Università Cattolica del Sacro Cuore

Facoltà di Scienze Bancarie, Finanziarie e Assicurative

Master of Science in Banking and Finance

ESG materiality in the European equity market

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“Profit for a company is like oxygen for a person.
If you do not have enough of it, you are out of the game.
But if you think your life is about breathing,
you are really missing something”.

Peter Drucker

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Acknowledgements

I would like to express my deepest gratitude to all those who supported me during my studies and, specifically, while conducting this research.

On the academic side, I immensely thank my supervisor, Prof. Croci: his promptness in replying to my emails and thoroughness in reviewing my drafts were pivotal to make me work effectively, considering my internship and the consequent time pressure. I also thank Prof. Newton, whose lectures at the Frankfurt School of Finance & Management introduced me to the fascinating concept of ESG materiality, and Prof. Del Giudice, Prof. Moslener and Prof. Lucius who advised me on the most relevant issues to be investigated in the domain of responsible finance.

On the personal level, many other people deserve special thanks.

I thank my parents for their presence and my siblings for being an infinite source of inspiration: Francesco for his achievements and vividness, Benedetta for her sharp but affectionate genuiness, Andrea for his gentleness, humor and loyal closeness. My grandma's exemplary stamina also taught me a lot. I am then grateful to my uncle Marco – whose stories of successful entrepreneurs and managers helped me understand business was the right track for me – Elisabetta, and my kind and joyful cousins Enrica, Camilla and Giovanni. I finally thank my relatives from Apulia and Calabria for their unconditional love and our unforgettable vacations together.

Last but not least, some much needed friends. I thank Alessandro and Matteo for growing up with me, the group in Canaro for reminding me my wonderful childhood and adolescence, Nicola, Sara, Laura, Caterina, Leonardo for their cheering company in the challenging years of Padova and HyunWoo, Joming, Valentine and Giancarlo for the light-hearted and enriching moments shared in Frankfurt.

1. Introduction

Asset management companies use more and more ESG data to make financial decision. As of January 2018, $12.0tn and $13.6tn are invested taking into account sustainability criteria in the US and Europe (US SIF, Eurosif, 2018): 26% and 44% of the total assets under professional management in those markets.

Not all ESG data are relevant from an investment standpoint. Eccles and Serafeim (2013) define ESG material issues as "*the ones that have the greatest impact on the firm's ability to create shareholders value*". The increasing importance of sustainability and the large amount of ESG information available make ESG materiality particularly topical. However, little evidence is provided on its contribution to the generation of positive abnormal returns.

The Sustainability Accounting Standard Board (SASB), the body accredited to set sustainability accounting standards by the American National Standards Institute, recently created the Materiality Map®. The basic idea behind this map is that the material nature of a certain sustainability issue depends on the industry a company belongs to.

The purpose of my study is to investigate the relation between financial and both material and immaterial sustainability performance. I follow the methodology outlined by Khan *et al.* (2015), the only scholars exploiting SASB's powerful classification of ESG issues and I complement their analysis focusing on the European – rather than US – market and using a different sustainability database.

This is very relevant. On one hand, many studies demonstrate that the impact of ESG sustainability over a company's financial performance may vary a lot, depending on the market where it is tested – see, for instance, Auer and Schuhmacher (2016); on the other hand, Chatterji *et al.* (2015) document that extra-financial rating agencies are

characterized by a surprising lack of agreement. The first point suggests that the evidence emerged in the US may not apply in Europe. The second highlights that, as ESG ratings tend to diverge, results based on KLD may be different from the ones based on Asset4.

The ultimate importance of this study lies in the possibility to be useful to a large spectrum of actors, notably companies and investors. With reference to the former, it intends to define whether it is financially worth it to distinguish between material and immaterial issues. Focusing on the latter, it may help investors include ESG analysis in their investment decisions with a greater awareness on the financial implications of the sustainability criteria used.

In this thesis, I define a way to fit Thomson Reuters Asset4's datatypes into the framework provided by the Materiality Map® and I standardize the former to be able to compute a yearly score for each company's material and immaterial performance, consistently with Khan *et al.* (2015).

I regress the yearly changes into the material (immaterial) performance score onto changes into proxies for size, growth opportunities, leverage and profitability. The resulting residuals represent the unexplained portion of the score's change. The higher such portion is, the greater is the company's unpredicted effort in increasing its material (immaterial) sustainability performance. Henceforth, the firms with the highest (lowest) residuals are considered as material or immaterial sustainability outperformers (underperformers) and allocated to the most (least) materially or immaterially sustainability portfolios. Equal- and value-weighted portfolios are formed according to different cutoffs of the obtained residuals (deciles, quintiles, quartiles and tertiles).

I test whether portfolios including companies with high ESG material and immaterial performance beat portfolios whose constituents fall behind on these issues (Hypothesis 1 and 2) and whether portfolios including companies that rationalize their investments in

only the most ESG material issue, neglecting the immaterial ones, beat portfolios of firms with a poor performance on material issues and concurrently good performance on immaterial ones (Hypothesis 3).

Given the evidence emerged in the US market I expect that: companies with a high performance on material sustainability issues (HM) significantly outperform firms that do not properly cope with these issues (LM); companies with a high performance on immaterial sustainability issues (HI) do not to significantly outperform firms with low performance on them (LI); and firms with a good performance on material issues and poor performance on immaterial ones (HM&LI) deliver the highest abnormal returns.

To test the three hypotheses, I estimate each portfolio's abnormal returns through the Carhart four-factor model, over a ten-year time horizon: from the beginning of July 2008 to the end of June 2018. To have a more precise idea on the differential alpha associated with being included in HM rather than LM portfolios (Hypothesis 1), in HI rather than LI portfolios (Hypothesis 2) and in HM&LI rather than HI&LM portfolios (Hypothesis 3), I also construct an augmented version Carhart model where the excess returns of both portfolios of my comparisons are used as dependent variable and a dummy variable distinguishing them is added among the regressors. Abnormal returns estimated through the Fama-French three-factor – original and augmented – model are used as robustness checks.

Results suggest that the evidence emerged in the US market applies to Europe only as long as material portfolios are concerned and only in the strictest – i.e. decile – cutoff. Being a material sustainability outperformer in Europe pays off. However, contrarily to the US, immaterial sustainability leads to a significant positive abnormal returns too and the alpha associated with the LM&HI is the highest one.

Focusing on Hypothesis 1, when using the strictest cutoff, both equal- and value-weighted HM portfolios generate a positive and significant annualized abnormal return, whereas the alphas referred to the LM equal- and value-weighted portfolios are not statistically significant. HM annualized alpha is 3.55% for the equal-weighted portfolio and 4.00% for the value-weighted one. The augmented version of the Carhart model also indicates that HM generates a 5.24% greater annualized alpha than LM, in the value-weighted case. Quintile cutoffs lead to slightly less clear-cut results. On one hand, the equal-weighted HM portfolio generates a 2.56% annualized alpha (significant at 10%) whereas the abnormal return associated to the LM portfolio is lower (2.48% *per annum*) but – contrarily to what emerged with decile cutoffs – significant at 10%. On the other hand, value-weighted portfolios never generate a significant alpha. Likewise, robustness tests do not always confirm support the overperformance of HM. For instance, although the augmented Fama-French model confirms the 5.24% greater annualized alpha of HM *versus* LM, the remaining estimated abnormal returns are usually not significant.

With reference to Hypothesis 2, estimates suggest that a high immaterial sustainability leads to positive and significant abnormal returns, ranging from 3.5% to a 4.7% *per annum*. However, my analysis leads to mixed results on the effects of a low immaterial sustainability over portfolios' financial performance. On one hand, equal-weighted LI portfolios generate a positive and significant alpha, always lower than, but not significantly different from, the one characterizing HI. On the other hand, value-weighted LI portfolios generate no significant abnormal return but the differential alpha associated with being HI is always positive and significant. Apart from the clear superiority of HI portfolios, this suggests that whereas smaller firms should definitely not focus on immaterial issues as this leads to positive abnormal returns, if larger firms neglect

immaterial sustainability issues this does not bring any financial advantage – confirming the role of public scrutiny over larger companies only.

Alphas are usually not significant in the robustness tests conducted on equal-weighted portfolios but they support the advantage of HI on the value-weighted ones.

The European equity market appears to factor in companies' immaterial sustainability performance in a very different way than the US one. Such results may nonetheless be driven by a mere methodological aspect. Whereas Khan *et al.* (2015) use all data items available in KLD – matching only the KLD items with the sustainability issues defined as material by SASB and classifying as immaterial all the remaining KLD items – I restrict the Asset4 database making it fit to the Materiality Map® and hand-map both its material and immaterial sustainability items.

Finally, all portfolios strategies based on mixed material and immaterial sustainability performance generate positive and significant abnormal returns which range from a maximum of 6.3% to a minimum 2.9% *per annum*. LM&HI is the best performing portfolio, across all specifications. It generates a significant 6.3% and 6.1% annualized abnormal return, in the equal- and value-weighted case, when using quartile cutoffs; and a significant annualized 3.54% alpha in equal-weighted case defined through tertile cutoffs. It is followed by HM&HI, whose annualized abnormal returns stand between 3.04% and 4.23% *per annum*, and HM&LI and LM&LI, which nonetheless tend to be characterized by non significant alphas. As a general trend, given a certain portfolio, quartile cutoffs lead to higher significant abnormal returns, implying that a severe sustainability stock-picking pays off. Furthermore, considering the lower number of firms included in HL portfolios, results referred to HH and LL portfolios appear to be more robust. This encourages me not to over-emphasize the superior performance of LM&HI. Once again, Fama and French model mostly leads to non significant parameters.

