversy score is assigned to each of them. The controversy score is significantly determined by how recurring a given event is, how typical an event is for a given sector, and the strength of the impact on stakeholders. Stakeholders should be interpreted broadly, including the environment (e.g., number of animals that died due to corporate activities). The interviewee presented the technical details as follows:

"Technically, we utilise cutting edge deep learning algorithms and artificial intelligence, meaning that we usually scan 83,000 news sources daily to identify corporate incidents that violate their own rules."

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[42] ESG rating agencies collect further data from publicly available resources such as regulatory or government documents, NGOs, print and online media.

The interviewee mentioned that the general methodology changed at Sustainalytics in 2017: they have been using risk ratings since then[43]. Compared to previous ESG scores, these ratings are already suitable for direct comparisons of companies from different industries. The new scores are complex ESG metrics, distinguishing between manageable and unmanageable ESG risks made up of different MEIs for each industry (MEI stands for material ESG issues).

Finally, both interviewees confirmed that the most critical challenges for rating firms would be to enhance data quality and identify *material* ESG factors to ease corporations' reporting obligations.

Regulation

Previous interviewees pointed out the need for proper regulation. ESG reporting in line with legal requirements will be much more reliable than current more or less voluntary corporate practices, given that legislation is binding on everyone. The interviewee works at the Hungarian central bank; thus, he has a comprehensive understanding of the regulatory and supervisory aspects of ESG. He introduced the essence of the European legal framework[44].

In terms of European regulation, NFRD[45] is the starting point for a standardised reporting framework for non-financial business activities[46]. TCFD[47] recommendations, complementing NFRD, are strong standards for climate change since most market participants apply them (i.e., large corporations, banks, financial companies). The

[43] However, the company still reports the former scores as well, which range from 0 to 100. The dissertation applies these scores since the new ratings are only available from 2017. In addition, the interviewee pointed out that many of the risk ratings for the first years are iterated.

[44] The interviewee emphasised that several countries still lack an appropriate regulatory framework. Although in the European Union and even in China, regulators have already started to elaborate recommendations and laws, straightforward regulatory requirements are unspecified in many other countries, including the United States.

[45] Directive 2014/95/EU - Non-Financial Reporting Directive

[46] The interviewee pointed out that the EU only deals with environmental sustainability for now. He argued: *"Social sustainability is very much in its infancy from a regulatory point of view. In essence, its regulation does not exist very much today."*

[47] Task Force on Climate-related Financial Disclosures is a committee established by the Financial Stability Board.

interviewee shared the following practical experiences concerning NFRD and TCFD recommendations:

> *"So far, the NFRD has been taken »lightly« in the EU, in Hungary too. The Hungarian Accounting Act has integrated NFRD, but, in practice, neither companies nor audit firms have really considered it in reporting. However, audit firms' attitude has changed: today, they see it as a potentially integral part of the normal audit process. In my opinion, the combination of NFRD and TCFD will be better than professional initiatives such as GRI, SASB."*

The next piece of legislation is the Taxonomy Regulation (TR)[48], which is mandatory for all EU members and is effective from January 1, 2022. Simply put, TR defines what is green and delivers input data for NFRD. It is essential for corporates and financial markets because it defines previously very subjective definitions with scientific rigour (circa 600-page definition set). TR classifies economic activities according to EU NACE codes (e.g., electricity production) and identifies activities relevant to sustainability within this structure (e.g., wind, solar energy, biomass). Next, the regulation determines the methodology with which it is possible to calculate revenues from sustainable economic activities. Furthermore, it also calculates the proportion of sustainability-related capital expenditures (CapEx), showing what companies think about their transition risks. In this regard, the interviewee gave the following illustrative example:

> *"Today, a company's revenues might still come largely from dirty activities; however, the investment policy already shows a shift towards sustainable activities, i.e., the company's business model has been changing."*

Finally, the interviewee presented SFDR[49]. He maintained that SFDR is "the taxonomy of financial enterprises" (e.g., investment firms, pension funds, insurance companies). The regulation has entered into force in March 2021 and answers the following question: what percentage does the managed portfolio meet environmental requirements?

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[48] Regulation (EU) 2020/852

[49] Regulation (EU) 2019/2088 - Sustainable Finance Disclosure Regulation

In summary, the interviewee concluded that the whole EU legal framework enhance previously started self-regulation. Firstly, companies report their ESG performance based on NFRD and TR. Secondly, investment funds seek to build portfolios with good ESG performance. Thirdly, funds must report, based on SFDR, the extent to which their investment policy corresponds to environmental requirements. In the end, investors, based on all information they have been provided, may decide which fund to invest their savings. Hopefully, they allocate financial resources to portfolios with good ESG performance. Through this several-step information channel, companies receive feedback that investors prefer ESG-conscious behaviour; thus, it is advisable to remain or become ESG-compliant.

The final remark of the interviewee was the following:

> *"The possible impact of regulation is very indirect. The question is: will it work? The »bottleneck« is the investor: how could they be led to care about all this? Besides education and media attention, it would be helpful to introduce an indicator just like the annual percentage rate of charge (APR) related to loans, which has become a well-known notion among households. Indicators based on SFDR may play this role."*

Conclusion

In conclusion, interviews provided several informative insights. ESG approach requires long-term strategic thinking considering transition risks; hence it is more like a marathon than a 100-meter sprint. Interviewees confirmed that different ESG strategies could have different sustainability goals (cf. organisational and global sustainability). Furthermore, proper regulation and supervision are desirable and creative investment strategies are also welcomed that meet regulatory requirements. ESG scores and ESG rating agencies will play an important role in the future as well. Finally, measuring ESG's performance independently of other secondary factors such as industries and countries is essential.

3. EMPIRICAL RESEARCH

After discussing the theoretical aspects of sustainable investing, including the roles and responsibilities of shareholders in the corporate ecosystem, the dissertation now turns to the empirical analysis. It seeks to answer the following research question: is it possible to attain statistically significant superior risk-adjusted returns with ESG integration and ESG-themed investment strategies to promote sustainability?

The upcoming subchapters utilise a wide variety of statistical methods and financial models as well as performance measures to answer the previous research question. Firstly, ESG-conscious equity portfolio construction rests on a constrained weighted least squares (C-WLS) regression technique, which is, in fact, an *extended* version of the Fama-MacBeth (FM) procedure. The extended FM approach helps filter out a plethora of secondary style, industry, and country factor exposures to measure *pure* ESG performance. Evaluating pure performance is an essential requirement based on both the indications of the literature and what was suggested by the interviewees. After portfolio construction, time-series regressions applies the CAPM and different Fama-French factor models. Further, to obtain robust findings, alternative performance measures such as the delta and Sharpe ratio are employed. Statistically speaking, time-series methods include OLS HAC, EGARCH, and $GMM\text{-}IV_d$ to address several deficiencies of the usual OLS estimator.

The chapter continues as follows. Firstly, the performance of nine ESG-related themes is analysed. The dataset, methods and findings presented in this subchapter have been published in *Naffa and Fain (2020)*[50]. The next subchapter covers the performance of ESG leaders and laggards, thus introduces ESG integration strategy. The subchapter rest on the study of *Naffa and Fain (2021)*[51]. The last subchapter synthesises the two approaches and incorporates the effects of the COVID-19 pandemic. This subchapter, as an independent study, has been submitted to the Journal of Business Ethics.

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[50] Naffa, H., Fain, M., 2020. Performance measurement of ESG-themed megatrend investments in global equity markets using pure factor portfolios methodology. *PLoS ONE* 15, e0244225. https://doi.org/10.1371/journal.pone.0244225

[51] Naffa, H., Fain, M., 2021. A Factor Approach to the Performance of ESG Leaders and Laggards. *Finance Research Letters* 102073. https://doi.org/10.1016/j.frl.2021.102073

3.1. PERFORMANCE OF ESG-THEMED MEGATREND INVESTMENTS[52]

Sustainable investing has become an attractive strategy both for investors and policymakers all around the world. According to the *Global Sustainable Investment Alliance's 2018* report, sustainable investing reached USD 30.7 trillion at the start of 2018, a 34 per cent increase in two years. Also, the proportion of sustainable investments relative to total managed assets made up 33 per cent in 2018 while it was 21 per cent in 2012, which corresponds to an almost 60 per cent increase in six years. Nevertheless, due to a lack of consistent definitions, it is difficult to determine the actual size of sustainable finance worldwide; for instance, J.P. Morgan estimates 'only' USD 3 trillion (*J.P. Morgan, 2019*). *United Nations'* 2030 Agenda for Sustainable Development sets out 17 Sustainable Development Goals (SDGs) and 169 targets to balance the economic, social and environmental dimensions of sustainable development *(Ielasi and Rossolini, 2019; Martí-Ballester, 2020; United Nations, 2015*). Some of the goals are as follows: end hunger, achieve food security (SDG2), ensure healthy lives and promote well-being for all of all ages (SDG3), make cities and human settlements inclusive, safe, resilient and sustainable (SDG11).

Sustainable investing has at least 50 years of history, as the first related publications of *Belkaoui (1976)*, *Bowman and Haire (1975)*, *Bragdon and Marlin (1972)*, and *Moskowitz (1972)* appeared in the '70s. However, the concept of sustainable investing covers numerous different strategies and approaches; besides, several alternative names and terms exist. This heterogeneity in both terminology and investment strategies are apt to give rise to misunderstandings among academics and practitioners (*Capelle-Blancard and Monjon, 2012*; *Daugaard, 2019*). For simplicity, the dissertation uses the widely accepted terms of responsible investing (RI), sustainable investing (SI), socially responsible investing (SRI), environmental-social-governance (ESG) investing interchangeably throughout the chapter.

Further, according to *GSIA (2014)*, there are seven representative ESG investing strategies: exclusionary screening, best-in-class screening, norm-based screening, ESG integration, sustainability-themed investing, impact/community investing, and

[52] This chapter is based on the study of *Naffa and Fain (2020).*

corporate engagement. Sustainability-themed ESG investment strategies are the focus of the chapter. Based on the *UNCTAD (2020, p. 15)* definition, ESG-themed portfolios include stocks that only concentrate on one particular sustainability theme (e.g., gender equality or low carbon). However, stocks also belong to this group if they primarily focus on only one ESG pillar (environment, social or governance); alternatively, they track a "quasi sector", such as energy efficiency or food security. The chapter also introduces the term "megatrend", a closely related concept. *Naisbitt* and *Boesl-Bode* define megatrends as large transformative social, environmental, economic, political, and technological changes that could dramatically alter daily life (*Boesl and Bode, 2016*; *Naisbitt, 1982*).

The sustainability-themed investing approach is among the youngest ESG strategies, given that at the end of 2012, only USD 70 billion had been invested in ESG-themed funds. Since then, the strategy has shown impressive growth, with total Assets Under Management (AUM) reaching USD 1,018 million by the end of 2018. This figure corresponds to 56.23 per cent CAGR (*GSIA, 2018*). *UNCTAD (2020),* referring to Blackrock, predicts that the ESG ETF market will exceed USD 500 billion by 2030.

The chapter analyses the following nine ESG-themed megatrends: Energy efficiency, Food security, Water scarcity (environmental megatrend); Ageing, Millennials, Urbanisation (social megatrend); Cybersecurity, Disruptive technologies, Robotics (governance megatrend). The stocks in each thematic portfolio come from ESG-themed ETFs. The stock selection approach relies on signalling theory meaning that the relative amount of money inflows targeting megatrend funds signal the portfolio management industry's belief in those stocks being the best candidates to represent megatrends.

The chapter's research question examines whether megatrend investing is valid; that is, it tests if megatrend factor portfolios could generate superior returns on a risk-adjusted basis. The chapter first compares the returns to the passive strategy (viz., with CAPM alphas and Sharpe ratios relative to the market benchmark) and then measure the alpha applying various Fama-French model specifications (e.g., FF three-factor model, FF five-factor model). The research question can also be interpreted as a test of the efficient market hypothesis (EMH) (*Fama, 1970*). The empirical analysis also attempts to infer whether investing in megatrends may help achieve some of the United Nations' Sustainable Development Goals (SDGs) (see Appendix 1).

The investment universe covers global equity markets spanning January 2015 and June 2019, which is a relatively short timeframe; however, the inflows into ESG-themed funds, as mentioned above, do not have a long history, therefore limiting the reference period. Further, several studies in the corresponding literature on mutual fund performance have a similarly shorter timeframe (e.g., *Alvarez and Rodríguez, 2015*; *Muley et al., 2019*; *Reboredo et al., 2017*). Weekly trading data are sourced from Bloomberg, and the widely tracked MSCI All Country World Index (MSCI ACWI) is the benchmark. Besides ESG factors, the chapter defines eleven traditional style factors (beta, value, momentum, size, volatility, liquidity, profitability, growth, investment, leverage, and earnings variability) derived from 28 firm characteristics; 24 industry group factors (based on MSCI's global industry classification standards, GICS); and 48 individual country factors to control for secondary factors. Altogether, the analysis covers a uniquely organised database that includes approximately 15 million data points, covering roughly 2,700 individual stocks, for a period spanning 234 weeks, and measuring 92 factors (together with thematic factors).

A suitable methodology is required to capture the actual performance characteristics of the megatrend portfolios. Secondary factor exposures such as size, value, momentum, or any other factors could substantially affect the performance, i.e. these disturbing effects should be disentangled. To this end, the chapter applies pure factor portfolios, which rest on constrained WLS (CWLS) cross-sectional regressions. The cross-sectional calculations originate from the classic work of *Fama-MacBeth (Fama, 1976; Fama and MacBeth, 1973*), and it is also in line with current empirical asset pricing literature *(Back et al., 2013, 2015; Clarke et al., 2017; Fama and French, 2020*; *Menchero, 2010*; *Menchero and Ji, 2017*). Filtering out the effects of secondary factors is consistent with the creation of factor-mimicking long-short dollar-neutral portfolios. Concurrently, the analysis avoids using the 'cumbersome' double-sort quintile portfolio selection methodology introduced by *Fama and French (2015, 1996, 1992)*. Next, the analysis of the time series of megatrend portfolios' returns resulting from CWLS by employing OLS with Newey-West standard errors. The empirical section also applies a GMM estimator that relies on a new and innovative set of distance instrumental variables (GMM-IV_d) to account for the well-known phenomenon that the FF factors usually incorporate different forms of endogeneity *(Racicot, 2015; Racicot et al., 2018; Racicot and Théoret, 2014, 2012; Roy and Shijin, 2018*).

The remainder of the chapter is organised as follows. The next subchapter introduces the ESG literature, followed by a brief insight into the 'ESG-themed megatrends' concept. Then, the essential features of pure factor portfolios and the GMM-IV approach is highlighted. The megatrend portfolio construction technique is also presented in this subchapter. Subsequently, the introduction of the unique database compiled for the empirical analysis follows. The empirical results and some concluding remarks end the chapter.

3.1.1. LITERATURE REVIEW

There are many competing terms and definitions of sustainable investing. According to *Daugaard (2019, p. 4),* the term "ethical" was the commonly used expression in the early times. "Ethical" was then replaced by "socially responsible investing" (SRI). However, the relevance of "social" had become controversial and was frequently replaced with the term "sustainable" or researchers simply negligeed it; hence only the concept of "responsible investing" (RI) remained. Nowadays, "ESG" is also applied routinely. The chapter does not distinguish between these terms; therefore, it uses them interchangeably throughout the text.

Sustainable investing has rich literature that dates back to the early 1970s. The pioneering study of *Moskowitz (1972)* argues that responsible corporate behaviour might manifest in superior financial performance. The influence of Moskowitz's work is incontestable, as evidenced by the fact that the US Social Investment Forum has awarded the Moskowitz prize named in his honour since 1996 for the best article about the financial impact of socially responsible investing (*Daugaard, 2019*; *Sparkes, 2003*). In contrast to Moskowitz, *Friedman (1970)* claims that including ESG criteria in managerial decisions generates additional costs, resulting in weaker financial performance. Supplemented by neutrality and non-linear relationships (e.g., inverted U-shape), these two contradictory views have persisted until today and fundamentally determine research initiatives.

As mentioned, there exist four[53] competing hypotheses in the management literature. The first one accepts the views of Moskowitz and emphasises the positive relationship between ESG and financial performance. Various management theories underpin this concept. Stakeholder theory *(Clarkson, 1995; Freeman, 2010; Hillman and Keim, 2001; Mitchell et al., 1997*) or good management theory (*Waddock and Graves, 1998*) argue that the satisfaction of primary stakeholders (e.g., customers, employees, local communities, shareholders, natural environment) is critical in achieving superior financial performance. The second hypothesis argues for a negative relationship; namely, higher ESG performance lowers financial performance. The trade-off hypothesis (*Dam, 2008*; *Friedman, 1970*; *Preston and O'Bannon, 1997*; *Vance, 1975*) declares that higher ESG performance is expensive: resource reallocation to socially responsible activities like charity, community development do not pay off (*Preston and O'Bannon, 1997*), but higher operating costs are incurred due to internalisation of externalities (*Dam, 2008*). The third hypothesis is the "no effect" premise, often attributed to *McWilliams and Siegel (2001, 2000)*. The authors claim that incorporating R&D factors in the ESG and financial performance relationship analysis eliminates the positive impact, resulting in neutrality.

Over the past fifty years, many studies have been culminated in examining the actual relationship between ESG and financial performance. Further, parallel with primary researches, several summarising literature reviews have also been published (*Griffin and Mahon, 1997*; *Margolis and Walsh, 2003*; *McWilliams et al., 2006*; *Renneboog et al., 2008b*; *Revelli and Viviani, 2013*). The most comprehensive one is probably written by Friede et al. (2015), who combine the findings of about 2,200 individual papers using second-order meta-analysis and concluding that roughly 90 per cent of studies found a nonnegative ESG-financial performance relationship.

This chapter aims to measure the *market performance* of ESG-themed investing. Though the ESG versus market performance relation is characterised by the same three hypotheses (neutral, positive, negative) as those emphasised in the management literature, some specific facets are worth mentioning. The no-effect hypothesis is closely related to the modern portfolio theory (MPT) of *Markowitz (1952)* and the efficient market hypothesis (EMH) of *Fama (1970)*. The former argues that there is no

[53] The fourth relationship, "inverted U", is presented in detail in Subchapter 3.3.

return premium for factors that bear only idiosyncratic risk, i.e. it is assumed that ESG risks can be diversified (*Bauer et al., 2005*). The latter maintains that stock prices reflect all available and relevant information; hence it is impossible to achieve superior risk-adjusted returns relative to the market portfolio (*Bodie et al., 2018*).

Some equilibrium models support the 'trade-off' hypothesis (*Dam, 2008; Heinkel et al., 2001; Merton, 1987*). Each suggests that socially responsible stocks have a lower cost of capital either due to incomplete information (*Merton, 1987*), investor preferences (*Heinkel et al., 2001*) or the internalisation of externalities (*Dam, 2008*), which, in turn, results in higher valuation and lower future (expected) return (*Galema et al., 2008*; *Henriksson et al., 2018*). Another critical view, according to *Bauer et al. (2005, p. 1752),* is that ESG investments are likely to underperform in the long run because ESG portfolios are by nature a subset of the market portfolio, i.e. the degree of diversification is relatively lower.

Hamilton et al. (1993) and *Renneboog et al. (2008b)* claim that investors may do well while doing good. Equivalently, investors earn positive risk-adjusted returns while contributing to a good cause. Outperformance happens if ESG screening procedures generate value-relevant information otherwise not available to investors. "Value-relevant information" indicates that the "doing well while doing good" hypothesis might hold if markets misprice social responsibility; therefore, it is against the EMH.

According to GSIA, ESG-themed investments are still in their infancy, but they have exceptional growth potential, which is also supported by the fact that they achieved and maintained a 56.23 per cent CAGR between 2012 and 2018. Due to its short history, only a few studies have paid attention to ESG-themed (megatrend) investment strategies to the best of the author's knowledge. *Alvarez and Rodríguez (2015)* focused on the water sector, *Malladi (2019)* constructed children-oriented indices, *Martí-Ballester (2020)* analysed the performance of SDG mutual funds dedicated to biotechnology and healthcare sectors, while *Muley et al. (2019)* evaluated infrastructure-themed mutual fund schemes in India. Renewable energy and climate change themes are probably the most popular among scholars. *Ibikunle and Steffen (2017)* measured European green mutual fund performance; *Reboredo et al. (2017)* asked if investors pay a premium for "going green", *Martí-Ballester (2019)* also analysed sustainable energy-related mutual funds. At the same time, *Dopierała et al.*

(2020) tested whether asset allocation policy affected the performance of climate-themed mutual funds in the Scandinavian markets (Denmark, Norway, and Sweden).

3.1.2. IDENTIFYING MEGATRENDS

The chapter analyses the following nine ESG-themed megatrend equity portfolios: Energy efficiency, Food security, Water scarcity (environmental megatrend); Ageing, Millennials, Urbanisation (social megatrend); Cybersecurity, Disruptive technologies, Robotics (governance megatrend) (see Table).

Table 6. Megatrends and themes

Megatrends	Themes
Environment (E)	Energy efficiency (EE) Food security (FS) Water scarcity (WS)
Social (S)	Ageing (AG) Millennials (MI) Urbanisation (UR)
Governance (G)	Disruptive technology (DT) Cybersecurity (CS) Robotics (RO)

This table presents the nine analysed thematic portfolios. Each thematic portfolio fits either environmental, social, or governance megatrend and is consistent with thematic investing introduced in Table 5.

Classifying technological megatrends such as cybersecurity, robotics, and disruptive technologies as governance-related megatrends might not seem to be straightforward. However, *von Solms and von Solms (2018, p. 2)* highlight that corporate boards are realising that protecting their companies in cyberspace is, in fact, a corporate governance responsibility; consequently, they are accountable for the related cyber risks in their companies. According to *Fenwick and Vermeulen (2019, pp. 2–3),* disruptive technologies and robotics continue to facilitate and drive more dispersed forms of corporate organisation – what they call "*community-driven corporate organisation and governance*". The authors also maintain that technological changes enhance the "*decentralisation and disintermediation*" of business organisations, i.e., these disrupt traditional hierarchical forms. Summing up, the G-themed megatrend portfolios include firms that provide technological solutions related to specific governance issues. Each megatrend portfolio can be considered as “quasi-sectors” that, at the same time, address ESG concerns.

Besides technological G megatrends, the paragraphs below provide a summary of the investment policies of the E and S themes. *Energy efficiency* megatrend invests in companies that provide products and services, enabling a more sustainable energy sector (for instance, solar and wind energy). Current primary energy demand accounts for 7-9 per cent of GDP, and it is expected to grow by at least 1/3 by 2035; hence energy efficiency standards are continuously rising. *Food security* theme focuses on companies that operate mainly in agribusinesses: agricultural equipment, agribusiness and protein, farming, safety inspection firms, health and wellness, waste reduction. The *water scarcity* theme tracks companies that create products to conserve and purify water for homes, businesses and industries since 750 million people do not have access to clean drinking water.

Ageing aims to track the performance of developed and emerging market companies exposed to the growing purchasing power of the ageing population. Older persons (older than 60) are expected to more than double from 841 million in 2013 to above 2 billion by 2050. Specific industry sectors are healthcare, insurance, senior living. *Millennials* portfolio seeks to track the performance of companies that provide exposure to the millennial generation. Millennials are emerging as a new dominant economic force. They are the largest generation by workforce headcount in the US. Attractive sectors for millennials are accommodation, autos, finance, media, technology, and travel. *Urbanisation* has been designed to replicate, to the extent possible, the performance of energy, industrial, and utility stocks, i.e. mainly infrastructure companies. The world’s urban population is expected to surpass 6 billion by 2045; therefore, investments that include home-building, infrastructure construction, civil engineering, air and road transport, and utilities could have immense potential.

The dissertation relies here on signalling theory to select stocks from ESG-themed ETFs and allocate them into thematic megatrend portfolios. *Spence (1973)* states that signalling theory explains how decision-makers interpret and react in incomplete and asymmetrically distributed information among parties to a particular transaction. The theory has its foundation on the premise that one party (e.g., seller) has complete information while external parties (e.g., buyers) have to rely on what the seller wishes to share. *Bergh and Gibbons (2011)* emphasise that one way for buyers to reduce their risks is to identify observable characteristics that affect the probability of the seller's performance. Such a characteristic is known as a signal. *Spence (1974)* defines a signal as activities and characteristics which are visible and convey information in a market. According to *Connelly et al. (2011)*, signals are proper to reduce information asymmetry. Further, they form credible communication that transmits information from sellers to buyers (*Bergh and Gibbons, 2011*).

In the dissertation, ETF portfolio managers' (i.e., sellers) stock selection practices indicate (signal) to investors and analysts (i.e., buyers) that the companies they have carefully chosen are suitable for megatrend investment. Consequently, the relative amount of money inflows into megatrend funds signals the market's belief in those stocks being the best candidates to represent megatrends. The dissertation's signalling theory approach rests on the assumption that market participants (viz., ETF portfolio managers) intend to select stocks that do belong to the various ESG megatrends. Conversely, if the stocks are "conventional" and the ESG megatrend flag is only used as a "buzzword", we may come to a wrong conclusion on the megatrends' market performance. *Revelli and Viviani (2015)* also raise this problem, which is the well-known concept of "green-washing" (*Jo and Na, 2012; Lin, 2010*). The next subchapter introduces the formula to calculate a company's exposure to a particular megatrend.

3.1.3. METHODOLOGY

As *Clarke et al. (2014, 2017)* argue, the performance measurement of investment strategies requires two phases. The first one is to implement cross-sectional analyses (not necessarily regressions) to calculate factor returns (for a comprehensive summary of various factor models, see *Walter and Berlinger, 1999*). Secondly, time-series analyses (again, not necessarily regressions, see *Fama and French, 2020*) are applied to estimate portfolio alphas and sensitivities to the predetermined set of factors. In the literature, the *Fama and French (2015, 1996, 1992) (FF)* and the *Fama-MacBeth* (*Fama, 1976; Fama and MacBeth, 1973*) *(FM)* procedures are the two most commonly employed approaches to attain factor returns. The empirical analysis rests on FM; however, in the following paragraphs, a brief comparison of the underlying "philosophy" of the two methods are presented to justify the choice. Next, the mathematical background of the FM method and the innovative GMM-IV$_d$ used for times series analysis is introduced. The subchapter ends with the formula applied to calculate megatrend exposures.

FF's well-known portfolio sorting technique is the dominant analysis tool in empirical asset pricing. Despite several favourable properties, such as simplicity or the lack of any required functional format, it also has some drawbacks. One is that extending the number of explanatory factors beyond a certain number makes the modelling cumbersome (*Clarke et al., 2017*). Another problematic issue is the quasi arbitrary choice of the number of securities in the top and bottom portfolios (i.e. quintiles, deciles), which results in the exclusion of many stocks; thus, valuable information is lost (*Mérő et al., 2020*). Further, Fama-French rebalances the portfolios underlying SMB, HML, RMW, CMA only annually (at the end of June); that is, the factors might rely on stale information (*Asness and Frazzini, 2013*; *Back et al., 2013*). Finally, in their recent article *Fama and French (2020, p. 1893)* summarise the essence of the FF5 factor *time-series analysis* as follows: "*it optimises the loadings on factors that are, in fact, not themselves optimised*".

The FM method applies regressions that correct most of the FF procedure's drawbacks but introduces new ones. Firstly, it simultaneously controls for several secondary exposures, which is indeed a crucial requirement. Next, it uses the whole investment universe, not just the top and bottom quantiles. Further, it rebalances the factor portfolios at the beginning of each period. The drawbacks are the following: it is parametric (requires a strict functional format), endogeneity problems may emerge (e.g. errors-in-variables), and microcaps as wells as influential observations could have a significant impact (*Fama and French, 2008*).

Turning to the time series analysis method, *Fama and French (2020)* emphasise four approaches of applying the output of cross-sectional analyses (either FF or FM) to explain market anomalies. The first one (*I.*) is the traditional FF modelling technique using time-series (TS) FF factors (i.e., SMB, HML, RMW, CMA) in time-series regressions. The second (*II.*) is to apply cross-sectional (CS) FM factor returns in time-series regressions. The next approach (*III.*) is about "stacking" FM (CS) regressions across periods (*t*); thus, it becomes an asset pricing model (model, not regression) that can be used in time-series applications. Finally, the application of an approach that augments the FF TS modelling procedure with interaction variables that allow loadings for SMB, HML, RMW, and CMA to vary with the corresponding firm characteristics of FM (*IV.*).

The empirical chapter of the dissertation uses the second approach (*II.*) to analyse the risk-adjusted performance of ESG-themed megatrend factor portfolios. *Back et al. (2013)* applied (*II.*) and found that it explains five market anomalies out of thirteen, while FF (i.e., *I.*) was not able to clarify any of them. *Fama and French (2020, p. 1913)* evaluate the performance of the four modelling techniques and argue that (*II.*) performs "a bit better" than (*I.*). However, the authors contend that (*III.*) provide a better description of returns than the other ones. Nevertheless, it is worth keeping in mind the remark by *Back et al. (2013, p. 4)* that in the absence of an accepted theory explaining why there are risk premia associated with size, value, profitability, and investment; there cannot be a universally best method to define factors based on these characteristics.

Pure factor portfolios

Pure factor portfolio (PFP) construction rests on constrained multivariate cross-sectional regression analysis. Variants of the methodological details presented in this section can be found, inter alia, in *Andersson et al. (2016)*, *Clarke et al. (2014, 2017)*, *Menchero (2010)*, *Menchero and Ji (2017)*, and *Menchero and Lee (2015)*. Furthermore, cross-sectional regressions are the basis of fundamental equity risk factor models provided by firms such as Axioma, Bloomberg, and MSCI (*Clarke et al., 2014*). The applied factors and firm characteristics rest on the Bloomberg fundamental factor model (see *Cahan and Ji, 2015*), although some modifications are introduced.

Pure factor portfolios have the advantage of removing many secondary factor effects without having a "black box" nature of portfolio construction. Filtering out secondary factor exposures and isolating the effects of ESG factors, as mentioned above, is a crucial methodological requirement (*Revelli and Viviani, 2015*). *Galema et al. (2008)* show that the book-to-market factor of the Fama-French model could incorporate some of the ESG characteristics. In the 1980s, *Grossman and Sharpe (1986)* also found that the positive market-relative performance of the South Africa-free portfolios can be attributed to the small firm size effect.

The upcoming paragraphs first outline the original FM procedure briefly, then the mathematical background of the *extended* FM approach. Finally, the two methods are compared. The following mathematical derivation of the FM method and supplemental explanations can be found, among others, in *Fama (1976, pp. 326–329)*, *Fama-French (2020)*, *Cochrane (2005)*, and *Back et al. (2015, 2013)*. The FM estimator is calculated by running cross-sectional regressions at each moment in time. With matrix algebra notation:

$$R_{t+1} \; = \; Z_t \hat{F}_{t+1} \; + \; u_{t+1} \;\;, \tag{1}$$

where R_{t+1} is the ($N \: x \: 1$) vector of stock returns on N individual securities from t to $t+1$; Z_t is the ($N \: x \: K$) matrix of standardised firm characteristics at date t (z-scores), with a vector of ones as its first column; $\hat{F}_{t+1}$ is the ($K \: x \: 1$) vector of the ordinary least squares (OLS) values of the regression coefficients at $t+1$, and u_{t+1} is the ($N \: x \: 1$) vector of security return disturbances for $t+1$ (K is the number of explanatory variables, including the market).

The OLS values for the regression coefficients are as follows:

$$\hat{F}_{t+1} \; = \; (Z'_t Z_t)^{-1} Z'_t R_{t+1} \tag{2}$$

Note that the individual security weights in each factor portfolio are the elements of matrix W_t:

$$W_t \; \stackrel{\text{def}}{=} \; (Z'_t Z_t)^{-1} Z'_t \tag{3}$$

One must emphasise that the portfolio weights are observable at t, even though the returns, hence the slope coefficients (F), are not observable until $t + 1$.

To determine the properties of the slope coefficients, one should study the properties of Z_t. Note first that

$$W_t \, Z_t \; = \; (Z'_t Z_t)^{-1} Z'_t \, Z_t \; = \; I_t \;, \tag{4}$$

where I_t is the ($K \: x \: K$) identity matrix. Given (4) and the fact that the first column of Z_t is an ($N \: x \: 1$) vector of 1's, the FM procedure has some notable features (*Fama and French, 2020, p. 1892*). Firstly, the F coefficients for each variable in an FM cross-section regression is the $t+1$ return on a portfolio of the left-hand-side assets with weights for the assets that set the month t portfolio exposure of that given variable to one and zero to other explanatory variables. Secondly, each FM slope portfolio requires zero net investment; that is, the short positions of the left-hand-side assets finance the long positions in other left-hand-side assets. Finally, the intercept is the month $t+1$ return on a standard portfolio of the left-hand-side (LHS) assets with security weights that sum to one and zero out each explanatory variable. The intercept, which is the level return, is the month $t+1$ return common to all assets and not captured by the regression explanatory variables.

From a mathematical-statistical perspective, the *dissertation's* pure factor portfolios (viz., FM procedure) rest on constrained weighted least squares (CWLS) multivariate cross-sectional regressions, explained in more details below.

The dissertation aims to compare the performance of pure megatrend factor portfolios with the benchmark market index and other traditional FF factors to find out whether megatrend factors could outperform it. To this end, market returns, and pure factor portfolio returns are calculated. PFP return calculation rests on the following formula:

$$pr_{t+1} = \sum_{i=1}^{N} pw_{nt} * r_{nt+1} \, , \tag{5}$$

where pr_{t+1} is the return of the given PFP at $t+1$, pw_{nt} is the pure factor weight of security n at date t, and r_{nt+1} is the return of security n at $t+1$.

The construction of PFPs uses traditional investment styles such as value, momentum, size or industries and countries measured by dummy variables. Calculation of stock weights rests on multi-factor constrained WLS regressions. By calculating the weights, the given factor portfolio will have a unit exposure relative to the benchmark. Parallel, it has market-neutral exposures to all other styles, including industries and countries. Industry and country neutrality means that the pure style portfolio has the same industry and country structure as the benchmark. PFPs are "fully invested" long-short factor mimicking portfolios. To sum up, the critical issue is to measure pure stock weights, $pw_{nt.}$

The starting point is to write the cross-sectional regression equation on stock returns (for convenience, the "hat" operator is dropped from now on):

$$r_{nt+1} = r_{Mt+1} + \sum_{s} z_{nst} f_{st+1} + \sum_{i} x_{nit} f_{it+1} + \sum_{s} x_{nct} f_{ct+1} + u_{nt+1} \, , \tag{6}$$

where r_{nt+1} is the return of stock n at $t+1$, r_{Mt+1} is the return of the market factor at $t+1$, z_{nst} is the standardised exposure of stock n to style factor s at time t, f_{st+1} is the active (market-relative) return of the style factor at time *t*. Similarly, x_{nit} and x_{nct} are the exposures of stock *n* to industry *i* and country *c* at *t*; f_{it+1} and f_{ct+1} are active returns for industry *i* and country *c* at time *t*. The u_{nt+1} is unexplained by the factors and is termed idiosyncratic or stock-specific. The stock-specific returns are assumed to be mutually uncorrelated and uncorrelated with the model factors.

From (6), it is apparent that every stock has unit exposure to the market factor (i.e., this average return is "modified"' by the *f* active returns). By contrast, dummy variables represent the country and industry exposures: a stock has unit exposure to its industry and country and zero exposures to all the others. Style factor exposures are standardised scores (z-scores), which have a capitalisation-weighted mean of zero and standard deviation of one (i.e., stocks with negative exposure score below the average of the market).

Weighted standardisation (*Clarke et al., 2017, 2014*) should be used for the rescaling process of raw or prior style exposures (e.g., P/E ratios for the value factor). This procedure ensures the consistency between the weighting scheme of the benchmark and the weights used to rescale prior style factor exposures. Since the benchmark is the MSCI ACWI Index, a cap-weighted index, the market capitalisation-weighting scheme is applied. The formula is as follows:

$$z_{ns} = \frac{x_{ns} - \sum_{n=1}^{N} w_{nM} * x_{ns}}{\sqrt{\sum_{n=1}^{N} w_{nM} * x_{ns}^2 - \left(\sum_{n=1}^{N} w_{nM} * x_{ns}\right)^2}} \,, \quad (7)$$

where x_{ns} is the prior exposure of security *n* to a particular style factor *s*, w_{nM} is the market weight of security *n*. In the numerator, the capitalisation-weighted average of the prior exposure of style *s* is subtracted from the prior style exposure x_{ns}, and then the difference is divided by the standard deviation of the prior exposure.

After introducing the cap-weighted standardisation convention, the more convenient matrix notation of (6) is used. Note that (8) is the same as (1):

$$R_{t+1} = Z_t F_{t+1} + u_{t+1} \,, \quad (8)$$

where R_{t+1} is the $(N \ x \ 1)$ vector of stock returns at time $t+1$, Z_t is the $(N \ x \ K)$ standardised factor exposure matrix (using (7)), F_{t+1} is the $(K \ x \ 1)$ vector of active factor returns, and u_{t+1} is the $(N \ x \ 1)$ vector of unexplained residuals (the first element of vector *F* is the market return, which is, by definition, not an active return). *K* equals the total number of factors, including the market factor; hence, the first column of Z_t contains 1's (exposures to the market factor). The exposure matrix is labelled with "Z", although not all the values are standardised: market, industry and country factor exposures are one and (0, 1), respectively.

One must recognise two exact collinearities in the model as the sum of industry and country factor exposures give one each (i.e., identical to the market factor). Equivalently, only *K-2* variables are genuinely independent; therefore, one must impose two constraints to obtain the Z matrix to have linearly independent columns (without constraints, the regression cannot be solved as $(Z'Z)^{-1}$ does not exist, i.e., it is singular). The sum of industry and country returns equals the market return; hence, the market-relative industry and country returns should equal zero. *Heston and Rouwenhorst (1994)* and *Menchero (2010)* applied these equations to eliminate exact multicollinearity. The simple mathematical formulae are as follows (w_{it} and w_{ct} are the market capitalisations for each i industry and c country factor at time t):

$$\sum_i w_{it} f_{it+1} = 0 \quad (9)$$

$$\sum_c w_{ct} f_{ct+1} = 0 \quad (10)$$

The constraints in matrix form are as follows:

$$F_{t+1} = C_t G_{t+1} \,, \quad (11)$$

where C_t is the $K \times (K - 2)$ constraint matrix at date t, and G_{t+1} is the $(K - 2) \times 1$ vector of auxiliary returns in time $t+1$. Below (12) is an example for $C_t G_{t+1}$. Here, for the sake of simplicity, four factors, including the market and three industry factors, are involved; therefore, only one constraint is applied:

$$\begin{bmatrix} r_M \\ f_{i1} \\ f_{i2} \\ f_{i3} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & w_{i1}/w_{i3} & w_{i2}/w_{i3} \end{bmatrix} \begin{bmatrix} g_M \\ g_{i1} \\ g_{i2} \end{bmatrix} , \quad (12)$$

The heteroscedastic nature of the stock-specific returns (u_{t+1}) and the influence of small stocks is well-known; therefore, weighted least squares (WLS) regressions ought to be applied. There are more technical opportunities to manage these challenges; therefore, the dissertation follows *Clarke et al. (2014)* when market capitalisations are utilised as weights. The authors argue that it is pretty common to use equal weights and "square-root-of-market-capitalisation-weights" (many commercial risk-factor models use this); the latter produces similar results capitalisation weighting scheme.

The ($N \; x \; N$) V_t diagonal matrix is used in (13), and C_tG_{t+1} in (11) is substituted for F_{t+1}. The diagonal elements of V_t are the securities' market capitalisations (w_{nM}) at t:

$$V_tR_{t+1} = V_tZ_tC_tG_{t+1} + V_tu_{t+1} \; , \tag{13}$$

Some changes in the variables make (13) a bit simpler ($\tilde{R}_{t+1}= V_tR_{t+1}$, $Y_t= V_tZ_tC_t$ and $\tilde{u}_{t+1} =V_tu_{t+1}$):

$$\tilde{R}_{t+1} = Y_tG_{t+1} + \; \tilde{u}_{t+1} \; . \tag{14}$$

Equation (14) is the standard homoscedastic regression formula again. The OLS solution is as follows:

$$G_{t+1} = (Y_t{}'Y_t)^{-1}Y_t{}'\tilde{R}_{t+1} \; . \tag{15}$$

After making some substitutions to transform back the variables, the final solution is as follows:

$$F_{t+1} = C_t(C_t{}'Z_t{}'V_tZ_tC_t)^{-1}C_t{}'Z_t{}'V_tR_{t+1} \; . \tag{16}$$

Next, in (17), the *(K x N)* matrix denotes pure factor active weights of securities (PW_t). Active weights mean, similarly to active returns, the weight of securities above or below the market weights, i.e. the over- or underweighting relative to the market:

$$PW_t \stackrel{\text{def}}{=} C_t(C'{}_tZ_t{}'V_tZ_tC_t)^{-1}C_t{}'Z_t{}'V_t \; . \tag{17}$$

According to (17), the active security weights in PFPs can be calculated directly by using the cap-weighted standardisation procedure for firm characteristics based on (7). The product of pure security active weights and the realised stock returns is the return of the pure factor portfolio in (5). The calculation of PFP returns can be derived alternatively, by using the slope coefficients (i.e., market return and factor portfolio active returns) in the CWLS cross-sectional regression of stock returns, R_{t+1}, on standardised factor exposures, Z_t, in equations (8) or, equivalently, in (16).