These results contribute to the current literature on the relation between a company's sustainable and financial performance by focusing on an as pivotal as still underrated topic: ESG materiality. I demonstrate that equity market participants do not interpret in a different way whether listed companies engage in material or immaterial issues in Europe. This implies that SASB classification is not successful in separating material from less material sustainability information for investment purposes in the European market. As a matter of fact, not only the portfolios including material sustainability outperformers (constructed with the strictest sustainability criteria) but also the ones gathering immaterial sustainability outperformers display a positive and significant abnormal return. These contradictory results may be due to two reasons: first, the Materiality Map® is not specifically designed to be applied in Europe, given that it is based on the legal framework provided by SEC requirements; second, my methodology introduces a slighty stricter way to match Asset4 data with SASB immaterial sustainability issues, than the one adopted by Khan *et al.* (2015).

The thesis is organized as follows. Section 2 includes the literature review, the motivation and the hypotheses' development. Section 3 is dedicated to the empirical analysis: it illustrates the sample, the methodology followed and the results obtained. Section 4 concludes.

2. Literature Review and motivation

2.1 A framework to understand responsible finance and ESG analysis

A theoretical framework around the intersection of sustainability and the business world is much-needed as a result of the historic development of sustainable finance, which emerged and widespread in a rather chaotic way.

Although von Wallis and Klein (2015) trace its origins back to the early biblical times, when Jewish law defined the first specific rules for ethical investment, the current idea of sustainable finance mainly refers to events occurred in the last decades, thanks to the growing relevance of concepts such as sustainable development and corporate social responsibility (CSR).

2.1.1 Sustainable development

According to Daly (1996) the term 'sustainable development' reached the prominence we currently attribute to it, following the 1987 publication of *Our Common Future*, a report sponsored by the United Nations World Commission on Environment and Development (WCED). That document described sustainable development as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*". Such a definition marked a milestone in the sustainability sphere and many initiatives were launched around it. These initiatives have been pertaining to both intergovernmental organizations and the corporate world, whereas academia supported them by means of a large amount of research papers and the development of a more and more sustainability-centered education offer.

With reference to the initiatives taken by intergovernmental organizations, I believe it is worth mentioning two actions: the UN-sponsored Sustainable Development Goals and the COP21 agreement. Both dates back to 2015.

The former regards 17 goals which form the so-called *2030 Agenda*. According to the UN (2015) these goals are broad and universal and will stimulate action in five areas of "*critical importance*": people, planet, prosperity, peace and partnerships. Each goal is characterized by sub-goals or specific targets, which amount overall to 169. All of these targets are to be reached by 2030 for the successful execution of the *2030 Agenda*. Although the 17 sustainable development goals (SDGs) are aspirational – aiming at ending, *inter alia*, poverty and hunger – not binding for the signatory states and, according to Hák *et al.* (2016), lacking of relevant indicators to understand the accomplishment made time by time, they represent a clear worldwide political commitment and "*gain moral force from having been adopted by consensus after three years of lengthy negotiations*" (Sengupta, 2015).

The latter is the COP 21 agreement, where 195 participating countries agreed, by consensus, on a global action plan starting from 2020 to limit global warming to below 2°C. According to the European Commission (2016), it enters into force when "*at least 55 Parties representing at least an estimated 55% of total greenhouse gas emissions join, by ratifying, accepting or approving it*". As opposed to the 17 SDGs, the COP-21 agreement includes not only voluntary but also binding provisions, e.g. the preparation and implementation of the intended Nationally Determined Contributions to achieve the 2°C target, even if it does not provide for enforcement or sanctions in case they are not respected.

The reason why I focused on these two intergovernmental organizations' initiatives, deriving, *latu sensu*, from the 1987 definition of sustainable development, is that they are deemed to have a significant impact over financial markets.

The Global Impact Investing Network (2016), a 501(c)3 nonprofit organization dedicated to increasing the scale and effectiveness of impact investing, published a research paper

stressing that the achievement of these goals by 2030 will need some $5-7tn per year of new capital deployed to this purpose. This is particularly important not only for its scale, but also for the actual behavioural shift it promotes the asset management industry. As a matter of fact, since the GIIN has started profiling how signatory investors were mapping their existing portfolios to the SDGs, investors were persuaded to track some or all of their sustainability impact performance. The *2030 Agenda* may therefore well condition financial players behavior and investment decisions in the next decade.

Consider also the piece of work written by McGlade and Ekins (2015). They estimated that the magnitude of fossil fuel companies' stranded assets in a 2°C scenario – consistently with the COP 21 agreement – will regard some 82% of total coal reserves, 49% of total gas reserves and 33% of total oil reserves. This means that if the COP 21 is enforced, a vast majority of these companies' cash flow generating assets may not be used and the equity markets will react accordingly. Likewise, Weyzig *et al.* (2014) highlighted that, as European financial institutions invest in fossil fuel companies, they are also characterized by a direct high carbon exposure to climate risks and policies. In particular, they quantified such exposure as 1.3%, 5% and 4.4% of banks, pension funds and insurance companies' total assets, respectively. Finally, Battiston *et al.* (2017) suggest that the impact of climate change policies on financial markets may be even more severe. According to their research paper, which focused on the North American and European market, whereas the aggregate equity portfolio exposure to the fossil sector is limited and ranges from 3.7% for Individuals to 11.4% for Governments, their exposure to the combined climate relevant sectors (i.e. fossil fuel extraction, utilities, transport, energy-intensive and housing industries) is significantly larger and goes from 39.8% for Insurance and Pension Funds to 53.8% for Governments. For this reason, they conclude that that climate policies may well create winners and losers across financial actors and

would not have adverse systemic impact only if they are implemented early on and within a stable framework.

As I mentioned earlier, the WCED definition of sustainable development induced the corporate world to take multilateral initiatives too. For the sake of this dissertation, I believe that the Principles for Responsible Investment (PRI), the Global Reporting Initiative (GRI) and the Sustainability Accounting Standard Board (SASB) are the three most prominent ones.

The Principles for Responsible Investment (PRI) is an independent international network of investors which set up six principles for responsible investment. It was originally formed by a group of 20 people drawn from institutions in 12 countries and additional 70 professionals from the investment industry, intergovernmental organizations and civil society. The PRI were launched in April 2006 at the NYSE and were supported by the United Nations. 2,000 financial companies, representing more than $80tn assets, were PRI signatories, as of the end of 2018 (PRI, 2019). All signatories are deemed to implement the principles, which are: i) we will incorporate ESG issues into investment analysis and decision-making processes; ii) we will be active owners and incorporate ESG issues into our ownership policies and practices; iii) we will seek appropriate disclosure on ESG issues by the entities in which we invest; iv) we will promote acceptance and implementation of the principles within the investment industry; v) we will work together to enhance our effectiveness in implementing the principles; vi) we will each report on our activities and progress towards implementing the principles.

The GRI is an independent international organization committed to the definition of agreed sustainability reporting standards. Its ultimate mission is to support businesses and governments in understanding and communicating their impact on critical sustainability issues. The GRI Sustainability Reporting Standards are the first and most

widely adopted global standards for sustainability reporting and are used by 93% of the world's largest companies (GRI, 2019).

Similarly to the GRI, SASB is an independent 501(c)3 non-profit organization which aims at developing and disseminating sustainability accounting standards that comply with SEC legal requirements – such as the Form 10-K and 20-F. This means that, as opposed to GRI, SASB's focus is mainly on the US market. While defining its sustainability standards, SASB relies on a concept which is fundamental for this dissertation: materiality. SASB's mission is indeed to help companies improve their ESG performance on the issues most likely to impact their financial value. The reason why SASB focuses on financially material issues is that its work mainly targets the investors' community.

I will extensively dwell upon SASB materiality later. What is relevant for the time being is to acknowledge how an agreed definition of sustainable development acted as a strong catalyst mobilizing the business community to set out a common framework to make sustainable development happen. Such a mobilization involved the financial industry too. The Global Sustainable Investment Alliance (GSIA) was launched as a collaboration of membership-based sustainable investment organizations around the world. The most relevant GSIA members are the US Sustainable Investing Forum and (US SIF) and the European Sustainable Investment Forum (Eurosif). Both of them are multi-stakeholder entities whose goal is to develop sustainability through the North American and European financial markets. Eurosif, on top of providing leading research and updates on the state of sustainable finance in Europe, coordinates the activities of all continental Europe, country-based, responsible investment forums (such as Forum per la Finanza Sostenibile in Italy and Forum pour l'Investissement Responsable, in France). US SIF members alone represents more than $3tn of asset under management or advisement (US SIF, 2019) and the 263 asset managers which were willing to participate in the most recent Eurosif

research study, constituted some 79% of the entire European market or €20tn (Eurosif, 2018). Other members of GSIA are the United Kingdom Sustainable Investment Forum (UKSIF), the Canadian Responsible Investment Association (RIA) and the Dutch Association of Investors for Sustainable Development (VBDO).

Such an active response on the side of the corporate world was paired by a strong recognition of the importance of Corporate Social Responsibility, whose definition will be provided in the next paragraph.

2.1.2 Corporate social responsibility

The World Business Council for Sustainable Development (1998) provided the most commonly adopted definition of CSR, according to which "*corporate social responsibility is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large*". This definition has the advantage of encompassing several key aspects of CSR. It conveys, in particular, the message that CSR involves not only the economic but also the societal domain of a company's day-to-day activity. However, it lacks to emphasize the connection between CSR and sustainable development. To this purpose, Marais (2015) highlighted that CSR may be seen as "*the contribution of companies to sustainable development, in their sphere of influence*".