At last, below comes a comparison of the weight matrices of the original (W_t in (3)) and the modified FM procedure (PW_t in (17)) to summarise the differences. The adapted CWLS regression has the following enhancement compared to the classical *Fama-MacBeth* regression technique. The formulae presented above and the explanations below, regarding the improvements of the classic FM, is the "merger" of the studies of *Clarke et al. (2017, p. 77 and online Appendix A)* and *Menchero (2010)*.

If one looks at the formulae, the first impression may be that (17) is more intricate; that is, it indeed considers issues that (3) does not. Firstly, the observations in each cross-sectional regression are weighted by market capitalisation, viz., V_t diagonal matrix is used, missing in (3). Thus, including smaller stocks has little impact on the regression results, except that more missing or outlier values emerge among the explanatory variables. Secondly, each style and megatrend characteristics are shifted every period to have a cross-sectional capitalisation-weighted mean of zero. Together with observation weighting, this step makes the estimated regression intercept precisely equal to the return on a capitalisation-weighted portfolio of all admitted stocks. Non-zero values for the other four types of factors then measure exposures relative to the market portfolio. Further, every descriptor is scaled each period to have a cross-sectional standard deviation of one. In summary, (17) applies the "mean" and the "scale" adjustments for the firm characteristics based on capitalisation weighted standardisation of (7) while (3) uses arithmetic (i.e., equal-weighted) means and standard deviations for standardisation. Finally, the extended method uses constraints (C_t) to manage exact multicollinearities, consequently filtering out secondary industry and country exposures, which is not the case for the original FM method.

Times-series analysis with GMM-IV$_d$

After calculating PFP returns, the next step is measuring and testing the megatrend portfolios' alphas using time-series regressions. The empirical subchapter covers the tests of the traditional CAPM, the Fama-French-Carhart (FFC), the Fama-French 5 factor (FF5) and the augmented version of the FF5 factor model that includes liquidity as a sixth factor (FF5L). Equation (18) is the CAPM:

$$RP_{et} = \alpha_e + b_{1e} MRP_t + u_{et}, \tag{18}$$

where RP_{et} is the excess return (R_{et} - R_{ft}) of megatrend e at t (e is the abbreviation for ESG-themed megatrend); R_{ft} is the one-year US Treasury bill rate; α_e is the Jensen's alpha; MRP_t is the market risk premium ($R_{Mt} - R_{ft}$) at t; b_{1e} is the beta of megatrend e (sensitivity to the market), and u_{et} is the error term. CAPM is an appropriate model for testing the performance of ESG-themed investments relative to the passive strategy.

Equation (19) is the Fama-French-Carhart four-factor model (FFC):

$$RP_{et} = \alpha_e + b_{1e}\,MRP_t + b_{2e}\,F_{SIZEt} + b_{3e}\,F_{VALUEt} + b_{4e}\,F_{MOMt} + u_{et}, \quad (19)$$

where F_{SIZEt}, F_{VALUEt}, F_{MOMt} are, respectively, the market-relative pure factor returns from (16) for size, value, and momentum firm characteristics. The regression coefficients b_{2e}, b_{3e}, b_{4e} are the ESG-themed portfolios' sensitivities to the prespecified factors. FFC model is employed to account for the effects of momentum.

The next model is the FF5 factor model:

$$RP_{et} = \alpha_e + b_{1e}\,MRP_t + b_{2e}\,F_{SIZEt} + b_{3e}\,F_{VALUEt} + b_{4e}\,F_{PROITt} + b_{5e}\,F_{INVt} + u_{et}, \quad (20)$$

where $F_{PROFITt}$, F_{INVt} are PFP returns for profitability and investment factors. The coefficients b_{4e} and b_{5e} are the left-hand-side assets' sensitivities to profitability and investment factors.

The last model is the FF5 augmented with a liquidity factor:

$$RP_{et} = \alpha_e + b_{1e}\,MRP_t + b_{2e}\,F_{SIZEt} + b_{3e}\,F_{VALUEt} + b_{4e}\,F_{PROITt} + b_{5e}\,F_{INVt} + b_{6e}F_{LIQt} + u_{et}, \quad (21)$$

In the empirical asset pricing literature, it is common to identify new factors besides traditional Fama-French exposures (*Cochrane, 2011*, thus not inadvertently uses the term "zoo of factors"). The effect of liquidity or illiquidity is undoubtedly in researchers' focus (see *Amihud, 2002*; *Pástor and Stambaugh, 2003*; or *Racicot et al., 2019*). Beyond liquidity, the applied factors are, in fact, very diverse: *López-García et al. (2019)* applied a long term memory factor, *Chan et al. (2001)* used R&D and advertising expenses, *Thomas and Zhang (2002)* analysed the performance of inventory changes.

The critical methodological question is how to estimate the coefficients of each equation. Two methods are applied: 1.) traditional OLS with *Newey-West* (HAC) standard errors (*Newey and West, 1987*), and 2.) generalised method of moments using innovative, robust distance instrumental variables (GMM-IV_d), referring to *Racicot (2015)*, *Racicot and Rentz (2015)*, *Racicot and Théoret (2012)* and *Roy and Shijin (2018)*. The GMM-IV_d method is suitable to address the various manifestations of endogeneity inherent in factor models (*Ferson, 2019*). According to Racicot (2015), the GMM-IV_d approach provides solutions to measurement errors and specification errors.

Following *Racicot and Rentz (2015)*, the GMM estimator in (22) chooses the value, $\hat{b}_e$, that minimises a quadratic function of the moment conditions. The estimator is defined as follow (we changed the notation of *Racicot and Rentz* slightly to have consistent formulae with previous equations):

$$\hat{b}_e \equiv argmin_{\hat{b}_e} \left\{T^{-1}\left[d'\left(RP - F\hat{b}_e\right)\right]' W T^{-1}\left[d'\left(RP - F\hat{b}_e\right)\right]\right\} \quad (22)$$

The GMM-IV_d estimator makes the moment conditions as close to zero as possible. Each variable in (22) is defined below from (23) to (34). In (22), *T* is the total number of observations (i.e. periods $t = 1,\ldots,T$). *W* is a symmetric positive-definite matrix known as a weight matrix with the same number of rows and columns as the number of columns of *d*. W is estimated with the Newey-West HAC estimator. RP is defined as follow:

$$RP = F\hat{b}_e + u \quad (23)$$

where *F* is assumed to be an unobserved matrix of explanatory variables. The observed matrix of observed variables is assumed to be measured with normally distributed error:

$$F^* = F + v \quad (24)$$

$\hat{b}_e$ is defined as:

$$\hat{b}_e = \hat{b}_{e2SLS} = (F'P_Z F)^{-1} F'P_Z RE \quad (25)$$

P_z is defined as the standard ‘predicted value maker’ or ‘projection matrix’ used to compute:

$$P_Z = Z(Z'Z)^{-1}Z', \quad (26)$$

In (26), *Z* is the matrix of instruments (should not be confused with *Z* from the previous section). Here, Z is obtained by optimally combining the *Durbin (1954)* and *Pal (1980)* estimators using GLS.

Using the projection matrix, the formula for the predicted values of *F* is as follows:

$$P_Z F = Z(Z'Z)^{-1}Z'F = Z\hat{\theta} = \hat{F} \quad (27)$$

From (27) extract the matrix of residuals:

$$d = F - \hat{F} = F - P_Z F = (I - P_Z)F \tag{28}$$

In (28), *d* is a matrix of instruments that can be defined *individually* in deviation form as

$$d_{it} = f_{it} - \hat{f}_{it} \tag{29}$$

As *Racicot (2015, p. 986)* highlights, Equation (29) may be considered a filtered version of the endogenous variables. It removes some of the nonlinearities embedded in the f_{it}. Formula (29) is thus a smoothed version of f_{it}, which might be regarded as a proxy for its long-term expected value, the relevant variables in the asset pricing models being theoretically defined on the explanatory variables' expected values.

The next step is to calculate the values of $\hat{f}_{it}$ which is obtained by performing OLS regressions based on the *z* (cumulant) instruments:

$$f_{it} = \hat{\gamma}_0 + z\hat{\varphi} + \varsigma_t = \hat{f}_{it} + \varsigma_t \tag{30}$$

(30) amounts to running a polynomial adjustment on each explanatory variable.

The z instruments are defined as $z = \{z_0, z_1, z_2\}$, where

$$z_0 = \iota_T \tag{31}$$

$$z_1 = f \odot f \tag{32}$$

$$z_2 = f \odot f \odot f - 3f\,[(D(f'f/T)] \tag{33}$$

$$D(f'f/T) = p \lim_{T \to \infty} (f'f/T) \odot I_k \tag{34}$$

In (31), ι_T stands for a vector of one (*T x 1*). In (32)-(34), *f* is the matrix of the explanatory variables expressed in deviation from their mean; the operator ⊙ is the Hadamard product; *D(f'f/T)* is a diagonal matrix, and I_k is an identity matrix where *k* is the number of explanatory variables. Again, z_1 contains the instruments used in the *Durbin (1954)* estimator, and z_2 contains the cumulant instruments employed by *Pal (1980)*. *Racicot and Rentz (2015, p. 332)* emphasise that the assumption of normality is a sufficient condition for the estimators to be consistent once measurement errors are purged using these third and fourth cross-sample moments as instruments.

Calculating megatrend factor exposures – a new mathematical formula

To quantify *megatrend exposures,* the application of dummy variables would seem an obvious solution: one could collect exchange-traded funds (ETFs) that consider themselves as thematic investment funds, then each company in these ETFs are classified into a particular megatrend, hence get a value of one. Those firms that are not listed in any of the thematic ETFs get a value of zero. In contrast, the idea in the dissertation is that megatrend exposures ought to be measured on a ratio scale as companies are different regarding how much they are affected by different megatrends, viz., how well they fit into megatrends. Further, applying dummy variables would introduce another exact multicollinearity in the model, which is, in fact, not a real challenge to handle but makes the modelling a bit more complicated. The applied formula for megatrend exposures is, therefore, as follows:

$$MTE_{nmt} = \frac{\sum_{e=1}^{E} FI_{nmt}}{MCap_{nt}}\,, \tag{35}$$

where MTE_{nmt} is the megatrend exposure of stock *n* in megatrend *m* at time *t*. FI_{nmt} is the total fund inflow (the total number of share *n* multiplied by its stock price) into ETF *e* that invests in stock *n* and belongs to a particular megatrend *m* at time *t* (there are a total of *E* ETFs), and $MCap_{nt}$ is the total market capitalisation of stock *n* at time *t*. The higher the ratio, the higher the exposure of a given stock to a particular megatrend *m*.

37 ETFs are analysed, considering themselves as thematic funds to get *FIs* (Appendix 2). All the ETFs had more than USD 40 million AUM at the end of September 2019 (September 27, 2019) and the total managed assets was USD 16,943 million. Due to data limitations, constant positions are used (i..e, the number of stocks remains unchanged during the entire period and reflects positions of September 20, 2019.). Nevertheless, the stock prices vary weekly to quantify fund inflows for each week between 2015 and 2019.

3.1.4. DATASET

To obtain valid results, the sound choice of the investment universe is essential. According to *Cahan and Ji (2015),* there are two types of security universes: coverage universe and estimation universe. Throughout the dissertation, we employ a global investor perspective; that is, the *coverage universe* includes theoretically "all" stocks traded in global markets. However, for practical reasons, a widely accepted index satisfies research goals. The MSCI All Country World Index (MSCI ACW) is studied, which had more than 2.700 constituents at the end of 2018. The *estimation universe* is the subset of stocks from the coverage universe utilised to construct pure factor portfolios. The availability of critical variables such as stock prices, total returns, and market capitalisations – besides standard data cleansing procedures – determines the size of the estimation universe.

Weekly stock data are collected from Bloomberg covering January 2015 and June 2019 on MSCI ACWI Index members to calculate total returns, 9 thematic exposures, 28 prior style descriptor exposures, 24 industry (based on second level GICS) and 48 country dummies. Prior style *descriptors* are the inputs to compute style *factor* exposures by employing principal component analysis (PCA). As a result of PCA, eleven style factors are produced (see Table 7). Appendix 3 contains the detailed descriptions, calculation methods and applied Bloomberg codes related to each factor.

Table 7. Pure style factors and factor-related descriptors

Factor	Descriptor
Beta (B)	Market-relative beta: *Beta-1*
Value (V)	E/P CF/P BV/P
Momentum (M)	Return momentum Price momentum Sharpe-momentum
Size (S)	-ln(MCap) -ln(Assets) -ln(Sales)
Volatility (Vol)	Total volatility Residual volatility Price range
Liquidity (L)	*Amihud* liquidity ratio
Profitability (P)	ROE ROA ROIC/WACC Profit margin

Table 7. *(Continued)*

Factor	Descriptor
Growth (G)	EBT growth Net income growth Sales growth
Investment (I)	Asset growth
Leverage (L)	Book leverage Market leverage Debts/Assets
Earnings variability (EV)	Sales variability Net income variability FCFF variability

The first column of this table presents the 11 style factors used in the FM procedure as control variables to construct ESG-themed pure factor portfolios. Principal component analysis (PCA) is used to merge descriptors into factors. Bloomberg's US fundamental factor model served as a starting point for variable (i.e., descriptor) selection (see *Cahan and Ji, 2015*).

All the traded stocks between 2015 and 2019 are analysed, which helps eliminate survivorship bias. For precise statistical inference, data cleansing procedures were performed on a year-by-year basis. First, each corporation was excluded that did not have, for any reasons, market price, total return, or market capitalisation. Second, the so-called penny stocks were removed[54], in line with *Back et al. (2013)* and *Fama and French (2008)*.

Despite best efforts, there were missing values for several descriptors and many firms, which is not surprising as several, 28 company characteristics are analysed. Appendix 4 presents the proportion of missing observations: one can see that 1.81 per cent of observations are missing, which is relatively moderate (CF/P has the highest missing rate with 12.01 per cent); however, this represents 200-300 companies (i.e., many firms have only a few missing values). One solution could have been to delete these observations listwise; however, that would have decreased the sample size radically. Instead, multiple imputations (MI) procedure were implemented (see *Rubin, 1987*). Due to the relatively low proportion of missing data, only three imputations were executed. MI utilised the Markov Chain Monte Carlo (MCMC) imputation procedure with all the 28 descriptors.

[54] Stocks, which had a maximum price of below five dollars in a given year.

The MCMC procedure assumes that each variable in the imputation model has a joint multivariate normal distribution (MVN), probably the most common parametric approach for MI (*UCLA: Statistical Consulting Group, 2020*). The specific algorithm used is called the data augmentation (DA) algorithm, an iterative MCMC procedure, which fills in the gaps by drawing from a conditional distribution. Here, the hypothesised distribution was an MVN of the missing data given the observed data (for a detailed explanation of DA in the Stata environment, see *StataCorp LP, 2013*). In most cases, simulation studies have concluded that the assumption of MVN leads to reliable estimates even if the normality assumption is violated given sufficient sample size (*Demirtas et al., 2008*; *Lee and Carlin, 2010*). Table 8 summarises the sample size year by year, suggesting a large dataset. Consequently, the MCMC is an appropriate procedure for the analysis.

Table 8. Sample size after data cleansing and multiple imputation procedures

Sample size	2015	2016	2017	2018	2019
MSCI ACWI members (30th June)	2 483	2 481	2 500	2 781	2 849
Companies in the final sample	1 915	1 893	1 953	2 031	2 040
Sample size/MSCI ACWI members	77.12%	76.30%	78.12%	73.03%	71.60%

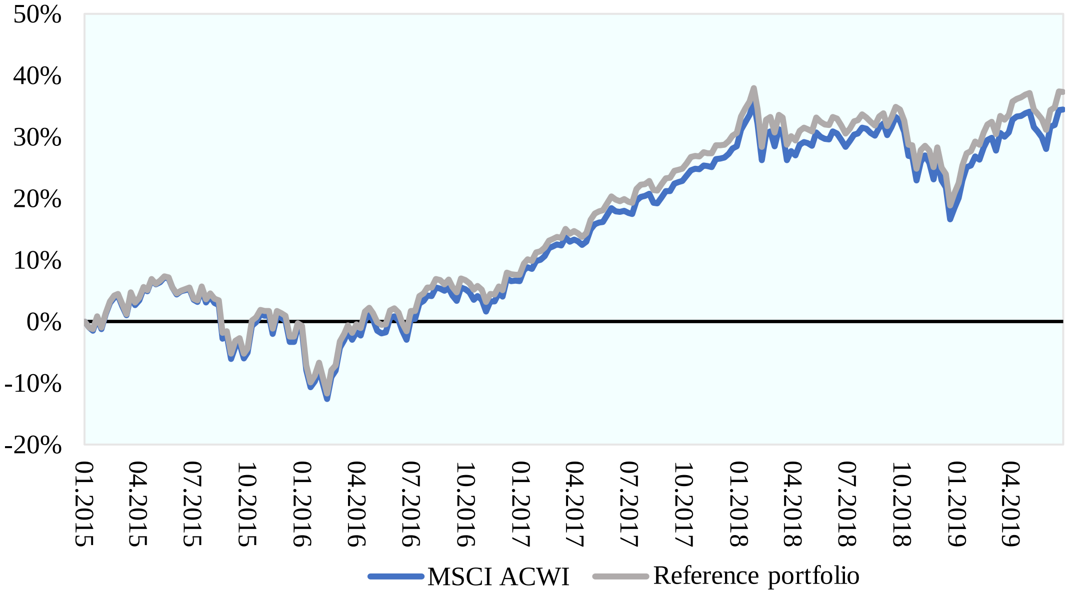
This table summarises MSCI ACWI members ("coverage universe") between 2015 and 2019. Further, it contains the final sample size ("estimation universe") after data cleansing and multiple imputations (MI).

In the next, winsorisation limits were specified to ensure that extreme values would not affect statistical inferences. The limits were the 1st and the 99th percentiles of descriptors; viz., each extreme descriptor value is replaced with the corresponding the 1st and 99th percentile.

The estimation universe covers on average 75 per cent of the benchmark, which is sufficient. Because of consistency issues, a market-cap weighted portfolio of the estimation universe was constructed, serving as the reference portfolio in FM cross-sectional regressions. Using the jargon of FF, this reference portfolio corresponds to the "standard portfolio" in the FM approach (see *Fama-French, 2020, p. 1892*). In Figure 8, one could see the cumulative total logarithmic returns of the MSCI ACWI Index and the reference (standard) portfolio. The prices move together and are almost overlapping (the cumulative return difference is 2.88 per cent for the entire period).

However, the performance measurement in the time-series analysis of pure megatrend factor portfolios is measured relative to the benchmark index (i.e., MSCI ACWI).

Figure 8. Returns of MSCI ACWI and the reference portfolio.



This figure depicts the cumulative total logarithmic returns of the MSCI ACWI Index and the reference (standard) portfolio. The reference portfolio corresponds to FF's standard portfolio in the FM context. The reference portfolio contains only companies with prices, total returns, and market capitalisations and are not penny stocks. Although the reference portfolio is the benchmark portfolio for the cross-sectional regressions, the MSCI ACWI is the market portfolio for the time-series analysis.

After prior style descriptor calculations, data cleansing, and multiple imputation procedures, principal component analysis (PCA) is employed to calculate descriptor weights every week. The PCA results in the dimension reduction of descriptors. As a result of the procedure, eleven traditional style factors are created: market-relative beta, value, momentum, size, volatility, liquidity, profitability, growth, investment, leverage, and earnings variability.

Turning back to Table 7, the concept of market-relative beta hinges on the modified CAPM equation, which is as follows:

$$R_n = R_M + (\beta_n - 1)R_M \,, \tag{36}$$

where R_n and R_M are the excess returns for stock n and the market, respectively. The term (β_n - 1) represents the market-relative beta. According to the traditional CAPM, the expected return of unscaled relative betas (i.e., before standardisation) should be equal to the market risk premium, the slope coefficient of the security market line

(SML). When active returns are calculated (i.e., after standardisation), the return premium should be zero if CAPM assumptions hold. If the return premium is negative, the slope of SML is flatter or even downward sloping. Empirical researches (*Frazzini and Pedersen, 2014*) found that the SML is, most of the time, flat or downward sloping (hence the name "low beta anomaly").

The value factor measures the cheapness of a particular stock by using the inverse P/E, P/CF and P/BV. The momentum factor combines three different metrics – these are applied in practice; for further details, see *FTSE (2014*). The size factor is the so-called "small-size" factor, measured with negative logs. The Amihud ratio is an illiquidity ratio; however, we prefer measuring liquidity, hence the inverse Amihud (*Danyliv et al., 2014*). Earnings variability is the volatility of CF and P&L lines. Assets growth represents the investment (CapEx) factor, measuring it in line with *Fama and French (2015)*.

Beyond style factors listed in Table 7, the empirical analysis also covered 48 *countries* and *24 industry group factors (second level GICS)* to be neutralised and obtain pure ESG (and style) factors. However, pure industry and country factors are style and ESG neutral. Dummy variables are applied to measure sector and country factors (Appendix 5 includes the sectors and countries analysed in the dissertation).

3.1.5. EMPIRICAL RESULTS

The dissertation asks whether investing in ESG-themed megatrend equity factor portfolios could generate significant positive risk-adjusted returns. More formally, the following two hypotheses are tested.

Hypothesis 1: Pure megatrend factor portfolios produced significant alphas.

Statistically:

H_0: $\alpha_e = 0$

H_A: $\alpha_e \neq 0$

Beyond measuring alphas against the passive strategy (i.e., testing (18)), the difference of the Sharpe ratios to check the robustness of CAPM alpha is also tested. The second hypothesis is the following:

Hypothesis 2: The megatrend factor portfolios, based on the Sharpe ratios, produced significant risk-adjusted excess returns relative to the passive strategy.

Statistically:

H_0: Sharpe-ratio (megatrends) - Sharpe-ratio (passive strategy) = 0

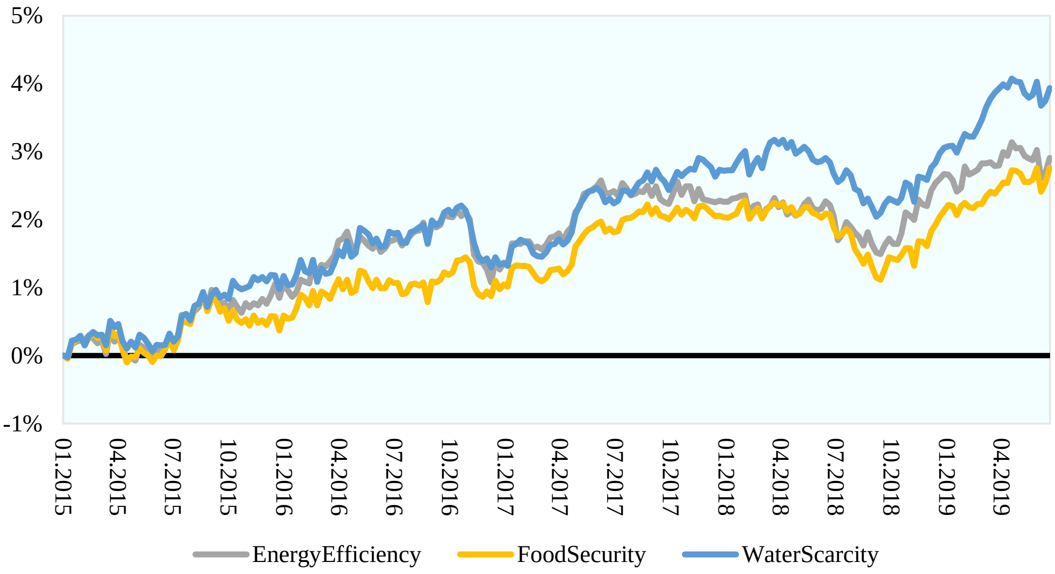
H_A: Sharpe-ratio (megatrends) – Sharpe-ratio (passive strategy) $\neq 0$

Sharpe ratio measures total risk. Regarding the relationship between total market risk and the volatility of various factors, see the paper by *Csóka et al. (2009)*. A general tool to test the significance of Sharpe ratios is to use the procedure introduced by *Jobson and Korkie (1981)* and modified and improved by *Memmel (2003)*. However, this test is not valid if returns are not normally distributed or have a time-series nature. For a more detailed discussion about the possible mistakes and correct applications, see the comprehensive work of *Ledoit and Wolf (2008)*. The calculations rest on the procedure of *Ledoit and Wolf (2008)* to solve statistical problems.

Before presenting the results, the performance of ESG-themed portfolios compared to the benchmark (MSCI ACWI Index) is visualised. Figure 9 depicts the cumulative market-relative total log returns of the three environmental thematic portfolios introduced previously. One can see that each thematic portfolio realised positive market-relative returns, among which water scarcity yielded the highest return (3.94 per cent). Energy efficiency was the second-best strategy with a cumulative return of 2.91 per cent. Food security portfolio ranked third. Nevertheless, it also outperformed the benchmark by 2.76 per cent.

The general belief among market participants is that ESG-themed investments impact society in the long-term, as megatrends are structural shifts; therefore, the possible higher performance should also prevail in the longer term. However, the chart shows that we already live "in the long run", meaning that companies offering solutions to environmental challenges perform relatively well.

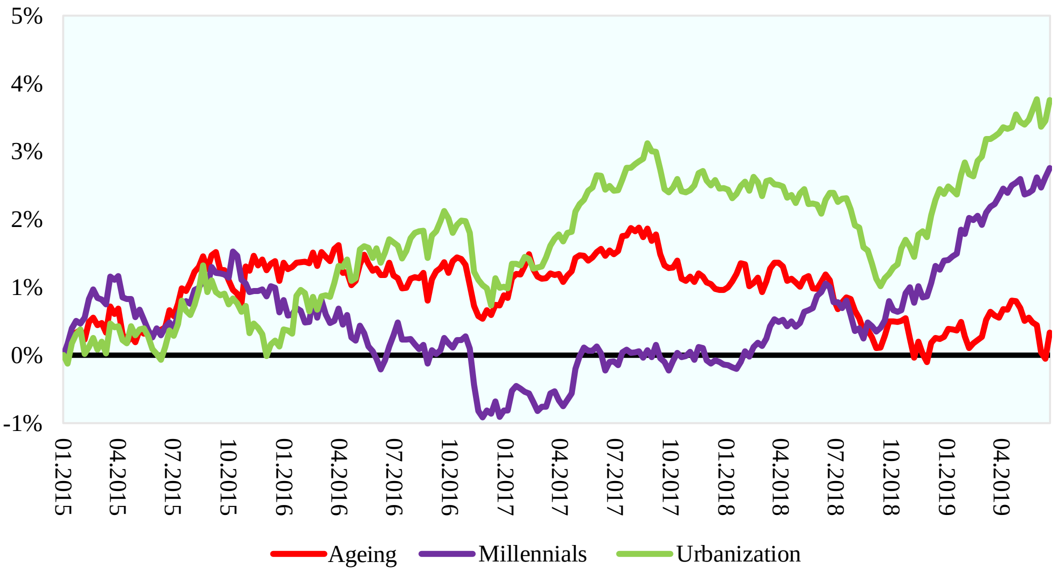
Figure 9. Cumulative market-relative returns of thematic environmental portfolios



This figure depicts cumulative market-relative total log returns of thematic environmental portfolios. The market benchmark is the MSCI ACWI Index.

Figure 10 illustrates the performance of social themes. Urbanisation and millennials thematic portfolios achieved a return of 3.76 and 2.76 per cent, respectively. Urbanisation did well during the past 4.5 years, but millennials was an underperformer from June 2016 till March 2018. Ageing had a stable 1.00-1.50 per cent surplus over the benchmark, but during 2019 this extra return vanished.

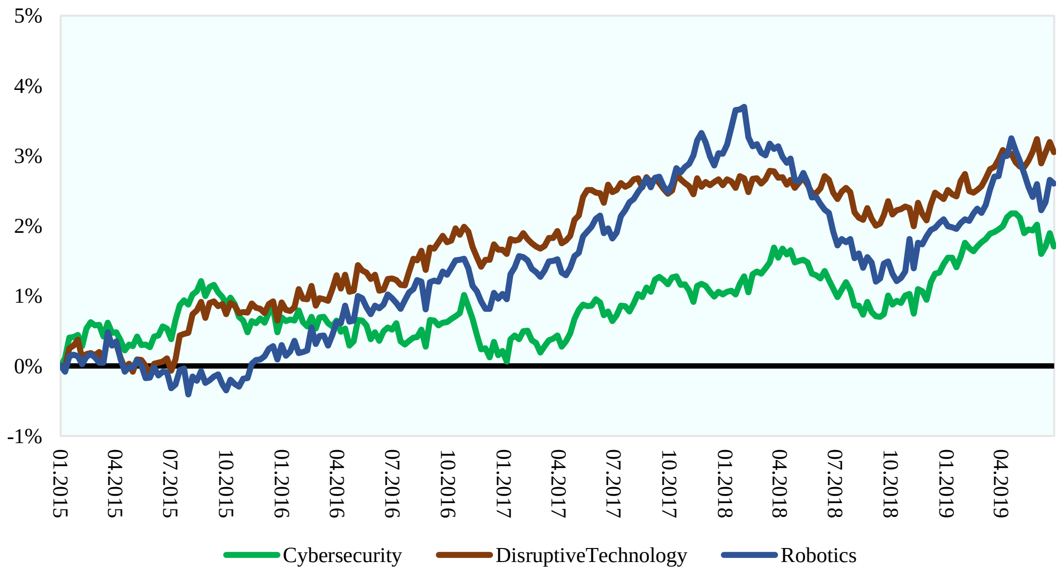
Figure 10. Cumulative market-relative returns of thematic social portfolios



This figure depicts cumulative market-relative total log returns of thematic social portfolios. The market benchmark is the MSCI ACWI Index.

Technology-related governance megatrend also outperformed the market (Figure 11), though Robotics was more volatile than Cybersecurity and Disruptive technology. Disruptive technology yielded 3.05 per cent excess return above the market, which was the highest among this megatrend (Robotics: 2.60 per cent; Cybersecurity: 1.70 per cent).

Figure 11. Cumulative market-relative returns of thematic governance portfolios



This figure depicts cumulative market-relative total log returns of thematic governance portfolios. The market benchmark is the MSCI ACWI Index.

Table 9 and 10 summarises the regression results of OLS (with HAC standard errors) and GMM-IV$_d$ for (18)-(21). Comparing the ESG-themed factor portfolio returns to the passive strategy (Panel A and E), each environmental theme (Energy efficiency, Food security, Water scarcity) and the Disruptive technologies outperformed the market significantly. The performance of Energy efficiency and Food security is marginally significant, while Water scarcity and Disruptive technology are significant at 5.00 per cent. None of the social thematic portfolio alphas is significant; further, Cybersecurity and Robotics do not have significant figures either. Examining the Sharpe ratios, two themes, Water scarcity and Disruptive technologies, remained significant. The t-statistics, however, decreased: the Disruptive technologies portfolio is significant only at 10.00 per cent; the Energy efficiency and Food security themes are not significant anymore at the usual statistical significance levels.

Looking at the FFC model (Panel B and F), the alphas are still positive for each thematic portfolio, except for Ageing. Ageing has a negative alpha of 21.7 basis points p.a. in OLS and 20.9 basis points p.a. in a GMM-IV_d setting. Nevertheless, none of the abnormal returns is significantly different from zero; thus, ESG-themed factor portfolios achieved fair returns, at least, based on the FFC model.

The figures of the FF5 model (Panel C and G) are more heterogeneous than the previous ones, as five thematic portfolios (Food security, Ageing, Millennials, Cybersecurity, and Robotics) underperformed the market in the OLS, and four (Ageing, Millennials, Cybersecurity, and Robotics) realised negative alphas in the GMM-IV_d context. Based on GMM-IV_d, each environmental portfolio still has positive alphas. Once again, these abnormal returns are insignificant at the usual statistical levels.

Finally, the tables introduce the results of the liquidity factor augmented FF5 model. The conclusions are almost the same as the "plain" FF5 model: the same five megatrends yielded negative returns via OLS, but now the GMM-IV_d estimation results in negative alpha for Food security. However, none of the regression intercepts is statistically significant.

Table 9. OLS results for ESG-themed investment portfolios

Factors	**EE**	**FS**	**WS**	**AG**	**MI**	**UR**	**CY**	**DT**	**RO**
A: CAPM									
Alpha	0.602*	0.590*	0.841**	0.177	0.547	0.851	0.404	0.666**	0.495
	1.76	*1.89*	*2.24*	*0.47*	*1.11*	*1.58*	*1.35*	*2.40*	*0.92*
MRP	1.000***	1.000***	1.000***	1.000***	1.000***	0.990***	1.000***	1.000***	1.010***
	163.41	163.54	147.69	130.76	219.07	121.00	200.39	186.92	170.31
Sharpe	0.565	0.559	0.580**	0.522	0.557	0.576	0.547	0.565*	0.548
	1.63	*1.57*	*2.07*	*0.20*	*1.04*	*1.48*	*1.04*	*1.89*	*0.88*
B: Fama-French-Carhart (FFC)									
Alpha	0.270	0.219	0.471	-0.217	0.175	0.438	0.036	0.274	0.124
	0.67	*0.68*	*1.18*	*-0.67*	*0.32*	*0.77*	*0.13*	*1.01*	*0.24*
MRP	1.000***	1.000***	1.000***	1.000***	1.010***	1.000***	1.000***	1.000***	1.010***
	167.61	*178.73*	*147.03*	*155.58*	*222.28*	*114.04*	*240.43*	*236.24*	*231.43*
SIZE	0.031	0.045***	0.050***	0.049**	0.037	0.083**	0.039	0.046***	0.041*
	1.01	*2.90*	*2.91*	*2.37*	*1.50*	*2.27*	*1.46*	*3.31*	*1.72*
VALUE	0.186***	0.221***	0.189***	0.223***	0.191***	0.188***	0.207***	0.237***	0.218***
	5.66	*7.10*	*5.00*	*6.34*	*4.85*	*3.53*	*7.28*	*8.15*	*8.15*
MOM	0.109***	0.107***	0.117***	0.118***	0.129***	0.12***	0.116***	0.112***	0.111***
	4.53	*5.40*	*5.23*	*5.77*	*3.71*	*4.40*	*7.16*	*8.11*	*4.75*

Table 9. *(Continued)*

C: Fama-French 5-factor model									
Alpha	0.006	-0.027	0.223	-0.439	-0.084	0.109	-0.137	0.089	-0.115
	0.02	*-0.15*	*0.81*	*-1.56*	*-0.17*	*0.30*	*-0.67*	*0.45*	*-0.29*
MRP	0.990***	0.990***	1.000***	0.990***	1.000***	0.990***	0.990***	0.990***	1.010***
	155.86	*189.64*	*153.13*	*169.91*	*196.48*	*117.14*	*251.40*	*254.44*	*261.46*
SIZE	0.008	0.026	0.029	0.036	0.017	0.043	0.021	0.024*	0.021
	0.30	*1.59*	*1.60*	*1.38*	*0.59*	*1.53*	*0.67*	*1.68*	*0.95*
VALUE	0.055**	0.097***	0.059**	0.102**	0.052*	0.028	0.095***	0.123***	0.093**
	2.41	*4.23*	*2.04*	*2.48*	*1.74*	*0.70*	*4.90*	*4.33*	*2.14*
PROFIT	0.171***	0.163***	0.163***	0.156***	0.175***	0.193***	0.116***	0.115***	0.157***
	5.84	*4.74*	*4.30*	*4.42*	*3.75*	*3.73*	*3.37*	*3.83*	*2.90*
INV	0.350***	0.325***	0.360***	0.319***	0.378***	0.466***	0.339***	0.354***	0.342***
	7.55	*10.73*	*10.75*	*7.82*	*10.10*	*11.67*	*10.40*	*10.96*	*8.15*
D: Fama-French 5-factor model, augmented with a liquidity factor									
Alpha	0.000	-0.041	0.189	-0.478	-0.112	0.063	-0.119	0.075	-0.13
	0.00	*-0.24*	*0.69*	*-1.60*	*-0.23*	*0.17*	*-0.55*	*0.39*	*-0.34*
MRP	0.990***	0.990***	1.000***	0.990***	1.000***	0.990***	0.990***	0.990***	1.010***
	154.57	*193.72*	*154.86*	*168.89*	*198.39*	*116.81*	*256.04*	*254.30*	*275.43*
SIZE	0.005	0.019	0.012	0.016	0.003	0.019	0.030	0.016	0.013
	0.16	*0.92*	*0.54*	*0.48*	*0.09*	*0.54*	*0.96*	*0.81*	*0.34*
VALUE	0.055**	0.097***	0.058*	0.102**	0.051*	0.0270	0.096***	0.123***	0.093**
	2.38	*4.11*	*1.93*	*2.44*	*1.70*	*0.66*	*5.05*	*4.31*	*2.11*
PROFIT	0.170***	0.163***	0.162***	0.155***	0.174***	0.192***	0.116***	0.115***	0.157***
	5.84	*4.70*	*4.12*	*4.24*	*3.77*	*3.66*	*3.47*	*3.75*	*2.92*
INV	0.350***	0.324***	0.358***	0.316***	0.376***	0.463***	0.340***	0.353***	0.341***
	7.58	*10.33*	*10.18*	*7.27*	*9.66*	*11.99*	*10.67*	*10.52*	*7.52*
LIQ	0.004	0.009	0.020	0.024	0.017	0.028	-0.011	0.008	0.009
	0.23	*0.61*	*1.25*	*0.86*	*0.63*	*1.28*	*-0.76*	*0.53*	*0.26*

This table presents OLS results for ESG-themed investment portfolios. Both alphas (log returns) and Sharpe-ratios are annualised figures. Alphas are expressed in percentage points (e.g. an alpha of 0.15 is 15 basis points per year).

EE – Energy efficiency, FS – Food security; WS – Water scarcity; AG – Ageing; MI – Millennials; UR – Urbanisation; CY – Cybersecurity; DT- Disruptive technology; RO – Robotics

Standard errors (SE) are Newey-West (HAC) standard errors. The coefficient t-statistics are in italics.

*** p < 0.01 ** p < 0.05 * p < 0.10

Turning to explanatory factor coefficients, one can see that the betas are equal to one in almost every case (in fact, they do not statistically differ from one), which is the consequence of the PFP construction technique: we control for beta risk (see Table 7), meaning that thematic portfolios are beta neutral, viz., they have the same beta as the market (i.e., 1).

Table 10. GMM-IV$_d$ results for ESG-themed investment portfolios

Factors	EE	FS	WS	AG	MI	UR	CY	DT	RO
E: CAPM									
Alpha	0.600*	0.590*	0.840**	0.190	0.540	0.840	0.400	0.670**	0.490
	1.71	*1.85*	*2.15*	*0.52*	*1.08*	*1.52*	*1.28*	*2.37*	*1.04*
MRP	1.000***	1.000***	1.000***	1.000***	1.010***	1.000***	1.000***	1.000***	1.010***
	163.40	161.91	159.91	126.97	180.77	111.03	181.07	174.25	151.11
F: Fama-French-Carhart (FFC)									
Alpha	0.263	0.214	0.455	-0.209	0.158	0.425	0.024	0.271	0.119
	0.68	*0.69*	*1.15*	*-0.61*	*0.30*	*0.79*	*0.09*	*1.03*	*0.27*
MRP	1.000***	1.000***	1.000***	1.000***	1.010***	1.000***	0.990***	1.000***	1.010***
	174.24	*182.94*	*172.03*	*139.11*	*155.91*	*107.27*	*178.60*	*201.95*	*161.96*
SIZE	0.030	0.048***	0.060***	0.052*	0.048**	0.083**	0.054**	0.050***	0.051*
	0.98	*2.62*	*2.77*	*1.89*	*2.05*	*2.27*	*2.25*	*3.27*	*1.68*
VALUE	0.182***	0.217***	0.182***	0.22***	0.185***	0.178***	0.203***	0.237***	0.214***
	6.16	*7.44*	*5.34*	*6.53*	*4.58*	*3.68*	*6.92*	*8.12*	*6.52*
MOM	0.112***	0.113***	0.129***	0.117***	0.139***	0.123***	0.124***	0.121***	0.120***
	5.94	*7.81*	*7.93*	*5.84*	*5.85*	*6.23*	*9.59*	*10.55*	*4.99*
G: Fama-French 5-factor model									
Alpha	0.047	0.011	0.247	-0.381	-0.059	0.145	-0.114	0.124	-0.099
	0.16	*0.06*	*0.88*	*-0.96*	*-0.13*	*0.37*	*-0.45*	*0.62*	*-0.24*
MRP	0.990***	0.990***	1.000***	0.990***	1.000***	0.990***	0.990***	0.990***	1.000***
	161.60	*195.17*	*175.30*	*168.72*	*174.22*	*107.48*	*178.32*	*209.67*	*171.46*
SIZE	0.012	0.033*	0.040**	0.041	0.025	0.055	0.036	0.031**	0.029
	0.40	*1.84*	*2.00*	*1.51*	*0.83*	*1.62*	*1.40*	*2.11*	*1.19*
VALUE	0.057**	0.107***	0.063**	0.123***	0.055	0.024	0.102***	0.130***	0.117**
	2.26	*4.30*	*2.07*	*2.93*	*1.48*	*0.65*	*3.31*	*4.06*	*2.55*
PROFIT	0.156***	0.149***	0.155***	0.135***	0.173***	0.173***	0.107***	0.107***	0.145***
	4.51	*4.29*	*3.91*	*3.13*	*3.25*	*3.84*	*2.91*	*3.26*	*2.83*
INV	0.331***	0.309***	0.347***	0.294***	0.363***	0.453***	0.334***	0.345***	0.344***
	6.67	*9.13*	*9.76*	*6.66*	*9.66*	*10.34*	*8.54*	*10.32*	*6.70*
H: Fama-French 5-factor model, augmented with a liquidity factor									
Alpha	0.040	-0.008	0.197	-0.437	-0.108	0.077	-0.117	0.100	-0.123
	0.13	*-0.04*	*0.69*	*-1.16*	*-0.24*	*0.20*	*-0.47*	*0.52*	*-0.30*
MRP	1.000***	0.990***	1.000***	0.990***	1.000***	0.990***	0.990***	0.990***	1.000***
	166.34	*208.91*	*187.94*	*162.56*	*179.69*	*115.52*	*177.57*	*217.97*	*182.44*
SIZE	0.010	0.025	0.021	0.026	0.005	0.034	0.038	0.024	0.016
	0.31	*1.16*	*0.97*	*0.79*	*0.17*	*0.92*	*1.39*	*1.13*	*0.42*
VALUE	0.059**	0.107***	0.062*	0.122***	0.055	0.024	0.102***	0.129***	0.116***
	2.37	*4.22*	*1.96*	*2.96*	*1.46*	*0.61*	*3.55*	*4.02*	*2.59*
PROFIT	0.152***	0.146***	0.151***	0.131***	0.169***	0.168***	0.106***	0.106***	0.145***
	4.38	*4.18*	*3.59*	*2.93*	*3.22*	*3.46*	*2.91*	*3.10*	*2.95*
INV	0.325***	0.306***	0.342***	0.286***	0.358***	0.444***	0.332***	0.343***	0.344***
	6.64	*8.94*	*9.34*	*6.24*	*8.87*	*10.34*	*8.70*	*10.09*	*6.03*
LIQ	0.003	0.011	0.027	0.027	0.027	0.034	0	0.012	0.015
	0.19	*0.74*	*1.60*	*0.99*	*1.07*	*1.50*	*-0.01*	*0.74*	*0.39*

This table presents GMM-IV$_d$ results for ESG-themed investment portfolios. Alphas (log returns) are annualised figures and expressed in percentage points (e.g. an alpha of 0.15 is 15 basis points per year). EE – Energy efficiency, FS – Food security; WS – Water scarcity; AG – Ageing; MI – Millennials; UR – Urbanisation; CY – Cybersecurity; DT- Disruptive technology; RO – Robotics

Standard errors (SE) are Newey-West (HAC) standard errors. The coefficient t-statistics are in italics.

*** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

The momentum factor is significant at a 1.00 per cent level both with the OLS and GMM-IV_d estimation method. The coefficients of the size factor in the FFC model calculated via OLS and GMM-IV_d are significant in the case of six and eight megatrends, respectively. On average, the coefficients are a little higher for GMM-IV_d. The impact of the size coefficient in the FF5 model is almost entirely insignificant using OLS, and insignificant for six thematic portfolios with GMM-IV_d (again, coefficient values are somewhat higher in the GMM context). The FF5 model augmented with a liquidity measure suggests that size becomes insignificant regardless of using the OLS or GMM-IV_d estimator. The value factor in the FFC model is significant for each megatrend at a 1.00 per cent level with both estimator; however, they are now higher for OLS. In the FF5 and FF5L model context, the value factor is significant for eight themes of OLS and six of GMM-IV_d. The profitability and investment factors are significant at a 1.00 per cent level either calculated by OLS or GMM-IV_d. The liquidity factor of OLS and GMM-IV_d is not significant for any megatrends, which is mostly in line with *Racicot et al. (2019)*.

Based on the GMM-IV_d estimates, the coefficients for value, investment, and profitability are significant, contrary to *Racicot et al. (2019)*, who found that the market factor is the only variable that has significant explanatory power. The authors highlight that measurement errors may be the reason for their results. To test the errors-in-variables bias, they suggest using a $Hausman_d$ procedure. By executing the calculations, it is found that the residual t-statistics are mostly not significant, which indicates that there are, at most, modest measurement errors. However, F tests were also calculated to see if collectively, none of the ω coefficients in the artificial regressions is significantly different from zero. F statistics indicate measurement errors in five thematic portfolios, including Food security, Ageing, and each technological governance themes. The Hausman artificial regression tests and the relevance and exogeneity tests are presented in Appendix 6.

Besides measurement errors, the GMM-IV_d method is also a practical analysis tool in the dissertation since none of the variables is normally distributed. (Jarque-Bera statistic shows non-normality for both the dependent and explanatory variables). However, *Racicot et al. (2018, p. 58)* emphasise that non-normality does support the application of the method since it uses higher moments (cumulants) as instruments for the GMM estimation process.

Table 11 summarises the ESG-themed portfolios' alpha estimates. The takeaway message is that 50 model specification out of 72 resulted in positive alphas; however, only the four CAPM alphas are statistically significant. Three ESG-themed portfolios (Water scarcity, Urbanisation, Disruptive technology) have a positive alpha value regardless of FF model specification.

Table 11. Summary of alphas based on OLS HAC and GMM-IV$_d$

Model	**EE**	**FS**	**WS**	**AG**	**MI**	**UR**	**CY**	**DT**	**RO**
OLS									
CAPM	0.602*	0.590*	0.841**	0.178	0.548	0.851	0.404	0.666**	0.495
FFC	0.271	0.219	0.472	-0.217	0.176	0.438	0.037	0.274	0.124
FF5	0.007	-0.027	0.223	-0.439	-0.084	0.109	-0.138	0.090	-0.116
FF5L	-0.000	-0.042	0.189	-0.478	-0.112	0.063	-0.119	0.076	-0.131
GMM-IV$_d$									
CAPM	0.600*	0.589*	0.839**	0.190	0.540	0.840	0.400	0.670**	0.490
FFC	0.264	0.214	0.455	-0.210	0.159	0.425	0.025	0.272	0.120
FF5	0.048	0.012	0.248	-0.382	-0.060	0.146	-0.115	0.124	-0.100
FF5L	0.040	-0.008	0.198	-0.438	-0.109	0.077	-0.117	0.101	-0.124

In this table, alphas (log returns) are annualised figures and expressed in percentage points (e.g. an alpha of 0.15 is 15 basis points per year). The green and red figures represent positive and negative alphas, respectively. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

The impact of transaction costs is a critical consideration in assessing the profitability of trading strategies (*Della Corte et al., 2009*); therefore, the analysis control costs and fees. As did two recent studies, the calculations concentrate on the expense ratio (*Alda, 2020*; *Brakman Reiser and Tucker, 2019*). Following the logic of *Derwall et al. (2005)* and *Kempf and Osthoff (2007)*, an expense ratio between 25 and 150 basis points were considered, which are slightly lower than in the mentioned studies (50 and 200 basis points). However, these expense ratios are, in fact, in line with what *Alda (2020)* and *Brakman Reiser and Tucker (2019)*. The authors found these figures typical extremes nowadays for ESG ETFs.

Table 12 provides the performance statistics in the same manner as Table 11. The alphas decrease as the transaction cost increase. If one assumes an annual 25 basis points expense ratio, the Ageing portfolio has a statistically significant negative alpha for FF5 and FF5L models (GMM-IV$_d$); nevertheless, the other thematic portfolio alphas do not significantly differ from zero. If assuming a 50 basis points expense ratio, Food security, Ageing and Cybersecurity portfolios yield significant negative alphas. Again, these significant results are found in the case of FF5 and FF5L and using GMM-IV$_d$. The 100 and 150 basis points scenarios show significant underperformance in almost each model specification. According to *Morningstar* (*Lynch, 2020*), in practice, ESG-themed funds have an average expense ratio of around 50-60 basis points per annum. Assuming the average case, one can see that six thematic portfolio alphas are not statistically different from zero and only three underperform significantly.

Table 12. Summary of alphas after controlling transaction costs

Model	EE	FS	WS	AG	MI	UR	CY	DT	RO
				25 basis points					
OLS									
CAPM	0.352	0.340	0.591	-0.072	0.297	0.601	0.154	0.416	0.245
FFC	0.020	-0.030	0.221	-0.467	-0.074	0.188	-0.213	0.024	-0.125
FF5	-0.243	-0.277	-0.026	-0.689**	-0.334	-0.140	-0.387*	-0.160	-0.365
FF5L	-0.249	-0.2919*	-0.061	-0.7283**	-0.362	-0.187	-0.3692*	-0.174	-0.381
GMM-IV									
CAPM	0.350	0.341	0.592	-0.058	0.291	0.590	0.158	0.423	0.246
FFC	0.013	-0.035	0.205	-0.459	-0.091	0.175	-0.225	0.021	-0.130
FF5	-0.202	-0.238	-0.002	-0.631*	-0.309	-0.104	-0.364	-0.125	-0.349
FF5L	-0.209	-0.258	-0.052	-0.687*	-0.358	-0.172	-0.367	-0.149	-0.373
				50 basis points					
OLS									
CAPM	0.102	0.090	0.341	-0.322	0.047	0.351	-0.095	0.166	-0.004
FFC	-0.229	-0.280	-0.028	-0.717**	-0.324	-0.061	-0.463*	-0.225	-0.375
FF5	-0.493	-0.527***	-0.276	-0.939***	-0.584	-0.390	-0.637***	-0.410**	-0.615
FF5L	-0.499	-0.5419***	-0.311	-0.9783***	-0.612	-0.437	-0.6192***	-0.4241**	-0.631
GMM-IV									
CAPM	0.100	0.091	0.342	-0.308	0.041	0.340	-0.091	0.173	-0.003
FFC	-0.236	-0.285	-0.044	-0.709*	-0.341	-0.074	-0.475	-0.228	-0.380
FF5	-0.452	-0.488*	-0.252	-0.881**	-0.559	-0.354	-0.614**	-0.375	-0.599
FF5L	-0.459	-0.508**	-0.302	-0.937**	-0.608	-0.422	-0.617**	-0.399	-0.623
				100 basis points					
OLS									
CAPM	-0.397	-0.409	-0.158	-0.822**	-0.452	-0.148	-0.595**	-0.333	-0.504
FFC	-0.729*	-0.78**	-0.528	-1.217***	-0.824	-0.561	-0.963***	-0.725***	-0.875*
FF5	-0.993***	-1.027***	-0.776***	-1.439***	-1.084**	-0.890**	-1.137***	-0.910***	-1.115***
FF5L	-0.999***	-1.0419***	-0.8105***	-1.4783***	-1.1123**	-0.9369**	-1.1192***	-0.9241***	-1.1309***
GMM-IV									
CAPM	-0.399	-0.408	-0.157	-0.808*	-0.458	-0.159	-0.591	-0.326	-0.503
FFC	-0.736**	-0.785***	-0.544	-1.209***	-0.841*	-0.574	-0.975***	-0.728***	-0.88**
FF5	-0.952***	-0.988***	-0.752**	-1.381***	-1.059**	-0.854**	-1.114***	-0.875***	-1.099***
FF5L	-0.959***	-1.008***	-0.802***	-1.437***	-1.108***	-0.922**	-1.117***	-0.899***	-1.123***
				150 basis points					
OLS									
CAPM	-0.897***	-0.909***	-0.658*	-1.322***	-0.952*	-0.648	-1.095***	-0.833***	-1.004*
FFC	-1.229***	-1.28***	-1.028**	-1.717***	-1.324**	-1.061*	-1.463***	-1.225***	-1.375***
FF5	-1.493***	-1.527***	-1.276***	-1.939***	-1.584***	-1.39***	-1.637***	-1.41***	-1.615***
FF5L	-1.499***	-1.541***	-1.31***	-1.978***	-1.612***	-1.436***	-1.619***	-1.424***	-1.63***
GMM-IV									
CAPM	-0.899**	-0.908***	-0.657*	-1.308***	-0.958*	-0.659	-1.091***	-0.826**	-1.003**
FFC	-1.236***	-1.285***	-1.044***	-1.709***	-1.341***	-1.074**	-1.475***	-1.228***	-1.38***
FF5	-1.452***	-1.488***	-1.252***	-1.881***	-1.559***	-1.354***	-1.614***	-1.375***	-1.599***
FF5L	-1.459***	-1.508***	-1.302***	-1.937***	-1.608***	-1.422***	-1.617***	-1.399***	-1.623***

In this table, alphas (log returns) are annualised figures and expressed in percentage points (e.g. an alpha of 0.15 is 15 basis points per year). The green and red figures represent positive and negative alphas, respectively. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

In summary, the findings show that most ESG-themed portfolios yielded at least fair returns compared to the benchmark after accounting for risk but before accounting for transactions costs. One could say that there is a minimum neutral relationship between ESG and market performance, which supports the hypothesis that ESG risks can be diversified, or ESG companies have a low level of idiosyncratic risk (see *Boutin-Dufresne and Savaria, 2004*). Further, these findings support the hypothesis of *Diltz (1995)* that there is no under-diversification effect due to the immense size and ample liquidity of the equity markets. Alternatively, one could conclude that the EMH holds.

Further, the results suggest that investors should recognise ESG investing as a superior strategy relative to conventional approaches as they can attain comparable financial performance and still address ESG concerns. The results are in line with the findings of *Revelli and Viviani (2015)* and *Martí-Ballester (2020)*. Thematic investing can help in achieving UN’s Sustainable Development Goals (SDGs) such as “end hunger, achieve food security” (SDG2), “ensure healthy lives and promote well-being for all at all ages” (SDG3), “make cities and human settlements inclusive, safe, resilient and sustainable” (SDG11). Furthermore, it is conventional wisdom among practitioners that megatrends should work out in the long run (*Manohar et al., 2019*). The results are not in contradiction to this notion. Also, one can pinpoint that ESG-themed megatrend factors by themselves are not a recipe for outperformance, at least after adjusting for transaction costs.

Environmental megatrend and disruptive technologies outperformed the passive strategy. This finding is against the semi-strong form of EMH and supports the “doing well while doing good” concept suggested by *Hamilton et al. (1993)*. In line with *Renneboog et al. (2008b)*, the findings highly recommend that investors pursue fundamental research to determine the asset allocation among the winning themes to enhance investor returns. Further, due to transaction costs, the surplus can quickly vanish, meaning that they should carefully analyse the market to discover cheap opportunities.

The positive alphas and Sharpe-ratios show that investors are turning to thematic investments in a hunt for stocks with a particular quality attribute that supersedes the advantages of the traditional style investments: seeking investments well-positioned to benefit from secular growth that can surpass economic cycles.

3.1.6. CONCLUSION

The chapter emphasises the growing importance of ESG themed megatrend investments. Megatrends are secular, transformative processes that can impact the environment, economy, and society at large. To verify the validity of ESG-themed investing, nine themes that fit E, S, and G-related megatrends are defined. These are as follows: Energy efficiency, Food security, Water scarcity (environmental megatrend); Ageing, Millennials, Urbanisation (social megatrend); Cybersecurity, Disruptive technologies, Robotics (governance megatrend).

This chapter introduces a new mathematical formula of stock megatrend exposures (MTE), drawing on signalling theory. Based on the analysis, portfolio managers' (i.e., sellers) stock selection practices indicate (signal) to investors and analysts (i.e., buyers) that the companies they have selected are a suitable proxy for megatrend investment. Consequently, the relative amount of money inflows into megatrend funds signals the market's belief that those stocks are the best candidates to represent megatrends.

The research question examines whether ESG-themed megatrend investing can be a tool to align investment schemes of investors with UN Sustainable Development Goals (SDGs) without sacrificing returns. To this end, tests were executed to determine whether megatrend factor portfolios could generate superior returns on a risk-adjusted basis and accounting for transaction costs. First, returns were compared to the passive strategy (i.e., CAPM alphas and Sharpe ratios relative to the market benchmark), and then alphas were measured applying various Fama-French model specifications (e.g., FFC, FF5). The research question can also be interpreted as a test of the efficient market hypothesis (EMH).

Filtering out secondary factor exposures and isolating the effects of ESG factors is a crucial methodological requirement; therefore, a pure factor portfolio methodology was utilised that applies multivariate cross-sectional regression equations following the Fama-MacBeth procedure. Pure factor portfolios are fully invested long-short factor mimicking portfolios. One of the critical methodological challenges is how to estimate the coefficients in time-series analysis. Two methods were covered: traditional OLS with Newey-West (HAC) standard errors and generalised method of moments using innovative, robust distance instrumental variables (GMM-IV_d). The GMM-IV_d method is suitable to address errors-in-variables, a manifestation of endogeneity inherent to factor models. Further, it also handles non-normality as it uses higher moments (cumulants) as instrumental variables for the GMM estimation process.

One cardinal result is that most thematic factors yielded non-negative excess returns comparing with the MSCI All Country Wolrd Index benchmark, even after accounting for transaction costs up to 50 basis points per annum. This result implies that, on the one hand, ESG risks can be diversified, and on the other hand, sustainability-aligned investors bear no extra costs. The latter finding supports that investors can promote UN SDGs without forgoing returns. Some of these sustainability goals include "end hunger, achieve food security" (SDG2), "ensure healthy lives and promote well-being for all at all ages" (SDG3), "make cities and human settlements inclusive, safe, resilient and sustainable" (SDG11).

Higher transaction costs, as is the case for some ESG-thematic ETFs with expense ratios reaching 80-100bps, may be an indication of two things: ESG themed megatrend investors are willing to sacrifice approximately 30-50 basis points of annual return to remain aligned with sustainability objectives, or that expense ratio may well decline in the future. The interviews in Chapter 2 indicate the latter findings.

Further, the findings are consistent with some literature indications that there is no under-diversification effect due to the massive size and ample liquidity of markets (*Diltz, 1995*; *Revelli and Viviani, 2015*). Overall, in most cases, the findings simultaneously support the efficient market hypothesis and that investors can promote sustainability without sacrificing returns.

3.2. PERFORMANCE OF ESG LEADERS & LAGGARDS[55]

As emphasised previously, ESG investing is becoming mainstream in global equity markets[56] driven by rising demand for investments that promote sustainability[57]. Regulators[58] require disclosure to evaluate the extent to which ESG alignment impacts portfolio performance. This chapter contributes to the literature by introducing a factor methodology to quantify ESG alignment impact on investment performance. Hence, *pure* ESG equity factor portfolios (PFP) are constructed, rated on a five-point scale[59], filtering out secondary factor effects. Then, the empirical subchapter covers the risk-adjusted performance of the pure ESG factors. These ESG PFPs may function as *sustainability indices* used to calculate investment portfolio tilt to ESG factors and quantify the performance attribution of the ESG factor tilt. Further, the approach simultaneously tests ESG strategy performance and serves to validate ESG as new factors in the Fama-French (FF) 5-factor model (FF5).

Literature on ESG investment performance covers three general arguments[60]. First, the neutral relationship contends that markets are informationally efficient; hence, it is not possible to achieve superior risk-adjusted returns (*Fama, 1970*). Studies by *Hartzmark and Sussman (2019)* and *Managi et al. (2012)* support neutrality. In contrast, *Adler and Kritzman (2008), Bauer et al. (2005)* and *Berlinger and Lovas (2015)* argue that ESG investments result in potential underperformance; one explanation is that ESG investments are a subset of the market, hence have lower diversification capability; another is that sustainability aspects sacrifice short-term growth. Finally, *Consolandi et al. (2009)* and *Renneboog et al. (2008)* attest to superior returns emphasising “doing

[55] This chapter is based on the study of *Naffa and Fain (2021)*.

[56] According to the *GSIA (2018)*, sustainable investments accounted for 33 per cent of total assets under management globally in 2018 compared to 21 per cent two years earlier.

[57] *Tucker and Jones (2020)* found that 85 per cent of millennials have a high demand for ESG. *Amel-Zadeh and Serafeim (2018)* argue that the second most important motivation of investment professionals for using ESG is client demand.

[58] In the EU, Regulation 2019/2088 (SFDR) requires sustainability-related disclosures.

[59] The five categories cover ESG leaders, followers, loungers, laggards, and not rated companies in line with *Triguero et al. (2016)*.

[60] The next chapter also introduces the inverted U-shaped relationship.

well while doing good". The empirical analysis contributes to the literature by testing if, at least, a neutral relationship exists.

The investment literature follows two distinct approaches to evaluate ESG investments. One compares ESG funds' performance with their non-ESG counterparts (*Lesser et al., 2016*; *Nofsinger and Varma, 2014*; *Pástor and Vorsatz, 2020*). Another approach is to identify ESG as new risk factors similar to the original FF factors (*Hübel and Scholz, 2020*; *Jin, 2018*; *Maiti, 2020*). The dissertation applies the right-hand-side (RHS) method, popularised by *FF (2018),* which combines the two approaches with the benefit of capturing specific factors' pure performance (*Bali et al., 2016*) while testing whether they are valid new factors (*FF, 1996, 2015, 2017*). This chapter's novelty lies in applying the RHS approach to ESG factors.

Portfolio managers who integrate sustainability in their investment portfolios undertake a dual optimisation process that combines ESG strategies with fundamental valuation. To measure the impact of sustainability risk on portfolio returns, we propose using our ESG PFPs as indices to measure ESG tilt to different ESG factors from leaders to laggards. This method is superior to calculating the overall ESG rating of investment portfolios currently commonly used by asset managers, as it separates the performance contribution of the ESG tilt from the secondary factors such as geographical, industry or style effects. *Menchero (2010)* and *Menchero and Ji (2017)* present a similar technique; however, the comprehensive approach presented here controls, together with ESG factors, 98 different style factors, and industry and country factors.

ESG PFPs rest on constrained WLS cross-sectional regressions derived from the *Fama – MacBeth (1973)* (FM) approach. In FF5 time-series spanning regressions, tests uncover whether ESG factors achieve superior risk-adjusted returns. *FF (2020 p. 1913)* argue that the application of FM cross-sectional factors in an FF-type time series regression context explain average asset returns "*a bit better*" than the traditional FF time-series factors. Despite its advantages, this combination of methods is still not widespread in the literature; bar the applications presented in *Back et al. (2013, 2015*).

According to *Jahmane and Gaies (2020 p. 2),* endogeneity remains a largely unaddressed problem in the sustainability literature. The time-series analysis control for endogeneity by using a GMM distance IV estimator.

3.2.1. METHODOLOGY – CONSTRUCTING ESG PORTFOLIOS

The subchapter begins by constructing PFPs following *Back et al. (2013)*, *Clarke et al. (2014, 2017)*, *Menchero (2010)*, and *Walter and Berlinger (1999)*. From a mathematical perspective, PFPs rest on constrained WLS cross-sectional regressions. Pure factor (PF) returns are as follows:

$$r_{it+1} = r_{Mt+1} + \sum_k \beta_{kt+1} z_{kit} + \varepsilon_{it+1} \tag{37}$$

where r_{it+1} is the return of security *i* at time *t+1;* the regressors are the market-weight standardised factor exposures, z_{kit}. Regression betas are the market-relative excess returns of PFPs.

The beta coefficients in (1) could be measured as the returns to factor-mimicking long-short portfolios. The critical step is to calculate stock weights. Formula (38) derives from matrix algebra:

$$W = R(R'Z'VZR)^{-1}R'Z'V \tag{38}$$

where *W* is the *(m+1) x N* matrix for active security weights, *Z* is the *N x (m+1)* matrix of standardised exposures, *V* is a *N x N* diagonal matrix with market capitalisations in the diagonal. Variable *m* represents the number of PFs, '+1' indicates the market factor. *R* is the *(m+1) x (m+1-3)* constraint matrix (*Heston – Rouwenhorst, 1994*), which manages exact multicollinearity due to ESG, countries and industries.

ESG dummy variables rest on Sustainalytics scores[61] to obtain PFPs. Environmental, social, and governance scores are treated separately and categorised into four rated groups, in decreasing order of ESG quality, in addition to a fifth group of unrated companies[62]. Table 1 summarises our grouping scheme.

[61] For further details regarding how the methodology of Sustainalytics's has developed in recent years, see the qualitative chapter of the thesis.

[62] Dummy variables are utilised to handle the issue of missing scores; hence, it is possible to include unrated firms. Another statistical issue could be the sample selection bias. *Wong et al. (2021)* argue that adopting ESG rating is not randomly distributed across firms: their sample firms with ESG score tend to be more mature, high performing and carry lower tangible assets. In this dissertation, the FM procedure overcomes this bias as it neutralises numerous firm characteristics while constructing ESG portfolios.

Table 13. Grouping scheme of ESG exposures

Group code	Classification	Classification rules
A	Leader in E/S/G	$NormESG_i \geq 60$
B	Follower in E/S/G	$60 > NormESG_i \geq 50$
C	Lounger in E/S/G	$50 > NormESG_i \geq 40$
D	Laggard in E/S/G	$NormESG_i < 40$
NR	Not rated	ESG scores are not disclosed

This table classifies ESG scores into four plus one groups. The first four groups are in decreasing order of ESG quality, and the group codes A, B, C and D are analogous to credit ratings. Companies that do not have scores belong to a separate class and are labelled "not rated". The classification (leader, follower, lounger and laggard) follows the naming convention of *Triguero et al. (2016)*. The classification rules are as follows: 60 = one standard deviation above the average score, 50 = average score, 40 = one standard deviation below the average score.

Industry-specific scores are not comparable across sectors; therefore, Morningstar's approach is followed, allowing for cross-sectorial comparison via standardisation (*Justice and Hale, 2016*):

$$zESG_i = \frac{ESG_i - \mu_{peer}}{\sigma_{peer}}, \tag{39}$$

where ESG_i is the company-level score, μ_{peer} and σ_{peer} are the mean and standard deviation of the peer scores. In the next step, z-scores are transformed into normalised scores on a 0-100 scale, with a mean and standard deviation of 50 and 10, respectively:

$$NormESG_i = 50 + (zESG_i \; x \; 10) \tag{40}$$

The derivation of the GMM-IV$_d$ formula presented below can be found in *Racicot (2015)*, *Racicot et al. (2019)*, *Roy and Shijin (2018)*:

$$argmin_{\hat{\beta}} \left\{ n^{-1} \left[d'\left(Y - X\hat{\beta}\right)\right]' W n^{-1} \left[d'\left(Y - X\hat{\beta}\right)\right]\right\} \tag{41}$$

The *d* matrix in (41) is a 'distance' matrix that corresponds to the robust instruments and defined as:

$$d = X - \hat{X} = X - P_Z X = (I - P_Z)X \tag{42}$$

The elements of *d* in (42) can be expressed in a deviation form as:

$$d_{it} = x_{it} - \hat{x}_{it} \tag{43}$$

where x_{it} and $\hat{x}_{it}$ are matrix X_{it} and $\hat{X}_{it}$ taken in deviation from their means. Intuitively, d_{it} is a filtered version of the endogenous variables. Variable $\hat{x}_{it}$ in (43) is obtained by applying OLS on the z_t instruments:

$$x_{it} = \hat{\gamma}_0 + z_t\hat{\phi} + \varsigma_t = \hat{x}_{it} + \varsigma_t \tag{44}$$

The z_t instruments are defined as $z_t = \{z_{0t}, z_{1t}, z_{2t}\}$, where z_{0t} is a vector of one ($Tx1$), $z_{1t} = x_{it} \odot x_{it}$ and $z_{2t} = x_{it} \odot x_{it} \odot x_{it} - 3x_{it}[D(x_{it}'x_{it}/T)]$. The symbol ⊙ is the Hadamard product, $D(x_{it}'x_{it}/T) = (x_{it}'x_{it}/T) \odot I_n$ is a diagonal matrix, and I_n is an identity matrix of dimension (k x k), where k is the number of regressors. These instruments are consistent with *Dagenais and Dagenais (1997)*.

The empirical analysis covers the tests of alphas of the FF5:

$$RP_{it} = \alpha_i + b_{1i}\,MRP_t + b_{2i}\,R_{SIZEt} + b_{3i}\,R_{VALUEt} + b_{4i}\,R_{PROITt} + b_{5i}\,R_{INVt} + u_{it}, \tag{45}$$

where RP_{it} is the excess return[63] of E, S, and G, α_t is the alpha, MRP_t is the market risk premium, R_{SIZEt}, R_{VALUEt}, $R_{PROFITt}$, and R_{INVt} are the market-relative returns of size, value, profitability, and investment PFPs, respectively. Variables b_{1i}, b_{2i}, b_{3i}, b_{4i}, and b_{5i} are sensitivities to factor returns. Equation (45) is calculated by applying OLS with *Newey – West (1987)* standard errors and GMM-IV_d approach.

3.2.2. DATABASE

ESG investing is assessed from a global equity investor perspective; hence, the MSCI ACWI Index is the investment universe[64]. We calculate weekly total returns, 15 ESG, 28 raw style descriptors, 24 industry, and 48 country exposures based on Bloomberg data for 2015-2019[65]. Raw style descriptors are the inputs to compute style factor exposures with principal component analysis (PCA). PCA results in eleven style factors (Table 2).

[63] The risk-free rate is the 1-year T-Bill return.

[64] The index serves as a proxy for the global equity market and as the benchmark.

[65] The great majority of firms did not disclose sustainability reports until recent years, meaning that ESG scores from earlier periods are not reliable: in 2017, 85 per cent of S&P 500 Index companies published sustainability reports, up from 11 per cent in 2011 (*Matos, 2020*). The shortage of reliable scores, which the interviewees also underpinned, is the reason for the relatively short timeframe.

Table 14. Style factors and factor-related descriptors in ESG integration

Factor	Descriptor
Beta	Market-relative beta: $Beta_i$ - $Beta_M$
Value	E/P, CF/P, BV/P
Momentum	Return, price, and Sharpe-momentum
Size	-ln(MCap), -ln(Assets), -ln(Sales)
Volatility	Total & residual volatility, price range
Liquidity	Amihud (2002) liquidity ratio
Profitability	ROE, ROA, ROIC/WACC, Profit margin
Growth	Profit before tax, net income, and sales growth
Investment	Assets growth
Leverage	Book & market leverage, Debts/Assets
Earnings variability	Sales, net income, FCFF variability
Environment-Social-Governance	E, S, G scores from Sustainalytics

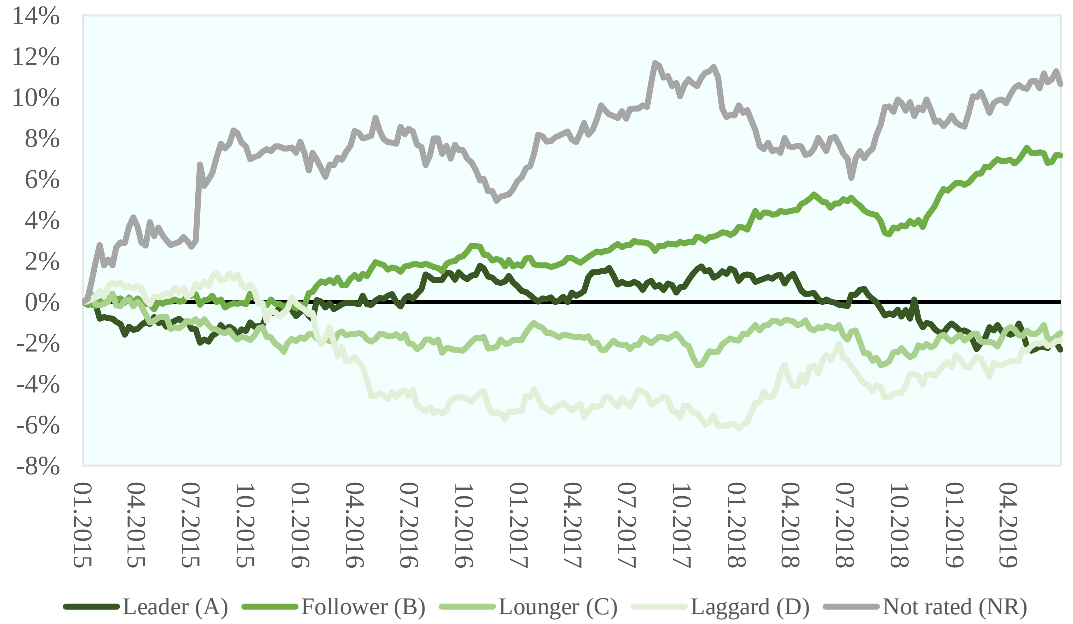
This table presents the style factors controlled in FM regressions. PFP methodology neutralises the effects of 11 well-known style, 24 industry and 48 country factors when constructing Fama-MacBeth-based E, S and G factor portfolios (due to limited space, we do not report sectors and countries). The size, value, investment, and profitability factors are applied in the FF 5-factor model. The momentum factor is often attributed to *Carhart (1997).* Most of the factors consist of more than one firm characteristics as descriptors. Descriptors are merged into factors via principal component analysis (PCA).

All stocks traded between 2015-2019 are analysed, controlling survivorship bias. For statistical inference, data cleansing procedures are performed. First, companies that did not have, for any reason, price, total return, or market capitalisation are excluded. Second, the penny stocks (maximum price below USD 5) were filtered out. Concerning missing values: instead of removing observations, multiple imputations (MI) is employed. After MI, winsorisation rules are specified based on the 1st and the 99th percentiles to manage extreme values.

3.2.3. RESULTS

Figures 12-14 depict the market-relative returns of ESG PFPs. Figure 12 shows environmental portfolio returns, not accounting for risk at this stage. The leaders resulted in a negative cumulative market-relative return (-2.32 per cent). The follower outperformed (7.15 per cent) while loungers (-1.53 per cent) and laggards (-1.88 per cent) underperformed the market. Unrated companies outperformed each PFP (10.65 per cent).

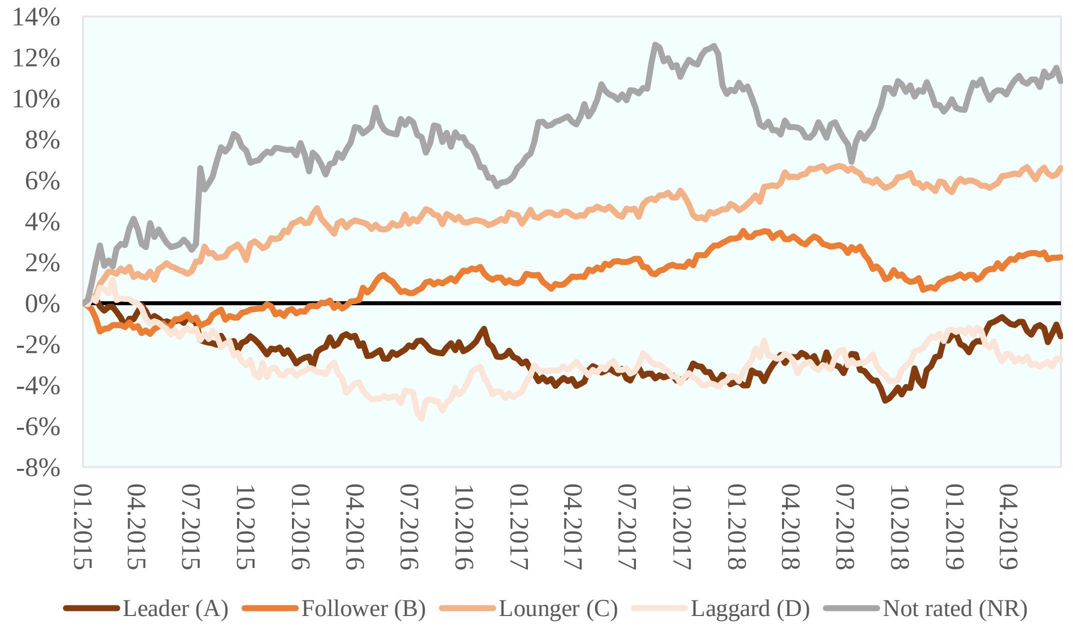
Figure 12. Cumulative market-relative returns of environment factor portfolios



The figure depicts the cumulative market-adjusted performance of pure environmental portfolios classified according to Table 1. Returns are total log returns. MSCI ACWI Index represents the market.

Social factor portfolios are presented in Figure 13. The leaders realised a negative market-relative return (-1.61 per cent). The followers outperformed the market (2.24 per cent), the loungers also added 6.60 per cent, while the laggards realised a negative return of -2.75 per cent. Unrated companies accumulated 10.86 per cent.

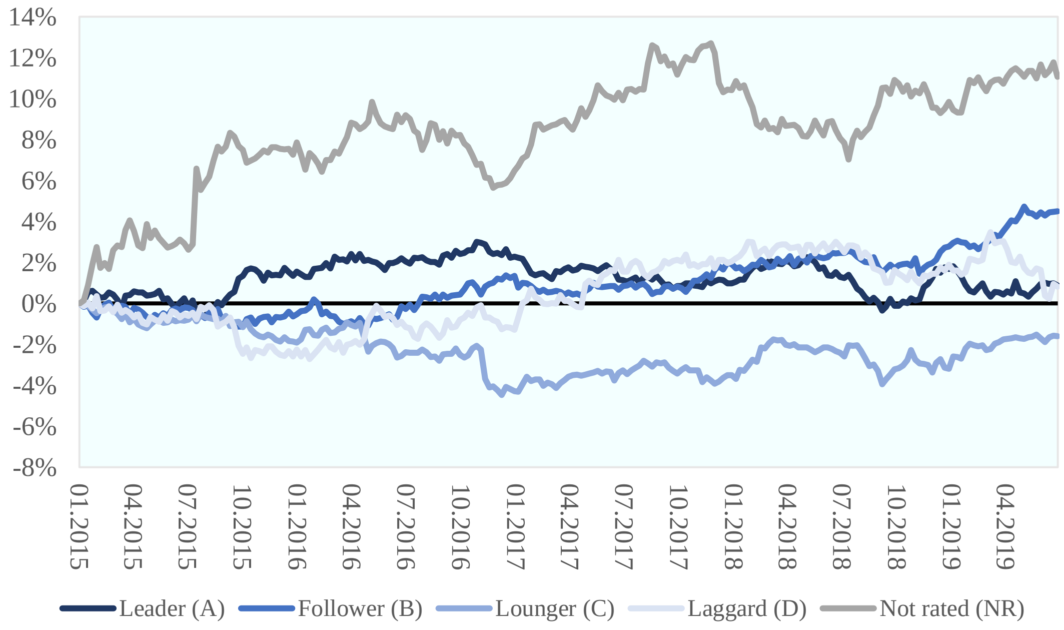
Figure 13. Cumulative market-relative return of social factor portfolios



The figure depicts the cumulative market-adjusted performance of pure social portfolios classified according to Table 1. Returns are total log returns. MSCI ACWI Index represents the market.

Governance portfolio returns are in Figure 14. The leader portfolio was up merely 0.87 per cent. The follower portfolio outperformed the market by 4.50 per cent, but loungers underperformed (-1.61 per cent). The laggards resulted in a 0.82 per cent surplus. Similarly to the previous cases, the NR outperformed the most, by 11.07 per cent.

Figure 14. Cumulative market-relative return of governance factor portfolios



The figure depicts the cumulative market-adjusted performance of pure governance portfolios classified according to Table 1. Returns are total log returns. MSCI ACWI Index represents the market.

Below, Table 15 presents the results from the risk-adjusted performance measures. The leader portfolios generated negative alphas; however, only the environmental portfolio's results were significant at 10 per cent, achieving -1.19 and -1.18 per cent per annum for both OLS and GMM-IV$_d$. Unrated portfolios across ESG were not significant in any instance after risk adjustment, despite their high returns. Follower E and G portfolios had positive alphas; the former marginally significant in both estimation methods (1.15 and 1.14 per cent p.a.). The lounger S portfolio realised a marginally significant 1.09 per cent alpha, according to GMM-IV$_d$.