Ciciretti *et al*. (2015), while describing the increasingly relevance of CSR in the last few decades, flag how countries, consumers and investors started requiring large multinational companies to adopt strict CSR policies as a consequence these entities' economic and social power – often perceived as even greater than the one of many national governments. This point of view stresses how public scrutiny induced multinationals to put in place convincing measures of self-regulation in the sustainability

domain and helps understand why large companies usually implement more advanced CSR programmes.

Now that a definition of CSR has been given, we can illustrate the meaning of sustainable finance. As a matter of fact, the latter is often considered as a subset of the former, given that it can be argued that it aims to include the concepts stressed by CSR and sustainable development in the context of the financial industry.

2.1.3 Sustainable finance

First of all, when focusing on a merely lexical point of view, there exists several ways to refer to what is generally defined as sustainable finance. Both academia and the corporate world interchangeably use terms such as sustainable finance, responsible finance, ethical finance, value-based finance and socially responsible finance.

According to von Wallis and Klein (2015) the existence of this plethora of terms is due to the different historical moments in which they have been coined.

In particular, the earliest reference to investment allocation based on extra-financial criteria was promoted by religious entities. According to Eurosif (2012), the Quaker movement first defined exclusion rules to avoid investing in companies involved with slavery, in the 17th century. Likewise, Sparkes (2002) reported that the UK Church Investors Group set up their financial portfolios after having defined some basic constraints, in 1948. Finally, Renneboog *et al.* (2008) and Hussein and Omran (2005) highlighted how the Muslim community determined its own rules to give birth to the so-called Islamic finance – notably based, on the idea of excluding some industries, like pork production, as well as the prohibition to develop the fixed-income market – in the 19th century. As a consequence of these religion-driven initiatives, sustainable finance was

initially defined with terms referring to the religious domain, such as moral and or ethical finance.

However, following the 1968 protests, a widespread secularization of these concepts took place. In this framework, the Pax World Fund was started to avoid investments in companies involved in the arms industry, in light of the Vietnam War, and was soon followed by other funds which adopted similar strategies – such as divesting from South Africa during the apartheid regime (von Wallis and Klein, 2015).

This paved the way for the use of a more neutral terminology which still holds today. In order to guarantee consistency throughout my study, as well as a prompt comprehension of the topic treated, I will hereafter use the term sustainable finance only.

Eurosif (2016) defines sustainable finance as "*a long-term oriented investment approach which integrates ESG factors in the research, analysis and selection process of securities within an investment portfolio. It combines fundamental analysis and engagement with an evaluation of ESG factors in order to better capture long term returns for investors and to benefit society by influencing the behavior of companies*."

Before illustrating the relevant aspects of this definition, it is necessary to clarify the meaning of the ESG acronym. ESG stands for environmental, social and governance. According to the Financial Times (2019), ESG is a generic term, part of the capital markets jargon, used by investors to describe the extent to which a corporate behavior is sustainable. ESG factors underlie an analysis of the environmental, social and governance performance of either specific firms or entire industries. This is done for a wide spectrum of purposes, which are usually comprised within the umbrella of risk-mitigation techniques. Principles for Responsible Investment (PRI, 2019) provides some practical examples of the themes that should be considered in each ESG factor. For instance,

environmental issues should regard topics such as climate change, resource depletion, waste, pollution and deforestation. Likewise, aspects falling within the social field are: working conditions – including slavery and child labour, the relation with local communities, conflict, health and safety, employee relations and diversity. Finally, the governance factor concerns executive pay, corruption, political lobbying and donations, board diversity and structure as well as the tax strategies adopted by firms.

Two important elements of the previously quoted definition are to be emphasized. First, sustainable finance is characterized by a long-term approach. Second, the ESG inclusion is not conducted on an occasional basis but rather in a structured and systematic way. The former is related to the idea that the successful pursuit of sustainable development is not consistent with the short-termism that may characterize the financial industry. The latter aims at differentiating a full commitment towards sustainability from a partial engagement, which may leave room to greenwashing.

On top of providing a definition of sustainable finance, Eurosif (2012) classifies into seven categories the investing strategies that can be implemented consistently with this approach to finance. Below, a brief description of each of them:

- ESG Integration. This investment approach regards the explicit inclusion of ESG considerations alongside the traditional financial analysis and is based on a systematic process and appropriate research sources.
- Sustainability Themed Investment. It focuses on specific themes deemed to contribute to address social and or environmental challenges such as climate change and eco-efficiency.
- Best-in-Class Investment Selection. It is based on the selection of the best performing companies or assets within a defined investment universe, as identified by ESG analysis; this strategy also includes the *Best-Effort* approach

which aims at rewarding companies whose ESG performance improved the most in a given period;

- Norms-based Screening. This strategy requires a screening of the investees based on their compliance with international standards and norms regarding ESG factors, defined by bodies such as the United Nations.
- Exclusion. It involves the exclusion of certain classes of investment – such as companies, sectors or countries – from the investible universe if they result involved in specific activities. Common criteria include weapons, pornography, tobacco and animal testing. This strategy may also be also referred to as value-based exclusions.
- Engagement and Voting. It is a long-term process based on the idea of active ownership: investors establish a dialogue with investees on ESG matters, seeking to improve the corporate behaviour or increase disclosure.
- Impact Investment. The GIIN (2019) defines it as an investment strategy made with the purpose to generate positive and measurable social and environmental impact alongside a financial return. It can be implemented in both emerging and developed markets, it targets returns both below market and to market rate and is often project-specific. According to Eurosif (2012), impact investment includes microfinance, community investing and the French *fonds solidaires*.

This framework is needed as the broader question I intend to answer through this empirical study is whether or not and under which circumstances ESG integration leads to superior returns.

2.2 The increasing relevance of ESG screens and sustainable investing

Eurosif and US SIF track the yearly amount of assets under management invested in line with sustainable investing strategies in Europe and in the US, respectively. According to

their last published reports, sustainable investing assets under management were $13.6tn (€11tn) in Europe and $12tn in the US (+38% from 2016), as of January 2018 (Eurosif, US SIF, 2018). This means that 44% of the $31.25tn (€25.2tn) total assets under professional management in Europe and 26% of the $46.6tn total assets under professional management in the US were invested following at least one of the sustainable investing strategies previously illustrated. As I mentioned above, intergovernmental organizations' attention for sustainable development was a strong catalyst for the growth of sustainable finance. In light of this, nowadays, asset management companies use more and more ESG data when making financial decision. However, ESG mainstreaming was not solely driven by intergovernmental organizations. Other factors underlie its success, notably: asset owners' demand and ESG analysis' effectiveness as a risk mitigation tool.

Morgan Stanley 2017 survey of individual investors (2018) finds that 87% of U.S. consumers say they would purchase a product because of a company's stance on an issue they care about. This trend is even stronger for millennials, who are reportedly more than twice as likely as other generations to purchase products from companies they view as sustainable. This latter aspect emerged also in a recent joint research project undertaken by First State Investments (2018) and Kepler Cheuvreux where 41%, 40% and 2% of the millennials responding to the survey stated to be interest, very interest and already invested in sustainable finance products, respectively. In line with this, ETFGI (2018) an independent research & consultancy firm for the ETF and ETP industry, reported last December that ESG ETFs assets increased 33.8% to $23.2bn, in the period from January to November 2018. This figure compares with a significantly weaker growth of globally listed non-ESG ETFs assets, which stood at 4.6%. Furthermore, according to the same research, since the launch of iShares MSCI USA ESG Select ETF, the first ESG ETF, in 2002, the number and diversity of ESG products has increased steadily, with 205 ESG

ETFs/ETPs listed globally at the end of November – and 66 new ESG ETFs/ETPs launched during 2018 alone. Likewise, Mr. Larry Fink, CEO at BlackRock, estimated that assets in ETFs that incorporate ESG factors will grow from $25bn to more than $400bn in a decade (Financial Times, 2018a). The importance of retail investors' demand and activism with respect to responsible finance products also pushed Edmans to criticize the proposal of the new UK stewardship code which asked fund managers to take ESG factors into account when overseeing the companies where they invest. The British scholar stressed that stewardship should be embedded across the investment chain, with asset owners, rather than regulators guaranteeing its enforcement. This stems from the fact that, in his opinion, asset owners "*ultimately regulate asset managers by choosing who to award mandates to*" (FT, 2018a).

Therefore, retail investors ask more and more for ESG screenings and the financial industry is getting ready to serve this emerging need in the best possible way. However, to effectively do so, it needs reliable data on firms' non-financial performance. In this sense, the European Union has contributed in a significant way. The Directive 2014/95 requires 6,000 large public-interest companies and groups across the EU to publish reports on the policies they implement in relation to environmental protection, social responsibility and treatment of employees, human rights, anti-corruption as well as diversity on company boards. According to PRI (2018), similar regulatory initiatives were launched by North American and APAC entities. Companies responded favourably to this call to action. Specifically, according to Khan *et al.* (2015) the number of companies publishing ESG reports has grown from less than 30 in early 1990s to more than 7,000 in 2014. Such an increased transparency targeted not only the consumers but also the financial community. The Boston Consulting Group (2017) published a study that investigated the relation between business valuation and ESG performance across five

industries: consumer packaged goods, biopharmaceuticals, oil and gas, retail and business banking, and technology. Results suggested that nonfinancial performance was statistically significant in predicting the valuation multiples of companies in all industries. In more details, investors rewarded the top performers in specific ESG topics with valuation multiples that were 3% to 19% higher, *ceteris paribus*, than those of the median performers in those topics, in each industry. Additionally, Serafeim (2018) demonstrated that the valuation premium paid for companies with strong sustainability performance has increased over time and it is increasing as a function of positive public sentiment momentum.