Table 15. Financial performance of pure ESG factor portfolios

	PFPs	(A)				(B)			
		α (OLS HAC)	t-stat	p-value		α ($GMM\text{-}IV_d$)	t-stat	p-value	
E	Leader (A)	**-1.19%**	**-1.84**	**0.067**	*	**-1.18%**	**-1.81**	**0.071**	*
	Follower (B)	**1.15%**	**1.94**	**0.054**	*	**1.14%**	**1.79**	**0.073**	*
	Lounger (C)	-0.78%	-1.53	0.126		-0.73%	-1.31	0.189	
	Laggard (D)	-0.42%	-0.33	0.743		-0.33%	-0.27	0.786	
	Not rated (NR)	1.07%	0.84	0.402		1.13%	0.89	0.373	
S	Leader (A)	-0.97%	-1.20	0.231		-0.94%	-1.14	0.256	
	Follower (B)	0.02%	0.03	0.977		0.01%	0.02	0.987	
	Lounger (C)	1.06%	1.62	0.107		**1.09%**	**1.73**	**0.083**	*
	Laggard (D)	-0.80%	-0.83	0.406		-0.73%	-0.84	0.402	
	Not rated (NR)	1.13%	0.84	0.404		1.18%	0.87	0.386	
G	Leader (A)	-0.18%	-0.29	0.775		-0.15%	-0.22	0.823	
	Follower (B)	0.65%	1.25	0.213		0.67%	1.28	0.200	
	Lounger (C)	-0.90%	-1.30	0.194		-0.94%	-1.35	0.178	
	Laggard (D)	-0.41%	-0.43	0.670		-0.30%	-0.31	0.757	
	Not rated (NR)	1.03%	0.76	0.448		1.07%	0.79	0.428	

Alphas (log returns) are annualised figures. Both Panels (A) and (B) apply risk factors from (45) (FF5), which rest on (37) and (38). In Panel (A), alphas are calculated, applying OLS with Newey-West standard errors. In Panel (B), alphas are the $GMM\text{-}IV_d$ outcomes using the HAC weighting matrix and standard errors. Based on tests of *Racicot et al. (2019)* and *Olea and Pflueger (2013)*, IVs are found robust and exogenous. Further, there are some measurement errors based on OLS; hence $GMM\text{-}IV_d$ is a more appropriate method for measuring performance than OLS. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

The Sharpe-ratio and two alternative alpha estimation methods were analysed as robustness tests (Table 4.). Instead of the GMM, we apply the two-stage least squares (TSLS) estimator. The IVs are (1) the "z" instruments from Equation (44) also used by *Racicot and Théoret (2014)*, and (2) the higher-order moments up to three of the regressors. The latter approach is consistent with *Cragg (1997)* and *Lewbel (1997)*. Lewbel contends that these instruments are appropriate for estimation when no other alternative IVs are readily available.

The Sharpe ratios support alpha results, though the leader environmental portfolio's negative performance is no longer significant. Concurrently, the follower governance portfolio has become a marginally significant outperformer. The follower environmental and the lounger social portfolios also beat the market but now at a 5 per cent significance level. Based on the IV_z and IV_m approaches, the leader environmental portfolio's negative alpha is not significant anymore at the usual significance levels. No other results are significant, except for the follower environmental portfolio with a marginally significant alpha based on $TSLS\text{-}IV_m$.

Table 4. Robustness tests of ESG PFPs' financial performance

PFPs		(A)			(B)				(C)			
		α (TSLS-IV$_z$)	t-stat	p-value	α (TSLS-IV$_m$)	t-stat	p-value		Sharpe$_{i-M}$	t-stat	p-value	
E	Leader (A)	-1.63%	-1.29	0.199	-1.33%	-1.16	0.246		-0.049	-0.81	0.420	
	Follower (B)	1.25%	1.24	0.215	**1.19%**	**1.70**	**0.090**	*	**0.119**	**2.30**	**0.023**	**
	Lounger (C)	-0.45%	-0.28	0.778	-0.21%	-0.26	0.799		-0.032	-0.57	0.568	
	Laggard (D)	-1.53%	-0.66	0.512	-0.91%	-0.59	0.553		-0.013	-0.16	0.875	
	Not rated (NR)	1.07%	0.35	0.726	1.58%	1.03	0.305		0.16	1.30	0.196	
S	Leader (A)	-0.87%	-0.70	0.483	-1.65%	-1.35	0.179		-0.042	-0.60	0.546	
	Follower (B)	0.24%	0.25	0.805	-0.11%	-0.14	0.892		0.031	0.60	0.548	
	Lounger (C)	0.70%	0.73	0.468	1.57%	1.55	0.122		**0.118**	**2.19**	**0.030**	**
	Laggard (D)	-2.90%	-1.35	0.178	-0.43%	-0.28	0.782		-0.035	-0.44	0.658	
	Not rated (NR)	1.67%	0.70	0.481	1.48%	1.00	0.316		0.16	1.30	0.193	
G	Leader (A)	-0.83%	-0.67	0.505	-0.06%	-0.05	0.958		0.013	0.23	0.817	
	Follower (B)	0.30%	0.37	0.710	0.87%	1.18	0.240		**0.077**	**1.65**	**0.100**	*
	Lounger (C)	0.29%	0.18	0.861	-0.34%	-0.24	0.812		-0.027	-0.42	0.672	
	Laggard (D)	-1.11%	-0.45	0.654	-0.84%	-0.58	0.564		-0.004	-0.05	0.962	
	Not rated (NR)	0.30%	0.11	0.912	0.94%	0.66	0.507		0.164	1.33	0.186	

Alphas (log returns) and Sharpe-ratios are annualised figures. Sharpe$_{i-M}$ refers to the ith portfolio's Sharpe ratio over the market's (M) Sharpe ratio. Both Panel (A) and (B) apply risk factors from Equation (45) (FF5), which rest on (37) and (38). In Panel (A), alphas are calculated, applying TSLS with the "z" instruments based on (44) and proposed by *Dagenais and Dagenais (1997)* in line with *Durbin (1954)* and *Pal (1980)*. In Panel (B), alphas are the TSLS method outcomes using higher-order moments (m) as instruments (further details on why higher moments are proper IVs are in *Cragg, 1997;* and *Lewbel, 1997*). In both cases, HAC standard errors are applied. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

The results have the following implications: environmental leader portfolio realised significant negative risk-adjusted returns, though the results are not robust. The environmental follower portfolio showed positive risk-adjusted performance as results were significant for four model specifications, yet the model failed in the robustness checks. All ESG laggard portfolios underperformed; however, results remain statistically not significant.

One could conclude that the factor portfolios did not have robust significant alphas. This result supports literature findings that the FF5 effectively explains stock returns (*Guo et al., 2017; Zaremba and Czapkiewicz, 2017*).

Another conclusion comes from the applied FF spanning regression technique as it tests if ESG factors are viable new factors in the FF5. *Harvey et al. (2016, p. 37)* argue that a newly discovered factor requires a t-statistic of at least 3.0. Although the ESG portfolios are suitable to measure the performance attribution of ESG factors, the low t-statistics do not justify them as complementary new factors to the FF5, in line with *Xiao et al. (2013)*. In contrast, *Hübel and Scholz (2020)* and *Díaz et al. (2021)* find evidence in support of ESG as valid additional factors.

We propose another application for the asset management industry. The PFPs may be used as ESG indices to capture the sustainability risks of investment portfolios. Consequently, asset managers may regress their portfolios on the ESG PFPs to find their portfolios' ESG tilt and quantify the performance attribution of the ESG factors.

3.2.4. CONCLUSION

This chapter examined the performance of ESG pure factor portfolios in global equity markets from 2015 to mid-2019, covering ESG portfolios from leaders to laggards. ESG portfolios did not generate significant alphas, corroborating literature findings on neutrality. Further, results also suggest that investors can promote sustainability without forgoing returns. The applied RHS approach following *FF* also served to test the validity of ESG factors to explain the cross-section of expected returns. No sufficient evidence was found for ESG factors to be considered as additional factors in the FF5. However, ESG PFPs may serve as indices to capture sustainability risks by quantifying the performance attribution of the ESG factor tilt while excluding secondary factor impacts.

3.3. ESG INTEGRATION & THEMATIC INVESTING – IS THERE A VIRTUOUS CIRCLE?

The primary goal of this chapter is to assess the *pure performance*[1] of two distinct sustainable[2] investment strategies, "ESG integration" and "ESG-themed" investments, under changing global stock market conditions, including the COVID-19 crisis. Incorporating sustainability into investment decisions is becoming a standard procedure in the asset management industry. While ethical considerations, such as divesting from sin stocks and sectors, played a central role at the dawn of sustainable investments, more recently, rational aspects are also pronounced. *Krueger et al. (2020)* surveyed global institutional investors to clarify their rational motives for integrating climate risks into the investment processes. They found that the most common reasons are protecting reputation, considering legal concerns, and improving the risk and return profile of investment portfolios. *Ailman et al. (2017*) emphasise the forward-looking nature of ESG information. This long-term perspective is in line with what *Bénabou and Tirole (2010, p. 9)* call the "win-win vision" and results in the "doing well while doing good" concept[3]. The "shared value" principle popularised by *Porter and Kramer (2019)* is about creating economic value that simultaneously benefits society by addressing its needs and challenges.

Besides the rational considerations of institutional investors, asset owner preferences are also changing substantially; hence, there is a rising demand for investments that

[1] *Cornell and Damodaran (2020)* identify three fundamental questions concerning ESG. (1) How does ESG affect a firm's operations and value? (2) How does the market price the consequences of ESG? (3) Do investors make excess returns on ESG stocks? The dissertation focuses on the third question.

[2] Sustainability has several competing definitions in the literature. Scholars and practitioners use the terms "ethical investing", "socially responsible investing (SRI)", "responsible investing (RI)", or "corporate social responsibility (CSR)" and "ESG investing" interchangeably; however, each concept have evolved over decades and has unique characteristics. *Daugaard (2019)* and *Townsend (2020)* give a comprehensive overview of these concepts, while *Eccles and Viviers (2011)* reflect on the origins and meanings of the naming conventions. The chapter uses "sustainable investing" and "ESG" as broad umbrella terms in line with *GSIA (2018, p. 3)* terminology: "*Sustainable investing is an investment approach that considers environmental, social and governance (ESG) factors in portfolio selection and management.*"

[3] The "doing well while doing good" concept is often associated with *Hamilton et al. (1993)*, although the authors did not find any significant evidence for positive relationship.

promote sustainability. *Tucker and Jones (2020)* report that Millennials and even Gen Xers have a high overall preference for ESG investing, with 85 per cent of Millennials and 73 per cent of Gen Xers having a moderate or high demand. A survey of *Amel-Zadeh and Serafeim (2018)* with mainstream investment organisations concludes that one of the most critical motivations of investment professionals for using ESG is client demand.

In response to elevated client demand, the asset management sector has increased the share of sustainable investments within total assets under management (AUM). According to *GSIA (2018)*, sustainable investing attained USD 30.7 trillion at the start of 2018, a 34 per cent increase in two years. Also, the proportion of sustainable investments relative to total AUM made up 33 per cent in 2018 while it was 21 per cent in 2012, corresponding to an almost 60 per cent increase in six years. By the end of 2020, over 3,000 global asset owners and asset managers representing more than USD 103 trillion AUM had signed the United Nations Principles for Responsible Investment (*PRI, 2020*). According to *Diab and Martin Adams (2021)*, global ESG assets are on track to exceed USD 53 trillion by 2025, representing 38 per cent of the projected total AUM.

Global standard-setting organisations (e.g., GRI, SASB, CDSB)[4] have played a considerable role in developing corporate sustainability reporting systems. However, the ever-growing importance of sustainable investments underlined the need for a coherent and mandatory regulatory framework. *Friede (2019)* found that the major impediments to further growth in ESG are data quality and the absence of clear standards and definitions. Regions around the world are progressing at different paces; however, the two most prominent players to pay attention are still the United States and the European Union (*GSIA 2018*). In the US, the regulatory environment is not yet settled; however, ESG objectives are likely to be more emphasised in the upcoming years[5]. Contrary to the US, the EU is already adopting a classification framework

[4] *Eccles et al. (2015)* introduce a comprehensive review of the leading sustainability and integrated reporting organisations.

[5] ESG is not new for US authorities. The SEC adopted a series of environmental disclosures for public companies in the 1970s to resolve protracted litigation with the Sierra Club. The SEC also adopted the Commission Guidance Regarding Disclosure Related to Climate Change in 2010; however, relatively

designed to determine whether an economic activity is environmentally sustainable (Taxonomy Regulation[6]). The EU also implements standardised procedures through the Sustainable Finance Disclosure Regulation (SFDR)[7] (*Gyura, 2020*).

One of the leading credit rating agencies, Moody's, noted that the main obstacle – besides the lack of standardised definitions – to the even wider acceptance of sustainable investing is the usual investor perception that there is a trade-off between doing good and maximising investment returns (*Moody's, 2020*). The debate over the actual relationship between ESG and corporate financial performance (CFP) also exists in the academic literature. Moreover, this discussion is not new-fangled: the performance measurement of sustainable investing has at least 50 years of history, as the first wave of studies were published in the 1970s (*Moskowitz 1972; Bragdon and Marlin 1972; Bowman and Haire 1975)*[8].

There are two rival hypotheses in the business management literature concerning the ESG-CFP relationship. The first strain, which originates from Moskowitz's pioneering study (*Moskowitz 1972*), concludes that responsible corporate behaviour produces superior financial performance. The "antagonist" to Moskowitz, *Friedman (1970)* claims that including ESG criteria in managerial decisions generates additional costs, resulting in weaker financial performance. These two contradictory views have endured until today and essentially characterize research.

Several theories have emerged following the traditions of Moskowitz or Friedman. Stakeholder theory (*Freeman, 2010; Hillman and Keim, 2001; Mitchell et al., 1997*) or good management theory (*Waddock and Graves, 1998*) argue that primary stakeholder satisfaction is critical in achieving superior financial performance. The

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little has since said on these challenges (*Kimpel et al., 2021*). *Matos (2020)* introduces further details on the US regulatory environment.

[6] Regulation (EU) 2020/852 on the establishment of a framework to facilitate sustainable investment. The Taxonomy Regulation was published in the Official Journal of the EU on the June 22, 2020 and entered into force on July 12, 2020. However, the Regulation contemplates a phased implementation, with certain rules applying from different dates (*Dobránszky-Bartus and Valdemar Krenchel 2020*).

[7] Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial services sector

[8] In fact, the studies of the 1970s had forerunners. For instance, Merrick Dodd, in the 1930s, raised the issue that "*business corporation as an economic institution has a social service as well as a profit-making function*" (*Dodd 1932, p. 1148*).

trade-off hypothesis (*Aupperle et al., 1985*; *Preston and O'Bannon, 1997*) claims that higher ESG performance comes with higher costs: resource reallocations to socially responsible activities are not viable – higher operating expenses are incurred due to internalisation of externalities. The third hypothesis is the neutrality principle, which is often attributed to *McWilliams and Siegel (2000, 2001)*. The authors assert that incorporating R&D factors, often omitted in the empirical literature, eliminates the positive impact in the CSP-CFP relationship, resulting in neutrality. Finally, *Bowman and Haire (1975)* introduce an inverted "U" relationship, meaning that only the intermediate level of ESG pays off. *Azmi et al. (2021)* and *Sun et al. (2019)* also found evidence that ESG activity is beneficial only up to a point; after that, there are diminishing marginal returns to ESG.

Over the past fifty years, a wealth of empirical studies accumulated in the academic literature to examine ESG-CFP relation. Numerous literature reviews summarised these empirical results (e.g., *Griffin and Mahon 1997; Margolis and Walsh 2003; van Beurden and Gössling 2008*). The most comprehensive one is probably from *Friede, Busch, and Bassen (2015),* who combine the findings of about 2,200 individual articles using second-order meta-analysis and concluding that roughly 90 per cent of studies found a non-negative ESG-CFP performance relationship.

This chapter makes several contributions to the business ethics and finance literature. Firstly, ESG equity portfolios are constructed based on *two* well-distinguishable investment strategies. As emphasised in Chapter 2, ESG integration is rather consistent with the "organisational sustainability" concept, while ESG-themed investing corresponds more to the "global sustainability" idea (*Garvare and Johansson, 2010*). Further, in the first approach, *ESG integration*, ESG portfolio construction relies solely on ESG ratings. Equivalently, the investment scheme takes and adapts the ESG valuation techniques of external actors, i.e., ESG rating agencies. The second approach, *ESG-themed investments* or thematic investing, rests on market signals by selecting stocks from thematic ETFs. Consequently, the relative amount of money inflows into these ESG-themed funds signals the market participants' beliefs that these firms can promote sustainability. This strategy, contrary to the ESG integration approach, reflects a pure market-oriented attitude. Evaluating the two different investment strategies' market performance allows examining sustainable investments from different angles. To the best of the author's knowledge, no one in the investment literature has applied the stakeholder-based conceptual model of *Garvare and Johansson (2010)* that distinguishes between organisational and global sustainability.

Secondly, ESG-themed investments are among the *less analysed* sustainability strategies in the academic literature (e.g., *Ibikunle and Steffen 2017; Martí-Ballester 2019; Reboredo et al. 2017*), even though the strategy has grown the most dramatically in recent years. In 2012, about USD 83 billion was allocated to sustainability-themed strategies, while in 2018, it was above USD 1,000 billion (1,200 per cent increase in 6 years), meaning that ESG-themed investment strategies are starting to resonate with investor beliefs (GSIA, 2018). Furthermore, the nine themes[9] analysed align with the UN Sustainable Development Goals (SDGs) as well as the spirit of the EU Taxonomy Regulation. We believe that thematic investments are also in line with *Porter and Kramer's (2019)* shared-value concept.

Tsai and Wu (2021) argue that most studies in the literature assume a stationary relationship between ESG and financial performance. However, the authors also claim that the value of ESG is likely to be revealed during bear market conditions. The *COVID-19 pandemic* provides an opportunity to examine sustainable investments during an exogenous market crash. The dissertation contributes to the existing literature (e.g., *Albuquerque et al. 2020; Pástor and Vorsatz 2020*) by analysing the performance of ESG integration and ESG-themed investment strategies during the first wave of the coronavirus crisis.

Next, pure factor portfolios (PFP) methodology is used to compile ESG *factor* portfolios. The approach is in line with the Fama-MacBeth (FM) procedure (*Fama 1976; Fama and MacBeth 1973*); however, an *extended* version is utilised that combines the methods employed by *Menchero (2010)*, *Menchero and Lee (2015)*, and *Clarke et al. (2014, 2017)*. PFPs have favourable properties of removing secondary factor effects without being methodologically "black boxes". *Revelli and Viviani (2015)* assert that if the reference period of empirical analysis is relatively short, it becomes difficult to isolate ESG effects from other factors. The authors claim that the

[9] The nine themes cover Energy efficiency, Food security, Water scarcity, Ageing, Millennials, Urbanisation, Cybersecurity, Disruptive technologies, and Robotics. The first three are considered as environmental (E) megatrends, the second three as social (S) megatrends, the last three as technology-focused megatrends that respond to corporate governance (G) challenges.

empirical findings on financial performance could be due to transitory factors or the correlation between ESG characteristics and other factors. Further, *Galema et al. (2008)* show that the Fama-French (FF) model's value factor could incorporate some ESG characteristics. *Grossman and Sharpe (1986)* found that the positive market-relative performance of South Africa-free portfolios might be due to the small size effect. Therefore, filtering out secondary factor exposures and isolating ESG factors is a critical requirement satisfied by PFPs.

The investment literature follows two different approaches to evaluate ESG investments. One compares ESG fund performance with their non-ESG counterparts (*Lesser et al., 2016*; *Nofsinger and Varma, 2014*). Another strain tries to identify ESG as new risk factors in the FF framework *(Hübel and Scholz, 2020; Jin, 2018; Maiti, 2020*; *Xiao et al., 2013*). The chapter applies the *right-hand-side (RHS) method* in time-series analysis, popularised by *FF (2018),* which combines the two approaches with the benefit of capturing specific factors' pure performance (*Bali et al., 2016*) while testing their validity as new factors. The RHS approach is a standard procedure in the FF universe (see *FF 1996, 2015, 2017*). The paper contributes to the literature in applying the RHS approach to ESG factors.

Portfolio managers who integrate sustainability in their investment portfolios undertake a dual optimisation process that combines ESG strategies with fundamental valuation. By measuring the impact of sustainability risk on portfolio returns, the theis proposes using the PFPs as *smart beta indices*[10] to measure ESG tilt to different ESG factors. This method is superior to calculating the overall ESG rating of investment portfolios currently commonly used by asset managers, as it separates the performance contribution of the ESG tilt from the secondary factors such as geographical, industry, or style effects. *Alessandrini and Jondeau (2020)* and *Bender et al. (2017)* present a similar technique; however, the comprehensive approach presented below controls 107 different styles (including each ESG factor), industry, and country factors.

[10] According to *Zaher (2019)*, the investment industry uses terms like "smart beta", "risk factors", or "factor-based investing" as synonyms. We do not wish to distinguish between these definitions either.

3.3.1. Literature review and hypothesis development

In the investment literature, the conclusions on the role of ESG are mixed, just like in management studies. There are essentially three competing arguments concerning the risk-adjusted returns of ESG strategies: the positive, the negative, and the neutral relationship. Neutrality or the no-effect hypothesis is closely related to the modern portfolio theory (MPT) of *Markowitz (1952)* and the efficient market hypothesis (EMH) of *Fama (1970)*. The former argues that there is no return premium for factors that incorporate only idiosyncratic risk, i.e., ESG risks are diversifiable. The latter insists that stock prices reflect all public and relevant information; hence it is not possible to attain superior risk-adjusted returns relative to the market portfolio. Studies from *Bauer et al. (2007)*, *Hamilton et al. (1993)*, *Hartzmark and Sussman (2019),* and *Managi et al. (2012)* support neutrality.

The advocates of the negative relationship or trade-off hypothesis contend that ESG investments are likely to underperform in the long run either because ESG portfolios are a subset of the market; thus, the degree of diversification is limited or due to overvaluations that might derive from investors' value-driven attitude[11]. *Renneboog et al. (2008b)* argue that diversification constraints may shift the mean-variance frontier towards less favourable risk-return trade-offs than those of conventional portfolios. *Hong and Kacperczyk (2009)* demonstrate that sin stocks have historically outperformed the market; therefore, underinvestment in such financially attractive investment opportunities results in significantly lower risk-adjusted returns. According to *Derwall et al. (2011)*, investors' non-pecuniary utilities might be the reason why ESG investments can achieve significant negative risk-adjusted returns. The authors argue that if a significant number of investors are values-driven, they are willing to sacrifice returns to meet high ESG standards by shunning sin stocks. The other concept of negative abnormal returns is in line with the possible overvaluation of ESG stocks found by *Renneboog et al. (2008b)*. Put another way, ESG-conscious investors pay a price for ESG compliance. Overvaluation, hence forgoing returns, also corresponds to the "delegated philanthropy vision" emphasised by *Bénabou – Tirole (2010)*.

[11] The effects of values-driven ESG investors on stock prices can be understood theoretically by *Merton*'s *(1987)* model on neglected stocks and segmented markets.

Several research studies claim that investors may realise significant superior risk-adjusted returns by incorporating ESG criteria into the investment process. *Hamilton et al. (1993)* refer to this positive ESG-CFP relation as the "doing well while doing good" concept; *Derwall et al. (2011)* term it the "errors-in-expectations hypothesis", *Porter and Kramer (2019)* introduce the "shared-value" concept, while *Bénabou and Tirole (2010)* draw up the "win-win" vision which underlines the long-term perspective of ESG. *Derwall et al. (2011)* argue that at least two conditions should be met to maintain the errors-in-expectations hypothesis. First, firms expected future cash flows – i.e., projects with positive net present value, NPV – should associate with their use of ESG practices. Second, stock prices should not reflect all the value-relevant information related to ESG practices. In summary, "true" NPV and "value-relevant information" indicate that the "doing well while doing good" hypothesis might be valid only if markets misprice social responsibility; therefore, it is against the EMH. There might be several reasons for mispricing, which are summarised in *Derwall et al. (2011)*. The possible explanations of *Klassen and McLaughlin (1996)* are also appealing: financial markets pay less attention to positive corporate social responsibility practices than to controversies[12]. *Derwall et al. (2005), Edmans (2011), Flammer (2012),* and *Kempf and Osthoff (2007)* found evidence for the "doing well while doing good" concept.

Besides the trade-off and the win-win approaches, the proponents of the inverted U-shaped relationship doubt the linear relation between ESG and financial performance. Instead, in many cases, considering non-linearity may be a suitable assumption. The inverted U-shaped relation, first described by *Bowman and Haire (1975),* contends that the intermediate level of ESG performance maximises investor yields. The economic rationale behind non-linearity is the diminishing marginal returns to ESG. According to *Sun et al. (2019),* ESG activities utilise substantial corporate resources, such as dedicating employees to ESG duties and managerial investments. The resource reallocation to ESG becomes increasingly challenging because of the increased competition between ESG and other core business activities. Thus, the authors assert,

[12] This argument is consistent with the well-known stylised fact of financial time series that there is a gain/loss asymmetry in returns (*Cont, 2001*). Further, it is also underpinned by interviews with ESG rating agency representatives, who emphasised corporate controversies much more than "best practices".

the cost of managing ESG becomes high and thus reduces returns. Beyond a certain point, consumers also perceive that additional costs of excessive ESG compliance reflected in product prices no longer associated with sufficient utility, resulting in demand reduction (*Bhattacharya and Sen, 2004*). The drop in demand reduces net cash flows, which, in turn, pushes down shareholder value. Recent empirical studies of *Azmi et al. (2021)*, *Grassmann (2021)*, *Groening and Kanuri (2018)*, and *Han et al. (2016)* found some evidence on inverted U-shaped relation.

This chapter examines the pure market performance of ESG integration and ESG-themed investment strategies in global equity markets between 2015 and mid-2020. Consequently, each theory presented so far might be relevant. However, the first hypothesis derives from the "doing well while doing good" concept and Porter's and Kramer's shared-value theory. Therefore, the hypothesis is the following.

Hypothesis 1 (H_1): Assuming a positive relation between ESG and financial performance, we predict that, in the *longer term*, it is possible to generate significant positive risk-adjusted returns with ESG leaders in the ESG integration approach (**H_{1A}**) and with ESG-themed investment strategies (**H_{1B}**).

The reference period covers the first wave of the COVID-19 pandemic, allowing the performance measurement of ESG-conscious investment strategies during an exogenous market crash. According to *Tsai and Wu (2021)*, most academic literature presumes a stationary relation between ESG and financial performance. However, there is some empirical evidence that this assumption is unrealistic. Although research is limited concerning the performance of ESG during crisis periods *(Broadstock et al., 2021*), some insights can still be gained from previous research. *Nofsinger and Varma (2014)* study two crisis periods – 2000-2002 after the dot-com bubble and the global financial crisis of 2007-2009 – and found that socially responsible mutual funds outperform during periods of market crises. *Cornett et al. (2016)* report that US banks' financial performance during the global financial crisis (GFC) is positively related to their ESG rating. *Lins et al. (2017)* show that during the GFC, non-financial US firms with high ESG scores have better financial performance than other firms with low ratings.

Studies examining ESG performance during the COVID-19 pandemic have mixed results. *Broadstock et al. (2021)* analyse a dataset covering China's CSI300 constituents and show high-ESG portfolios generally outperform low-ESG portfolios. *Pástor and Vorsatz (2020)* investigate US active equity mutual funds' performance and flows, including sustainable funds, and conclude that most active funds underperform passive benchmarks. However, they find funds with higher sustainability ratings perform better than their conventional counterparts. *Ding et al. (2021)* evaluate 6,700 firms across 61 economies and assert that pandemic-induced drop in stock returns is milder among firms with stronger pre-2020 finances, less exposure to COVID-19 through global supply chains and customer locations, *more corporate social responsibility activities*, and less entrenched executives. *Albuquerque et al. (2020)* analyse 2,171 US stocks and show that firms with higher ES ratings have significantly higher returns, lower return volatility, and higher operating profit margins during the first quarter of 2020.

Contrary to the previous findings, *Demers et al. (2021)* find evidence that once industry effects, market-based measures of risk, and accounting-based measures of performance, financial position, and intangibles investments have been controlled, ESG does not offer positive explanatory power for returns. The authors conclude that a high ESG level is not associated with significant superior returns during the first wave of COVID and the entire year of 2020. The results of *Folger-Laronde et al. (2020)* also indicate that higher levels of the sustainability performance of the examined ETFs do not safeguard investments from financial losses during a severe market downturn.

Some of the studies presented above are consistent with the "flight to quality" phenomenon (*Broadstock et al., 2021*) and underline the "insurance-like protection" ability of ESG (*Shiu and Yang 2017*). Regarding ESG performance during the COVID-19 crisis, most of the publications cover the US stock market. This chapter's empirical section analyses ESG factor portfolios in *global* markets by controlling 83 secondary style, industry, and country factors to measure *pure* ESG performance during the COVID-19 crisis. Consequently, the research question is whether "flight to quality" maintains in global circumstances. The second hypothesis tested is as follows:

Hypothesis 2 (H_2): Assuming a positive relation between ESG and financial performance, we predict that it is possible to beat the market with ESG leaders in the

ESG integration approach (**H_{2A}**) and with ESG-themed investment strategies (**H_{2B}**) during severe market conditions such as the COVID-19 pandemic.

The investment literature follows two distinct approaches to evaluate ESG investments. One compares ESG funds' performance with their non-ESG counterparts (*Lesser et al., 2016*; *Nofsinger and Varma, 2014*; *Pástor and Vorsatz, 2020*). Another approach is to identify ESG as new risk factors beyond the original FF factors (*Hübel and Scholz, 2020*; *Jin, 2018*; *Maiti*, *2020*). The chapter applies the right-hand-side (RHS) method, popularised by *FF (2018),* which combines the two approaches with the benefit of capturing specific factors' pure performance (*Bali et al., 2016*) while testing whether they are valid new factors (*FF, 1996, 2015, 2017*). *Harvey et al. (2016, p. 37)* argue that, due to data mining, a newly discovered factor requires a t-statistic of at least 3.0; therefore, ESG factors might be considered as new risk measures in the FF universe if this requirement is satisfied. The third hypothesis is the following.

Hypothesis 3 (H3): Following the literature's recommendations on the t-statistic being higher than 3.0, it is assumed that ESG factors can be included in the FF framework as new risk factors.

3.3.2. EMPIRICAL METHODOLOGY

The baseline performance evaluation rests on *alpha* calculations utilising the CAPM and Fama-French factor models and consists of two consecutive stages, cross-sectional and time-series analysis. The cross-sectional analysis applies *Fama and MacBeth (1973)* regressions to construct ESG as well as style, industry, and country pure factor portfolios (PFP). The style factors, among others, include the *FF (2015)* five factors and the momentum factor popularised by *Carhart (1997)*. The term "pure" factor portfolio is "borrowed" from *Clarke et al. (2017)* and *Menchero (2010)* to point out that *numerous* secondary factor exposures are disentangled compared to "simple" or "primary" factor portfolios that concentrate solely on one factor. In the time-series analysis, ESG PFP returns are regressed on the FF pure factors to get ESG PFP alphas. The time-series regression approach corresponds to the FF right-hand-side technique using spanning regressions (*FF 2018*), a routine in the FF universe as emphasised in the previous section[13].

Factor Portfolio Construction

The standard FM procedure runs cross-sectional regressions in each time period. The method is concurrently suitable for determining factor portfolio returns (i.e., regression coefficients) and calculating stock weights in each factor portfolio[14]. The FM regressions equation using conventional matrix algebra notations is the following:

$$R_{t+1} = Z_t F_{t+1} + u_{t+1} \,, \tag{46}$$

where R_{t+1} is the (N x 1) vector of stock returns on N individual securities from t to $t+1$; Z_t is the (N x K) matrix of standardised factor exposures[15] at date t, with a vector of ones in the first column[16]; $\hat{F}_{t+1}$ is the (K x 1) vector of the ordinary least squares (OLS) values of the regression coefficients at $t+1$, and u_{t+1} is the (N x 1) vector of security return disturbances for $t+1$. K is the number of explanatory variables, including the standard portfolio.

[13] *Fama and French (2018, p. 234)* argue that spanning regressions are handy tools to determine whether individual factors contribute to an empirical asset pricing model's explanatory power. Each candidate factor is regressed on the model's other factors. If the intercept (i.e., alpha) statistically differs from zero, that factor adds to the model's explanation of average returns in the given sample period.

[14] In their 2020 article, Fama and French give a thorough and intuitive overview and summary of the asset pricing universe they have created, including the FM approach. In this study, they refer to Fama's famous 1976 book (Foundations of Finance), which explicitly explains that the FM coefficients of the explanatory variables can also be referred to as the returns of (factor) portfolios (*FF 2020*). The book was published later than the FM article itself, however, in a video interview of the *American Finance Association (2008)* project, Fama acknowledges that the FM article is less intuitive than Chapter 9 in Foundations of Finance. The description of the methodology, therefore, follows *Fama (1976)*.

[15] Factor exposures might cover, for instance, corporate size, financial profitability, leverage, liquidity. The factor exposures are proxied mostly by accounting and stock market measures (i.e., firm descriptors). The reason for calculating z-sores is detailed in *FF (2020, p. 1896-1897)*. Factor exposures and firm descriptors are presented in the "Database and Variables" section.

[16] The first column of Z_t represents a "standard" portfolio (*FF 1976, 2020*), against which each left-hand-side (LHS) asset has a unit exposure. Further, the standard portfolio constituents have weights that sum to one and zero out each explanatory variable. The regression intercept of (46) is the return of the standard portfolio and is called the level return. The level return is the month t+1 return common to all assets and not captured by the regression explanatory variables.

The OLS solution for the regression coefficients is as follows.

$$F_{t+1} = (Z_t{`}Z_t)^{-1}Z_t{`}R_{t+1} \tag{47}$$

Fama (1976) notes that the individual security weights in each factor portfolio are the elements of the weight matrix W_t.

$$W_t \stackrel{\text{def}}{=} (Z_t{`}Z_t)^{-1}Z_t{`} \tag{48}$$

One must emphasise that even though the stock weights are observable at *t*, the returns (i.e., slope coefficients, *F*) are not observable until the next period[17] $(t + 1)$.

Perfect multicollinearity emerges from ESG, sector, and country dummy factors, making the $(Z_t{'}Z_t)$ matrix singular. The thesis follows *Heston and Rouwenhorst (1994)* and *Menchero (2010)* to solve this problem by imposing three and two constraints[18] in the ESG integration and ESG-themed investment strategies. The heteroscedasticity of u_{t+1} and the influence of small stocks are well-known facts; therefore, weighted least squares regressions (WLS) are applied supplemented with the predefined constraints[19] (CWLS). The z-scores calculation of firm characteristics rests on the capitalisation weighting scheme presented by *Clarke et al. (2017)*. The extended version of the FM regression is the following.

$$V_tR_{t+1} = V_tZ_tC_tG_{t+1} + V_tu_{t+1} \tag{49}$$

In (49), V_t is the $(N \times N)$ diagonal matrix in time *t* with market capitalisations in the diagonal to correct heteroscedasticity. Matrix C_tG_{t+1} equals F_{t+1}, where C_t is the $K \times (K - 2)$ or $K \times (K - 3)$ constraint matrix depending on which ESG strategy is examined. G_{t+1} is the $(K - 2) \times 1$ or $(K - 3) \times 1$ vector of auxiliary returns in time $t+1$.

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[17] In fact, the weights (W_t) and returns (F_{t+1}) are active weights and active returns except for the standard portfolio. "Active" refers to the *difference* between the factor and the standard portfolio weights and returns. The sum of the standard portfolio weights (returns) and factor active weights (returns) equals the *total* weights (returns) of the given factor portfolio.

[18] The applied constraints are as follows: the market capitalisation-weighted return of industries (as well as countries and E, S, G) must, by definition, be equal to the return on the standard portfolio. Hence, the market capitalisation-weighted active industry, country and E/S/G returns must equal zero. In ESG-themed investing, two exact collinearities exist (due to industries and countries) as thematic portfolio compilation, in contrast to E/S/G, does not use dummy variables.

[19] We use market capitalisations as weights.

After some calculations, the final solution is in Equation (50) (for further derivation, see *Menchero 2010*).

$$F_{t+1} = C_t(C_t{}'Z_t{}'V_tZ_tC_t)^{-1}C_t{}'Z_t{}'V_tR_{t+1} \tag{50}$$

The individual stock weights are calculated according to (51):

$$W_t \stackrel{\text{def}}{=} C_t(C'_tZ_t{}'V_tZ_tC_t)^{-1}C_t{}'Z_t{}'V_t \tag{51}$$

Performance analysis

The alpha calculations derive from the CAPM and the Fama-French factor models:

$$RP_{it} = \alpha_i + b_{1i}\,MRP_t + u_{it}, \tag{52}$$

$$RP_{it} = \alpha_i + b_{1i}\,MRP_t + b_{2i}\,R_{SIZEt} + b_{3i}\,R_{VALUEt} + u_{it}, \tag{53}$$

$$RP_{it} = \alpha_i + b_{1i}\,MRP_t + b_{2i}\,R_{SIZEt} + b_{3i}\,R_{VALUEt} + b_{4i}\,R_{MOMt} + u_{it}, \tag{54}$$

$$RP_{it} = \alpha_i + b_{1i}\,MRP_t + b_{2i}\,R_{SIZEt} + b_{3i}\,R_{VALUEt} + b_{4i}\,R_{PROITt} + b_{5i}\,R_{INVt} + u_{it}, \tag{55}$$

Equation (52) is the CAPM, and Equations (53)-(55) are the Fama-French three (FF3), Carhart's four (FFC), and Fama-French five-factor (FF5) models, respectively. In each equation, RP_{it} is the excess return[20] of ESG PFP i, α_t is the abnormal return, MRP_t is the market risk premium, R_{SIZEt}, R_{VALUEt}, R_{MOMt}, $R_{PROFITt}$, and R_{INVt} are the factor returns of size, value, momentum, profitability, and investment, respectively. Variables b_{1i}, b_{2i}, b_{3i}, b_{4i}, and b_{5i} are sensitivities to factor returns. The OLS method with *Newey and West (1987)* HAC standard errors is used to calculate regressions.

3.3.3. DATABASE

The dissertation analyses the validity of ESG in global equity markets; thus, the choice of the investment universe is critical. The investable universe and benchmark, which concurrently represents the market portfolio, is the MSCI All Country World Index (MSCI ACWI). The MSCI ACWI is a widely recognised benchmark in the asset management sector and academic sphere. The database covers the total weekly returns

[20] The risk-free rate is the 1-year T-Bill return.

of the MSCI ACWI constituents from January 9, 2015, to June 26, 2020[21], including a long bull market period and the market crash after the outbreak of the COIVD-19 pandemic. To study ESG integration and ESG-themed strategies' performance as purely as possible (see *Demers et al. 2021*), we control 11 styles, 24 industries, and 48 country factor exposures[22].

Portfolio Construction of ESG Integration Strategy

ESG factor portfolios are based on Sustainalytics scores. Sustainalytics is one of the leading ESG rating providers, with Morningstar as the sole owner from April 2020. Environmental, social, and governance scores are treated separately and categorise stocks into four rated groups, in decreasing order of ESG quality. An additional fifth group of unrated companies was also created. Dummy variables are used to handle the issue of missing scores; hence one can include unrated firms. The four categories of leaders, followers, loungers, and laggards are also applied by *Triguero et al. (2016)*. The applied Sustainalytics ratings are not comparable across industries; therefore, approach of *Justice and Hale (2016*) is followed, allowing for cross-sectorial comparison via standardisation:

$$zESG_i = {(ESG_i - \mu_{peer})}/{\sigma_{peer}}, \quad (56)$$

where ESG_i is the company-level score, μ_{peer} and σ_{peer} are the mean and standard deviation of the peer scores. Next, z-scores are transformed into normalised scores on a 0-100 scale, with a mean and standard deviation of 50 and 10, respectively.

$$NormESG_i = 50 + (zESG_i \; x \; 10) \quad (57)$$

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[21] The majority of firms did not disclose sustainability reports until recent years; thus, ESG ratings from earlier periods are not trustworthy: in 2017, 85 per cent of S&P 500 Index companies published sustainability reports, up from 11 per cent in 2011 (*Matos 2020*). ESG-themed investing is one of the youngest sustainable investment strategies: in 2014, it was in an embryonic phase as the total ESG-themed AUM was "only" USD 166 billion (for comparison, the same figure for negative/exclusionary screening was USD 14,390 billion) (*GSIA, 2014*). The lack of reliable ESG scores and the limited lifetime of ESG-themed investments are the reasons for the shorter timeframe. However, to obtain statistically reliable results, weekly returns are examined instead of monthly figures (*Foye et al., 2013*).

[22] Throughout the dissertation, exposure means corporate characteristic. For instance, corporate characteristics might include financial figures (e.g., ROE for profitability, market capitalisation for firm size) or sector and country dummies.

Table 16 summarises the grouping scheme.

Table 16. Classification scheme of ESG integration strategy

Group code	Classification	Classification rules
A	Leader in E/S/G	$NormESG_i \geq 60$
B	Follower in E/S/G	$60 > NormESG_i \geq 50$
C	Lounger in E/S/G	$50 > NormESG_i \geq 40$
D	Laggard in E/S/G	$NormESG_i < 40$
NR	Not rated	ESG scores not disclosed

ESG scores are classified into five groups. The first four groups are in decreasing order of ESG quality, and the group codes A, B, C, and D are analogous to credit ratings. Companies that do not have scores belong to a separate class and are labelled "Not rated". The classification (leader, follower, lounger, and laggard) follows the naming convention of *Triguero et al. (2016)*. The classification rules are as follows: 60 = one standard deviation above the average score, 50 = average score, 40 = one standard deviation below the average score.

In summary, ESG integration takes and adapts the ESG valuation techniques of external actors, in this case, Sustainalytics. ESG score integration considers primary and secondary stakeholders more than interested parties (e.g., nature, future generations); hence, it is a more suitable strategy to promote organisational sustainability than global sustainability (*Garvare and Johansson, 2010*).

Finally, this procedure might incorporate the risk of adopting inaccurate ratings[23]; however, in line with *Zaher (2019)*, one could argue that ESG-rating based factor investing might be an easy-to-implement, transparent and inexpensive strategy for asset managers and owners. Furthermore, evidence shows that the ESG rating agency sector is somewhat consolidating *(Avetisyan and Hockerts, 2017*).

Compilation of ESG-themed Portfolios

In recent years, ESG-themed investing has grown the most rapidly among sustainability strategies. In 2012, about USD 83 billion was allocated to thematic funds, while in 2018, it was above USD 1,000 billion, equivalent to a 1,200 per cent increase in 6 years (*GSIA, 2018*). The figures show that ESG-themed approaches started to resonate with investors. The thematic concept employed in the dissertation is closest to *Whittaker et al.*'*s (2018)* definition. According to the authors, thematic investing strategies identify specific global ESG-related *trends* and determine which

[23] *Gibson et al. (2019)* analyse the divergence between different rating agency scores.

firms and sectors are best positioned to benefit from these *trends*. It differs from the ESG integration approach in that it concentrates on specific business models rather than ESG ratings. Consequently, some of the chosen companies might have weak performance on some ESG criteria, but their business models provide products and services that address critical ESG challenges even in the very long run; therefore, they promote global sustainability.

The following nine ESG themes are examined: Energy efficiency (EE), Food security (FS), Water scarcity (WS); Ageing (AG), Millennials (MI), Urbanisation (UR); Cybersecurity (CS), Disruptive technologies (DT), and Robotics (RO). The dissertation implements the "megatrend" (MT) concept as an umbrella term to group the nine themes. The first three themes belong to the environment megatrend, the second three to the social megatrend, while the last three technology-related themes to the governance megatrend.

The reason for classifying technology-focused portfolios into corporate governance megatrend is that the portfolio companies follow business models that provide business solutions (products and services) to other firms' governance-related challenges. The studies of *von Solms and von Solms (2018)* and *Fenwick and Vermeulen (2019)* underscore that protecting companies in cyberspace is a corporate governance responsibility, while robotics and disruptive technologies might enhance more diverse forms of corporate organisations.

Furthermore, studies in the literature assert that ESG-themed investment strategies align with the UN SDGs; hence they are suitable in fostering capital flows towards sustainable economic activities. *Zhan and Santos-Paulino (2021)* assess the global trends in both investing in and financing the SDGs. The authors argue that sustainability-themed funds mainly target ESG- or SDG-related themes or sectors, such as clean energy, clean technology, sustainable agriculture, and food security; consequently, capital markets aligned with sustainable development can fill the SDGs financing gap. *Whittaker et al. (2018)* detect numerous ESG-themed investment opportunities that offer exposure to companies with solutions to pressing sustainability challenges. They relate each ESG theme closely to one or more SDGs. Table 2 summarises the chapter's grouping scheme of ESG-themed strategies and matches them with several SDGs.

Table 2. ESG-themed investment strategies and UN SDGs

Megatrends	Themes	UN SDGs
Environment	Energy efficiency (EE)	Affordable and clean energy – SDG7 Climate action – SDG13
	Food security (FS)	Zero hunger – SDG2 Responsible consumption and production – SDG12
	Water scarcity (WS)	Zero hunger – SDG2 Clean water and sanitation – SDG6
Social	Ageing (AG)	Good health and well-being – SDG3 Reduced inequalities – SDG10
	Millennials (MI)	Decent work and economic growth – SDG8 Sustainable cities and communities – SDG11
	Urbanisation (UR)	Industry, innovation, and infrastructure – SDG9 Sustainable cities and communities – SDG11
Governance	Disruptive technology (DT)	Decent work and economic growth – SDG8 Responsible consumption and production – SDG12
	Cybersecurity (CS)	Responsible consumption and production – SDG12 Peace, justice, and string industries – SDG16
	Robotics (RO)	Decent work and economic growth – SDG8 Responsible consumption and production – SDG12

This table classifies nine ESG-themed investment strategies into environmental, social, and governance megatrends. Technology-focused portfolios belong to corporate governance megatrend since these companies offer products and services that could solve corporate governance challenges (see *Fenwick and Vermeulen 2019; von Solms and von Solms 2018*). The third column represents UN SDGs supported by the nine ESG-themed strategies (see *Whittaker et al. 2018;* and *Zhan and Santos-Paulino 2021*).

Exchange-traded funds (ETFs) are collected considering themselves as thematic ETFs to quantify ESG megatrend exposures; then, each ETF constituent is categorised into a particular theme. We follow the approach of Chapter 3.1, according to which corporate megatrend exposures should be measured on a ratio scale rather than with dummy variables since companies differ in the extent to which they are exposed to a particular theme. The applied formula for megatrend exposures is, therefore, as follows:

$$MTE_{nmt} = \frac{\sum_{e=1}^{E} FI_{nmt}}{MCap_{nt}}, \quad (58)$$

where MTE_{nmt} is the megatrend exposure of stock n in megatrend m in time t. FI_{nmt} is the total fund inflow (the total number of share n multiplied by stock price) into ETF e that invests in stock n and belongs to a particular megatrend m in time t (there are E ETFs), and $MCap_{nt}$ is the total market capitalisation of stock n at t. The higher the ratio, the higher the exposure of a given stock to a particular megatrend.

37 ETFs are analysed that consider themselves as thematic funds to have FIs[24]. Each ETF had more than USD 40 million AUM at the end of September 2019 (September 27, 2019). The total AUM is USD 16,943 million. Due to data limitations, constant positions are used (the number of stocks remains unchanged during the entire period and reflects positions on September 20, 2019).

Factors Controlled

The control variables cover 28 raw style descriptors, 24 industry (based on second level GICS), and 48 country dummies. The data source is Bloomberg. Raw style descriptors are the inputs to compute style factor exposures with principal component analysis (PCA). As a result of PCA, eleven style factors are generated (see Table 17 below). Appendix 3 includes detailed descriptions, calculation methods, and applied Bloomberg codes related to each factor and descriptor. The values of the 11 style factors in Table 17, together with the ESG factors as well as the industry and country[25] factors, are company exposures that represent the explanatory variables in the FM regressions. Descriptors and factors are calculated for each week.

Table 17. Style factors constructed to create pure ESG portfolios

Factor	Descriptor
Beta (BETA)	CAPM beta
Value (VALUE)	E/P CF/P BV/P
Momentum (MOM)	Return momentum Price momentum Sharpe-momentum

[24] Appendix 2 presents the ETFs covered in the empirical analysis.

[25] Appendix 5 introduces the analysed countries and sectors.

Table 17. *(Continued)*

Factor	Descriptor
Size (SIZE)	-ln(MCap) -ln(Assets) -ln(Sales)
Volatility (VOL)	Total volatility Residual volatility Price range
Liquidity (LIQ)	*Amihud* liquidity ratio
Profitability (PROFIT)	ROE ROA ROIC/WACC Profit margin
Growth (GRO)	EBT growth Net income growth Sales growth
Investment (INV)	Asset growth
Leverage (LEV)	Book leverage Market leverage Debts/Assets
Earnings variability (EVAR)	Sales variability Net income variability FCFF variability

This table presents the factors applied in FM. With FM regressions, 11 pure style factor portfolios are constructed, including the value, size, profitability, investment factors identified by *FF (1996, 2015)*, and the momentum factor popularised by *Carhart (1997)*. Besides these factors, other effects such as beta, volatility, liquidity, growth, leverage, and earnings variability are also controlled. Each factor is proxied by one or more firm descriptors (28 in total). If there is more than one descriptor to describe a given factor, principal component analysis (PCA) is used to merge them into factors. Most of these factors are included in the Bloomberg fundamental factor model (*Cahan and Ji, 2015*).

Database corrections and cleansing procedures are performed on a year-by-year basis. First, each stock included in the MSCI ACWI between 2015 and 2020 is analysed to eliminate survivorship bias. Second, companies that did not have stock prices, total returns, or market capitalisations are excluded. Third, penny stocks are removed (i.e., stocks with a maximum price below five dollars). Missing values for several firms still remained. One solution could have been to drop these observations listwise; however, that would have reduced the sample size dramatically. Instead, the method of multiple imputations (MI) was introduced (*Rubin 1987*) procedures. Due to the relatively low proportion of missing data (ca. 2.00 per cent), only three imputations were executed, based on the Markov Chain Monte Carlo (MCMC) imputation procedure (all the 28 descriptors were used). Finally, winsorisation limits were specified to ensure that extreme values would not affect conclusions. The limits were the 1st and the 99th percentiles of each descriptor.

Finally, several statistical tests were implemented to validate the choice of applied cross-sectional and time-series methods and approaches. These were as follows: (1) the Phillips-Perron unit-root test; (2) calculation of VIF for detecting disturbing multicollinearity; (3) Hausman endogeneity test; (4) Breusch-Pagan test for heteroscedasticity; (5) Breusch-Godfrey test and correlograms for autocorrelation; (6) Shapiro-Wilk test and Q-Q plots for testing normality. The tests have proven that there is no unit root and the level of multicollinearity in the time series is low[26]. However, there is endogeneity (errors-in-variables), heteroscedasticity, and autocorrelation (at least in the squared residuals) in the data. Heteroscedasticity and autocorrelation are controlled with HAC standard errors. Further, in the empirical section, a GMM estimator with distance instrumental variables (IV_d) was utilised as a robustness check to manage endogeneity.

3.3.4. EMPIRICAL RESULTS

This chapter first presents the baseline regression results: the alpha calculations for the whole period and then the COVID-19 pandemic.

Performance on the Longer Term

Alphas of the CAPM, the FF 3-factor, FFC 4-factor, and FF 5-factor models are analysed to obtain robust results from 2015 to mid-2020[27]. The applied equations (52)-(55) are from section "Performance analysis". Tables 18 and 19 summarise the outcomes of the two distinct ESG strategies.

Panel A in Table 18 includes the results of the environmental PFPs. The follower portfolio realised a 1.00 to 1.33 per cent annual alpha depending on model specification. The result is marginally significant in the FF5 context and significant at a 5 per cent level for the other FF models. The lounger portfolio – in which companies have below-average scores but not lower than one standard deviation below the mean

[26] A low level of multicollinearity was expected due to the features of the FM procedure.

[27] By analysing four different factor models, the approach of *Pástor and Vorsatz (2020)* is followed.

– generated significant negative alphas, except for the CAPM. The laggards achieved negative alphas irrespective of model specification (the values span from -1.01 to -0.34 per cent); however, the results are not statistically significant. The sign of the leader PFP alpha is mixed because the CAPM shows a small but positive alpha (0.18 per cent), while the FF model outcomes are negatives but very close to zero (from -0.39 to -0.04 per cent). The portfolio of unrated companies, with investors not implementing any ESG screening activities, realised a relatively high and positive alpha (0.33-1.76 per cent); however, the results are not significant due to large standard errors (SE).

Table 18. Performance of pure E, S, and G, portfolios from 2015 to mid-2020

	Leader	**Follower**	**Lounger**	**Laggard**	**Not rated**
A: Environment					
CAPM	0.18	1.33	-1.07	-0.34	1.76
	(0.236)	*(2.168)***	*(-1.559)*	*(-0.348)*	*(1.237)*
FF3	-0.04	1.29	-1.16	-0.44	1.58
	(-0.052)	*(2.294)***	*(-1.689)**	*(-0.472)*	*(1.050)*
FFC	-0.04	1.28	-1.23	-0.56	1.43
	(-0.054)	*(2.233)***	*(-1.944)**	*(-0.637)*	*(1.008)*
FF5	-0.39	0.97	-1.58	-1.01	0.33
	(-0.510)	*(1.851)**	*(-2.285)***	*(-0.995)*	*(0.247)*
B: Social					
CAPM	-0.70	0.37	1.80	-0.77	1.90
	(-0.977)	*(0.571)*	*(3.346)****	*(-0.964)*	*(1.373)*
FF3	-0.80	0.30	1.71	-0.91	1.72
	(-1.072)	*(0.517)*	*(2.976)****	*(-1.062)*	*(1.168)*
FFC	-0.85	0.30	1.68	-0.97	1.61
	(-1.141)	*(0.509)*	*(2.847)****	*(-1.137)*	*(1.164)*
FF5	-1.39	0.06	1.41	-1.44	0.56
	*(-2.022)***	*(0.104)*	*(2.408)***	*(-1.554)*	*(0.435)*
C: Governance					
CAPM	0.23	1.03	-0.03	-0.71	1.87
	(0.456)	*(1.970)***	*(-0.0548)*	*(-0.812)*	*(1.318)*
FF3	0.18	1.07	-0.20	-0.96	1.65
	(0.343)	*(2.072)***	*(-0.284)*	*(-1.097)*	*(1.107)*
FFC	0.17	1.07	-0.24	-1.07	1.52
	(0.335)	*(2.051)***	*(-0.350)*	*(-1.230)*	*(1.095)*
FF5	-0.07	0.70	-0.71	-1.47	0.37
	(-0.118)	*(1.427)*	*(-0.997)*	*(-1.462)*	*(0.283)*

This table reports the annualised abnormal returns (in percentage points) of the ESG factor portfolios from 2015 to mid-2020. Companies are classified into five pure ESG factor portfolios. The first four groups are in decreasing order of ESG quality. Corporates that do not have scores belong to a separate class and are labelled "Not rated". The classification from leaders to laggards follows the naming convention of *Triguero et al. (2016)*. The t-statistics are in parentheses and based on *Newey-West (1987)* standard errors. ***, ** and * represent significance at 1, 5, and 10 per cent levels, respectively.

The results suggest that it was possible to attain significant positive risk-adjusted returns with the "second-best" follower portfolio but not with the leaders and laggards or loungers. Equivalently, there is a non-linear relationship between environmental and stock market performance, viz., after a certain level in environmental performance, the market performance does not improve but instead falls back. This outcome is in line with the original findings of *Bowman and Haire (1975)* on an inverted U-shaped relationship.

Turning to social PFPs in Panel B, the outcomes are somewhat different. The most impressive result is that the lounger portfolio generated significant positive alphas in each model (1.41-1.80 per cent). The CAPM, FF3, and FFC results are significant at 1 per cent, while the FF5 alpha is significant at 5 per cent. The follower portfolio was an outperformer as well; however, the abnormal returns are modest (0.06-0.37 per cent) and statistically insignificant. According to each specification, the two extremes (leaders and laggards) are underperformers with similar abnormal returns (from -0.70 to -1.44 per cent). Although most of the outcomes are not significant, the leader portfolio in FF5 is an exception, which shows a -1.39 per cent significant alpha at a 5 per cent level. The "Not rated" portfolio performed similarly to its environmental counterpart; thus, the alphas are positive but not significant.

Investor perceptions of social concerns might not be as straightforward as those of the other two factors. What can be interpreted as a desirable balance, for instance, in terms of trade union influence and labour rights? There seems to be a particular level of social performance below which company behaviour is unacceptable for the markets. However, it is a social justice issue of how a company should be managed: "reward" increased social sensitivity or greater business efficiency? The question about the fair limits for "social sensitivity versus business efficiency" is no longer an economic issue but rather a moral one. The results suggest that investors prefer increased financial efficiency, but not without limits. In other words, inverted U-shaped relation also exists, in line with *Grassmann 2021*, but at a "lower" level. The conclusions contradict the positive social responsibility and financial performance relation of *Edmans (2011)*, though Edmans examined the social aspect in a narrower sense by studying employee satisfaction.

Finally, Panel C summarises the findings concerning governance PFPs. The CAPM, FF3 and FFC models show that the follower governance portfolio was a significant outperformer during the reference period (1.03-1.07 per cent, at a 5 per cent significance level), akin to environmental followers. According to FF5, however, the 0.70 per cent positive risk-adjusted return is not significant anymore. The leader portfolio mostly realised positive alphas from 0.17 to 0.23 per cent, with an exception in FF5 (-0.07 per cent) but without statistical and economic significance. The lounger and laggard portfolios underperformed, but the alphas are not significant at the usual levels. The results support the inverted U-shaped relation for governance factors and concur with *Han et al. (2016)*.

To sum up, investments in ESG laggards might induce negative externalities without achieving superior risk-adjusted returns since no evidence is found for significant outperformance. Hence asset owners investing in the worst ESG performing companies are not doing well while doing bad. Put another way, allocating financial resources to ESG leaders might not provide significant positive abnormal returns, but there is no significant underperformance either; therefore, investors do good without forgoing returns. These findings are in line with *Xiao et al. (2013)*. Further, the results underline the potential inverted U-shaped relationship, i.e., there is a diminishing marginal utility in the ESG and financial performance relation. Thus, investors can realise significant positive risk-adjusted returns with follower environmental and governance portfolios as well as lounger social portfolio. The findings regarding followers align with the "doing well while doing good" concept since these portfolios possess above-average E and G scores.

The following paragraphs present the outcomes related to ESG-themed investments; findings are summarised in Table 19. First, examining the abnormal returns of the environmental themes (Panel A), one could conclude that the alphas are all positive, except FS in the FF5 context (-0.20 per cent). Furthermore, according to some model specifications, EE and WS realised significant risk-adjusted returns. The CAPM alpha of EE is 0.63 and significant at a 5 per cent level; however, none of the FF models shows significant intercepts. The results for WS are more robust compared to EE: the CAPM, FF3, and FFC resulted in significant alphas (0.78-0.63 per cent). Findings are partly consistent with *Alvarez and Rodríguez (2015),* who analysed water-related mutual funds and found neither outperformance nor underperformance. The study of

Ibikunle and Steffen (2017) also corresponds to the dissertation's results in part: although the authors conclude that over the 1991–2014 period, the green funds underperformed their black peer group, evidence suggests that the green funds are beginning to significantly outperform their black counterparts, especially over the 2012–2014 investment window.

Table 19. Performance of thematic investing between 2015 and mid-2020

	A: Environment			**B: Social**			**C: Governance**		
	EE	**FS**	**WS**	**AG**	**MI**	**UR**	**CS**	**DT**	**RO**
CAPM	0.63	0.43	0.78	-0.01	0.50	0.73	0.29	0.70	0.66
	*(2.124)***	*(1.584)*	*(2.441)***	*(-0.020)*	*(1.137)*	*(1.634)*	*(1.069)*	*(2.925)****	*(1.524)*
FF3	0.55	0.33	0.68	-0.12	0.33	0.56	0.20	0.60	0.57
	(1.609)	*(1.227)*	*(1.966)***	*(-0.391)*	*(0.698)*	*(1.246)*	*(0.790)*	*(2.175)***	*(1.275)*
FFC	0.51	0.28	0.63	-0.17	0.25	0.50	0.14	0.55	0.52
	(1.442)	*(1.091)*	*(1.865)**	*(-0.624)*	*(0.566)*	*(1.119)*	*(0.601)*	*(1.914)**	*(1.226)*
FF5	0.03	-0.20	0.11	-0.60	-0.24	-0.12	-0.29	0.12	0.02
	(0.095)	*(-1.049)*	*(0.467)*	*(-1.732)**	*(-0.553)*	*(-0.312)*	*(-1.470)*	*(0.656)*	*(0.048)*

This table reports the annualised abnormal returns (in percentage points) of nine ESG-themed factor portfolios from 2015 to mid-2020. The studied ESG themes are as follows: Energy efficiency (EE), Food security (FS), Water scarcity (WS); Ageing (AG), Millennials (MI), Urbanisation (UR); Cybersecurity (CS), Disruptive technologies (DT), Robotics (RO). The exposures to specific themes are based on (58). The t-statistics are in parentheses and based on *Newey-West (1987)* standard errors. ***, ** and * represent significance at 1, 5, and 10 per cent levels, respectively.

The performance of the social megatrend in Panel B is more heterogeneous than those of the environment MT's. According to the Fama-French 5-factor model, each theme realised negative alphas; however, only the -0.60 per cent of Ageing is marginally significant. Furthermore, Ageing attained negative alphas in all the other asset pricing models. These figures may indicate that investors are willing to pay a premium to be socially responsible or that Ageing-related portfolio companies are simply overpriced (*Renneboog et al. 2008b*). The resulting negative alphas contradict *Martí-Ballester (2020)*, who appraised SDG3-related healthcare mutual funds[28] and observed an annual average FFC alpha of 1.6 per cent. On the other hand, most of the funds (85 per cent) did not achieve significant alphas, confirming the findings presented in Table 19. The millennials and the urbanisation themes realised positive abnormal returns based on the CAPM, FF3, and FFC, but these figures are not different from zero at the usual significance levels.

[28] Nearly one-third of the companies with exposure to the Ageing theme belongs to the healthcare sector (the other sector with remarkable exposure is the finance sector, especially insurance companies).

In Panel C, returns of technology-focused governance PFP follow a similar pattern to environmental portfolios, in the sense that only one negative alpha is detected, namely, Cybersecurity in the FF5 model. The negative CS alpha of -0.29 per cent is, however, not significant. The disruptive technology portfolio generated significant abnormal returns in the CAPM, FF3, and FFC model specifications (0.55-0.70 per cent)[29]. The intercepts of Robotics and Cybersecurity are positive but not significant.

In summary, investors pursuing pure ESG-themed strategies achieved returns at least commensurate with risk in eight out of the nine themes in the second half of the 2010s, when the fund flows of sustainability-themed investments have begun to rise. Further, according to the CAPM, FF3, and FFC, it was possible to achieve significant and superior risk-adjusted returns by investing in WS and DT, consistent with the "doing well while doing good" concept. The findings suggest that allocating capital to ESG-themed portfolios can enhance alignment with UN SDGs without forgoing risk-adjusted returns. ESG-themed investing resonates with the shared-value concept of *Porter and Kramer (2019)*, which prevails if corporate policies and operating practices simultaneously improve company competitiveness and the economic and social conditions in the communities in which it operates. Finally, SDG-focused ESG investments align with the spirit of global sustainability introduced by *Garvare and Johansson (2010)* and regulatory frameworks such as the EU Taxonomy Regulation, which defines sustainable economic activities.

Comparing ESG integration and ESG-themed investment strategies, one could conclude that E- and G-related investment strategies are suitable for promoting the environmental and economic dimensions of sustainability irrespective of the applied approach. The performance of social strategies is not straightforward: the ESG integration approach shows that markets prefer business efficiency instead of increased responsibility, though minimal social compliance is required. Social themes produced positive and negative alphas depending on the model specification and the particular theme; however, except for Ageing, none had statistically significant alphas; therefore, investors can do good without forgoing returns. Finally, based on overall findings, we reject the H_1 hypothesis that, in the longer term, it was possible to generate

[29] The figures show that the FF5 model is very effective in explaining megatrend returns. None of the themes has significant alphas, and 6 portfolios have 0.20 per cent or smaller intercepts in absolute terms.

significant and positive risk-adjusted returns with ESG leaders in the ESG integration approach and with ESG-themed investment strategies.

Another conclusion is related to the applied FF spanning regression technique that tests whether ESG factors are relevant new risk factors in the FF framework. *Harvey et al. (2016)* argue that a newly detected factor requires a t-statistic of at least 3.0. Although the ESG portfolios are suitable to measure the performance attribution of ESG factors, the t-statistics, in line with *Xiao et al. (2013)*, do not justify them as new factors in the FF factor models. Nonetheless, PFPs may serve as ESG indices for asset managers to quantify ESG factor tilt and performance attribution. In conclusion, we reject the H_3 hypothesis; that is, no sufficient evidence was found for ESG factors to complement Fama-French models.

The Effects of the COVID-19 Pandemic

The COVID-19 pandemic provides a unique opportunity to examine the resilience of sustainable investments during an exogenous[30] market crash. The first news about the coronavirus was released in late 2019; however, equity markets were still growing until February 21, 2020, after which global stock markets suddenly and enormously collapsed[31]. The sample spans from February 28, 2020, to June 26, 2020[32]; thus, the 18 weeks time frame covers the whole first wave of the pandemic. The reason for analysing only the first wave is that it was a surprise to all investors, and therefore no one had adequate experiences from their peers to learn (*Wang, 2021*). Table 20 summarises the findings. Only CAPM and FF3 are applied because of limited number of observations[33].

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[30] *Albuquerque et al. (2020)* term the crisis as an unpredictable public health shock.

[31] The earliest WHO report of human-to-human transmission was on January 19, 2020. See the WHO's descriptive timeline on notable COVID-related developments (https://www.who.int/news/item/29-06-2020-covidtimeline).

[32] The returns on February 28, 2020 reflect the outcomes of the portfolio compilation of February 21, 2020, which is right before the market crash. June 26, 2020 was chosen as the end of the period because the first wave of the pandemic in the northern hemisphere attenuated in summer (*Wang, 2021*).

[33] One rule of thumb is that five observations per explanatory variable is required to obtain valid results (*Kovács, 2014*).

Table 20. Performance of ESG factor portfolios during the COVID-19 pandemic

	Leader	**Follower**	**Lounger**	**Laggard**	**Not rated**
A: Environment					
CAPM	-1.10	-4.36	-2.33	5.82	7.90
	(-0.925)	*(-1.792)**	*(-1.013)*	*(2.577)****	*(2.124)***
FF3	-0.21	-0.13	-2.92	3.35	1.51
	(-0.175)	*(-0.059)*	*(-0.579)*	*(1.021)*	*(0.304)*
B: Social					
CAPM	-3.36	-4.86	5.46	-0.55	7.12
	*(-2.502)***	*(-4.028)****	*(5.462)****	*(-0.428)*	*(2.110)***
FF3	-5.00	0.26	6.66	-4.73	1.42
	*(-3.278)****	*(0.267)*	*(4.723)****	*(-1.444)*	*(0.289)*
C: Governance					
CAPM	-1.60	-1.29	1.59	-4.88	6.14
	(-0.631)	*(-0.609)*	*(1.576)*	*(-1.531)*	*(1.848)**
FF3	-1.25	4.28	-0.80	-5.72	0.63
	(-0.728)	*(2.931)****	*(-0.353)*	*(-1.289)*	*(0.142)*

This table reports the annualised abnormal returns (in percentage points) of the ESG factor portfolios from the CAPM and the FF3 factor model during the first wave of the COVID-19 pandemic (February 28, 2020 – June 26, 2020). Firms are classified into five pure ESG factor portfolios. The first four groups are in decreasing order of ESG quality. Companies that do not have scores belong to a separate class and are labelled "Not rated". The classification from leaders to laggard follows the naming convention of *Triguero et al. (2016)*. The t-statistics are in parentheses and based on *Newey-West (1987)* standard errors. ***, ** and * represent significance at 1, 5, and 10 per cent levels, respectively.

Previous studies in the literature suggest a positive ESG-financial performance relationship during adverse market conditions (*Nofsinger and Varma 2014; Cornett et al. 2016; Lins et al. 2017*), and some studies examining ESG during the coronavirus crisis confirm these findings (*Albuquerque et al., 2020; Broadstock et al., 2021; Ding et al., 2021*). The outperformance hypothesis is often referred to as the "flight to quality" or the "insurance-like protection" ability of ESG.

The dissertation's results refute the literature's general findings. Firstly, none of the leader portfolios generated significant positive alphas, but they did attain negative abnormal returns. Although the figures of E and G leaders are not statistically different from zero, the alphas of social leaders are significant and equal to -3.36 (CAPM) and -5.00 (FF3) per cent. According to the CAPM, both the follower E and S portfolios underperformed significantly, as the alphas are -4.36 and -4.86 per cent, respectively. However, the results were not significant in FF3.

Furthermore, based on the CAPM, the environmental laggards portfolio was a significant outperformer at a 1.00 per cent significance level with an annualised abnormal return of 5.82 per cent. Nevertheless, only the CAPM confirms the significant negative alphas of followers and significant superior returns of environmental laggards, meaning that the FF3 model specification explained returns more efficiently, resulting in much lower and insignificant alphas, especially for followers. Although the observed results are not entirely robust, we could argue that the magnitude of the negative alphas and the outperformance of environmental laggards are remarkable.

Some of the findings are consistent with the previous section's conclusions. Both models show that the alphas of the lounger social PFP are positive and significant at a 1.00 per cent level. Additionally, the CAPM 5.46 and the FF3 6.66 per cent alphas are significant economically. Consequently, for social portfolios, the inverted U-shaped relation existed during the COVID-19 pandemic. The follower G portfolio attained a 4.28 per cent FF3 alpha, which is statistically significant at 1.00 per cent; however, Jensen's alpha does not deviate from zero at conventional significance levels. According to the CAPM, the portfolios with unrated companies generated significant superior risk-adjusted returns, but these surpluses vanished in the FF3 context.

In summary, the "verdict" is that pure leader and follower E and S strategies with above-average scores could not produce significant superior risk-adjusted returns during the COVID-19 pandemic. This conclusion mostly holds in the case of governance PFPs. In line with *Demers et al. (2021)*, the primary reason for such outcomes could be that once numerous styles, industry, and country factors have been controlled, rating-based high ESG performance did not provide "flight to quality" against an exogenous shock such as the coronavirus crisis.

Table 21 summarises the findings for thematic investing. Similar patterns emerge concerning environmental themes (Panel A) as in the longer-term analysis, which is good news for sustainability advocates. EE and WS obtained significant and positive alphas. The 0.67 per cent CAPM and 1.09 per cent FF3 alpha of EE are significant at 5 per cent. For WS, 0.65 per cent CAPM alpha is also significant at 5 per cent, although FF3 no longer shows significant outperformance. The intercepts of FS are negative but without statistical and economic significance.

Table 21. Performance of thematic portfolios during the COVID-19 pandemic

	A: Environment			B: Social			C: Governance		
	EE	**FS**	**WS**	**AG**	**MI**	**UR**	**CS**	**DT**	**RO**
CAPM	0.67	-0.60	0.65	-1.55	1.78	-0.63	-0.33	1.19	2.79
	*(2.106)***	*(-1.564)*	*(2.173)***	*(-1.749)**	*(1.395)*	*(-1.053)*	*(-0.330)*	*(1.384)*	*(2.756)****
FF3	1.09	-0.26	1.26	-0.06	0.35	-1.29	-1.57	0.73	2.82
	*(2.132)***	*(-0.402)*	*(1.493)*	*(-0.073)*	*(0.289)*	*(-2.337)***	*(-1.242)*	*(0.831)*	*(1.974)***

This table reports the annualised abnormal returns (in percentage points) of nine ESG-themed factor portfolios during the first wave of the COVID-19 pandemic (February 28, 2020 – June 26, 2020). The covered themes are Energy efficiency (EE), Food security (FS), Water scarcity (WS), Ageing (AG), Millennials (MI), Urbanisation (UR), Cybersecurity (CS), Disruptive technologies (DT), and Robotics (RO). The exposures to specific themes are based on (58). The t-statistics are in parentheses and based on *Newey-West (1987)* standard errors. ***, ** and * represent significance at 1, 5, and 10 per cent levels, respectively.

The Ageing and Urbanisation PFPs attained negative risk-adjusted returns, from which the Ageing PFP's -1.55 per cent CAPM alpha was marginally significant, while the -1.29 per cent FF3 alpha of Urbanisation was significant at 5.00 per cent. The Ageing theme was an underachiever during the whole period, and there was no change in the pandemic. Urbanisation performed better during the whole period, but in the crisis, the theme's performance deteriorated. However, these results are not surprising, as segments such as older generations and urban lifestyle have been hit most severely by the pandemic.

In Panel C, performance measures suggest that superior risk-adjusted returns could be obtained by investing in DT and RO, while CS was an underperformer. Although DT's outperformance and CS's negative alphas were not statistically different from zero, the 2.79 (CAPM) and 2.82 (FF3) per cent abnormal returns for RO were significant in both model specification.

In conclusion, environmental and governance megatrends were resilient during the first wave of the pandemic as investors could obtain at least returns commensurate with risks. Furthermore, it was possible to realise superior performance with EE and RO portfolios, consistent with the "doing well while doing good" concept. Negative alphas of AG and UR prove that ESG-themed investing does not guarantee satisfactory returns in all cases; consequently, investors should choose themes carefully. The conflicting conclusions of the two approaches of ESG integration and ESG-thematic investing suggest that the performance of distinct ESG strategies is not homogenous, viz., underlying philosophy and motivation of the applied strategy do matter during adverse market conditions. In summary, we accept the H_{2B} hypothesis: it was possible to outperform with two themes, WS and RO. However, we reject H_{2A} as ESG leaders could not generate significant superior returns.

3.3.5. ROBUSTNESS TESTS

This section performs robustness tests to check if the findings are valid under various model conditions. Robustness checks include different performance measures (deltas and Sharpe ratios), other statistical methods than OLS HAC (GMM-IV_d and EGARCH), different sample periods (Pre-crisis), and transaction costs.

Alternative Measure of Financial Performance

Relying solely on factor alphas might lead to incomplete conclusions; therefore, two alternative performance measures, the Sharpe ratio (SR) and the delta (Δ), were analysed. Sharpe ratio calculation follows the study of *Sharpe (1994)*:

$$SR_i = {}^{\mu_i}/_{\sigma_i} \tag{59}$$

In (14), μ_i is the sample mean of the *excess* returns of ESG portfolio *i* beyond the risk-free rate[34], and σ_i is the sample standard deviation of the *excess* returns.

The goal is to compare particular PFP's SR with the benchmark SR and test if the difference statistically deviates from zero. The difference between ESG factor SR and benchmark SR is termed benchmark-adjusted SR. In order to conduct reliable statistical inference, we apply a cutting edge bootstrap test proposed by *Ledoit and Wolf (2008)*[35] (LW) instead of the traditional procedure of *Jobson and Korkie (1981)* and *Memmel (2003)*, which gives biased estimates in the presence of non-normality, autocorrelation, and relatively small samples.

Further, delta (Δ) is simply the difference between the given ESG PFP return (R_i) and the benchmark return (R_B):

[34] The risk-free rate is the 1-year T-Bill return.

[35] A detailed description of the method is introduced in the original study. The R code used in the dissertation is freely available on the website of Prof. Wolf: https://www.econ.uzh.ch/en/people/faculty/wolf/publications.html.

$$\Delta_i = R_i - R_B \tag{60}$$

We test whether average Δs are statistically different from zero with Newey-West standard errors. Such delta calculations are also applied by *Pástor and Vorsatz (2020)*. There is a critical distinction between delta and Sharpe ratio as well as alphas: the latter two assess performance on a risk-adjusted basis, while delta is a benchmark-relative return without considering risks. In the literature and everyday practice[36], there is some evidence that investor return experiences drive updates in beliefs; thus, past returns positively impact return expectations and are positively related to fund flows, while past risk has moderate or sometimes no impact, except for sophisticated investors *(Hoffmann and Post, 2017; Sirri and Tufano, 1998*). This stylised fact of capital markets underlines the practicality of examining measures unadjusted for risks.

For the whole period in Panel A of Table 22, the deltas and the Sharpe ratios corroborate the baseline factor model results. In the ESG integration approach, the previously identified inverted U-shaped relationship still holds, i.e., there was a diminishing marginal utility in the ESG and financial performance relation. Further, investments in ESG laggards did not result in superior risk-adjusted returns. Also, ESG leaders did not outperform; however, there was no significant underperformance either. Finally, the significant deltas and benchmark-relative SRs of E and G followers support the “doing well while doing good” concept. The results confirm baseline findings concerning social portfolios in that investors prefer increased financial efficiency, but not without limits; i.e., the lounger portfolio significantly outperformed.

By examining the Δs and SRs, the conclusions regarding ESG-themed investments slightly change: Ageing does not show significant negative performance anymore. Further, the benchmark-adjusted SRs of the social themes were non-negative. The robustness tests indicate that investors engaging in pure ESG-themed strategies attained returns at least commensurate with risk, consistent with the baseline results. The performance of EE, WS, and DT is similar to what was found previously, i.e., it was possible to generate significant superior returns with these themes.

The results for the pandemic period, in Panel C, follow similar patterns to the baseline case. In the ESG integration approach, the figures are not significant at the usual levels;

[36] See interviews conducted with market professional in Chapter 2.

the negative Δs and benchmark-adjusted SRs for pure leader and follower ESG strategies indicate that portfolios with above-average ratings could not realise superior returns hence contradicting the literature's "flight to quality" belief. Further, the robustness test does not validate the baseline finding on the significant outperformance of environmental laggards. The figures concerning ESG-themed investing suggest that investors could obtain returns commensurate with risks. This finding also implies no significant under- or overperformance, which refutes the baseline outcomes on the significant negative alphas of AG and UR and the positive abnormal returns of EE, WS, and RO.

Alternative Statistical Methods

According to *Jahmane and Gaies (2020)*, endogeneity in studies examining corporate social performance and financial performance remains largely unresolved. Regarding asset pricing, *Campbell et al. (1997)* and *Cochrane (2005)* argue that Fama-MacBeth regressions introduce endogeneity in the form of errors-in-variables (EIV). Further, *Horváth and Wang (2020)* underline that the Fama-French factor models potentially incorporate measurement errors since they use generated regressors and proxies as explanatory variables known to cause biases in the standard OLS.

Following *Racicot and Rentz (2015)*, a modified Hausman specification test was executed to identify whether EIV is a potential problem in the dissertation's database. The test corroborated some degree of measurement errors in the variables; therefore, to correct alpha calculations' endogeneity, a GMM estimator with robust distance instrumental variables was applied ($GMM\text{-}IV_d$)[37]. The $GMM\text{-}IV_d$ approach was introduced by *Racicot (2015)* and utilised by *Horváth and Wang (2020), Racicot et al. (2019),* and *Roy and Shijin (2018)*[38].

[37] We also performed tests to check if the IVs satisfy the requirement of being exogenous but not being weak. The tests confirm that the IVs are robust and exogenous.

[38] In the ESG integration approach, another form of endogeneity emerges because of the sample selection bias. *Wong et al. (2021)* argue that adopting ESG rating is not random: their sample companies with ESG scores tend to be mature, with high profitability and have lower tangible assets. In this study, the Fama-MacBeth procedure overcomes this bias as it neutralises several firm exposures while compiling ESG factor portfolios.

In the empirical finance literature, volatility clustering is a well-known stylised fact (*Cont, 2001*). Engle's Lagrange multiplier (LM) test was performed to detect the presence of autoregressive conditional heteroskedasticity (ARCH). The LM test revealed that the portfolio returns exhibit significant ARCH effects; hence, as a robustness test for deltas, we conducted *Nelson's (1991)* EGARCH model to capture the possibility of asymmetric effects of returns on volatility. Nelson's model has the advantage of no parameter restrictions to ensure the nonnegativity of the conditional variance. An EGARCH(1,1) process was utilised, but only for the longer term. The reason for not employing the method for the crisis period is that, according to *Zumbach (2000)*, the maximisation process often does not converge to a meaningful solution but runs to infinity in small data sets. The calculations confirm *Zumbach (2000)*.

In Panel A of Table 22, GMM-IV_d and EGARCH do not alter the conclusions materially for the whole period. In the ESG integration approach, the inverted U-shaped relation prevailed, and it was possible to generate significant superior returns with E and G followers and S loungers. Except for AG in FF5, ESG-themed portfolios achieved returns that, at least, compensate the risks borne by the investors. Further, some model calibration shows significant superior risk-adjusted returns with investing in EE, WS, UR, and DT.

Panel C summarises the outcomes during the COVID-19 pandemic. The alternative statistical methods back up the original findings, i.e., pure leader and follower ESG strategies did not generate superior returns during the crisis. Further, the GMM-IV_d method does not verify the baseline finding on significant outperformance of environmental laggards. The ESG-thematic portfolios returns were in line with risks, viz. there were neither underperformance nor outperformance.

Subsample Analysis

To verify whether conclusions prevail in alternative sample periods, we consider a subsample without the COVID-19 pandemic and conduct the same analyses on the ESG factor portfolios as previously. The subsample period is termed "Pre-crisis" and covers January 9, 2015 – February 21, 2020.