The second reason explaining the success of ESG factors stems from the fact that there is a wide recognition in the financial industry on their usefulness as risk mitigation tools. As a matter of fact, investors tend to avoid investing companies that may be subject to costly events such as environmental clean-ups and lawsuits or losses arising from corporate misconducts and frauds. As such, ESG information certainly help reduce risk by minimizing the exposure to as harsh as unexpected blow-ups (Bonne and Ribando, 2010). As an example of the predictive power of extra-financial information, Asset4 ESG scores of Bear Stearns prior to the March 2008 collapse were significantly lower than the ones of peers such as Goldman Sachs and Morgan Stanley, owing to its lack of transparency of extra-financial information. Likewise, following the *Dieselgate*, MSCI (2015) came out with a press release describing how Volkswagen ESG rating dropped in the years immediately prior to the scandal. In particular, Volkswagen was flagged on controversies classified under the categories of product and service quality, bribery and fraud, and collective bargaining, between 2013 and 2015. As a consequence of this warning signals, Volkswagen's overall governance score was in the lowest 28th percentile of companies covered by MSCI ESG Research globally, as per April 2015, and the company was dropped

from the MSCI ACWI ESG Index, one month later. Similarly, prior to the Morandi bridge collapse, the ESG ratings that RepRisk attributed to Autostrate Per l'Italia was lower than international peers (FFSF, 2018).

This is why ESG analysis has recently gathered interest from a plethora of financial professionals. BlackRock has already a 25% stake in the global ESG ETFs market segment, with some $7bn of assets as of October 2018, and intends to further increase it (Financial Times, 2018a). Likewise, Norges Bank Investment Management, the Norway sovereign fund, has been implementing exclusion investment strategies for firms involved with nuclear weapons, cluster munitions, tobacco and coal, since 2006 (Financial Times, 2018d). Finally, the Financial Times (2018c) reported that even hedge funds are increasingly adopting ESG-centered strategies. In particular, the article quoted a survey published in May 2018 by the Alternative Investment Management Association, the British hedge funds' lobby group, saying that around 10% of their combined $550bn assets under management were committed to such strategies and that consequently the time horizon of their investments was significantly growing.

ESG insights allow for effective risk mitigation not only for investors but also for companies themselves and the entirety of the financial system is expected to benefit from it. In this sense, the speech delivered at Lloyd's of London by Mark Carney, Governor of the Bank of England and Chairman of the Financial Stability Board on 29 September 2015 appears to be of utmost importance. Mr Carney focused on climate change and stressed that it heavily threatens the global financial stability via: i) physical risks, the impacts on insurance liabilities and the value of financial assets that arise from weather-related events; ii) liability risks, if parties who have suffered loss or damage from the effects of climate change seek compensation from those they hold responsible – such as carbon

extractors and emitters and, if they have liability cover, their insurers; and iii) transition risks, which may result from the process of adjustment towards a lower-carbon economy.

He further acknowledged that such triple impact falls beyond the traditional horizons of most actors – i.e. the business cycle, the political cycle and the horizon of technocratic authorities, like central banks – and this may result in a concrete cost on the future generations. However, he emphasized that "*by managing what gets measured, we can break the Tragedy of the Horizon*" through "*a virtuous circle of better understanding of tomorrow's risks, better pricing for investors, better decisions by policymakers, and a smoother transition to a lower-carbon economy*". The foundation of this process is clearly a greater consideration of non-financial information by all parties involved.

Notice that I have so far avoided to dwell upon the correlation between firms' non-financial and financial performance. This is due to a twofold reason. First, results are mixed and not univocal. Second, there is a very broad literature on this theme – which is also the core of my empirical study – and I intend to extensively focus on it in the next paragraph of this literature review.

2.3 On the convenience of ESG integration

The existence and the nature of a nexus between financial and sustainable performance has long been a debated area of study within academia. Scholars studied it both directly, by investigating the causality between ESG scores and stock performance, and indirectly, by focusing on the operational (dis)advantages of highly sustainable firms.

2.3.1 Sustainability and operational performance

On the one hand, according to neoclassical economists, sustainability investments are basically considered as a pointless waste of a company's resources. Jensen (2002) argued that managers should not consider multiple objectives – hence the maximization of both

firms' value and ESG performance – as "*multiple objectives is no objectives*" and this will cause strategic confusion and a lack of purpose that hinders the company in its competition for survival. Friedman (1970) stressed that sustainable goals unnecessarily raise a firm's costs, hence generating a significant disadvantage versus competitors. Becchetti *et al.* (2015), albeit not neoclassical economists, added that sustainable investing requires higher costs for fund managers too. They highlighted that asset managers willing to implement, *latu sensu*, a sustainable investing strategy incur in three additional costs with respect to asset managers whose strategy does not include ESG analysis. First, the cost of acquiring and managing the specific ESG information. Second, the cost of missed diversification opportunities due to a restricted investable universe. Third, the market timing cost stemming from the potential constraints to sell or buy stocks whose firms' features made it lose or acquire a certain ESG status. De Giuli and Kostovetsky (2014) demonstrated that sustainable performance is determined by political beliefs, in the US, and this is mirrored by the amount of CSR investments made: on average, a Democratic-leaning firm included in the S&P500 index invests *circa* $80m per year more in sustainability than a Republican-leaning one. Consistently with the neoclassical economic thinking, given that a firm's commitment to sustainability is driven by political rather than a clear strategic reason, their results show that high CSR ratings lead to poor future profitability.

On the other hand, plenty of scholars have demonstrated that a good sustainability performance may lead to a competitive advantage. Graves and Waddock (1994) proved the existence of a significant, positive relation between social performance and the number of institutional investors, such as pension funds and mutual funds, holding shares of a company. An additional point in the KLD social performance score was related to a 0.15 increase in the number of institutional investors holding shares in the company,

keeping constant the control variables for firms' size, leverage and profitability. This would reportedly translate into a more stable ownership structure and engaged shareholders, interested in a long-term relation with the investees. Turban and Greening (1997) provided evidence on a strong multi- and uni-variate relation between KLD ratings of corporate social performance and a company's reputations and attractiveness as employers – as measured by a college students' survey – suggesting that sustainable companies more easily attract applicants. Fombrun and Shanley (1990) tested the relation between reputation and contributions to social welfare and demonstrated that people assign higher reputations to firms that have created foundations (10% significance) and donate proportionally more money to charities (5% significance). Similarly, Sen and Bhattacharya (2001) found that, although at an aggregate level CSR increases the product purchase intentions, there is much heterogeneity in clients' reaction which mainly stems from the fact that consumers' company evaluations are "*mediated by their perceptions of self-company congruence and moderated by their support of sustainability*". Furthermore, Eccles *et al.* (2014) demonstrated that companies that were at the forefront of sustainability in the early 1990s, appeared to have adopted by 2009 much more advanced organizational processes than peers that lacked these sustainable features. In particular, they found that, in the considered period, the first sample of firms, on top of benefiting from a more stable investor base, were more likely: to assign responsibility on sustainable policies to the board of directors and create a distinct sustainability board committee; to constraint top management's compensation to ESG factors; to set up a structured stakeholder engagement process; to transparently disclose ESG data. All these factors translated, through time, in a stronger financial and accounting performance, as I will illustrate later. Finally, Porter and Van Der Linde (1995) highlighted how a high environmental performance may contribute to limit the amount of waste

within the productive process hence enhancing a company's efficiency. Consistently with such broad and diversified evidence in favour of a positive relation between the ESG and operational performance, the so-called stakeholder theory emerged. This theory criticizes neoclassical economists' cynicism and emphasizes the importance of a careful and effective management of all stakeholder relations to mitigate the likelihood of social pressures as well as negative regulatory, legislative or fiscal action (Freeman, 1984). Berman *et al.* (1999) tried to provide empirical evidence to the stakeholder theory by regressing five classes of variables pertaining to stakeholders' posture of Fortune 100's companies onto ROA. These classes of ESG variables were: i) employees' safety; ii) product quality; iii) community relations; iv) diversity; and v) environmental impact. Whereas the first two types of variables had a positive and significant effect on ROA, the relation with the remaining three proved to be not significant. Robinson and Dechant (1997) and Waddock and Graves (1997) conducted similar analyses and found that there was a strong and significant positive relation with community relations and diversity too.

2.3.2 Sustainability and financial performance

Given the highly conflictual evidence on firms' competitive (dis)advantages deriving from a good sustainable performance, there is not a clear response to whether or not ESG integration leads to superior financial returns.

Geczy *et al.* (2003) demonstrated that ESG investments may turn out extremely expensive. They studied the financial performance of sustainable investments from the perspective of an investor who selects a portfolio of U.S. domestic equity ESG mutual funds, by relying on the historical returns and the perceived stock-picking skill possessed by fund managers as well as various asset-pricing models. They compared the optimal portfolio of funds selected by the fictional ESG investor to the optimal portfolio chosen from a larger fund universe. Results suggested that the limited diversification of ESG constraints

implied a cost which ranges, according to the tested hypotheses, from a few basis points per month, in case the investor precludes fund managers' skill and believes strongly in the Capital Asset Pricing Model, to some 30bps/month, when the investor relies on the Fama French model, and more than 1,000bps when the investor construct his funds' portfolio on the sole basis of funds track record.