Literature often emphasises that ESG significantly overperform during periods of market crisis. Consequently, several studies analyse the crisis resiliency of ESG. However, these studies also underscore that the mitigation of downside risk during adverse market conditions comes at the cost of underperforming during non-crisis periods (*Broadstock et al., 2021; Nofsinger and Varma, 2014; Tsai and Wu, 2021*). Thus, by examining the period without the crisis, the goal is to test whether ESG investments indeed underperform in the long term when markets are optimistic. The bull market between 2015 and 2020 is suitable for this analysis.

According to Panel C in Table 8, during the Pre-crisis period, the inverted U-shaped relationship prevailed for the ESG integration strategy. Also, the outperformance of follower E and lounger S were significant regardless of statistical methods and performance measures. Follower G produced significant deltas, alphas and benchmark-adjusted Sharpe ratio; however, the figures are not fully robust due to insignificant EGARCH delta and FF5 alpha.

The two most remarkable findings concerning ESG-themed investments are that there were no significant negative alphas except for Ageing in the OLS-HAC FF5 model context, and each environmental theme generated significant superior returns according to CAPM and SR.

The findings contradict the inference of *Nofsinger and Varma (2014)* about the underperformance of ESG-conscious investments under non-crisis market conditions. One could contend that it might be worth investing in better-than-average ESG-rated companies and ESG-themed strategies in the long term when there are no major crisis events.

Transaction costs

Transaction costs substantially impact the abnormal returns of trading strategies; therefore, this section analysed ESG leaders, followers, and S loungers as well as each ESG-themed strategy after controlling costs and fees. Calculations concentrate on the expense ratio (ER), as did recent studies (e.g., *Alda 2020*). The practise followed is consistent with *Derwall et al. (2005)* and *Kempf and Osthoff (2007)*, assuming an expense ratio between 25 and 100 basis points. In fact, 25 and 100 bps ERs are typical extremes for ESG ETFs nowadays (*Alda 2020*). The net return is the ESG portfolio return less the expense ratio.

Table 23 contains the net returns. Panel A summarises the results for the ESG integration approach. During the whole period, up to a 25 basis points expense ratio, the environmental follower PFP attained significant superior risk-adjusted returns except for FF5[39]. Social loungers generated significant and positive alphas after deducing 25 bps ER, and this outcome is irrespective of model specification. However, the outperformance of G follower vanished after 25 bps ER. The overperformance of E and S PFPs vaporised at an ER higher than 25 bps. However, up to 75 bps expense ratio, E/S/G portfolios with above-average ratings, excluding S leaders, generated returns that compensated risks borne by the investors, i.e., there was not underperformance nor overperformance. During the coronavirus crisis, the alphas of governance leaders and followers were not statistically different from zero regardless of model specifications and ER. Environmental leader PFP achieved similar results, except for 100 bps ER in the CAPM when it became a significant underperformer. According to the CAPM, the environmental follower portfolio realised significant negative alphas no matter how much the ER was. However, FF3 alphas are not statistically different from zero at all.

Turning to ESG-themed investing (Panel B), in the longer term, the figures indicate that up to 25 bps ER, most of the themes attained returns that compensated risks regardless of model specifications. The exceptions are AG, FS, and DT, which realised significant negative alphas; however, only in FF5. By assuming 50 bps ER, the results show that in FF5, most of the themes achieved significant and negative alphas. Consequently, ESG megatrend investing can promote alignment with sustainability goals without sacrificing returns up to 25-50 bps ER. The conclusion is similar during the COVID-19 pandemic.

Overall, robustness tests validate the rejections of H_1 (significant outperformance of ESG leaders and ESG-thematic strategies) and H_{2A} (significant and positive abnormal returns of ESG leaders during the coronavirus crisis). However, they do not support the previous acceptance of H_{2B} (significant positive alphas of ESG-themed investing under the pandemic).

[39] In the pre-crisis period, FF5 alpha was also positive and at the same time significant.

Table 22. Results of robustness tests

	ESG integration															ESG-themed investing								
	Environmental					Social					Governance					Environmental			Social			Governance		
	A	B	C	D	NR	A	B	C	D	NR	A	B	C	D	NR	EE	FS	WS	AG	MI	UR	CS	DT	RO
(A) Whole period																								
Delta (Δ)																								
OLS HAC	0.17	1.27**	-1.00	-0.40	1.81	-0.71	0.37	1.79***	-0.81	1.96	0.17	0.96*	-0.01	-0.61	1.94	0.62*	0.45	0.77**	0.00	0.56	0.74	0.28	0.69**	0.68
EGARCH	0.47	1.49***	-0.84	-0.24	0.84	-0.10	0.76	1.44**	-1.01	0.40	0.12	1.06*	0.44	-0.84	0.91	0.82**	0.11	0.76**	-0.06	0.62	0.61	-0.06	0.50	0.98**
Alpha (α)																								
CAPM																								
OLS HAC	0.18	1.33**	-1.07	-0.34	1.76	-0.70	0.37	1.80***	-0.77	1.90	0.23	1.03**	-0.03	-0.71	1.87	0.63**	0.43	0.78**	-0.01	0.50	0.73	0.29	0.70***	0.66
GMM-IV$_d$	0.18	1.28**	-0.97	-0.32	1.73	-0.65	0.36	1.75***	-0.67	1.88	0.23	0.97*	0.02	-0.61	1.85	0.62**	0.45	0.75**	0.01	0.55	0.75*	0.29	0.69***	0.62
FF3																								
OLS HAC	-0.04	1.29**	-1.16*	-0.44	1.58	-0.80	0.30	1.71***	-0.91	1.72	0.18	1.07**	-0.20	-0.96	1.65	0.55	0.33	0.68**	-0.12	0.33	0.56	0.20	0.60**	0.57
GMM-IV$_d$	-0.05	1.22**	-1.01	-0.36	1.46	-0.74	0.25	1.64***	-0.69	1.63	0.15	0.94*	-0.12	-0.77	1.57	0.54	0.34	0.63*	-0.11	0.37	0.58	0.19	0.58**	0.49
FFC																								
OLS HAC	-0.04	1.28**	-1.23*	-0.56	1.43	-0.85	0.30	1.68***	-0.97	1.61	0.17	1.07**	-0.24	-1.07	1.52	0.51	0.28	0.63*	-0.17	0.25	0.50	0.14	0.55*	0.52
GMM-IV$_d$	-0.08	1.16**	-1.10*	-0.56	1.29	-0.83	0.23	1.55***	-0.80	1.50	0.12	0.94*	-0.19	-0.98	1.44	0.45	0.26	0.54	-0.18	0.26	0.49	0.09	0.49*	0.40
FF5																								
OLS HAC	-0.39	0.97*	-1.58**	-1.01	0.33	-1.39**	0.06	1.41**	-1.44	0.56	-0.07	0.70	-0.71	-1.47	0.37	0.03	-0.20	0.11	-0.60*	-0.24	-0.12	-0.29	0.12	0.02
GMM-IV$_d$	-0.34	0.91	-1.43**	-0.89	0.03	-1.29*	0.05	1.40**	-1.28	0.26	-0.09	0.68	-0.57	-1.31	0.09	0.02	-0.18	0.07	-0.56**	-0.20	-0.08	-0.29	0.09	-0.02
Sharpe ratio (SR)																								
LW bootstrap	0.01	0.08*	-0.06	-0.02	0.10	-0.04	0.02	0.11***	-0.05	0.10	0.01	0.06*	0.00	-0.04	0.10	0.04*	0.03	0.05**	0.00	0.03	0.04	0.02	0.04***	0.04
(B) Pre-crisis																								
Delta (Δ)																								
OLS HAC	0.25	1.61***	-0.85	-0.80	1.42	-0.53	0.71	1.52**	-0.78	1.62	0.26	1.07**	-0.09	-0.26	1.67	0.61*	0.53*	0.77**	0.11	0.51	0.85	0.32	0.64**	0.54
EGARCH	-0.54	1.70***	-0.82	-0.61	-0.01	-0.53	1.20**	1.11	-1.08	-0.16	0.21	1.02	0.36	-0.96	0.56	0.77**	0.22	0.81**	0.00	0.55	0.98**	-0.07	0.35	0.77*
Alpha (α)																								
CAPM																								
OLS HAC	0.25	1.60***	-0.80	-0.60	1.28	-0.46	0.68	1.47***	-0.54	1.49	0.32	1.07**	-0.03	-0.25	1.52	0.60*	0.53*	0.74**	0.13	0.49	0.88*	0.35	0.62**	0.44
GMM-IV$_d$	0.24	1.60***	-0.79	-0.59	1.28	-0.47	0.68	1.48***	-0.52	1.49	0.32	1.07**	-0.02	-0.23	1.53	0.61*	0.53*	0.75**	0.13	0.50	0.88*	0.35	0.63**	0.44
FF3																								
OLS HAC	0.00	1.47**	-0.89	-0.66	1.02	-0.57	0.51	1.32***	-0.59	1.24	0.24	0.97*	-0.20	-0.42	1.25	0.47	0.38	0.59	-0.04	0.34	0.69	0.21	0.47*	0.28
GMM-IV$_d$	0.00	1.49**	-0.89	-0.62	0.99	-0.58	0.51	1.34***	-0.51	1.23	0.24	0.96*	-0.18	-0.38	1.24	0.48	0.38	0.60	-0.04	0.36	0.70	0.21	0.48*	0.29
FFC																								
OLS HAC	-0.01	1.42**	-1.01*	-0.88	0.78	-0.66	0.48	1.23***	-0.68	1.04	0.22	0.96*	-0.29	-0.63	1.02	0.38	0.28	0.48	-0.14	0.22	0.58	0.11	0.37	0.18
GMM-IV$_d$	-0.03	1.42**	-1.00	-0.85	0.75	-0.68	0.48	1.24***	-0.62	1.03	0.20	0.94*	-0.27	-0.61	1.02	0.38	0.28	0.48	-0.14	0.22	0.59	0.10	0.37	0.18
FF5																								
OLS HAC	-0.35	1.13**	-1.32**	-1.01	0.02	-1.16	0.28	1.08**	-1.06	0.28	-0.04	0.70	-0.63	-0.98	0.18	0.00	-0.09	0.10	-0.48**	-0.19	0.08	-0.20	0.04	-0.18
GMM-IV$_d$	-0.29	1.18**	-1.29*	-0.97	-0.19	-1.10	0.32	1.11**	-1.02	0.10	0.00	0.73	-0.56	-0.93	-0.01	0.02	-0.08	0.10	-0.45	-0.16	0.10	-0.19	0.05	-0.16
Sharpe ratio (SR)																								
LW bootstrap	0.01	0.13***	-0.07	-0.06	0.08	-0.05	0.05	0.11**	-0.06	0.09	0.02	0.08*	-0.01	-0.03	0.10	0.05*	0.04*	0.06**	0.01	0.04	0.07*	0.03	0.05**	0.03

Table 22. *(Continued)*

	ESG integration															ESG-themed investing								
	Environmental					Social					Governance					Environmental			Social			Governance		
	A	**B**	**C**	**D**	**NR**	**A**	**B**	**C**	**D**	**NR**	**A**	**B**	**C**	**D**	**NR**	**EE**	**FS**	**WS**	**AG**	**MI**	**UR**	**CS**	**DT**	**RO**
(C) COVID-19 crisis																								
Delta (Δ)																								
OLS HAC	-1.02	-3.74	-3.21	5.62	7.75**	-3.46	-4.69**	5.77**	-1.14	6.97*	-1.18	-0.57	1.12	-5.88	5.93*	0.83	-0.73	0.84	-1.65	1.27	-0.86	-0.33	1.39	2.89*
Alpha (α)																								
CAPM																								
OLS HAC	-1.10	-4.36*	-2.33	5.82***	7.9**	-3.36**	-4.86***	5.46***	-0.55	7.12**	-1.60	-1.29	1.59	-4.88	6.14*	0.67**	-0.60	0.65**	-1.55*	1.78	-0.63	-0.33	1.19	2.79***
GMM-IV$_d$	-1.42	-4.01**	-2.95	6.66	7.80**	-4.10	-4.62***	6.03***	-0.58	6.92**	-1.78	-0.56	1.36	-5.25	5.82**	0.68	-0.70	0.97	-1.58	1.43	-0.50	-0.18	1.18	3.03**
FF3																								
OLS HAC	-0.21	-0.13	-2.92	3.35	1.51	-5.00***	0.26	6.66***	-4.73	1.42	-1.25	4.28***	-0.80	-5.72	0.63	1.09**	-0.26	1.26	-0.06	0.35	-1.29**	-1.57	0.73	2.82**
GMM-IV$_d$	-0.18	0.33	-3.55	5.88	-0.31	-6.08**	0.53	8.22***	-2.96	-0.64	-2.31	5.18**	-0.42	-3.98	-1.41	0.98	-0.27	1.64	-0.13	0.32	-0.38	-1.14	0.57	3.32**
Sharpe ratio (SR)																								
LW bootstrap	-0.02	-0.09	-0.05	0.12	0.17**	-0.07	-0.10***	0.12**	-0.01	0.15**	-0.03	-0.03	0.03	-0.10	0.13*	0.01	-0.01	0.01	-0.03	0.04	-0.01	-0.01	0.03	0.06

This table contains the findings of the robustness tests, along with the baseline results (OLS HAC for factor model alphas). The robustness tests cover (1) alternative performance measures, including the Sharpe ratio (SR) and delta (benchmark-adjusted return without incorporating risks); (2) subsample period excluding the coronavirus pandemic to examine ESG in a "pure" non-crisis period (Pre-crisis); (3) additional statistical methods such as EGARCH to control volatility clustering in the case of deltas, and GMM-IV$_d$ to manage endogeneity in alpha calculations. Alphas and deltas are annualised figures in percentage points. Sharpe ratios are annualised and are over the benchmark's (MSCI ACWI) Sharpe ratio. The bootstrap method of *Ledoit and Wolf (2008)* (LW bootstrap) is applied to test SRs. In the ESG integration approach, the category codes from A to NR are the Group codes from Table 16 (A – Leaders, B – Followers, C – Loungers, D – Laggards, NR – Not rated). The abbreviations regarding ESG-themed investing are as follows: Energy efficiency (EE), Food security (FS), Water scarcity (WS); Ageing (AG), Millennials (MI), Urbanisation (UR); Cybersecurity (CS), Disruptive technologies (DT), Robotics (RO). ***, ** and * represent significance at 1, 5, and 10 per cent levels, respectively.

Table 23. The effects of transaction costs between 2015 and mid-2020

	25 basis points						50 basis points					
	Whole period				COVID-19 Crisis		Whole period				COVID-19 Crisis	
	CAPM	FF3	FFC	FF5	CAPM	FF3	CAPM	FF3	FFC	FF5	CAPM	FF3
(A) ESG integration												
E												
Leader	-0.07	-0.29	-0.29	-0.64	-1.36	-0.46	-0.32	-0.54	-0.54	-0.89	-1.61	-0.71
Follower	1.08	1.05	1.03	0.72	-4.62*	-0.38	0.83	0.80	0.78	0.47	-4.87*	-0.63
S												
Leader	-0.95	-1.05	-1.10	-1.64	-3.61*	-5.25*	-1.45*	-1.54*	-1.59*	-2.13*	-3.85*	-5.51*
Follower	0.12	0.05	0.05	-0.19	-5.11*	0.01	-0.38	-0.45	-0.45	-0.69	-5.36*	-0.24
Lounger	1.55	1.46	1.44	1.16	5.19*	6.40*	1.06*	0.96*	0.94	0.66	4.94*	6.19*
G												
Leader	-0.02	-0.07	-0.08	-0.32	-1.85	-1.50	-0.52	-0.57	-0.58	-0.82	-2.10	-1.75
Follower	0.79	0.82	0.82	0.45	-1.54	4.03*	0.28	0.32	0.32	-0.05	-1.79	3.78*
(B) ESG-themed investing												
E												
EE	0.39	0.30	0.26	-0.22	0.42	0.84	0.14	0.05	0.01	-0.47*	0.17	0.59
FS	0.18	0.08	0.03	-0.45*	-0.85*	-0.51	-0.07	-0.17	-0.22	-0.69*	-1.10	-0.76
WS	0.53*	0.43	0.38	-0.14	0.40	1.01	0.28	0.18	0.13	-0.39*	0.15	0.76
S												
AG	-0.26	-0.37	-0.42	-0.85*	-1.80*	-0.31	-0.51	-0.62*	-0.67*	-1.09*	-2.05*	-0.56
MI	0.25	0.08	0.00	-0.49	1.53	0.10	0.00	-0.17	-0.25	-0.74*	1.27	-0.15
UR	0.48	0.31	0.25	-0.37	-0.88	-1.54*	0.23	0.06	0.00	-0.61*	-1.13	-1.79*
G												
CS	0.04	-0.05	-0.11	-0.54	-0.58	-1.81	-0.21	-0.30	-0.36	-0.78*	-0.83	-2.06
DT	0.45*	0.35	0.30	-0.13*	0.94	0.49	0.20	0.10	0.05	-0.38*	0.69	0.24
RO	0.41	0.31	0.27	-0.23	2.54*	2.57*	0.16	0.07	0.02	-0.48	2.29*	2.32

Table 23. *(Continued)*

	75 basis points						100 basis points					
	Whole period				COVID-19 Crisis		Whole period				COVID-19 Crisis	
	CAPM	**FF3**	**FFC**	**FF5**	**CAPM**	**FF3**	**CAPM**	**FF3**	**FFC**	**FF5**	**CAPM**	**FF3**
(A) ESG integration												
E												
Leader	-0.57	-0.79	-0.79	-1.14	-1.86	-0.96	-0.83	-1.04	-1.04	-1.39*	-2.11*	-1.21
Follower	0.58	0.54	0.53	0.22	-5.12*	-0.88	0.33	0.29	0.28	-0.03	-5.36*	-1.13
S												
Leader	-1.45*	-1.54*	-1.59*	-2.13*	-4.11*	-5.77*	-1.70*	-1.79*	-1.84*	-2.38*	-4.36*	-5.98*
Follower	-0.38	-0.45	-0.45	-0.69	-5.62*	-0.49	-0.62	-0.70	-0.70	-0.94	-5.88*	-0.74
Lounger	1.06*	0.96*	0.94	0.66	4.69*	5.93*	0.81	0.71	0.69	0.41	4.44*	5.67*
G												
Leader	-0.52	-0.57	-0.58	-0.82	-2.35	-2.00	-0.77	-0.82	-0.83	-1.07*	-2.59	-2.25
Follower	0.28	0.32	0.32	-0.05	-2.04	3.53*	0.03	0.07	0.07	-0.30	-2.29	3.28*
(B) ESG-themed investing												
E												
EE	-0.11	-0.20	-0.24	-0.72*	-0.08	0.34	-0.36	-0.45	-0.49	-0.97*	-0.33	0.09
FS	-0.32	-0.42	-0.47*	-0.95*	-1.35*	-1.01	-0.56*	-0.67*	-0.72*	-1.20*	-1.60*	-1.26*
WS	0.03	-0.07	-0.12	-0.63*	-0.10	0.51	-0.22	-0.32	-0.37	-0.88*	-0.35	0.26
S												
AG	-0.75*	-0.87*	-0.92*	-1.34*	-2.23*	-0.81	-1.01*	-1.12*	-1.17*	-1.59*	-2.55*	-1.07
MI	-0.25	-0.42	-0.50	-0.99*	02.jan	-0.40	-0.50	-0.67	-0.74*	-1.24*	0.77	-0.64
UR	-0.02	-0.20	-0.25	-0.86*	-1.39*	-2.04*	-0.27	-0.45	-0.50	-1.11*	-1.64*	-2.29*
G												
CS	-0.46*	-0.55*	-0.6*	-1.04*	-1.08	-2.31*	-0.71*	-0.80*	-0.85*	-1.28*	-1.33	-2.56*
DT	-0.05	-0.15	-0.20	-0.63*	0.44	-0.01	-0.30	-0.40	-0.45	-0.88*	0.19	-0.26
RO	-0.09	-0.19	-0.23	-0.73*	2.04*	07.febr	-0.34	-0.44	-0.48	-0.98*	1.79*	1.82

This table presents factor model alphas after controlling transaction costs (expense ratios). Alphas are annualised figures in percentage points. Covered ESG themes are as follows: Energy efficiency (EE), Food security (FS), Water scarcity (WS); Ageing (AG), Millennials (MI), Urbanisation (UR); Cybersecurity (CS), Disruptive technologies (DT), Robotics (RO). * indicates significant results.

3.3.6. CONCLUSION

This study analysed the performance of two distinct sustainable investment strategies, "ESG integration" and "ESG-themed" investments, under changing global equity market conditions, including the COVID-19 pandemic. In the ESG integration strategy, ESG ratings of Sustainalytics were used to form pure factor portfolios reflecting ESG ratings-based quality: leaders, followers, loungers, and laggards, as well as unrated firms. The second strategy was ESG-themed portfolios following megatrend market signals. The approach relied on money inflows into ESG-themed ETFs that signalled market conviction which firms promote sustainability. We analysed nine ESG themes aligned to SDGs: Energy efficiency, Food security, Water scarcity, Ageing, Millennials, Urbanisation, Cybersecurity, Disruptive technologies, and Robotics. Evaluating two different investment strategies allowed us to examine sustainability on different levels, thus examining organisational and global sustainability following the conceptual model of *Garvare and Johansson (2010)*.

The Fama-MacBeth cross-sectional regressions technique was applied to construct ESG pure factor portfolios. The effects of 83 secondary exposures were controlled, and hence, it was possible to measure the pure performance of the ESG factors. The time-series analysis covered alphas from the CAPM and various Fama-French factor models.

The ESG integration strategy covering the whole term, from 2015 to mid-2020, shows an inverted U-shaped relation between average risk-adjusted returns and ESG scores instead of strictly monotone increasing functions; hence, a diminishing marginal utility to ESG alignment for ESG leaders was observed. Consequently, instead of ESG leaders, environmental and governance followers and social loungers realised significant alphas. Investing in E and G followers remains in line with the "doing well while doing good" concept. The analysis also revealed that investing in ESG laggards might induce negative externalities without achieving superior risk-adjusted returns. Furthermore, the allocation of financial resources to ESG leaders did not produce significant positive abnormal returns, but there was no significant underperformance either; therefore, investors have the opportunity to prioritise impact without forgoing returns.

Investors pursuing pure ESG-themed investment strategies attained returns at least commensurate with risk in eight out of the nine themes during the whole period. However, the sole exception was Ageing, which obtained significant negative alpha only in the FF5 model. The findings suggest that allocating capital to ESG-themed portfolios can enhance alignment with UN SDGs without sacrificing risk-adjusted returns. ESG-themed investing resonates with the global sustainability concept and the shared-value theory of *Porter and Kramer (2019)*. Finally, SDG-focused ESG investments align with regulatory frameworks such as the EU Taxonomy Regulation defining sustainable economic activities.

Examining the impact of the first wave of the COVID-19 pandemic, the literature's typical finding that ESG-aligned investment strategies significantly outperform during adverse market conditions was refuted. Firstly, none of the leader portfolios generated significant positive alphas, but there were some model calibrations where the negative abnormal returns were significant. E and G leaders' returns were not statistically different from zero; by contrast, S leaders exhibited significantly negative alphas. Based on the CAPM, both the follower E and S portfolios underperformed significantly; however, the results were not significant in FF3. In conclusion, no evidence was found for a positive link between ESG and financial performance; however, a negative relationship arose, particularly for social leaders.

Most ESG-themed strategies resulted in positive alphas under the coronavirus crisis, albeit the majority were not statistically different from zero. Consequently, environmental and governance themes were resilient during the first wave of the pandemic as investors could obtain at least returns commensurate with risks. However, the CAPM alpha of Ageing and the FF3 alpha of Urbanisation indicated underperformance, which is not surprising, as segments such as older generations and urban lifestyle have been hit most severely by the pandemic.

We conducted several robustness tests, including alternative performance measures, different sample periods, and statistical methods that handle endogeneity and volatility clustering. The robustness checks corroborate the overall findings that the neutrality argument for ESG-themed investments and the inverted U-shaped relationship concerning ESG integration prevail in the longer term. During the first wave of COVID-19, test results verify neutrality in the case of E and G and underperformance of social leaders contrary to the literature's "flight to quality" concept. The findings suggest that, in general, it was possible to align investments with UN SDGs without forgoing returns. Transaction costs were also considered; the findings were robust up to 25-50 bps expense ratios.

In summary, the results show that ESG strategies were not a safe haven for investor during the pandemic period, and social theme reflected negatively as the pandemic was primarily a social crisis.

Finally, there was not sufficient evidence for ESG factors to complement Fama-French factor models. Nonetheless, PFPs may serve as ESG indices for asset managers to quantify ESG factor tilt and performance attribution.

4. SUMMARY AND CONCLUSION

The dissertation investigated the sustainability concept's viability in global equity markets by examining two well-distinguishable ESG-conscious investment strategies, ESG integration and ESG-themed megatrend investing. Theoretically speaking, the thesis followed an instrumental stakeholder approach augmented with sustainability management. Further, the focus was on shareholder wealth; therefore, the thesis sought to answer whether it was possible to attain superior risk-adjusted returns with ESG integration and thematic equity portfolios in the second half of the 2010s, including the exogenous market shock of the COVID-19 pandemic.

There are fundamentally four different presumptions in the investment literature concerning the relationship between ESG and financial performance. The first one, neutrality, is closely related to the modern portfolio theory of *Markowitz (1952)* and the efficient market hypothesis (EMH) attributed to *Fama (1970)*. The former argues that ESG is an idiosyncratic risk factor, while the latter contends that markets price all relevant public information. The second one, the "doing well while doing good" concept, assumes a positive relationship. *Derwall et al. (2011)* argue that at least two conditions should be met to obtain positive risk-adjusted returns: corporate future profitability should increase with ESG practices, and stock prices should not incorporate all value-relevant ESG information. The trade-off hypothesis (*Friedman, 1970*) contend that ESG investments are likely to underperform in the long run either because ESG portfolios are a subset of the market (*Renneboog et al., 2008b*); thus, diversification is limited or due to overvaluations (*Cornell and Damodaran, 2020*). Finally, proponents of inverted U-shaped relationship assert that considering non-linearity may be a suitable assumption in many cases (*Bowman and Haire, 1965*); that is, intermediate levels of ESG performance maximise investor yields.

The thesis helps scientific thinking about sustainability in several ways. Firstly, it contributes to the active debate of investment literature on the role of ESG, which is far from being settled. Secondly, it is a novelty that the dissertation introduces into the discipline of investments an expanded conceptual model of stakeholder theory, which distinguishes between organisational and global sustainability. Then, the dissertation emphasises the megatrend concept and integrates signalling theory into thematic portfolios' stock selection processes. It also creates a new mathematical formula for measuring megatrend exposures. Utilising the right-hand-side (RHS) approach of Fama and French in the ESG integration framework is a novelty as well. Further, ESG-themed investing is a relatively new strategy; hence, it is currently under-researched in the literature. Finally, the analysed database is unique and comprehensive that makes it suitable for measuring the *pure* performance of ESG factors.

The database includes nine different ESG themes (Energy efficiency, Food security, Water scarcity, Ageing, Millennials, Urbanisation, Cybersecurity, Disruptive technology, Robotics); five E, S, and G factors (altogether 15 portfolios from leaders to laggards); eleven traditional style factors (beta, value, momentum, size, volatility, liquidity, profitability, investment, growth, leverage and earnings variability); also 24 industries, and finally 48 country factors. Altogether, the thesis has a uniquely organised proprietary database consisting of more than 15 million data points, covering circa 3,000 individual stocks, for a period spanning 286 weeks and measuring 107 factors.

Methodologically, the dissertation follows a factor portfolio construction procedure. Stock weights and returns derive from an *extended* Fama-MacBeth (FM) cross-sectional regression procedure to construct *pure* ESG factor portfolios. The term "extended" refers to capitalisation weighted standardisation of firm characteristics – traditional FM uses arithmetic means and standard deviations. Further, the application of constraints enables managing exact multicollinearity emerging due to industry, country, and ESG factors – not a default in the original FM method. "Pure" means that ESG portfolio construction filters out 83 different style, industry, and country exposures to evaluate ESG performance on its own. The time-series analysis of ESG factor portfolio returns applies the Fama-French (FF) right-hand-side (RHS) approach, which simultaneously tests market performance and the validity of adding ESG factors to FF factor models.

The main findings of the dissertation are the following, for the entire period and COVID-19 pandemic, separately.

The ESG integration strategy covering the *entire period*, from 2015 to mid-2020, shows an inverted U-shaped relation between average risk-adjusted returns and ESG ratings. Economically speaking, instead of strictly monotone increasing functions, a diminishing marginal utility to ESG alignment for ESG leaders are observed. Consequently, instead of E, S, and G leaders, environmental and governance followers and social loungers produced significant alphas. *Sun et al. (2019)* draw attention that the inconclusive pattern of a positive, negative, and neutral relationship suggests there may be a more complicated mechanism at work than the traditional simple linear associations. The findings, therefore, corresponds to *Sun et al. (2019)* and other recent studies of *Azmi et al. (2021), Grassmann (2021),* and *Groening and Kanuri (2018)*.

Furthermore, the results still satisfy the "doing well while doing good" concept since the "second-best" follower environmental, and governance portfolios attain above-average E and G ratings. Investor perceptions of social concerns might not be as straightforward as E and G. What can be interpreted as a desirable balance, for instance, in terms of trade union influence and labour rights? There seems to be a particular level of social performance below which company behaviour is unacceptable for the markets. However, it is a social justice issue of how a company should be managed: reward increased social sensitivity or greater business efficiency? The question about the fair limits for "social sensitivity versus business efficiency" is no longer an economic issue but rather a moral one. The difficulty of the question is well illustrated by one interviewee's argument that, in contrast to environmental regulations, the regulatory framework of social sustainability is still in its infancy. Overall, the results suggest that investors prefer increased financial efficiency, but not without limits. In other words, inverted U-shaped relation also exists but at a "lower" level.

The analysis also uncovered that investing in ESG laggards might induce negative externalities without generating superior risk-adjusted returns. Additionally, although capital allocation to ESG leaders did not deliver significant positive alphas, there was no evidence for significant underperformance either. Consequently, investors have the chance to "do good" without forgoing returns.

Investors engaging in pure ESG-themed investment strategies attained returns at least commensurate with risk in eight out of the nine themes during the entire period. The lone exception was Ageing, which obtained significant negative alpha. However, this finding is only valid in the FF 5-factor model calibration; therefore, it fails to pass the robustness checks. The outcomes suggest that allocating capital to ESG-themed portfolios can enhance alignment with UN SDGs without any robust evidence of sacrificing risk-adjusted returns. These results coincide with the conclusions of *Alvarez and Rodríguez (2015)*, *Ibikunle and Steffen (2017)*, and *Reboredo et al. (2017)*. Further, ESG-themed investing resonates with the global sustainability concept of *Garvare and Johansson (2010)* and the shared-value theory of *Porter and Kramer (2019)*.

By examining the impact of the *first wave of the COVID-19 pandemic*, the thesis refutes the literature's usual finding that ESG-aligned investment strategies significantly outperform during adverse market conditions (e.g., *Cornett et al., 2016; Lins et al., 2017; Nofsinger and Varma, 2014*). Firstly, none of the leader portfolios generated significant positive alphas, but there were some model calibrations where the negative abnormal returns were significant. E and G leaders' returns were not statistically different from zero; by contrast, S leaders exhibited significantly negative alphas. Based on the CAPM, both the follower E and S portfolios underperformed significantly; however, the results were not significant in FF3. In conclusion, we found no evidence for a positive link between ESG and financial performance in line with *Demers et al. (2021)*; however, a negative relationship arose, particularly for social leaders.

Most ESG-themed strategies resulted in positive alphas under the coronavirus crisis, albeit the majority were not statistically different from zero. Consequently, environmental and governance themes were resilient during the first wave of the pandemic as investors could obtain at least returns commensurate with risks. However, the CAPM alpha of Ageing and the FF3 alpha of Urbanisation indicated underperformance, which is not surprising, as segments such as older generations and urban lifestyle have been hit most severely by the pandemic. To the best of the author's knowledge, no one has studied so far the performance of ESG-themed investment strategies during the coronavirus crisis.

The last conclusion is related to the applied FF spanning technique, or right-hand-side regression procedure that tests whether ESG factors are relevant new risk factors in the FF framework. *Harvey et al. (2016)* argue that a newly detected factor requires a t-statistic of at least 3.0. Although the ESG portfolios are suitable to measure the performance attribution of ESG factors, the t-statistics do not justify them as new factors in the FF factor models. The results contradict *Díaz et al. (2021)* and *Hübel and Scholz (2020)* but are consistent with *Xiao et al. (2013)*.

The findings have practical implications as well, which are listed below.

The first important implication is that most ESG portfolios yielded non-negative excess returns relative to the MSCI ACWI Index benchmark, even after accounting for *transaction costs* up to 25-50 basis points per annum. Higher transaction costs, as is the case for some ETFs with expense ratios reaching 80-100 basis points per annum, may be an indication of two things: ESG themed megatrend investors are willing to sacrifice approximately 25-50 basis points of annual return to remain aligned with sustainability targets, or that expense ratio may well decline in the future. The interviews with asset managers suggest no reason for such high fees as the competition among investment funds is intense, which will force cost reductions soon.

Portfolio managers who integrate sustainability in their investment portfolios undertake a dual optimisation process that combines ESG strategies with fundamental valuation. ESG pure factor portfolios might be utilised as *smart beta indices* to measure ESG tilt to different ESG factors. This method is superior to calculating the overall ESG rating of investment portfolios currently commonly used by asset managers, as it separates the performance contribution of the ESG tilt from the secondary factors such as geographical, industry, or style effects. *Alessandrini and Jondeau (2020)* and *Bender et al. (2017)* present a similar technique; however, the dissertation's comprehensive approach controls 107 different styles (including each ESG factor), industry, and country factors altogether. Furthermore, interviewees from the asset management sector underscored that they would welcome such indices. Corporate representatives also mentioned that belonging to a particular sector or country meaningfully determines ESG scores.

ESG portfolios presented in the dissertation are each suitable for asset owners and managers to align their investment policies with the requirements and targets of *international standards and regulations*. Based on the interview with a representative of the central bank of Hungary, both strategies are consistent with the EU SFDR requirements. Thematic investing might be aligned with the Taxonomy Regulation and can be flexibly adapted to the UN SDGs and the climate goals of the Paris Agreement.

As outlined above, the results do not provide sufficient evidence for "flight to quality" during the first wave of the COVID-19 pandemic regarding ESG leaders, which contradicts *Albuquerque et al. (2020), Broadstock et al. (2021), Ding et al. (2021)*. One possible explanation might be that secondary factor effects have a substantial influence on good ESG portfolios. Once these secondary effects are considered and filtered out, the otherwise observable outperformance disappears. For instance, both interviewees from the asset management sector drew attention that many good ESG stocks belonged to the tech sector; thus, the performance was partly due to sector effects. The robust outperformance of the Robotics thematic portfolio supports this argument. In summary, good ESG is not necessarily a guarantee to generate superior returns during adverse market conditions such as the COVID-19 pandemic. However, the combination with traditional styles or sectors might yield positive outcomes.

There are several possible directions for possible future research, which partly derives from the limitations of this dissertation. Firstly, analysing ESG scores from more ESG rating agencies might provide further valuable insights. Secondly, comparing ESG factors with other style factors (e.g., value, size) could contribute to the literature. Next, there are other emerging ESG strategies. One example is impact investing, which could be analysed by utilising, for instance, an event study approach. Additionally, other financial markets or asset classes could be covered, such as debt financing, real estates, or commodities. Besides corporate listed on stock exchanges, it would be worth investigating how sustainability-related state subsidies affect the financial performance of other companies. Through this topic, it would be possible to research the impact of SMEs on sustainability. Further, the macro-level perspective of ESG might be valid for research. Finally, EU regulations (Taxonomy, SFDR) will undoubtedly provide coherent and valuable datasets to discover in the longer term.