Other scholars found mixed or not significant results. For instance, Borgers *et al.* (2013) proved that companies whose ESG performance (as measured by KLD data) was in the upper tertile in the period 1992-2009 had a significant 2% and 10% higher risk-adjusted returns versus companies in the lower tertile, according to which ESG criteria were considered: social relations and environmental performance, respectively. However, they also found that firms with better ESG performance display lower alphas, in more recent years. Schröder (2003) investigated the risk-adjusted performance of 46 German, Swiss and US ESG funds by means of three models. The first was a multi-index model which relied on two benchmark indices, a blue-chip index and a small cap index. The second added to the regression two independent variables describing the fund management's market timing activities; these variables were computed by squaring the excess returns of the benchmark indeces, following the Treynor-Mazuy approach. The third, further included instrumental variables approximating changing market conditions: the U.S. long-term interest rate and the U.S. term spread, where the former was deemed to be a proxy for the global condition on the bond markets and the latter a leading indicator for the business cycle. None of these models suggested that ESG funds had a significantly lower risk-adjusted performance than their benchmarks. Auer and Schuhmacher (2016) contribution to the literature was also remarkable, for different reasons. To begin with, they compared the risk-adjusted performance of an active selection of high- versus low-rated stocks versus passive equity market investments on a global scale: their study

focused not only on the US but also on the European and APAC markets and was differentiated across four industries taking into account four cutoff percentiles (10%, 15%, 20% and 25%) to distinguish ESG high- and low-rated stocks. Furthermore, they measured portfolios' risk-adjusted performance by means of Sharpe ratios – as a consequence of the limited diversification imposed by ESG screens – and used a studentized bootstrap method to conduct statistical inference. To conclude, they measured companies' ESG performance using a novel dataset provided by Sustainalytics. Results indicated that none of the risk-adjusted performance differences were statistically significant, in the APAC region. In the US and European regions, a slightly different pattern emerged instead. Focusing on the first geographic area, only seven (out of three-hundreds) significant differences were observed: a reportedly marginal amount. Two of them were referred to the higher performance of low-rated stocks over high-rated ones (25% environmental cutoff in the miscellaneous sector) and a higher performance of low-rated stocks versus benchmark (10% social cutoff in the consumption sector). The remaining five regarded the miscellaneous sector where high-rated portfolios significantly underperformed their benchmarks in the following combinations: environmental screens (cutoff rate 25%), governance screens (5% and 15% percentiles) and total ESG screens (5%and 20% cutoffs). With reference to the European market, a rather strong evidence suggested the underperformance of high-rated ESG portfolios versus their benchmarks. This characterized the environmental (E) selection in the consumption and miscellaneous industries, the social (S) selection in the consumption and financial sectors and in the aggregate universe of industries and the total ESG selection in the financial and miscellaneous sectors and in the aggregate universe of industries. Scholars concluded that ESG screens do not impact financial performance in a significant way in APAC and in the US, whereas require to sacrifice returns in Europe.

Finally, a discrete amount of empirical works also demonstrated the positive contribution of ESG screens' adoption to financial performance. Becchetti *et al.* (2015) stressed the contracyclical nature of responsible investments, which outperformed traditional investments during the 2007 global financial crisis. Eccles *et al.* (2014) conducted a rather innovative study in this domain. They identified a sample of 90 U.S. firms that set ESG policies by 1993, before their adoption became widespread. They later matched this sample with competitors with similar financial performance, size, capital structure and valuation that adopted none of these policies, through propensity score matching. Finally, they investigated the impact of corporate sustainability on organizational processes and performance. Apart from the above-described remarkably more advanced organizational processes put in place by the firms in the first group, the 90 "High Sustainability" firms had 4.8% higher abnormal returns than the 90 "Low Sustainability" on a value-weighted base (at 5% significance) and 2.3% higher abnormal returns on an equal weighted-base (at 10% significance). Such abnormal returns were computed from 1993 to 2010 by means of Fama-French four-factor model augmented by Carhart's momentum to account for potential dissimilarities in the risk profile of the two groups. Furthermore, their results indicated that High Sustainability companies also displayed a more robust performance when looking at accounting measures such as ROE and ROA – especially for B2C firms. Finally, comparing sell-side equity analyst forecasts to actual annual earnings they found that the future profitability of the High Sustainability firms was underestimated (at 1% significance level). Another highly meaningful research paper on ESG contribution to financial performance is the one wrote by Dimson, Karakas and Li (2014), which focuses on the cumulative abnormal returns generated by successful and unsuccessful private CSR engagements with 613 U.S. listed companies in the decade from 1999 to 2009. The study was based on a proprietary database of private engagements and, for this reason,

cumulative abnormal returns were computed over a rather long time-span (18 calendar-time months) to allow the market to reflect information not initially in the public domain. They calculated CARs into two ways and both measures lead to the same results. They used size-adjusted returns, calculated as the monthly stock return minus size-decile matched portfolio return, in the first one; whereas they relied market-adjusted returns in the second one. Overall, after 12 months from the engagements CAR were equal to +2.3% for size-adjusted returns and to +1.8% for market-adjusted abnormal return. However, after having split the sample into successful and unsuccessful engagements, they found that successful engagements lead to a +7.1% (+4.9%) CAR of over the year following action, when using size-adjusted returns (market-adjusted returns) whereas unsuccessful engagements did not produce any abnormal return. Friede *et al.* (2015) also demonstrated the positive contribution of sustainable practices to firms' financial performance. Their work is particularly relevant as they summarized the aggregate findings of 60 review studies, combining from results of 3718 (gross) primary researches on the topic. After having removed overlaps in this sample, some 2200 unique studies were left, spanning from 1970s to 2010s: a dataset 35 times larger than the average primary studies conducted in that period. Such an effort was reportedly needed, as the vast majority of the previous review researches focused on just a fraction of existing primary studies, preventing generalizations. They conducted this job by first considering findings from vote-count studies and then aggregating results from meta-analyses, to derive a second-order meta-analysis. About 90% of studies in the entire sample proved nonnegative relation between ESG and financial performance. Furthermore, the ESG positive impact were stable over time and promising results also emerged when differentiating for portfolio and nonportfolio studies, regions, and asset classes.

As written while introducing this section, despite the encouraging findings provided by Friede *et al.* (2015), there is not a shared agreement among scholars on the ultimate effect of sustainability over firms' financial performance. This is also mirrored in the opinion of the 540 asset managers which were involved in the 2018 Sustainable Investing Survey conducted by the Royal Bank of Canada. Although 72% of them either somewhat or significantly integrate ESG screens in their investment decision making, only 30.9% of respondents believe that such adoption leads to superior financial performance.

In this context, it is necessary to highlight that all the above-mentioned studies considered a firm's ESG performance as a whole, without differentiating into material and immaterial ESG issues. Khan *et al*. (2015) demonstrated that such distinction leads to a more clear-cut evidence. In light of this, I am going to focus on their empirical work, which is extremely important, considering that my own study will try to complement theirs, by applying a similar methodology to a different market and relying on a different ESG database.

2.4 First evidence on ESG materiality

The concept of materiality does not primarily pertain to the sustainability domain. It is rather employed in the accounting sphere and is particularly important at the IFRS level. The International Accounting Standard Board – the IFRS-setting body – recently updated the definition of materiality: "*Information is material if omitting, misstating or obscuring it could reasonably be expected to influence the decisions that the primary users of general-purpose financial statements make on the basis of those financial statements, which provide financial information about a specific reporting entity*" (IASB, 2018).

When this word is associated to a firm's ESG performance, it intends to stress the fact that, as already highlighted by WBCSD and UNEPFI in 2010, the relevance of different

sustainability topics varies across companies and industries in a systematic way. In this sense, Eccles and Serafeim (2013) define material ESG issues as "*the ones that have the greatest impact on the firm's ability to create shareholders value*".

ESG materiality is gaining momentum as, on the one hand, more and more firms release more and more sustainability information – which is potentially a good piece of news for market participants; on the other hand, the significant confusion around sustainability disclosure may turn out detrimental to the overall degree of transparency. This is a particularly relevant point of tension. An increasing number of investors are committing to the use of ESG screens in their capital allocation process, but there is uncertainty on which of these ESG data matter the most and the actual materiality of the reported sustainability information for firm value is often questioned. For these reasons, in the last few years the actions taken by the international bodies in charge of setting the ESG standards, such as the International Integrated Reporting Council, the Global Reporting Initiative and the Sustainability Accounting Standards Board have been watched with particular interest.

Khal *et al.* (2015) relied on SASB's Materiality Map®, to assess which ESG issues were material across different industries and later hand-mapped SASB data onto US companies' sustainable and performance ones. This enabled them to investigate how material (immaterial) sustainability and financial performance influenced each other. In light of this, and its pivotal importance for my research, I am now going to focus on SASB Materiality Map®.

As I reported earlier, SASB is an independent non-profit organization which aims at defining sustainability accounting standards to provide a framework for companies in disclosing material factors that comply with SEC requirements (such as the Form 10-K and 20-F). SASB is accredited to set sustainability accounting standards by the American

National Standards Institute (ANSI). Such accreditation implies that the procedures followed by SASB meet the ANSI requirements with respect to openness, balance, consensus and due process hence representing a recognition of the quality of SASB's activity. SASB's standards are developed via a multi-stakeholder process based on industry working groups whose purpose is to provide a feedback on SASB's draft standards. Such groups are equally composed by corporations, market participants and other stakeholders. SASB Materiality Map® identifies sustainability issues that are likely to affect the financial condition or operating performance of companies within an industry. For each topic, SASB conducts an evidence of materiality test which has three components: evidence of interest, evidence of financial impact and forward impact adjustment (Khan *et al.* 2015). The map included 6 sectors and 45 industries as of February 2014 – when Khan *et al.* (2015) worked on it. The material (immaterial) ESG performance of each sector and industry is defined by SASB's sustainability topics which are 30 broadly relevant sustainability issues organized under 5 broad dimensions: Business Model and Innovation, Leadership and Governance, Environment, Social Capital, Human Capital.

Now that I have sketched the structure of SASB Materiality Map® out, I can report the main takeaways from the study made by Khan *et al.* (2015). In the next three sections, I will treat the way they constructed the materiality (immateriality) indices, created the ESG material (immaterial) under- out-performing portfolios and assessed their financial results.

2.4.1 Data, sample and material (immaterial) sustainability assessment

Khan *et al.* (2015) use MSCI KLD, rather than Bloomberg or Thomson Reuters Asset4, as source of sustainability data, given its broad coverage of the US market and a standardized, binary format.

The KLD binary dataset is divided into two macro-categories strengths and concerns. Strengths refer to a company's procedures, policies and outcomes that make it have positive impacts on a given issue. Concerns represent aspects that make it have a negative impact on that issue, instead. For each strength or concern of a company, KLD includes a "1" signaling the presence of that criterion and a "0" signaling its absence.

For each industry, every sustainability issue classified as material by SASB is matched to a KLD item, if available, and all the remaining KLD items are defined as immaterial. The materiality (immateriality) index for company *c* in year *t* is constructed by subtracting the concerns from the strengths so that to obtain at a net score, as explained below:

$$Material\ Performance\ (MP)_{c,t} = \sum KLD_{SASB}\ Strenght_{c,t} - \sum KLD_{SASB} Concern_{c,t} \qquad (1)$$

$$Immaterial\ Performance\ (IP)_{c,t} = \sum KLD_{NonSASB}\ Strenght_{c,t} - \sum KLD_{NonSASB} Concern_{c,t} \qquad (2)$$

This methodology to derive a single ESG score for each company from the KLD database is a common practice in the industry and was followed by many other scholars before, e.g. Graves and Waddock (1994), Griffin and Mahon (1997), Johnson and Greening (1999), Ruf *et al*. (2001) Eccles *et al*. (2014).

2.4.2 Portfolios construction

Portfolios are created on the basis of the material (immaterial) performance, as defined in the previous section. In particular, Khan *et al.* (2015) orthogonalize changes for each material (immaterial) performance with respect to: size (natural logarithm of market capitalization), market-to-book ratio, profitability (ROA), leverage (long-term debt plus current debt over the average of total assets of the current and previous year) and sector fixed effects (fs).

$$\Delta(MP)_{c,t} = b_1 + b_2\Delta(Size)_{c,t} + b_3\Delta(MTB)_{c,t} + b_4\Delta(ROA)_{c,t} + b_5\Delta(Leverage)_{c,t} + f_s + e_{c,t} \quad (3)$$

$$\Delta(IP)_{c,t} = b_1 + b_2\Delta(Size)_{c,t} + b_3\Delta(MTB)_{c,t} + b_4\Delta(ROA)_{c,t} + b_5\Delta(Leverage)_{c,t} + f_s + e_{c,t} \quad (4)$$

Finally, they rank the residuals from equations (3) and (4) according to the upper and lower quartiles, quintiles and deciles to define under- and out-performing companies in material (immaterial) ESG issues, each year.

Abnormal stock returns of each portfolio are estimated by means of a five-factor model where market, size, book-to-market (Fama and French, 1993), momentum (Carhart, 1997) and liquidity (Pastor and Stambaugh, 2003) are used as regressors. Robustness checks are performed, by re-estimating alphas through three- and four-factor asset pricing models.

2.4.3 Results in the US market

Khan *et al*. (2015) compare the Jensen's alphas obtained from:

- high vs low material sustainability performance portfolios – both for equal- and value-weighted portfolios;
- high vs low immaterial sustainability performance portfolios – both for equal- and value-weighted portfolios;
- high material & low immaterial sustainability performance portfolio vs low material & high immaterial sustainability performance portfolio vs high material and immaterial sustainability performance vs low material and immaterial sustainability performance – for value-weighted portfolios only.

With reference to the first comparison, the estimated alphas for the top portfolio are significant in all specifications for both equal- and value-weighted portfolios, ranging from about 3% to about 8% *per annum*. As a general trend, value-weighted alphas are higher than equal-weighted alphas across the same specifications. On the contrary, the

estimated alphas for the bottom portfolios are not significant in any specifications for value-weighted portfolios and only when considering deciles and quintiles as cut-off thresholds, for equal-weighted portfolios.

Focusing on the second comparison, none of the resulting alpha's estimate is statistically significant. According to the scholars, this suggests that a company's performance on immaterial issues does not allow to differentiate between sustainable and unsustainable firms therefore does not bring any sort of advantage or disadvantage to the future stock returns.

Finally, according to results from the third comparison: i) the 6.01% annualized alpha for the portfolio with a high material & low immaterial sustainability performance is the largest in magnitude among the four portfolios and is the only statistically significant; ii) the differential alpha resulting from the high material & low immaterial sustainability portfolio vs low material & high immaterial sustainability portfolio is 5.41% (significant at 1%); iii) the differential alpha resulting from the high material & low immaterial sustainability portfolio vs high material and immaterial sustainability portfolio is 4.05% (significant at 5%); iv) the differential alpha resulting from the high material & low immaterial sustainability portfolio vs low material and immaterial sustainability portfolio is 8.9% (significant at 1%). Portfolios were formed by relying on quartiles as the 0.3 correlation between $\Delta(MP)_{c,t}$ and $\Delta(IP)_{c,t}$ made it difficult to find a large enough sample of firms with both high(low) and low(high) material (immaterial) performance. Overall, this implies that the positive effect from investments in material sustainability issues are larger for firms caring about these issues only.

2.5 Hypotheses

As I wrote above, ESG materiality is gaining momentum, given the increasing importance of sustainability and the consequent amount of information disclosed by listed companies on this matter. However, little evidence is provided on its contribution to the generation of positive alphas, apart from the study carried out by Khan *et al.* (2015) in the US market.

For this reason, my analysis aims at complementing their research by focusing on the European market and understanding whether, and to which extent, the evidence provided for the US also applies in Europe. As documented in the literature review, the impact of ESG sustainability over a firm's financial performance varies a lot according to the market where it is tested – see, for instance, Auer and Schuhmacher (2016).

The relevance of my analysis also lies in the sustainability ratings I use as proxy for firms' material and immaterial sustainability. They are derived from the Thomson Reuters Asset4, rather than the KLD, database. This second aspect is particularly important in light of the empirical paper of Chatterji *et al.* (2015) on ESG raters' consistency. As a matter of fact, they document a surprising lack of agreement across six well-established extra-financial rating agencies – including KLD and Asset4 – with differences persisting even when the comparison is adjusted for these raters' dissimilarities in the definition of sustainability.

Following in Khan *et alia*'s footsteps, I will test whether portfolios including companies with high ESG material and immaterial performance beat portfolios whose constituents fall behind on these issues (H1 and H2) and whether the stock performance of companies that rationalize their investments in only the most ESG material issue, neglecting the immaterial ones, beats the one of firms with a poor performance on material issues and

concurrently good performance on immaterial ones[1]. If results were consistent with the evidence provided for the US market, I would expect: i) companies with a high performance on material sustainability issues to significantly outperform firms that do not properly cope with these issues; ii) companies with a high performance on immaterial sustainability issues not to outperform firms with low performance on them; and iii) firms with a good performance on material issues and poor performance on immaterial ones to deliver the highest abnormal returns. I report below a more precise description of the three hypotheses to be tested.

- Hypothesis 1, HM *vs.* LM: portfolios including companies characterized by a high material sustainability perfomance (HM) generate a significant greater abnormal return than portfolios formed by companies with a low material sustainability performance (LM);
- Hypothesis 2, HI *vs.* LI: portfolios including companies characterized by a high immaterial sustainability performance (HI) do not generate a significant greater abnormal return than portfolios formed by companies with a low immaterial sustainability performance (LI);
- Hypothesis 3, HM&LI *vs.* LM&HI: portfolios formed by companies with a high material sustainability and a concurrently low immaterial sustainability (HM&LI) generate a significant greater alpha than portfolios including companies with a low material sustainability and a concurrently high immaterial sustainability (LM&HI).

Abnormal returns are estimated by means of two asset pricing models: Fama and French (1993) three-factor model and Carhart (1997) four-factor model. A dummy variable is also added to both models to grasp the differential contribution to the generation of the

[1] Clearly, from a merely statistical point of view, the null hypotheses underlying my analysis is that, in each regression I estimate, alpha – i.e. the abnormal return – is equal to zero.

abnormal return stemming from being a material or immaterial sustainability outperformer rather than underperformer (while testing H1 and H2) and included in the HM&LI rather than in the LM&HI one.

3. Empirical analysis

3.1 Data and sample

The universe from which high and low material (immaterial) portfolios are constructed is the STOXX Europe 600 Index. This index is particularly suitable for my analysis for three reasons: i) it includes large, mid and small capitalization companies, hence preventing size bias; ii) constituents firms are listed in all the major European countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom), it is therefore a good proxy of the European equity market as a whole; iii) the 600 firms part of the index represent a sample large enough to avoid that the exclusion of datapoints due to missing ESG or financial data leads to an excessive restriction of the overall universe. Other indices were considered, however, none of the alternatives guaranteed the simultaneous presence of all these three pivotal features. In particular, although the FTSE Developed Europe Index has a similar country coverage, it includes fewer constituents (approximately 500) and only large and mid capitalization stocks. The same applies to the S&P Europe, which gathers 350 large capitalization companies.