In summary, the dissertation's most important conclusion is that, in most cases, investors could realise at least fair returns with sustainable investing. This finding is consistent with the efficient market hypothesis. Put it another way, although there is only a slight chance for investors to gain superior risk-adjusted returns, they could contribute to the higher goals of sustainability without sacrificing returns. Overall, investors should keep in mind the message of the Rolling Stones, the motto of this thesis: *"You can't always get what you want/ But if you try sometimes, well, you might find/ You get what you need."*

5. APPENDIX

Appendix 1. UN Sustainable Development Goals (SDGs)

Goal 1.	End poverty in all its forms everywhere
Goal 2.	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3.	Ensure healthy lives and promote well-being for all at all ages
Goal 4.	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5.	Achieve gender equality and empower all women and girls
Goal 6.	Ensure availability and sustainable management of water and sanitation for all
Goal 7.	Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8.	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9.	Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
Goal 10.	Reduce inequality within and among countries
Goal 11.	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12.	Ensure sustainable consumption and production patterns
Goal 13.	Take urgent action to combat climate change and its impacts
Goal 14.	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15.	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16.	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 17.	Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

Appendix 2. Thematic ETFs analysed to construct ESG megatrend portfolios

№	ETF Ticker	ETF Name	Megatrend group	Megatrend	AUM
1	ETHO US Equity	ETHO CLIMATE LEADERSHIP ETF	Environmental	Energy Efficiency	53
2	ACES US Equity	ALPS CLEAN ENERGY ETF	Environmental	Energy Efficiency	88
3	HAP US Equity	VANECK NATURAL RESOURCES	Environmental	Energy Efficiency	65
4	INRG LN Equity	ISHARES GLOBAL CLEAN ENERGY	Environmental	Energy Efficiency	288
5	PBD US Equity	INVESCO GLOBAL CLEAN ENERGY	Environmental	Energy Efficiency	48
6	PBW US Equity	INVESCO WILDERHILL CLEAN ENE	Environmental	Energy Efficiency	200
7	PZD US Equity	INVESCO CLEANTECH ETF	Environmental	Energy Efficiency	193
8	COW CN Equity	ISHARES GLOBAL AGRICULTURE I	Environmental	Food Security	177
9	ISAG LN Equity	ISHARES AGRIBUSINESS	Environmental	Food Security	61
10	MOO US Equity	VANECK AGRIBUSINESS	Environmental	Food Security	656
11	CGW US Equity	INVESCO S&P GLOBAL WATER IND	Environmental	Water Scarcity	669
12	CWW CN Equity	ISHARES GLOBAL WATER INDEX E	Environmental	Water Scarcity	125
13	FIW US Equity	FIRST TRUST WATER ETF	Environmental	Water Scarcity	468
14	PHO US Equity	INVESCO WATER RESOURCES ETF	Environmental	Water Scarcity	1 012
15	PIO US Equity	INVESCO GLOBAL WATER ETF	Environmental	Water Scarcity	188
16	AGED LN Equity	ISHARES AGEING POPULATION	Social	Ageing	255
17	MILN US Equity	GLOBAL X MILLENNIALS THEMATIC	Social	Millennials	76
18	CIF CN Equity	ISHARES GLOBAL INFRASTRUCTURE	Social	Urbanisation	111
19	GII US Equity	SPDR S&P GLOBAL INFRASTRUCTURE	Social	Urbanisation	400
20	IGF US Equity	ISHARES GLOBAL INFRASTRUCTURE	Social	Urbanisation	3 258
21	MICH AU Equity	MAGELLAN INFRA FUND-CURR HGD	Social	Urbanisation	303
22	NFRA US Equity	FLEXSHARES STOXX GLOBAL BROA	Social	Urbanisation	1 421
23	PAVE US Equity	GLOBAL X US INFRASTRUCTURE	Social	Urbanisation	135
24	QIF CN Equity	AGFIQ ENHANCED GLOBAL INFRA	Social	Urbanisation	229
25	TOLZ US Equity	PROSHARES GLB INFRASTRUCTURE	Social	Urbanisation	113
26	XSGI GR Equity	X S&P GLOBAL INFRA SWAP	Social	Urbanisation	226
27	ZGI CN Equity	BMO GLOBAL INFRASTRUCTURE	Social	Urbanisation	183
28	BLCN US Equity	REALITY SHRS NASDAQ NEXGEN	Governance	Disruptive Technology	66
29	CYBR CN Equity	EVOLVE CYBERSECURITY INDEX	Governance	Cybersecurity	44
30	HACK AU Equity	BETASHARES GLOBAL CYBERSECURITY	Governance	Cybersecurity	103
31	BOTZ US Equity	GLOBAL X ROBOTICS & ARTIFICI	Governance	Robotics	1 420
32	IRBO US Equity	ISHARES ROBOTICS & ARTIFICIAL	Governance	Robotics	49
33	RBOT LN Equity	ISHARES AUTOMATION&ROBOTIC-A	Governance	Robotics	1 999
34	ROAI LN Equity	LYXOR ROBOTICS & AI ETF	Governance	Robotics	116
35	ROBO LN Equity	L&G ROBO GLOBAL ROBOTICS&AUT	Governance	Robotics	862
36	ROBO US Equity	ROBO GLOBAL ROBOTICS AND AUT	Governance	Robotics	1 220
37	ROBT US Equity	FIRST TRUST NASDAQ ARTIFICIAL	Governance	Robotics	62
				Total AUM	**16 943**

Appendix 3. Applied style descriptors & factors

No	Factor	No	Descriptor	Brief description of the calculation methods	Bloomberg codes applied for calculation
1	Beta (B)	1	Beta-1	Market-relative beta. Regression on total returns (explanatory variable is the total return of the market; the dependent variable is the total return of the given share). The reference period is one year.	TOT_RETURN_INDEX_NET_DVDS
2	Value (V)	2	E/P	The inverse of forward P/E. The EPS is for the next four upcoming quarters.	BEST_PE_RATIO
		3	CF/P	The inverse of P/CF. The Cash Flow Per Share is calculated on a trailing 12-month basis where available.	PX_TO_CASH_FLOW
		4	BV/P	The inverse of P/BV. The BV data are from the most recent reporting period (quarterly, semi-annual or annual).	PX_TO_BOOK_RATIO
3	Momentum (M)	5	Return momentum	The sum of the weekly total returns for a given day (reference period: one year; from t-56 to t-4), excluding the last 4 weeks due to the reversal effect.	TOT_RETURN_INDEX_NET_DVDS
		6	Price momentum	The stock price for a given day divided by the highest price of the last year (last 4 weeks are excluded due to the reversal effect; from t-56 to t-4).	PX_LAST
		7	Sharpe-momentum	The sum of the weekly total returns for a given day for the last year, excluding the last 4 weeks due to the reversal effect (from t-56 to t-4). This is divided by the standard deviation (SD) of the weekly total returns of the last year (last four weeks also are excluded). SD is annualised.	TOT_RETURN_INDEX_NET_DVDS
4	Size (S)	8	-ln(MCap)	These are measures for the small size effect.	CUR_MKT_CAP
		9	-ln(Assets)		BS_TOT_ASSET
		10	-ln(Sales)		SALES_REV_TURN
5	Volatility (Vol)	11	Total volatility	Return volatility over latest 252 trading days.	PX_LAST
		12	Residual volatility	Residual volatility: total volatility - (beta x volatility of the market).	
		13	Price range	The ratio of maximum and minimum stock price over the previous year.	
6	Liquidity (L)	14	Amihud ratio	The inverse of the Amihud ratio.	VOLUME, PX_LAST
7	Profitability (P)	15	ROE	Return on common equity	RETURN_COM_EQY
		16	ROA	Return on assets	RETURN_ON_ASSET
		17	ROIC/WACC	Return on invested capital/Weighted average cost of capital	ROC_WACC_RATIO
		18	ROS	Return on sales (profit margin, net income/sales)	PROF_MARGIN

Appendix 3. *(Continued)*

No	Factor	No	Descriptor	Calculation method	Bloomberg codes applied for calculation
8	Growth (G)	19	EBT growth	For a given day: the average increase in earnings before tax (EBT), sales and net income for the last four years in the numerator, average assets of the last four years in the denominator.	PRETAX_INC
		20	Net income growth		IS_INC_BEF_XO_ITEM
		21	Sales growth		SALES_REV_TURN
9	Investment (I)	22	Asset growth	For a given day: the average increase in assets for the last four years in the numerator, average assets of the last four years in the denominator.	BS_TOT_ASSET
10	Leverage (L)	23	Book leverage	In the numerator: long + short loans (the latter netted with cash). Denominator: equity book value, equity market value and assets.	BS_LT_BORROW, BS_ST_BORROW
		24	Market leverage		BS_CASH_NEAR_CASH_ITEM
		25	Debt/Assets		CUR_MKT_CAP, TOT_COMMON_EQY, BS_TOT_ASSET
11	Earnings variability (EV)	26	Sales variability	In the numerator: standard deviation of the net income, FCFF, Sales volatility for the last four years; in the denominator: the median total assets for the last four years.	CF_CASH_FROM_OPER, SALES_REV_TURN
		27	Net income variability		IS_INC_BEF_XO_ITEM
		28	FCFF variability		BS_TOT_ASSET

Appendix 4. Missing data in the dataset

Descriptor	Missing	Total	Per cent missing
Beta	4 155	542 906	0.77%
E/P	8 080	542 906	1.49%
CF/P	65 192	542 906	12.01%
BV/P	15 082	542 906	2.78%
Return momentum	52	542 906	0.01%
Price momentum	99	542 906	0.02%
Sharpe-momentum	147	542 906	0.03%
-ln(MCap),	52	542 906	0.01%
-ln(Assets),	1 049	542 906	0.19%
-ln(Sales)	15 157	542 906	2.79%
Total volatility	79	542 906	0.01%
Residual volatility	4 155	542 906	0.77%
Price range	57	542 906	0.01%
Amihud	4 104	542 906	0.76%
ROE	6 530	542 906	1.20%
ROA	2 697	542 906	0.50%
ROIC/WACC	1 049	542 906	0.19%
Profit margin	1 540	542 906	0.28%
Asset growth	30 133	542 906	5.55%
Net income growth	8 137	542 906	1.50%
Sales growth	30 032	542 906	5.53%
Book leverage	3 209	542 906	0.59%
Market leverage	3 209	542 906	0.59%
Debts/Assets.	3 209	542 906	0.59%
Sales variability	20 273	542 906	3.73%
Net income variability	17 525	542 906	3.23%
FCFF variability	19 753	542 906	3.64%
Total	**264 756**	**14 658 464**	**1.81%**

Appendix 5. Industry and country classification

№	Industry groups (second level GICS)
1	Automobiles & Components
2	Banks
3	Capital Goods
4	Commercial & Professional Services
5	Consumer Durables & Apparel
6	Consumer Services
7	Diversified Financials
8	Energy
9	Food & Staples Retailing
10	Food, Beverage & Tobacco
11	Health Care Equipment & Services
12	Household & Personal Products
13	Insurance
14	Materials
15	Media & Entertainment
16	Pharmaceuticals, Biotechnology & Life Sciences
17	Real Estate
18	Retailing
19	Semiconductors & Semiconductor Equipment
20	Software & Services
21	Technology Hardware & Equipment
22	Telecommunication Services
23	Transportation
24	Utilities

№	Countries		
1	United Arab Emirates	25	India
2	Austria	26	Italy
3	Australia	27	Japan
4	Belgium	28	Korea, Republic of
5	Bermuda	29	Liberia
6	Brazil	30	Luxembourg
7	Canada	31	Mexico
8	Switzerland	32	Malaysia
9	Chile	33	Netherlands
10	China	34	Norway
11	Colombia	35	New Zealand
12	Curacao	36	Peru
13	Czech Republic	37	Philippines
14	Germany	38	Poland
15	Denmark	39	Portugal
16	Spain	40	Qatar
17	Finland	41	Russian Federation
18	France	42	Sweden
19	United Kingdom	43	Singapore
20	Greece	44	Thailand
21	Hong Kong	45	Turkey
22	Hungary	46	Taiwan
23	Ireland	47	United States
24	Israel	48	South Africa

Appendix 6. Tests of instrumental variables

To determine the validity of the GMM-IV_d estimator, one should calculate some tests. Based on *Racicot et al. (2019)*, the dissertation applies a relevance test, an exogeneity test and a modified *Hausman (1978)* artificial regression test ($Hausman_d$). The relevance test is about checking the robustness of the IVs. The relevance test helps decide if weak instruments happen to be in the analysis. According to *Racicot et al. (2018)*, an instrument is weak when it is only slightly correlated with the explanatory endogenous variables. *Olea and Pflueger (2013)* argue that if the resulting F-statistics from regressions of the explanatory variables on the IVs are smaller than 24 for all of the regressions, it indicates a potential weak instruments problem. If at least one of the F values is above the critical value of 24, then the instruments are robust. The exogeneity test is the regression of residuals on the IVs. The residuals are estimated from equations (18)-(21) on every single theme. If the instruments are uncorrelated with the error terms, the instruments are exogenous. The $Hausman_d$ is employed to check measurement/specification errors (for detailed mathematical background, see *Racicot and Rentz, 2015*).

Below, the tables present the results based on the Fama-French 5-factor model; however, the conclusions are representative in each model specification and every case of exogeneity test for all the megatrends.

The first table below presents the relevance test. Each F-statistic is well above the critical 24, i.e.; the instruments are robust. The diagonal elements are very close to 1 and have high t-statistics, meaning that each instrument is highly related to its respective explanatory variable.

	d_1	d_2	d_3	d_4	d_5	c	F
MRP	1.000	0.000	0.000	0.000	0.000	0.001	131.05
t	*24.354*	*0.000*	*0.000*	*0.000*	*0.000*	*2.128*	
SIZE	0.000	1.000	0.000	0.000	0.000	0.000	306.47
t	*0.000*	*36.107*	*0.000*	*0.000*	*0.000*	*2.855*	
VALUE	0.000	0.000	1.000	0.000	0.000	0.000	455.26
t	*0.000*	*0.000*	*41.811*	*0.000*	*0.000*	*3.689*	
PROFIT	0.000	0.000	0.000	1.000	0.000	0.000	326.18
t	*0.000*	*0.000*	*0.000*	*37.060*	*0.000*	*6.325*	
INV	0.000	0.000	0.000	0.000	1.000	0.000	441.28
t	*0.000*	*0.000*	*0.000*	*0.000*	*41.867*	*4.139*	

The next table summarises the exogeneity test, in the case of Water scarcity portfolio. Each coefficient of the instrumental variables is close to 0; further, they are not significant as p-values are higher than any of the usual significance levels. Further, the R^2 is very close to 0. Thus, one can conclude that the instruments are exogenous.

	d_1	d_2	d_3	d_4	d_5	c
Coef	-0.0029	0.0069	0.0093	-0.0148	-0.0155	0.0000
p-value	0.433	0.724	0.725	0.624	0.626	1.000
R2	0.0058					

Finally, the table below presents the output of $Hausman_d$ artificial regression tests. (The table repeats the regression coefficients of the $GMM\text{-}IV_d$ method from Table 10. The coefficients of the explanatory variables are the same in the two approaches, which is consistent with the expectations.) The t statistics of ω’s are mostly insignificant, indicating the lack of measurement errors. However, the F tests confirm the presence of errors-in-variables bias in 5 ESG-themed portfolios, viz., this kind of endogeneity exists.

	c	MRP	SIZE	VALUE	PROFIT	INV	ω_{MRP}	ω_{SIZE}	ω_{VALUE}	ω_{PROFIT}	ω_{INV}
Energy efficiency											
Coef. GMM	0.000	0.994	0.012	0.057	0.157	0.332					
Coef	0.000	0.994	0.012	0.057	0.157	0.332	0.010	-0.007	-0.041	0.150	0.174
SE	0.000	0.005	0.024	0.032	0.037	0.039	0.014	0.095	0.122	0.159	0.213
t	0.140	216.671	0.507	1.770	4.242	8.524	0.723	-0.069	-0.337	0.946	0.820
p-value	0.889	0.000	0.612	0.078	0.000	0.000	0.471	0.945	0.736	0.345	0.413
						F-test			1.540		
						p-value			0.177		
Food security											
Coef. GMM	0.000	0.991	0.034	0.107	0.149	0.310					
Coef	0.000	0.991	0.034	0.107	0.149	0.310	0.015	-0.048	-0.135	0.173	0.179
SE	0.000	0.004	0.019	0.026	0.030	0.031	0.011	0.076	0.098	0.128	0.171
t	0.043	267.809	1.741	4.118	5.000	9.856	1.332	-0.634	-1.377	1.347	1.044
p-value	0.966	0.000	0.083	0.000	0.000	0.000	0.184	0.526	0.170	0.179	0.297
						F-test			2.800		
						p-value			0.018**		
Water scarcity											
Coef. GMM	0.000	0.996	0.040	0.063	0.155	0.347					
Coef	0.000	0.996	0.040	0.063	0.155	0.347	0.006	-0.098	-0.099	0.061	0.212
SE	0.000	0.004	0.021	0.029	0.033	0.035	0.012	0.085	0.109	0.142	0.190
t	0.808	243.069	1.867	2.186	4.701	9.987	0.534	-1.163	-0.911	0.431	1.119
p-value	0.420	0.000	0.063	0.030	0.000	0.000	0.594	0.246	0.363	0.667	0.264
						F-test			1.250		
						p-value			0.2854		
Aging											
Coef. GMM	0.000	0.988	0.042	0.123	0.135	0.295					
Coef	0.000	0.988	0.042	0.123	0.135	0.295	0.018	-0.067	-0.281	0.213	0.359
SE	0.000	0.005	0.028	0.038	0.044	0.046	0.016	0.112	0.144	0.187	0.250
t	-0.944	182.868	1.478	3.240	3.107	6.428	1.159	-0.599	-1.956	1.138	1.432
p-value	0.346	0.000	0.141	0.001	0.002	0.000	0.248	0.550	0.052*	0.256	0.153
						F-test			3.380		
						p-value			0.006***		
Millennials											
Coef. GMM	0.000	0.996	0.026	0.056	0.173	0.364					
Coef	0.000	0.996	0.026	0.056	0.173	0.364	0.008	-0.080	-0.079	0.005	0.242
SE	0.000	0.005	0.028	0.038	0.043	0.046	0.016	0.111	0.143	0.186	0.249
t	-0.148	185.434	0.921	1.474	4.000	7.973	0.511	-0.722	-0.554	0.025	0.971
p-value	0.883	0.000	0.358	0.142	0.000	0.000	0.610	0.471	0.580	0.980	0.333
						F-test			0.500		
						p-value			0.778		

	c	MRP	SIZE	VALUE	PROFIT	INV	ω_{MRP}	ω_{SIZE}	ω_{VALUE}	ω_{PROFIT}	ω_{INV}
Urbanisation											
Coef. GMM	0.000	0.988	0.055	0.024	0.173	0.454					
Coef	0.000	0.988	0.055	0.024	0.173	0.454	0.011	-0.037	0.020	0.245	0.022
SE	0.000	0.006	0.030	0.040	0.046	0.048	0.017	0.118	0.151	0.197	0.264
t	0.342	173.334	1.843	0.604	3.774	9.379	0.633	-0.318	0.131	1.241	0.082
p-value	0.733	0.000	0.067	0.547	0.000	0.000	0.527	0.751	0.896	0.216	0.934
						F-test			1.220		
						p-value			0.302		
Cybersecurity											
Coef. GMM	0.000	0.985	0.037	0.102	0.107	0.334					
Coef	0.000	0.985	0.037	0.102	0.107	0.334	0.019	-0.088	-0.087	0.166	0.024
SE	0.000	0.005	0.024	0.032	0.036	0.038	0.013	0.093	0.120	0.156	0.209
t	-0.341	218.561	1.549	3.228	2.958	8.740	1.443	-0.945	-0.728	1.063	0.116
p-value	0.734	0.000	0.123	0.001	0.003	0.000	0.150	0.346	0.467	0.289	0.908
						F-test			2.540		
						p-value			0.029**		
Disruptive Technology											
Coef. GMM	0.000	0.990	0.032	0.130	0.108	0.346					
Coef	0.000	0.990	0.032	0.130	0.108	0.346	0.026	0.006	-0.035	0.203	-0.018
SE	0.000	0.004	0.022	0.030	0.034	0.036	0.013	0.088	0.113	0.147	0.197
t	0.391	233.112	1.431	4.354	3.147	9.591	2.066	0.074	-0.313	1.381	-0.093
p-value	0.696	0.000	0.154	0.000	0.002	0.000	0.040**	0.941	0.755	0.169	0.926
						F-test			2.310		
						p-value			0.045**		
Robotics											
Coef. GMM	0.000	1.002	0.029	0.118	0.146	0.344					
Coef	0.000	1.002	0.029	0.118	0.146	0.344	0.019	-0.079	-0.279	0.186	0.048
SE	0.000	0.005	0.029	0.039	0.044	0.047	0.016	0.113	0.146	0.190	0.255
t	-0.242	182.481	1.011	3.052	3.293	7.387	1.144	-0.693	-1.915	0.979	0.187
p-value	0.809	0.000	0.313	0.003	0.001	0.000	0.254	0.489	0.057*	0.329	0.852
						F-test			2.090		
						p-value			0.068*		

*** p < 0.01 ** p < 0.05 * p < 0.10

6. REFERENCES

Adler, T., Kritzman, M., 2008. The Cost of Socially Responsible Investing. The Journal of Portfolio Management 35, 52–56. https://doi.org/10.3905/JPM.2008.35.1.52

Agee, J., 2009. Developing qualitative research questions: a reflective process. International Journal of Qualitative Studies in Education 22, 431–447. https://doi.org/10.1080/09518390902736512

Aguilera, R.V., Bermejo, V.J., Capapé, J., Cuñat, V., 2019. Firms' Reaction to Changes in the Governance Preferences of Active Institutional Owners (No. N° 625/2019), ECGI Working Paper Series in Finance. European Corporate Governance Institute.

Ailman, C., Edkins, M., Mitchem, K., Eliopoulos, T., Guillot, J., 2017. The Next Wave of ESG Integration: Lessons from Institutional Investors. Journal of Applied Corporate Finance 29, 32–43. https://doi.org/10.1111/jacf.12231

Albuquerque, R., Koskinen, Y., Yang, S., Zhang, C., 2020. Resiliency of Environmental and Social Stocks: An Analysis of the Exogenous COVID-19 Market Crash. The Review of Corporate Finance Studies 9, 593–621. https://doi.org/10.1093/rcfs/cfaa011

Albuquerque, R., Koskinen, Y., Zhang, C., 2018. Corporate Social Responsibility and Firm Risk: Theory and Empirical Evidence. Management Science 65, 4451–4469. https://doi.org/10.1287/mnsc.2018.3043

Alda, M., 2020. ESG fund scores in UK SRI and conventional pension funds: Are the ESG concerns of the SRI niche affecting the conventional mainstream? Finance Research Letters 36, 101313. https://doi.org/10.1016/j.frl.2019.101313

Alessandrini, F., Jondeau, E., 2020. ESG Investing: From Sin Stocks to Smart Beta. The Journal of Portfolio Management 46, 75–94. https://doi.org/10.3905/jpm.2020.46.3.075

Alexander, S.S., 1964. Price Movements in Speculative Markets: Trends or Random Walks ,No. 2. Industrial Management Review 5, 25–46.

Alexander, S.S., 1961. Price Movements in Speculative Markets: Trends or Random Walks. Industrial Management Review 2, 7–26.

Alvarez, M., Rodríguez, J., 2015. Water-related mutual funds: investment performance and social role. Social Responsibility Journal 11, 502–512. https://doi.org/10.1108/SRJ-08-2013-0104

Amel-Zadeh, A., Serafeim, G., 2018. Why and How Investors Use ESG Information: Evidence from a Global Survey. Financial Analysts Journal 74, 87–103. https://doi.org/10.2469/faj.v74.n3.2

Amihud, Y., 2002. Illiquidity and stock returns: cross-section and time-series effects. Journal of Financial Markets 5, 31–56. https://doi.org/10.1016/S1386-4181(01)00024-6

Anderson, M.W., Teisl, M., Noblet, C., 2012. Giving voice to the future in sustainability: Retrospective assessment to learn prospective stakeholder engagement. Ecological Economics, The Economics of Degrowth 84, 1–6. https://doi.org/10.1016/j.ecolecon.2012.09.002

Andersson, M., Bolton, P., Samama, F., 2016. Hedging Climate Risk. Financial Analysts Journal 72, 13–32. https://doi.org/10.2469/faj.v72.n3.4

Ang, A., Hodrick, R.J., Xing, Y., Zhang, X., 2009. High idiosyncratic volatility and low returns: International and further U.S. evidence. Journal of Financial Economics 91, 1–23. https://doi.org/10.1016/j.jfineco.2007.12.005

Ang, A., Hodrick, R.J., Xing, Y., Zhang, X., 2006. The Cross-Section of Volatility and Expected Returns. The Journal of Finance 61, 259–299. https://doi.org/10.1111/j.1540-6261.2006.00836.x

Arbel, A., Carvell, S., Strebel, P., 1983. Giraffes, Institutions and Neglected Firms. Financial Analysts Journal 39, 57–63. https://doi.org/10.2469/faj.v39.n3.57

Asness, C., Frazzini, A., 2013. The Devil in HML's Details. The Journal of Portfolio Management 39, 49–68. https://doi.org/10.3905/jpm.2013.39.4.049

Auer, B.R., 2016. Do Socially Responsible Investment Policies Add or Destroy European Stock Portfolio Value? Journal of Business Ethics 135, 381–397. https://doi.org/10.1007/s10551-014-2454-7

Aupperle, K.E., Carroll, A.B., Hatfield, J.D., 1985. An Empirical Examination of the Relationship between Corporate Social Responsibility and Profitability. The Academy of Management Journal 28, 446–463. https://doi.org/10.2307/256210

Avetisyan, E., Hockerts, K., 2017. The Consolidation of the ESG Rating Industry as an Enactment of Institutional Retrogression. Business Strategy and the Environment 26, 316–330. https://doi.org/10.1002/bse.1919

Azmi, W., Hassan, M.K., Houston, R., Karim, M.S., 2021. ESG activities and banking performance: International evidence from emerging economies. Journal of International Financial Markets, Institutions and Money 70, 101277. https://doi.org/10.1016/j.intfin.2020.101277

Back, K., Kapadia, N., Ostdiek, B., 2015. Testing Factor Models on Characteristic and Covariance Pure Plays (SSRN Scholarly Paper No. ID 2621696). Social Science Research Network, Rochester, NY. https://doi.org/10.2139/ssrn.2621696

Back, K., Kapadia, N., Ostdiek, B., 2013. Slopes as Factors: Characteristic Pure Plays (SSRN Scholarly Paper No. ID 2295993). Social Science Research Network, Rochester, NY. https://doi.org/10.2139/ssrn.2295993

Baker, M., Bradley, B., Wurgler, J., 2011. Benchmarks as Limits to Arbitrage: Understanding the Low-Volatility Anomaly. Financial Analysts Journal 67, 40–54. https://doi.org/10.2469/faj.v67.n1.4

Bali, T.G., Cakici, N., Whitelaw, R.F., 2011. Maxing out: Stocks as lotteries and the cross-section of expected returns. Journal of Financial Economics 99, 427–446. https://doi.org/10.1016/j.jfineco.2010.08.014

Bali, T.G., Engle, R.F., Murray, S., 2016. Empirical Asset Pricing: The Cross Section of Stock Returns. First edition. John Wiley & Sons, Inc., Hoboken, NJ

Banz, R.W., 1981. The relationship between return and market value of common stocks. Journal of Financial Economics 9, 3–18. https://doi.org/10.1016/0304-405X(81)90018-0

Basu, S., 1983. The relationship between earnings' yield, market value and return for NYSE common stocks: Further evidence. Journal of Financial Economics 12, 129–156. https://doi.org/10.1016/0304-405X(83)90031-4

Basu, S., 1977. Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis. The Journal of Finance 32, 663–682. https://doi.org/10.1111/j.1540-6261.1977.tb01979.x

Bauer, R., Derwall, J., Otten, R., 2007. The Ethical Mutual Fund Performance Debate: New Evidence from Canada. Journal of Business Ethics 70, 111–124. https://doi.org/10.1007/s10551-006-9099-0

Bauer, R., Koedijk, K., Otten, R., 2005. International evidence on ethical mutual fund performance and investment style. Journal of Banking & Finance 29, 1751–1767. https://doi.org/10.1016/j.jbankfin.2004.06.035

Beard, C.G., Sias, R.W., 1997. Is There a Neglected-Firm Effect? Financial Analysts Journal 53, 19–23. https://doi.org/10.2469/faj.v53.n5.2113

Bebchuk, L.A., Cohen, A., Wang, C.C.Y., 2013. Learning and the disappearing association between governance and returns. Journal of Financial Economics 108, 323–348. https://doi.org/10.1016/j.jfineco.2012.10.004

Belkaoui, A., 1976. The Impact of the Disclosure of the Environmental Effects of Organizational Behavior on the Market. Financial Management 5, 26–31. https://doi.org/10.2307/3665454

Bell, S., Morse, S., 2008. Sustainability Indicators - Measuring the Immeasurable?, Second edition. Taylor & Francis, London.

Bénabou, R., Tirole, J., 2010. Individual and Corporate Social Responsibility. Economica 77, 1–19. https://doi.org/10.1111/j.1468-0335.2009.00843.x

Bender, J., Sun, X., Wang, T., 2017. Thematic Indexing, Meet Smart Beta! Merging ESG into Factor Portfolios. The Journal of Index Investing 8, 89–101. https://doi.org/10.3905/jii.2017.8.3.089

Bergh, D.D., Gibbons, P., 2011. The Stock Market Reaction to the Hiring of Management Consultants: A Signalling Theory Approach. Journal of Management Studies 48, 544–567. https://doi.org/10.1111/j.1467-6486.2010.00957.x

Berlinger, E., Lovas, A., 2015. Sustainability and growth: the Stern review and the model of directed technical change (IEHAS Discussion Papers No. MT-DP-2015/1; ISBN 978-615-5447-59-4). Hungarian Academy of Sciences, Institute of Economics, Centre for Economic and Regional Studies, Budapest.

Bhattacharya, C.B., Sen, S., 2004. Doing better at doing good: When, why, and how consumers respond to corporate social initiatives. California Management Review 47, 9–24.

BlackRock, 2020. BlackRock Client Letter | Sustainability [WWW Document]. BlackRock. URL https://www.blackrock.com/us/individual/blackrock-client-letter (accessed 5.2.21).

Blitz, D.C., Vliet, P. van, 2007. The Volatility Effect. The Journal of Portfolio Management 34, 102–113. https://doi.org/10.3905/jpm.2007.698039

Bodie, Z., Kane, A., Marcus, A.J., 2018. Investments, 11th ed. ed. McGraw-Hill Education, New York, NY.

Boesl, D.B.O., Bode, B.A.M., 2016. Technology Governance, in: 2016 IEEE International Conference on Emerging Technologies and Innovative Business Practices for the Transformation of Societies (EmergiTech). Presented at the 2016 IEEE International Conference on Emerging Technologies and Innovative Business Practices for the Transformation of Societies (EmergiTech), IEEE, Balaclava.

Boutin-Dufresne, F., Savaria, P., 2004. Corporate Social Responsibility and Financial Risk. The Journal of Investing 13, 57–66. https://doi.org/10.3905/joi.2004.391042

Bowman, E.H., Haire, M., 1975. A Strategic Posture toward Corporate Social Responsibility. California Management Review 18, 49–58. https://doi.org/10.2307/41164638

Bragdon, J.H., Marlin, J., 1972. Is Pollution Profitable. Risk Management 19, 9–18.

Brakman Reiser, D., Tucker, A.M., 2019. Buyer Beware: Variation and Opacity in ESG and ESG Index Funds. Cardozo Law Review 41, 1921–2018. https://doi.org/doi.org/10.2139/ssrn.3440768

Broadstock, D.C., Chan, K., Cheng, L.T.W., Wang, X., 2021. The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. Finance Research Letters 38, 101716. https://doi.org/10.1016/j.frl.2020.101716

Brown, K.C., Harlow, W.V., 1988. Market overreaction: Magnitude and intensity. The Journal of Portfolio Management 14, 6–13. https://doi.org/10.3905/jpm.1988.409137

Bryman, A., 2012. Social Research Methods, Fourth edition. Oxford University Press, New York, NY.

Cahan, E., Ji, L., 2015. US Equity Fundamental Factor Model. Bloomberg Whitepapers 1–33.

Campbell, J.Y., Lo, A.W., MacKinlay, A.C., 1997. The Econometrics of Financial Markets. Princeton University Press, Prinecton, NJ.

Capaul, C., Rowley, I., Sharpe, W.F., 1993. International Value and Growth Stock Returns. Financial Analysts Journal 49, 27–36. https://doi.org/10.2469/faj.v49.n1.27

Capelle-Blancard, G., Monjon, S., 2012. Trends in the literature on socially responsible investment: looking for the keys under the lamppost. Business Ethics: A European Review 21, 239–250. https://doi.org/10.1111/j.1467-8608.2012.01658.x

Cardoni, A., Kiseleva, E., Lombardi, R., 2020. A sustainable governance model to prevent corporate corruption: Integrating anticorruption practices, corporate strategy and business processes. Business Strategy and the Environment 29, 1173–1185. https://doi.org/10.1002/bse.2424

Carhart, M.M., 1997. On Persistence in Mutual Fund Performance. The Journal of Finance 52, 57–82. https://doi.org/10.1111/j.1540-6261.1997.tb03808.x

Carvell, S.A., Strebel, P.J., 1987. Is There A Neglected Firm Effect? Journal of Business Finance & Accounting 14, 279–290. https://doi.org/10.1111/j.1468-5957.1987.tb00544.x

Chan, L.K.C., Hamao, Y., Lakonishok, J., 1991. Fundamentals and Stock Returns in Japan. The Journal of Finance 46, 1739–1764. https://doi.org/10.1111/j.1540-6261.1991.tb04642.x

Chan, L.K.C., Lakonishok, J., Sougiannis, T., 2001. The Stock Market Valuation of Research and Development Expenditures. The Journal of Finance 56, 2431–2456. https://doi.org/10.1111/0022-1082.00411

Chen, N.-F., Roll, R., Ross, S.A., 1986. Economic Forces and the Stock Market. The Journal of Business 59, 383–403. https://www.jstor.org/stable/2352710

Chien-Ting, L., 1999. Misspecification of capital asset pricing model (CAPM): Implication for size and book-to-market effects (PhD thesis). Texas Tech University, Lubbock, TX.

Chikán, A., 2005. Vállalatgazdaságtan, Harmadik kiadás. AULA Kiadó, Budapest.

Chipman, K., 2020. California Water Futures Begin Trading Amid Fear of Scarcity [WWW Document]. Bloomberg.com. URL https://www.bloomberg.com/news/articles/2020-12-06/water-futures-to-start-trading-amid-growing-fears-of-scarcity (accessed 5.1.21).

Clarke, R., de Silva, H., Thorley, S., 2017. Pure Factor Portfolios and Multivariate Regression Analysis. The Journal of Portfolio Management 43, 16–31. https://doi.org/10.3905/jpm.2017.43.3.016

Clarke, R., de Silva, H., Thorley, S., 2014. The Not-So-Well-Known Three-and-One-Half-Factor Model. Financial Analysts Journal 70, 13–23. https://doi.org/10.2469/faj.v70.n5.3

Clarkson, M.B.E., 1995. A Stakeholder Framework for Analyzing and Evaluating Corporate Social Performance. The Academy of Management Review 20, 92–117. https://doi.org/10.2307/258888

Clementino, E., Perkins, R., 2020. How Do Companies Respond to Environmental, Social and Governance (ESG) ratings? Evidence from Italy. Journal of Business Ethics. https://doi.org/10.1007/s10551-020-04441-4

Cochrane, J.H., 2011. Presidential Address: Discount Rates. The Journal of Finance 66, 1047–1108. https://doi.org/10.1111/j.1540-6261.2011.01671.x

Cochrane, J.H., 2005. Asset Pricing. Revised edition. Princeton University Press, Princeton, NJ.

Connelly, B.L., Certo, S.T., Ireland, R.D., Reutzel, C.R., 2011. Signaling Theory: A Review and Assessment. Journal of Management 37, 39–67. https://doi.org/10.1177/0149206310388419

Conrad, J., Kaul, G., 1988. Time-Variation in Expected Returns. The Journal of Business 61, 409–425. https://doi.org/10.1086/296441

Consolandi, C., Jaiswal-Dale, A., Poggiani, E., Vercelli, A., 2009. Global Standards and Ethical Stock Indexes: The Case of the Dow Jones Sustainability Stoxx Index. Journal of Business Ethics 87, 185–197. https://doi.org/10.1007/s10551-008-9793-1

Cont, R., 2001. Empirical properties of asset returns: stylized facts and statistical issues. Quantitative Finance 1, 223–236. https://doi.org/10.1080/713665670

Cornell, B., Damodaran, A., 2020. Valuing ESG: Doing Good or Sounding Good? Journal of Impact and ESG Investing 1, 76–93. https://doi.org/10.3905/jesg.2020.1.1.076

Cornett, M.M., Erhemjamts, O., Tehranian, H., 2016. Greed or good deeds: An examination of the relation between corporate social responsibility and the financial performance of U.S. commercial banks around the financial crisis. Journal of Banking & Finance 70, 137–159. https://doi.org/10.1016/j.jbankfin.2016.04.024

Cragg, J.G., 1997. Using Higher Moments to Estimate the Simple Errors-in-Variables Model. The RAND Journal of Economics 28, S71–S91. https://doi.org/10.2307/3087456

Csóka, P., Herings, P.J.-J., Kóczy, L.Á., 2009. Stable allocations of risk. Games and Economic Behavior 67, 266–276. https://doi.org/10.1016/j.geb.2008.11.001

Dagenais, M.G., Dagenais, D.L., 1997. Higher moment estimators for linear regression models with errors in the variables. Journal of Econometrics 76, 193–221. https://doi.org/10.1016/0304-4076(95)01789-5

Dam, L., 2008. Corporate social responsibility and financial markets (dissertation). University of Groningen, Netherlands, Groningen.

Danyliv, O., Bland, B., Nicholass, D., 2014. A Practical Approach to Liquidity Calculation. Journal of Trading 9, 57–65. https://doi.org/10.2469/dig.v45.n2.12

Darnall, N., Henriques, I., Sadorsky, P., 2010. Adopting Proactive Environmental Strategy: The Influence of Stakeholders and Firm Size. Journal of Management Studies 47, 1072–1094. https://doi.org/10.1111/j.1467-6486.2009.00873.x

Daugaard, D., 2019. Emerging new themes in environmental, social and governance investing: a systematic literature review. Account Finance acfi.12479. https://doi.org/10.1111/acfi.12479

David Diltz, J., 1995. The private cost of socially responsible investing. Applied Financial Economics 5, 69–77. https://doi.org/10.1080/758529174

De Bondt, W.F.M., Thaler, R., 1985. Does the Stock Market Overreact? The Journal of Finance 40, 793–805. https://doi.org/10.1111/j.1540-6261.1985.tb05004.x

De Bondt, W.F.M., Thaler, R.H., 1989. Anomalies: A Mean-Reverting Walk Down Wall Street. Journal of Economic Perspectives 3, 189–202. https://doi.org/10.1257/jep.3.1.189

De Bondt, W.F.M., Thaler, R.H., 1987. Further Evidence On Investor Overreaction and Stock Market Seasonality. The Journal of Finance 42, 557–581. https://doi.org/10.1111/j.1540-6261.1987.tb04569.x

Deakin, H., Wakefield, K., 2014. Skype interviewing: reflections of two PhD researchers. Qualitative Research 14, 603–616. https://doi.org/10.1177/1468794113488126

Della Corte, P., Sarno, L., Tsiakas, I., 2009. An Economic Evaluation of Empirical Exchange Rate Models. Rev Financ Stud 22, 3491–3530. https://doi.org/10.1093/rfs/hhn058

Delmas, M.A., Burbano, V.C., 2011. The Drivers of Greenwashing. California Management Review 54, 64–87. https://doi.org/10.1525/cmr.2011.54.1.64

Demers, E., Hendrikse, J., Joos, P., Lev, B., 2021. ESG did not immunize stocks during the COVID-19 crisis, but investments in intangible assets did. Journal of Business Finance & Accounting n/a, 1–30. https://doi.org/10.1111/jbfa.12523

Demirtas, H., Freels, S.A., Yucel, R.M., 2008. Plausibility of multivariate normality assumption when multiply imputing non-Gaussian continuous outcomes: a simulation assessment. Journal of Statistical Computation and Simulation 78, 69–84. https://doi.org/10.1080/10629360600903866

Derwall, J., Guenster, N., Bauer, R., Koedijk, K., 2005. The Eco-Efficiency Premium Puzzle. Financial Analysts Journal 61, 51–63. https://doi.org/10.2469/faj.v61.n2.2716

Derwall, J., Koedijk, K., Ter Horst, J., 2011. A tale of values-driven and profit-seeking social investors. Journal of Banking & Finance 35, 2137–2147. https://doi.org/10.1016/j.jbankfin.2011.01.009

Diab, A., Martin Adams, G., 2021. ESG assets may hit $53 trillion by 2025, a third of global AUM. Bloomberg Professional Services.

Díaz, V., Ibrushi, D., Zhao, J., 2021. Reconsidering systematic factors during the Covid-19 pandemic – The rising importance of ESG. Finance Research Letters 38, 101870. https://doi.org/10.1016/j.frl.2020.101870

Ding, W., Levine, R., Lin, C., Xie, W., 2021. Corporate immunity to the COVID-19 pandemic. Journal of Financial Economics. https://doi.org/10.1016/j.jfineco.2021.03.005

Dobránszky-Bartus, K., Valdemar Krenchel, J., 2020. The EU Sustainable Finance Taxonomy Regulation: The First Regulatory Definition of What Constitutes Sustainable Economic Activity. Economy and Finance 7, 386–411. https://doi.org/10.33908/EF.2020.4.2

Dodd, E.M., 1932. For Whom Are Corporate Managers Trustees? Harvard Law Review 45, 1145–1163. https://doi.org/10.2307/1331697

Donaldson, T., Preston, L.E., 1995. The Stakeholder Theory of the Corporation: Concepts, Evidence, and Implications. AMR 20, 65–91. https://doi.org/10.5465/amr.1995.9503271992

Dopierała, Ł., Mosionek-Schweda, M., Ilczuk, D., 2020. Does the Asset Allocation Policy Affect the Performance of Climate-Themed Funds? Empirical Evidence from the Scandinavian Mutual Funds Market. Sustainability 12, 654. https://doi.org/10.3390/su12020654

Dowell, G., Hart, S., Yeung, B., 2000. Do Corporate Global Environmental Standards Create or Destroy Market Value? Management Science 46, 1059–1074. https://doi.org/10.1287/mnsc.46.8.1059.12030

Dunphy, D., Benveniste, J., Griffiths, A., Sutton, P. (Eds.), 2000. Sustainability: The Corporate Challenge of the 21st Century, First edition. ed. Allen & Unwin, St. Leonards, Australia.

Durbin, J., 1954. Errors in Variables. Revue de l'Institut International de Statistique / Review of the International Statistical Institute 22, 23–32. https://doi.org/10.2307/1401917

Eccles, N.S., Viviers, S., 2011. The Origins and Meanings of Names Describing Investment Practices that Integrate a Consideration of ESG Issues in the Academic Literature. J Bus Ethics 104, 389–402. https://doi.org/10.1007/s10551-011-0917-7

Eccles, R.G., Krzus, M.P., Ribot, S., 2015. Meaning and Momentum in the Integrated Reporting Movement. Journal of Applied Corporate Finance 27, 8–17. https://doi.org/10.1111/jacf.12113

Edmans, A., 2011. Does the stock market fully value intangibles? Employee satisfaction and equity prices. Journal of Financial Economics 101, 621–640. https://doi.org/10.1016/j.jfineco.2011.03.021

Eisenhardt, K.M., 1989. Building Theories from Case Study Research. AMR 14, 532–550. https://doi.org/10.5465/amr.1989.4308385

Elkington, J., 1998. Partnerships from cannibals with forks: The triple bottom line of 21st-century business. Environmental Quality Management 8, 37–51. https://doi.org/10.1002/tqem.3310080106

Escrig-Olmedo, E., Fernández-Izquierdo, M.Á., Ferrero-Ferrero, I., Rivera-Lirio, J.M., Muñoz-Torres, M.J., 2019. Rating the Raters: Evaluating how ESG Rating Agencies Integrate Sustainability Principles. Sustainability 11, 915. https://doi.org.10.3390/su11030915

Fain, M., 2020a. The Short-term Effects of Corporate Social Performance on Financial Profitability. Review of Economic Theory and Policy 15, 163–179. https://doi.org/10.14267/RETP2020.02.20

Fain, M., 2020b. Evaluating the Relationship between Corporate Profitability and ESG Performance with GMM-IV method. Economy and Finance 7, 454–473. https://doi.org/10.33908/EF.2020.4.6

Fain, M., Naffa, H., 2019. Performance Measurement of Active Investment Strategies Using Pure Factor Portfolios. Financial and Economic Review 18, 52–86. https://doi.org/10.33893/FER.18.2.5286

Fama, E.F., 1976. Foundations Of Finance - Portfolio Decisions and Securities Prices. Basic Books, New York, NY.