The constituents of the STOXX Europe 600 Index are rebalanced quarterly after the market closes every third Friday in March, June, September and December and effective the next trading day. I relied on the constituents' lists as of the end of June each year.

Data on companies' sustainable performance come from the Thomson Reuters Asset4 database. Thomson Reuters Asset4 starts coverage in 2002, reviews the constituents of its indices semiannually and evaluates more than 1,400 companies in Europe (ca. 7,000 worldwide), as of October 2018. Since its coverage evolves over time and is continuously expanded, I use sustainability data in the period from 2007 to 2017 to be able to rely on a

stable sample size throughout the period considered – the coverage in Europe is too limited prior to 2007. 276 Thomson Reuters Asset4 datatypes are active as of October 2018. I do not use all available datatypes as many of them cannot be matched to the SASB Materiality Map®.

As I briefly described above, SASB Materiality Map® identifies sustainability issues that are likely to affect the financial condition or operating performance of companies within an industry. It includes 10 sectors and 79 industries, as of October 2018 – a significant increase from the 6 sectors and 45 industries Khan *et alia* could rely on in 2014. As further detailed in Table 2 these sectors are healthcare, financials, technology and communications, transportation, services, consumer goods, extractives and mineral processing, food and beverage, infrastructure, renewable resources and alternative energy and resource transformation and such classification is registered as Sustainable Industry Classification System® (SICS®)[2]. Each sector and industry is matched with SASB's sustainability topics which are 30 broadly relevant sustainability issues organized under 5 broad dimensions: Environment, Social Capital, Human Capital, Business Model and Innovation and Leadership and Governance. Below a description of each of them (SASB, 2019):

- Environment. It regards the environmental impacts, either through the use of natural resources as inputs of the production process or through releases into the environment;
- Social Capital. It relates to businesses contribution to society in return for a social license to operate acquiesced by customers, local communities, the public, and the government. Some of the themes falling into this category are human rights,

[2] Please visit https://www.sasb.org/find-your-industry/ to find details on the relevance of an industry classification based on sustainability

protection of vulnerable groups, local economic development, responsible business practices in marketing, and customer privacy;

- Human Capital. It primarily focuses on the management of employees and individual contractors. It includes issues concerning productivity, labor relations, health and safety of employees;
- Business Model and Innovation. It addresses the inclusion of environmental, human, and social issues in a company's value-creation process (resource recovery, product innovation, efficiency and responsible design);
- Leadership and Governance. It entails issues inherent to the business model or common practice in the industry which are potentially detrimental for other stakeholders hence threatening the license to operate. This includes regulatory compliance, risk management, safety management, supply-chain and materials sourcing, anticompetitive behavior and bribery.

Given that 79 industries (grouped in 10 sectors) are matched with 30 sustainability issues (organized in 5 classes), SASB Materiality Map® appears as a 79x30 matrix, implying 2,370 datapoints, as of October 2018. Each datapoint binarily indicates whether a certain issue is material for a given industry. When all industries are grouped at the sector level, three colors indicated whether the issue is likely to be material for more than 50%/less than 50%/any of industries included in the sector. It is necessary to specify when I used the Materiality Map Map® because it is an ongoing project whose structure may be subject to changes through time[3]. All details on the map I use in my research can be found below in Table 1, Panel A,B,C,D and in Table 2.

[3] Please visit https://materiality.sasb.org/ for a more comprehensive description of SASB Materiality Map®

Table 1. SASB Materiality Map®

Panel A. Sector level

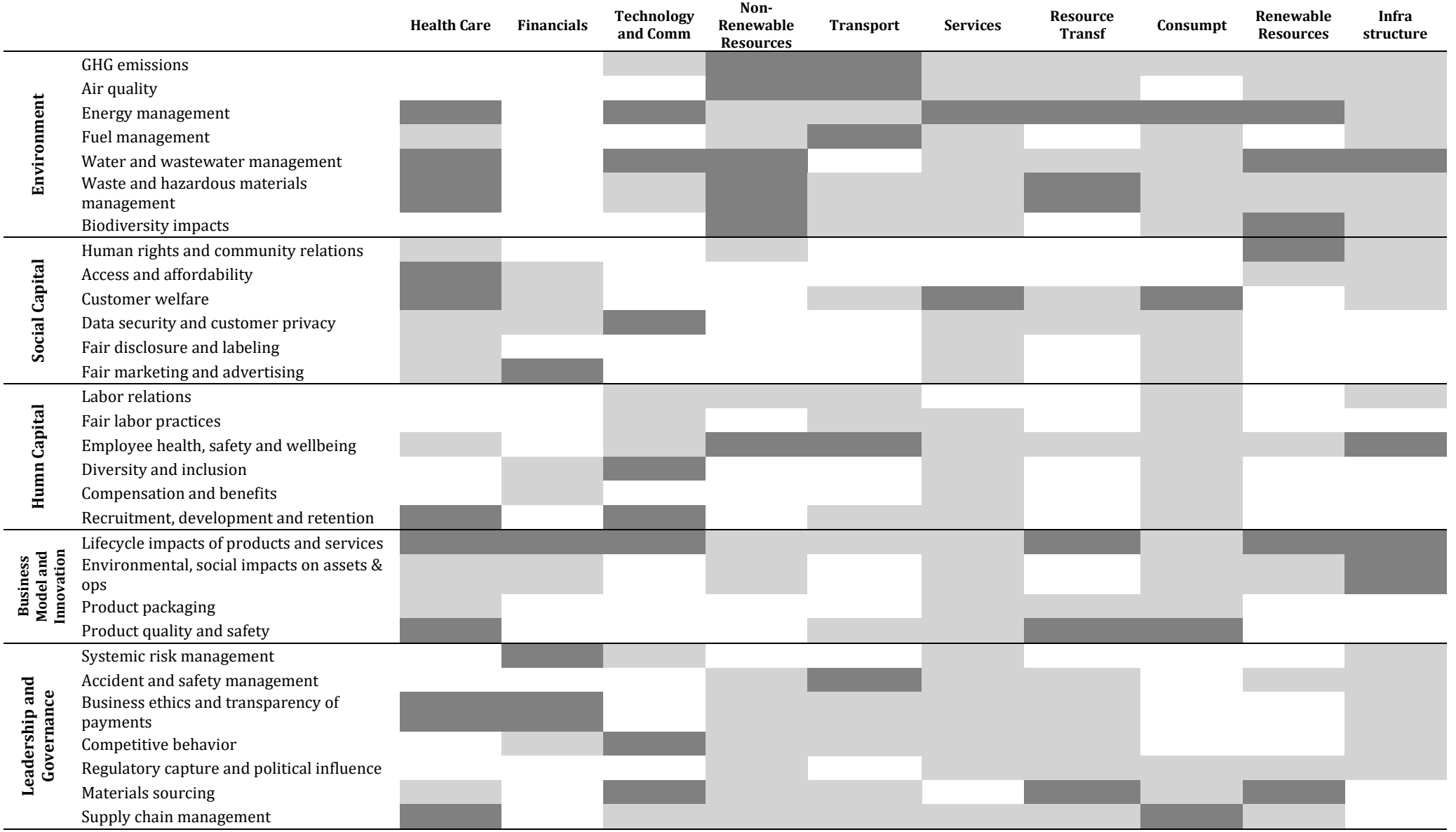

Table 1.A. SASB Materiality Map®, Sector level. Dark grey/Light grey/White cells indicate that the issue is likely to be material for more than 50%/less than 50%/any of the industries in a given sector.

Panel B. Industry level (Health Care, Financials, Transportation)

	Health Care						Financials							Transportation							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Environment																					
GHG emissions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Air quality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Energy management	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Fuel management	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Water and wastewater management	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste and hazardous materials management	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0
Biodiversity impacts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Social Capital																					
Human rights and community relations	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Access and affordability	1	1	1	1	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Customer welfare	1	1	1	1	0	1	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0
Data security and customer privacy	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Fair disclosure and labeling	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fair marketing and advertising	1	1	1	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0
Human Capital																					
Labor relations	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Fair labor practices	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Employee health, safety and wellbeing	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Diversity and inclusion	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Compensation and benefits	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0
Recruitment, development and retention	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Business Model and Innovation																					
Lifecycle impacts of products and services	1	1	1	0	1	0	1	1	1	0	0	0	1	1	1	1	0	0	0	0	0
Environmental, social impacts on assets & ops	0	0	0	1	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Product packaging	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Product quality and safety	1	1	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Leadership and Governance																					
Systemic risk management	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0
Accident and safety management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Business ethics and transparency of payments	1	1	1	1	1	0	1	1	1	0	0	1	0	0	0	0	0	0	1	0	0
Competitive behavior	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0
Regulatory capture and political influence	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials sourcing	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Supply chain management	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

Table 1.B SASB Materiality Map®, Industry level (Health Care, Financials, Transportation). 1 indicates that a certain sustainability issue is material for the given industry; 0 indicates that that issue is not material for the given industry. Industries are numbered. Table 2 illustrates what is the industry associated with each of these numbers.