Fama, E.F., 1970. Efficient Capital Markets: A Review of Theory and Empirical Work. The Journal of Finance 25, 383–417. https://doi.org/10.2307/2325486

Fama, E.F., Blume, M.E., 1966. Filter Rules and Stock-Market Trading. The Journal of Business 39, 226–241. https://doi.org/10.1086/294849

Fama, E.F., French, K.R., 2020. Comparing Cross-Section and Time-Series Factor Models. Rev Financ Stud 33, 1891–1926. https://doi.org/10.1093/rfs/hhz089

Fama, E.F., French, K.R., 2018. Choosing factors. Journal of Financial Economics 128, 234–252. https://doi.org/10.1016/j.jfineco.2018.02.012

Fama, E.F., French, K.R., 2017. International tests of a five-factor asset pricing model. Journal of Financial Economics 123, 441–463. https://doi.org/10.1016/j.jfineco.2016.11.004

Fama, E.F., French, K.R., 2015. A five-factor asset pricing model. Journal of Financial Economics 116, 1–22. https://doi.org/10.1016/j.jfineco.2014.10.010

Fama, E.F., French, K.R., 2008. Dissecting Anomalies. The Journal of Finance 63, 1653–1678. https://doi.org/10.1111/j.1540-6261.2008.01371.x

Fama, E.F., French, K.R., 1996. Multifactor Explanations of Asset Pricing Anomalies. The Journal of Finance 51, 55–84. https://doi.org/10.1111/j.1540-6261.1996.tb05202.x

Fama, E.F., French, K.R., 1992. The Cross-Section of Expected Stock Returns. The Journal of Finance 47, 427–465. https://doi.org/10.1111/j.1540-6261.1992.tb04398.x

Fama, E.F., MacBeth, J.D., 1973. Risk, Return, and Equilibrium: Empirical Tests. Journal of Political Economy 81, 607–636. https://doi.org/10.1086/260061

Feng, G., Giglio, S., Xiu, D., 2020. Taming the Factor Zoo: A Test of New Factors. The Journal of Finance 75, 1327–1370. https://doi.org/10.1111/jofi.12883

Fenwick, M., Vermeulen, E.P.M., 2019. Technology and Corporate Governance. Texas Journal of Business Law 48, 1–16.

Fernandez, P., 2015. CAPM: An Absurd Model. Business Valuation Review 34, 4–23. https://doi.org/10.5791/0882-2875-34.1.4

Fernandez, P., Fernández Acín, I., 2019. Expected and Required Returns: Very Different Concepts (SSRN Scholarly Paper No. ID 2591319). Social Science Research Network, Rochester, NY.

Ferson, W., 2019. Empirical Asset Pricing: Models and Methods. MIT Press, Cambridge, MA.

Flammer, C., 2012. Corporate Social Responsibility and Shareholder Reaction: The Environmental Awareness of Investors. AMJ 56, 758–781. https://doi.org/10.5465/amj.2011.0744

Folger-Laronde, Z., Pashang, S., Feor, L., ElAlfy, A., 2020. ESG ratings and financial performance of exchange-traded funds during the COVID-19 pandemic. Journal of Sustainable Finance & Investment 1–7. https://doi.org/10.1080/20430795.2020.1782814

Follett, M.P., 1942. Dynamic administration: The collected papers of Mary Parker Follett, First edition. ed. Harper and Brothers Publishers, New York, NY.

Foye, J., Mramor, D., Pahor, M., 2013. A Respecified Fama French Three-Factor Model for the New European Union Member States. Journal of International Financial Management & Accounting 24, 3–25. https://doi.org/10.1111/jifm.12005

Frazzini, A., Pedersen, L.H., 2014. Betting against beta. Journal of Financial Economics 111, 1–25. https://doi.org/10.1016/j.jfineco.2013.10.005

Freeman, R.E., 2010. Strategic Management: A Stakeholder Approach. Cambridge University Press, New York, NY.

Freeman, R.E., 1994. The Politics of Stakeholder Theory: Some Future Directions. Business Ethics Quarterly 4, 409–421. https://doi.org/10.2307/3857340

Freeman, R.E., 1984. Strategic management: A stakeholder approach, First edition. Pitman, Boston, MA.

Freeman, R.E., Harrison, J.S., Wicks, A.C., Parmar, B., de Colle, S., 2010. Stakeholder Theory - The State of the Art, First edition. ed. Cambridge University Press, New York, NY.

Freeman, R.E., Pierce, J., Dodd, R., Pierce, L.D. of P.J., 2000. Environmentalism and the New Logic of Business: How Firms Can be Profitable and Leave Our Children a Living Planet, First edition. ed. Oxford University Press, New York, NY.

Friede, G., 2019. Why don't we see more action? A metasynthesis of the investor impediments to integrate environmental, social, and governance factors. Business Strategy and the Environment 28, 1260–1282. https://doi.org/10.1002/bse.2346

Friede, G., Busch, T., Bassen, A., 2015. ESG and financial performance: aggregated evidence from more than 2000 empirical studies. Journal of Sustainable Finance & Investment 5, 210–233. https://doi.org/10.1080/20430795.2015.1118917

Friedman, M., 1970. The Social Responsibility of Business Is to Increase Its Profits. The New York Times Magazine.

Friedman, M., 1962. Capitalism and Freedom, First edition. University of Chicago Press and Phoenix Books, Chicago, IL.

FTSE, 2014. Factor exposure indexes - Momentum factor. FTSE.

Galema, R., Plantinga, A., Scholtens, B., 2008. The stocks at stake: Return and risk in socially responsible investment. Journal of Banking & Finance 32, 2646–2654. https://doi.org/10.1016/j.jbankfin.2008.06.002

Garvare, R., Johansson, P., 2010. Management for sustainability – A stakeholder theory. Total Quality Management & Business Excellence 21, 737–744. https://doi.org/10.1080/14783363.2010.483095

Gibson, R., Krueger, P., Schmidt, P.S., 2019. ESG Rating Disagreement and Stock Returns (SSRN Scholarly Paper No. ID 3433728). Social Science Research Network, Rochester, NY.

Graham, B., Dodd, D.L., 1934. Security Analysis, First edition. McGraw-Hill Book Company, New York, NY.

Grassmann, M., 2021. The relationship between corporate social responsibility expenditures and firm value: The moderating role of integrated reporting. Journal of Cleaner Production 285, 124840. https://doi.org./10.1016/j.jclepro.2020.124840

Griffin, J.J., Mahon, J.F., 1997. The Corporate Social Performance and Corporate Financial Performance Debate: Twenty-Five Years of Incomparable Research. Business & Society 36, 5–31. https://doi.org/10.1177/000765039703600102

Groening, C., Kanuri, V.K., 2018. Investor Reactions to Concurrent Positive and Negative Stakeholder News. Journal of Business Ethics 149, 833–856. https://doi.org/10.1007/s10551-016-3065-2

Grossman, B.R., Sharpe, W.F., 1986. Financial Implications of South African Divestment. Financial Analysts Journal 42, 15–29. https://doi.org/10.2469/faj.v42.n4.15

GSIA, 2018. Global Sustainable Investment Review 2018. GSIA. http://www.gsi-alliance.org/trends-report-2018/

GSIA, 2014. Global Sustainable Investment Review 2014. GSIA. http://www.gsi-alliance.org/members-resources/global-sustainable-investment-review-2014/

GSIA, 2012. Global Sustainable Investment Review 2012. GSIA. http://www.gsi-alliance.org/latest-trends-report/

Guo, B., Zhang, W., Zhang, Y., Zhang, H., 2017. The five-factor asset pricing model tests for the Chinese stock market. Pacific-Basin Finance Journal 43, 84–106. https://doi.org/10.1016/j.pacfin.2017.02.001

Gyura, G., 2020. ESG and Bank Regulation: Moving with the Times. Economy and Finance 7, 366–385. https://doi.oeg/10.33908/EF.2020.4.1

Hamilton, S., Jo, H., Statman, M., 1993. Doing Well While Doing Good? The Investment Performance of Socially Responsible Mutual Funds. Financial Analysts Journal 49, 62–66. https://doi.org/10.2469/faj.v49.n6.62

Han, J.-J., Kim, H.J., Yu, J., 2016. Empirical study on relationship between corporate social responsibility and financial performance in Korea. AJSSR 1, 61–76. https://doi.org/10.1186/s41180-016-0002-3

Hartzmark, S.M., Sussman, A.B., 2019. Do Investors Value Sustainability? A Natural Experiment Examining Ranking and Fund Flows. The Journal of Finance 74, 2789–2837. https://doi.org/10.1111/jofi.12841

Harvey, C.R., Liu, Y., Zhu, H., 2016. … and the Cross-Section of Expected Returns. The Review of Financial Studies 29, 5–68. https://doi.org/10.1093/rfs/hhv059

Hausman, J.A., 1978. Specification Tests in Econometrics. Econometrica 46, 1251–1271. https://doi.org/10.2307/1913827

Heinkel, R., Kraus, A., Zechner, J., 2001. The Effect of Green Investment on Corporate Behavior. The Journal of Financial and Quantitative Analysis 36, 431. https://doi.org/10.2307/2676219

Henriksson, R., Livnat, J., Pfeifer, P., Stumpp, M., Zeng, G., 2018. ESG Literature Review. SSRN Electronic Journal 1–14.

Heston, S.L., Rouwenhorst, K.G., 1994. Does industrial structure explain the benefits of international diversification? Journal of Financial Economics 36, 3–27. https://doi.org/10.1016/0304-405X(94)90028-0

Hillman, A.J., Keim, G.D., 2001. Shareholder value, stakeholder management, and social issues: what's the bottom line? Strategic Management Journal 22, 125139. https://doi.org/10.1002/1097-0266(200101)22:2<125::AID-SMJ150>3.0.CO;2-H

Hoffmann, A.O.I., Post, T., 2017. How return and risk experiences shape investor beliefs and preferences. Accounting & Finance 57, 759–788. https://doi.org/10.1111/acfi.12169

Hong, H., Kacperczyk, M., 2009. The price of sin: The effects of social norms on markets. Journal of Financial Economics 93, 15–36. https://doi.org/10.1016/j.jfineco.2008.09.001

Hörisch, J., Freeman, R.E., Schaltegger, S., 2014. Applying Stakeholder Theory in Sustainability Management: Links, Similarities, Dissimilarities, and a Conceptual Framework. Organization & Environment 27, 328–346. https://doi.org/10.1177/1086026614535786

Horváth, D., Wang, Y.-L., 2020. The examination of Fama-French Model during the Covid-19. Finance Research Letters 101848. https://doi.org/10.1016/j.frl.2020.101848

Howe, J.S., 1986. Evidence on Stock Market Overreaction. Financial Analysts Journal 42, 74–77. https://doi.org/10.2469/faj.v42.n4.74

Hübel, B., Scholz, H., 2020. Integrating sustainability risks in asset management: the role of ESG exposures and ESG ratings. Journal of Asset Management 21, 52–69. https://doi.org/10.1057/s41260-019-00139-z

Ibikunle, G., Steffen, T., 2017. European Green Mutual Fund Performance: A Comparative Analysis with their Conventional and Black Peers. Journal of Business Ethics 145, 337–355. https://doi.org/10.1007/s10551-015-2850-7

Ielasi, F., Rossolini, M., 2019. Responsible or Thematic? The True Nature of Sustainability-Themed Mutual Funds. Sustainability 11, 3304. https://doi.org/10.3390/su11123304

ILO, 2021. Statistics on collective bargaining [WWW Document]. ILOSTAT. URL https://www.ilostat.ilo.org/topics/collective-bargaining/ (accessed 5.1.21).

Jacobs, K., van Beaumont, K., Rietra, M., Buvat, J., Cherian, S., Robey, J., Lago, C., Hewett, S., Manchanda, N., B, A., 2020. Consumer Products and Retail - How sustainability is fundamentally changing consumer preferences (Survey No. MACS_CS_ MS_ 20200630). Capgemini.

Jahmane, A., Gaies, B., 2020. Corporate social responsibility, financial instability and corporate financial performance: Linear, non-linear and spillover effects – The case of the CAC 40 companies. Finance Research Letters 34, 101483. https://doi.org/10.1016/j.frl.2020.101483

Jegadeesh, N., Titman, S., 2001. Profitability of Momentum Strategies: An Evaluation of Alternative Explanations. The Journal of Finance 56, 699–720. https://doi.org/10.1111/j.1540-6261.1993.tb04702.x

Jegadeesh, N., Titman, S., 1993. Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. The Journal of Finance 48, 65–91. https://doi.org/10.1111/j.1540-6261.1993.tb04702.x

Jensen, M.C., 2002. Value Maximization, Stakeholder Theory, and the Corporate Objective Function. Business Ethics Quarterly 12, 235–256. https://doi.org/10.2307/3857812

Jin, I., 2018. Is ESG a systematic risk factor for US equity mutual funds? Journal of Sustainable Finance & Investment 8, 72–93. https://doi.org/10.1080/20430795.2017.1395251

Jo, H., Na, H., 2012. Does CSR Reduce Firm Risk? Evidence from Controversial Industry Sectors. Journal of Business Ethics 110, 441–456. https://doi.org/10.1007/s10551-012-1492-2

Jobson, J.D., Korkie, B.M., 1981. Performance Hypothesis Testing with the Sharpe and Treynor Measures. The Journal of Finance 36, 889–908. https://doi.org/10.2307/2327554

J.P. Morgan, 2019. J.P. Morgan perspective – ESG Investing 2019: Climate Change Everything. New York, NY.

Justice, P., Hale, J., 2016. Morningstar Sustainability Rating. Morningstar.

Kahneman, D., Tversky, A.N., 1979. Prospect Theory: An Analysis of Decision Under Risk. Econometrica 47, 263–291. https://doi.org/10.2307/1914185

Kaler, J., 2003. Differentiating Stakeholder Theories. Journal of Business Ethics 46, 71–83. https://doi.org/10.1023/A:1024794710899

Kasper, L.J., 1997. Business Valuations: Advanced Topics, First edition. ed. Greenwood Publishing Group, Westport, CT.

Kempf, A., Osthoff, P., 2007. The Effect of Socially Responsible Investing on Portfolio Performance. European Financial Management 13, 908–922. https://doi.org/10.1111/j.1468-036X.2007.00402.x

Khemir, S., 2019. Perception of ESG criteria by mainstream investors: evidence from Tunisia. International Journal of Emerging Markets 14, 752–768. https://doi.org/https:/doi.org/10.1108/IJOEM-05-2017-0172

Kimpel, S.H., Brown, S.L., Eames, F.R., Harrilchak, M., 2021. A Preview of ESG Regulation under the Biden Administration. The National Law Review 11, 1–4.

Klassen, R.D., McLaughlin, C.P., 1996. The Impact of Environmental Management on Firm Performance. Management Science 42, 1199–1214. https://doi.org/10.1287/mnsc.42.8.1199

Kovács, E., 2014. Többváltozós adatelemzés. Typotex, Budapest.

Krueger, P., Sautner, Z., Starks, L.T., 2020. The Importance of Climate Risks for Institutional Investors. The Review of Financial Studies 33, 1067–1111. https://doi.org/10.1093/rfs/hhz137

Laszlo, C., 2003. The Sustainable Company: How to Create Lasting Value through Social and Environmental Performance, First edition. ed. Island Press, Washington, DC.

Ledoit, O., Wolf, M., 2008. Robust performance hypothesis testing with the Sharpe ratio. Journal of Empirical Finance 15, 850–859. https://doi.org/10.1016/j.jempfin.2008.03.002

Lee, K.J., Carlin, J.B., 2010. Multiple Imputation for Missing Data: Fully Conditional Specification Versus Multivariate Normal Imputation. Am J Epidemiol 171, 624–632. https://doi.org/10.1093/aje/kwp425

Lesser, K., Rößle, F., Walkshäusl, C., 2016. Socially responsible, green, and faith-based investment strategies: Screening activity matters! Finance Research Letters 16, 171–178. https://doi.org/10.1016/j.frl.2015.11.001

Lewbel, A., 1997. Constructing Instruments for Regressions With Measurement Error When no Additional Data are Available, with An Application to Patents and R&D. Econometrica 65, 1201–1213. https://doi.org/10.2307/2171884

Lin, L.-W., 2010. Corporate Social Responsibility in China: Window Dressing or Structural Change? Berkeley Journal of International Law 28, 64–100.

Lins, K.V., Servaes, H., Tamayo, A., 2017. Social Capital, Trust, and Firm Performance: The Value of Corporate Social Responsibility during the Financial Crisis. The Journal of Finance 72, 1785–1824. https://doi.org/10.1111/jofi.12505

Lintner, J., 1965. Security prices, risk, and maximal gains from diversification. The Journal of Finance 20, 587–615. https://doi.org/10.1111/j.1540-6261.1965.tb02930.x

Liu, Z., Zhao, L., Wang, C., Yang, Y., Xue, J., Bo, X., Li, D., Liu, D., 2019. An Actuarial Pricing Method for Air Quality Index Options. Int J Environ Res Public Health 16. https://doi.org/10.3390/ijerph16244882

Lo, A.W., MacKinlay, A.C., 1988. Stock Market Prices Do Not Follow Random Walks: Evidence from a Simple Specification Test. Rev Financ Stud 1, 41–66. https://doi.org/10.1093/rfs/1.1.41

Lo Iacono, V., Symonds, P., Brown, D.H.K., 2016. Skype as a Tool for Qualitative Research Interviews. Sociological Research Online 21, 103–117. https://doi.org/10.5153/sro.3952

Lopez, C., Contreras, O., Bendix, J., 2020. Disagreement among ESG rating agencies: shall we be worried? (Working paper No. 103027). Munich Personal RePEc Archive.

López-García, M.N., Trinidad-Segovia, J.E., Sánchez-Granero, M.A., Pouchkarev, I., 2019. Extending the Fama and French model with a long term memory factor. European Journal of Operational Research. https://doi.org/10.1016/j.ejor.2019.07.071

Lynch, K., 2020. Where to Find Low-Cost ESG Funds [WWW Document]. Morningstar, Inc. URL https://www.morningstar.com/articles/987495/where-to-find-low-cost-esg-funds (accessed 10.31.20).

Maiti, M., 2020. Is ESG the succeeding risk factor? Journal of Sustainable Finance & Investment 0, 1–15. https://doi.org/10.1080/20430795.2020.1723380

Malladi, R., 2019. KIDS Thematic Indices: *Enabling Investors to Invest in Firms That Cater to Children*. JII 10, 85–103. https://doi.org/10.3905/jii.2019.1.075

Managi, S., Okimoto, T., Matsuda, A., 2012. Do socially responsible investment indexes outperform conventional indexes? Applied Financial Economics 22, 1511–1527. https://doi.org/10.1080/09603107.2012.665593

Manohar, S., Bartsch, E., Deese, B., Powell, R., Spiegel, J., 2019. Megatrends - The forces shaping our future (No. MKTGH0919A-938961– 3/20). BlackRock, Hong Kong.

Margolis, J.D., Walsh, J.P., 2003. Misery Loves Companies: Rethinking Social Initiatives by Business. Administrative Science Quarterly 48, 268. https://doi.org/10.2307/3556659

Markowitz, H., 1952. Portfolio Selection. The Journal of Finance 7, 77–91. https://doi.org/10.2307/2975974

Martí-Ballester, C., 2019. The role of mutual funds in the sustainable energy sector. Bus Strat Env 28, 1107–1120. https://doi.org/10.1002/bse.2305

Martí-Ballester, C.-P., 2020. Financial Performance of SDG Mutual Funds Focused on Biotechnology and Healthcare Sectors. Sustainability 12, 2032. https://doi.org/10.3390/su12052032

Martí-Ballester, C.-P., 2019. Do European renewable energy mutual funds foster the transition to a low-carbon economy? Renewable Energy 143, 1299–1309. https://doi.org/10.1016/j.renene.2019.05.095

Matos, P., 2020. ESG and Responsible Institutional Investing Around the World: A Critical Review (SSRN Scholarly Paper No. ID 3668998). Social Science Research Network, Rochester, NY. https://doi.org/10.2139/ssrn.3668998

McCoyd, J.L.M., Kerson, T.S., 2006. Conducting Intensive Interviews Using Email: A Serendipitous Comparative Opportunity. Qualitative Social Work 5, 389–406. https://doi.org/10.1177/1473325006067367

McWilliams, A., Siegel, D., 2001. Corporate social responsibility: A theory of the firm perspective. Academy of management review 26, 117–127. https://doi.org/10.2307/259398

McWilliams, A., Siegel, D., 2000. Corporate social responsibility and financial performance: correlation or misspecification? Strategic management journal 21, 603–609. https://doi.org/10.1002/(SICI)1097-0266(200005)21:5<603::AID-SMJ101>3.0.CO;2-3

McWilliams, A., Siegel, D.S., Wright, P.M., 2006. Corporate Social Responsibility: Strategic Implications*. J Management Studies 43, 1–18. https://doi.org/10.1111/j.1467-6486.2006.00580.x

Meadows, D.H., Meadows, D.L., Randers, J., Behrens III, W.W., 1972. The limits to growth: A report for the club of Rome's project on the predicament of mankind., First edition. ed. Potomac Associates - Universe Books, New York, NY.

Melas, D., Nagy, Z., Kulkarni, P., 2017. 15 - Factor Investing and ESG Integration, in: Jurczenko, E. (Ed.), Factor Investing. Elsevier, pp. 389–413. https://doi.org/10.1016/B978-1-78548-201-4.50015-5

Memmel, C., 2003. Performance hypothesis testing with the Sharpe ratio. Finance Letters 1, 21–23.

Menchero, J., 2010. The characteristics of factor portfolios. The Journal of Performance Measurement 15, 52–62.

Menchero, J., Ji, L., 2017. Pure Factor Returns in Real Time. Bloomberg White Papers 1–14.

Menchero, J., Lee, J.-H., 2015. Efficiently Combining multiple sources of alpha. Journal Of Investment Management 13, 71–86.

Mérő, B., Nagy, O., Neszveda, G., 2020. Testing New Factors in Empirical Asset Pricing. Szigma 50, 263–281.

Merton, R.C., 1987. A Simple Model of Capital Market Equilibrium with Incomplete Information. The Journal of Finance 42, 483–510. https://doi.org/10.2307/2328367

Mitchell, R.K., Agle, B.R., Wood, D.J., 1997. Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts. The Academy of Management Review 22, 853–886. https://doi.org/10.2307/259247

Moody's, 2020. Research Announcement: Moody's - Generating value in values investing; ESG a new growth frontier for global asset managers. Moody's, New York, NY.

Moskowitz, M., 1972. Choosing socially responsible stocks. Business and Society Review 1, 71–75.

Mossin, J., 1966. Equilibrium in a Capital Asset Market. Econometrica 34, 768. https://doi.org/10.2307/1910098

Muley, A., Tiwari, S., Gidwani, J., 2019. Performance Evaluation of Thematic Mutual Fund Schemes Using Capital Asset Pricing Model (CAPM). International Journal of Scientific Research and Review 7, 2277–2286. https://doi.org/16.10090.IJSRR.2018.V7I03.287391.3787

Naffa, H., 2009. Eszközárazási anomáliák többváltozós modellje. Hitelintézeti Szemle 8, 516–527.

Naffa, H., Fain, M., 2021. A Factor Approach to the Performance of ESG Leaders and Laggards. Finance Research Letters 102073. https://doi.org/10.1016/j.frl.2021.102073

Naffa, H., Fain, M., 2020. Performance measurement of ESG-themed megatrend investments in global equity markets using pure factor portfolios methodology. PLoS ONE 15, e0244225. https://doi.org/10.1371/journal.pone.0244225

Nagy, Z., Kassam, A., Lee, L.-E., 2016. Can ESG Add Alpha? An Analysis of ESG Tilt and Momentum Strategies. The Journal of Investing 25, 113–124. https://doi.org/10.3905/joi.2016.25.2.113

Naisbitt, J., 1982. Megatrends - Ten New Directions Transforming Our Lives. Warner Books, London.

Nelson, D.B., 1991. Conditional Heteroskedasticity in Asset Returns: A New Approach. Econometrica 59, 347–370. https://doi.org/10.2307/2938260

Newey, W.K., West, K.D., 1987. A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. Econometrica 55, 703–708. https://doi.org/10.2307/1913610

Nofsinger, J., Varma, A., 2014. Socially responsible funds and market crises. Journal of Banking & Finance 48, 180–193. https://doi.org/10.1016/j.jbankfin.2013.12.016

Novy-Marx, R., 2013. The other side of value: The gross profitability premium. Journal of Financial Economics 108, 1–28. https://doi.org/10.1016/j.jfineco.2013.01.003

Olea, J.L.M., Pflueger, C., 2013. A Robust Test for Weak Instruments. Journal of Business & Economic Statistics 31, 358–369. https://doi.org/10.1080/00401706.2013.806694

Pal, M., 1980. Consistent moment estimators of regression coefficients in the presence of errors in variables. Journal of Econometrics 14, 349–364. https://doi.org/10.1016/0304-4076(80)90032-9

Pástor, Ľ., Stambaugh, R.F., 2003. Liquidity Risk and Expected Stock Returns. Journal of Political Economy 111, 642–685. https://doi.org/10.1086/374184

Pástor, Ľ., Vorsatz, M.B., 2020. Mutual Fund Performance and Flows during the COVID-19 Crisis. The Review of Asset Pricing Studies 10, 791–833. https://doi.org/10.1093/rapstu/raaa015

Phillips, R., Freeman, R.E., Wicks, A.C., 2003. What Stakeholder Theory Is Not. Business Ethics Quarterly 13, 479–502.

Phillips, R.A., Reichart, J., 2000. The Environment as a Stakeholder? A Fairness-Based Approach. Journal of Business Ethics 23, 185–197. https://doi.org/10.1023/A:1006041929249

Porter, M.E., 1980. Competitive Strategy: Techniques for Analyzing Industries and Competitors, First edition. Free Press, New York, NY.

Porter, M.E., Kramer, M.R., 2019. Creating Shared Value, in: Lenssen, G.G., Smith, N.C. (Eds.), Managing Sustainable Business: An Executive Education Case and Textbook. Springer Netherlands, Dordrecht, pp. 323–346. https://doi.org/10.1007/978-94-024-1144-7_16

Porter, M.E., Serafeim, G., Kramer, M.R., 2019. Where ESG Fails. Institutional Investor.

Preston, L.E., O'Bannon, D.P., 1997. The corporate social-financial performance relationship: A typology and analysis. Business & Society 36, 419–429. https://doi.org/10.1177/000765039703600406

PRI, 2020. Principles for Responsible Investment releases new guidelines for asset owners on relationships with investment managers [WWW Document]. PRI. URL https://www.unpri.org/news-and-press/principles-for-responsible-investment-releases-new-guidelines-for-asset-owners-on-relationships-with-investment-managers/6667.article (accessed 4.7.21).

PRI, 2019. Fiduciary Duty in the 21st Century. Principles for Responsible Investing.

Racicot, F.-É., 2015. Engineering robust instruments for GMM estimation of panel data regression models with errors in variables: a note. Applied Economics 47, 981–989. https://doi.org/10.1080/00036846.2014.985373

Racicot, F.-E., Rentz, W.F., 2015. The Pástor-Stambaugh empirical model revisited: Evidence from robust instruments. J Asset Manag 16, 329–341. https://doi.org/10.1057/jam.2015.22

Racicot, F.-E., Rentz, W.F., Kahl, A., Mesly, O., 2019. Examining the dynamics of illiquidity risks within the phases of the business cycle. Borsa Istanbul Review 19, 117–131. https://doi.org/10.1016/j.bir.2018.12.001

Racicot, F.-É., Rentz, W.F., Tessier, D., Théoret, R., 2019. The conditional Fama-French model and endogenous illiquidity: A robust instrumental variables test. PLOS ONE 14, e0221599. https://doi.org/10.1371/journal.pone.0221599

Racicot, F.-É., Rentz, W.F., Théoret, R., 2018. Testing the new Fama and French factors with illiquidity: A panel data investigation. Finance Vol. 39, 45–102. https://doi.org/10.3917/fina.393.0045

Racicot, F.-É., Théoret, R., 2014. Cumulant instrument estimators for hedge fund return models with errors in variables. Applied Economics 46, 1134–1149. https://doi.org/10.1080/00036846.2013.868591

Racicot, F.-É., Théoret, R., 2012. Optimally weighting higher-moment instruments to deal with measurement errors in financial return models. Applied Financial Economics 22, 1135–1146. https://doi.org/10.1080/09603107.2011.629983

Reboredo, J.C., Quintela, M., Otero, L.A., 2017. Do investors pay a premium for going green? Evidence from alternative energy mutual funds. Renewable and Sustainable Energy Reviews 73, 512–520. https://doi.org/10.1016/j.rser.2017.01.158

Reinganum, M.R., 1983. The anomalous stock market behavior of small firms in January: Empirical tests for tax-loss selling effects. Journal of Financial Economics 12, 89–104. https://doi.org/10.1016/0304-405X(83)90029-6

Renneboog, L., Ter Horst, J., Zhang, C., 2008a. The price of ethics and stakeholder governance: The performance of socially responsible mutual funds. Journal of Corporate Finance, Special Issue: Contractual Corporate Governance 14, 302–322. https://doi.org/10.1016/j.jcorpfin.2008.03.009

Renneboog, L., Ter Horst, J., Zhang, C., 2008b. Socially responsible investments: Institutional aspects, performance, and investor behavior. Journal of Banking & Finance 32, 1723–1742. https://doi.org/10.1016/j.jbankfin.2007.12.039

Revelli, C., Viviani, J.-L., 2015. Financial performance of socially responsible investing (SRI): what have we learned? A meta-analysis. Bus Ethics Eur Rev 24, 158–185. https://doi.org/10.1111/beer.12076

Revelli, C., Viviani, J.-L., 2013. The Link Between SRI and Financial Performance: Effects and Moderators. mi 17, 105–122. https://doi.org/10.7202/1015403ar

Ritchie, H., Roser, M., 2021. CO2 emissions [WWW Document]. Our World in Data. URL https://www.ourworldindata.org/co2-emissions (accessed 5.1.21).

Ritter, J.R., 1988. The Buying and Selling Behavior of Individual Investors at the Turn of the Year. The Journal of Finance 43, 701–717. https://doi.org/10.1111/j.1540-6261.1988.tb04601.x

Rosenberg, B., 1974. Extra-Market Components of Covariance in Security Returns. The Journal of Financial and Quantitative Analysis 9, 263–274. https://doi.org/10.2307/2330104

Rosenberg, B., Guy, J., 1976. Prediction of Beta from Investment Fundamentals: Part One. Financial Analysts Journal 32, 60–72. https://doi.org/10.2469/faj.v32.n3.60

Rosenberg, B., McKibben, W., 1973. The Prediction of Systematic and Specific Risk in Common Stocks. The Journal of Financial and Quantitative Analysis 8, 317–333. https://doi.org/https:/doi.org/10.2307/2330027

Rosenberg, B., Reid, K., Lanstein, R., 1985. Persuasive evidence of market inefficiency. The Journal of Portfolio Management 11, 9–16. https://doi.org/10.3905/jpm.1985.409007

Ross, S., 1976. The arbitrage theory of capital asset pricing. Journal of Economic Theory 13, 341–360. https://doi.org/10.1016/0022-0531(76)90046-6

Rowley, J., 2012. Conducting research interviews. Management Research Review 35, 260–271. https://doi.org/10.1108/01409171211210154

Roy, R., Shijin, S., 2018. A six-factor asset pricing model. Borsa Istanbul Review 18, 205–217. https://doi.org/10.1016/j.bir.2018.02.001

Rubin, D.B. (Ed.), 1987. Frontmatter, in: Wiley Series in Probability and Statistics. John Wiley & Sons, Inc., Hoboken, NJ, USA, pp. i–xxix. https://doi.org/10.1002/9780470316696.fmatter

Russo, M.V., Fouts, P.A., 1997. A Resource-Based Perspective On Corporate Environmental Performance And Profitability. AMJ 40, 534–559. https://doi.org/10.5465/257052

Samuelson, P.A., Nordhaus, W.D., 2010. Economics, Nineteenth edition. ed. McGraw-Hill/Irwin, New York, NY.

Schaltegger, S., Hörisch, J., Freeman, R.E., 2019. Business Cases for Sustainability: A Stakeholder Theory Perspective. Organization & Environment 32, 191–212. https://doi.org/10.1177/1086026617722882

Schaltegger, S., Wagner, M., 2011. Sustainable entrepreneurship and sustainability innovation: categories and interactions. Business Strategy and the Environment 20, 222–237. https://doi.org/10.1002/bse.682

Seidman, I., 2006. Interviewing As Qualitative Research: A Guide for Researchers in Education And the Social Sciences, Third edition. ed. Teachers College Press, New York, NY.

Sharpe, W.F., 1994. The Sharpe Ratio. The Journal of Portfolio Management 21, 49–58. https://doi.org/10.3905/jpm.1994.409501

Sharpe, W.F., 1964. Capital asset prices: A theory of market equilibrium under conditions of risk. The Journal of Finance 19, 425–442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x

Shiu, Y.-M., Yang, S.-L., 2017. Does engagement in corporate social responsibility provide strategic insurance-like effects? Strategic Management Journal 38, 455–470. https://doi.org/10.1002/smj.2494

Sirri, E.R., Tufano, P., 1998. Costly Search and Mutual Fund Flows. The Journal of Finance 53, 1589–1622. https://doi.org/10.1111/0022-1082.00066

Sparkes, R., 2003. Socially Responsible Investment: A Global Revolution. John Wiley & Sons, Chichester, England.

Spence, M., 1974. Market Signaling: Informational Transfer in Hiring and Related Screening Processes. Harvard University Press, Cambridge, MA.

Spence, M., 1973. Job Market Signaling. The Quarterly Journal of Economics 87, 355. https://doi.org/10.2307/1882010

Starik, M., 1995. Should trees have managerial standing? Toward stakeholder status for non-human nature. Journal of Business Ethics 14, 207–217. https://doi.org/10.1007/BF00881435

Starik, M., Kanashiro, P., 2013. Toward a Theory of Sustainability Management: Uncovering and Integrating the Nearly Obvious. Organization & Environment 26, 7–30. https://doi.org/10.1177/1086026612474958

Starik, M., Rands, G.P., 1995. Weaving An Integrated Web: Multilevel and Multisystem Perspectives of Ecologically Sustainable Organizations. AMR 20, 908–935. https://doi.org/10.5465/amr.1995.9512280025

StataCorp LP, 2013. Stata Multiple Imputation Reference Manual - Release 13.

Stead, J.G., Stead, W.E., 2013. Sustainable Strategic Management, Second edition. ed. M.E. Sharpe, Armonk, NY.

Stead, J.G., Stead, W.E., 2009. Management for a Small Planet, Third edition. ed. M.E. Sharpe, New York, NY.

Sun, W., Yao, S., Govind, R., 2019. Reexamining Corporate Social Responsibility and Shareholder Value: The Inverted-U-Shaped Relationship and the Moderation of Marketing Capability. J Bus Ethics 160, 1001–1017. https://doi.org/10.1007/s10551-018-3854-x

The American Finance Association, 2008. Masters of Finance Videos. https://afajof.org/masters-of-finance-videos/

Thomas, J.K., Zhang, H., 2002. Inventory Changes and Future Returns. Review of Accounting Studies 7, 163–187. https://doi.org/10.1023/A:1020221918065

Townsend, B., 2020. From SRI to ESG: The Origins of Socially Responsible and Sustainable Investing. JESG 1, 10–25. https://doi.org/10.3905/jesg.2020.1.1.010

Triguero, A., Moreno-Mondéjar, L., Davia, M.A., 2016. Leaders and Laggards in Environmental Innovation: An Empirical Analysis of SMEs in Europe. Business Strategy and the Environment 25, 28–39. https://doi.org/10.1002/bse.1854

Tsai, H.-J., Wu, Y., 2021. Changes in Corporate Social Responsibility and Stock Performance. J Bus Ethics. https://doi.org/10.1007/s10551-021-04772-w

Tucker III, J.J., Jones, S., 2020. Environmental, Social, and Governance Investing: Investor Demand, the Great Wealth Transfer, and Strategies for ESG Investing. Journal of Financial Service Professionals 74, 56–75.

UCLA: Statistical Consulting Group, 2020. Multiple Imputation in Stata [WWW Document]. URL https://stats.idre.ucla.edu/stata/seminars/mi_in_stata_pt1_new/ (accessed 10.4.20).

UNCTAD, 2020. Leveraging the Potential of ESG ETFs for Sustainable Development (No. UNCTAD/DIAE/2020/1). UNCTAD, Geneva, Switzerland.

UNDP, 2021a. Goal 8: Decent work and economic growth [WWW Document]. UNDP. URL https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-8-decent-work-and-economic-growth.html (accessed 5.1.21).

UNDP, 2021b. Goal 16: Peace, justice and strong institutions [WWW Document]. UNDP. URL https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-16-peace-justice-and-strong-institutions.html (accessed 5.1.21).

United Nations, 2015. Transforming our world: the 2030 Agenda for Sustainable Development.

van Beurden, P., Gössling, T., 2008. The Worth of Values – A Literature Review on the Relation Between Corporate Social and Financial Performance. Journal of Business Ethics 82, 407. https://doi.org/10.1007/s10551-008-9894-x

van Duuren, E., Plantinga, A., Scholtens, B., 2016. ESG Integration and the Investment Management Process: Fundamental Investing Reinvented. J Bus Ethics 138, 525–533. https://doi.org/10.1007/s10551-015-2610-8

Vance, S.C., 1975. Are socially responsible corporations good investment risks. Management review 64, 19–24.

von Solms, B., von Solms, R., 2018. Cybersecurity and information security – what goes where? Info and Computer Security 26, 2–9. https://doi.org/10.1108/ICS-04-2017-0025

Waddock, S., 2011. We Are All Stakeholders of Gaia: A Normative Perspective on Stakeholder Thinking. Organization & Environment 24, 192–212. https://doi.org/10.1177/1086026611413933

Waddock, S.A., Graves, S.B., 1998. The Corporate Social Performance-Financial Performance Link. Strategic Management Journal 18, 303–319. https://doi.org/10.1002/(SICI)1097-0266(199704)18:4<303::AID-SMJ869>3.0.CO;2-G

Walter, G., Berlinger, E., 1999. Factor models in the securities market. The Arbitrage Pricing Theory (APT). Faktormodellek az értékpapírpiacon. Az arbitrált árfolyamok modellje (APT). Bankszemle 43, 34–43.

Wang, Y., 2021. Government policies, national culture and social distancing during the first wave of the COVID-19 pandemic: International evidence. Safety Science 135, 105138. https://doi.org/10.1016/j.ssci.2020.105138

Welcomer, S.A., 2010. Reinventing vs. Restoring Sustainability in the Maine Woods: Narratives of Progress and Decline. Organization & Environment 23, 55–75. https://doi.org/10.1177/1086026609358967

Whittaker, R., Spinoso, M., Lee, A., Stiehler, A., Müller, P.G., 2018. Sustainable investing Education primer : ESG thematic equities.

Williams, J.B., 1938. The Theory of Investment Value, First edition. North-Holland Publishing Company, Amsterdam.

Williamson, O., 1984. Corporate Governance. The Yale Law Journal 93, 1197–1230. https://doi.org/10.2307/796256

Wong, W.C., Batten, J.A., Ahmad, A.H., Mohamed-Arshad, S.B., Nordin, S., Adzis, A.A., 2021. Does ESG certification add firm value? Finance Research Letters 39, 101593. https://doi.org/10.1016/j.frl.2020.101593

World Commission on Environment and Development, 1987. Our Common Future, First edition. ed. Oxford University Press, Oxford.

Xiao, Y., Faff, R., Gharghori, P., Lee, D., 2013. An Empirical Study of the World Price of Sustainability. Journal of Business Ethics 114, 297–310. https://doi.org/10.1007/s10551-012-1342-2

Xue, J., Xu, Y., Zhao, L., Wang, C., Rasool, Z., Ni, M., Wang, Q., Li, D., 2019. Air pollution option pricing model based on AQI. Atmospheric Pollution Research 10, 665–674. https://doi.org/10.1016/j.apr.2018.10.011

Zaher, F., 2019. Index Fund Management - A Practical Guide to Smart Beta, Factor Investing, and Risk Premia, First edition. Palgrave Macmillan, Cham, Switzerland.

Zaremba, A., Czapkiewicz, A., 2017. Digesting anomalies in emerging European markets: A comparison of factor pricing models. Emerging Markets Review 31, 1–15. https://doi.org/10.1016/j.ememar.2016.12.002

Zhan, J.X., Santos-Paulino, A.U., 2021. Investing in the Sustainable Development Goals: Mobilization, channeling, and impact. J Int Bus Policy 4, 166–183. https://doi.org/10.1057/s42214-020-00093-3

Zsolnai, L., 2006. Extended stakeholder theory. Society and Business Review 1, 37–44. https://doi.org/10.1108/17465680610643337

Zumbach, G., 2000. The Pitfalls in Fitting Garch(1,1) Processes, in: Dunis, C.L. (Ed.), Advances in Quantitative Asset Management, Studies in Computational Finance. Springer US, Boston, MA, pp. 179–200. https://doi.org/10.1007/978-1-4615-4389-3_8