Panel C. Industry level (Services, Resource Transformation, Renewable Resources, Non-Renewable Resources)

	Services										Resource Transformation					Renewable Resources									Non-Renewable Resources				
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Environment																													
GHG emissions	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	1	1	1	0	1	1	1	1
Air quality	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	1	1	1
Energy management	0	0	1	1	1	1	0	0	0	1	1	1	1	1	1	0	1	0	1	0	1	0	0	0	0	0	1	1	1
Fuel management	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Water and wastewater management	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	1	0	1	1	1	1	1	1
Waste and hazardous materials management	0	0	0	0	1	0	1	0	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	1	1	1	1	1	1
Biodiversity impacts	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	1	0	0	1	0	1	1
Social Capital																													
Human rights and community relations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	1	0	1	0
Access and affordability	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Customer welfare	1	0	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Data security and customer privacy	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fair disclosure and labeling	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fair marketing and advertising	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Human Capital																													
Labor relations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Fair labor practices	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Employee health, safety and wellbeing	0	0	0	1	0	1	1	0	0	0	1	0	0	1	0	0	0	1	1	0	0	1	0	1	1	1	1	1	1
Diversity and inclusion	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compensation and benefits	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recruitment, development and retention	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Business Model and Innovation																													
Lifecycle impacts of products and services	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	0	0	0	1
Environmental, social impacts on assets & ops	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0
Product packaging	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Product quality and safety	0	0	0	0	1	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leadership and Governance																													
Systemic risk management	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Accident and safety management	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	1	1	1	0	0	0
Business ethics and transparency of payments	0	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0
Competitive behavior	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1
Regulatory capture and political influence	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	0
Materials sourcing	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0
Supply chain management	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0

Table 1.C SASB Materiality Map®, Industry level (Services, Resource Transformation, Renewable Resources and Alternative Energy, Non-Renewable Resources).

Panel D. Industry level (Consumer Goods, Technology and Communications, Infrastructure)

	Consumer goods															Technology and communications									Infrastructure				
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
Environment																													
GHG emissions	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0
Air quality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Energy management	1	1	1	1	1	0	0	1	1	1	1	0	0	1	0	0	1	0	1	1	1	0	0	1	0	0	0	1	0
Fuel management	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Water and wastewater management	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0	1	1	0	1	0	1	1	0	1	0	0	1	1	0
Waste and hazardous materials management	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0
Biodiversity impacts	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Social Capital																													
Human rights and community relations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Access and affordability	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Customer welfare	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Data security and customer privacy	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0
Fair disclosure and labeling	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fair marketing and advertising	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Human Capital																													
Labor relations	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Fair labor practices	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Employee health, safety and wellbeing	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	1	1	0	0
Diversity and inclusion	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
Compensation and benefits	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recruitment, development and retention	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0
Business Model and Innovation																													
Lifecycle impacts of products and services	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1
Environmental, social impacts on assets&ops	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0
Product packaging	0	0	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Product quality and safety	1	1	1	0	0	0	1	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leadership and Governance																													
Systemic risk management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0
Accident and safety management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Business ethics and transparency of payments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Competitive behavior	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	0	0	0
Regulatory capture and political influence	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Materials sourcing	1	1	1	1	1	0	0	1	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0
Supply chain management	1	1	1	1	1	0	1	1	1	1	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Table 1.D SASB Materiality Map®, Industry level (Consumer Goods, Technology and Communications, Infrastructure).

Table 2. SASB Sustainable Industry Classification System®

Health Care	1.	Biotechnology
	2.	Pharmaceuticals
	3.	Medical Equipment and Supplies
	4.	Health Care Delivery
	5.	Health Care Distribution
	6.	Managed Care
Financials	7.	Commercial Banks
	8.	Investment Banking and Brokerage
	9.	Asset Management and Custody Activities
	10.	Consumer Finance
	11.	Mortgage Finance
	12.	Security and Commodity Exchanges
	13.	Insurance
Transportation	14.	Automobiles
	15.	Auto Parts
	16.	Car Rentals & Leasing
	17.	Airlines
	18.	Air Freight & Logistics
	19.	Marine Transportation
	20.	Rail Transportation
	21.	Road Transportation
Services	22.	Education
	23.	Professional Services
	24.	Hotels & Lodging
	25.	Casinos & Gaming
	26.	Restaurants
	27.	Leisure Facilities
	28.	Cruise Lines
	29.	Advertising & Marketing
	30.	Media Production & Distribution
	31.	Cable & Satellite
Resource Transformation	32.	Chemicals
	33.	Aerospace and Defense
	34.	Electrical and Electronic Equipment
	35.	Industrial Machinery and Goods
	36.	Containers and Packaging
Renewable Resources and Alternative Energy	37.	Biofuels
	38.	Solar Energy
	39.	Wind Energy
	40.	Fuel Cells and Industrial Batteries
	41.	Forestry and Logging
	42.	Pulp and Paper Products
Non-Renewable Resources	1.	Oil and Gas - Exploration and Production
	2.	Oil and Gas - Midstream
	3.	Oil and Gas - Refining and Marketing
	4.	Oil and Gas - Services
	5.	Coal Operations
	6.	Iron and Steel Producers
	7.	Metals and Mining
	8.	Construction Materials
Consumer Goods	9.	Agricultural Products
	10.	Meat, Poultry and Dairy
	11.	Processed Foods
	12.	Non-Alcoholic Beverages
	13.	Alcoholic Beverages
	14.	Tobacco
	15.	Household and Personal Products
	16.	Food Retailers and Distributors
	17.	Drug Retailers and Convenience Stores
	18.	Multiline and Specialty Retailers and Distributors
	19.	E-commerce
	20.	Apparel Accessories and Footwear
	21.	Appliance Manufacturing
	22.	Building Products and Furnishings
	23.	Toys and Sporting Goods
Technology and Communications	24.	Electronic Manufacturing Services and ODM
	25.	Software and IT Services
	26.	Hardware
	27.	Semiconductors
	28.	Telecommunications
	29.	Internet Media and Services
Infrastructure	30.	Electric Utilities
	31.	Gas Utilities
	32.	Water Utilities
	33.	Waste Management
	34.	Engineering and Construction Services
	35.	Home Builders
	36.	Real Estate Owners, Developers and Investment Trusts
	37.	Real Estate Services

Table 2 SASB Sustainable Industry Classification System®. This table reports the SICS® as of October 2018. Industries are numbered to allow a full understanding of Table 1.1, 1.2, 1.3.

3.1.1 Asset4 - SASB Materiality Map® hand mapping

Hand mapping Thomson Reuters Asset4 data to SASB Materiality Map® is a two-step process. This stems from the structure of the Materiality Map® which is organized as an *Industry X Sustainability Issue* matrix. I first match the 276 Asset4 active datatypes to the 30 SASB's sustainability issues and then the 178 Thomson Reuters Industry Group Codes (datatype: *WC06011*) to the 77 industries of SASB's Sustainable Industry Classification System®.

With reference to the first paring, most of the 276 Asset4 datatypes are irrelevant or not comparable to SASB's scheme therefore the number of datatypes I eventually use is 97, with one datatype (*ENERDP073*: "*Does the company claim to have a certified Environmental Management System?"*) applied to all the sustainability issues related to the Environment class, hence repeated five times. Table 3, 4, 5, 6, 7 present the results of such process, for all SASB sustainability classes (Environment, Business Model Innovation, Leadership and Governance, Human Capital, Social Capital).

Table 3. Thomson Reuters Asset4-SASB Materiality Map® hand mapping, Environment

Asset4 item	Datatype	Description	Corresponding SASB item
Biodiversity Impact Reduction	ENERDP019	Does the company report on its impact or on activities to reduce its impact on biodiversity?	Biodiversity impacts
ISO 14000 or EMS*	ENERDP073	Does the company claim to have a certified Environmental Management System?	Waste and hazardous materials management
Targets Energy Efficiency	ENRRDP0192	Has the company set targets or objectives to be achieved on energy efficiency?	Energy management
Policy Energy Efficiency	ENRRDP0122	Does the company have a policy to improve its energy efficiency?	
Green Buildings	ENRRDP052	Does the company report about environmentally friendly offices?	
Staff Transport Impact Reduction Initiatives	ENERDP081	Does the company report on initiatives to reduce the environmental impact of transportation used for its staff?	Fuel management
Fleet Fuel Consumption	ENPIDP027	Total fleet's average fuel consumption in l/100km.	
Emissions Trading	ENERDP068	Does the company participate in any emissions trading initiative, as reported by the company?	GHG emissions
Targets Emissions Reduction	ENERDP0161	Has the company set targets or objectives to be achieved on emissions reduction?	
NOx and SOx Emissions Reduction Initiatives	ENERDP033	Does the company report on initiatives to reduce, reuse, recycle, substitute, or phase out SOx (sulfur oxides) or NOx (nitrogen oxides) emissions?	Air quality
Particulate Matter Reduction Initiatives	ENERDP037	Does the company report on initiatives to reduce, substitute, or phase out particulate matter less than ten microns in diameter (PM10)?	
VOC Emissions Reduction Initiatives	ENERDP036	Does the company report on initiatives to reduce, substitute, or phase out volatile organic compounds (VOC)?	
Targets Water Efficiency	ENRRDP0191	Has the company set targets or objectives to be achieved on water efficiency?	Water and wastewater management
Policy Water Efficiency	ENRRDP0121	Does the company have a policy to improve its water efficiency?	

Table 3 Thomson Reuters Asset4-SASB Materiality Map® hand mapping, Environment. This table illustrates how I mapped the Asset4 datatypes to the SASB's items related to the Environmental sustainability dimension.

***** This item was also matched with all the other SASB sustainability issues pertaining to the Environment field, i.e. Biodiversity Impacts, Energy Management, Fuel Management, GHG emissions, Air quality, Water and wastewater management

Table 4. Thomson Reuters Asset4- SASB Materiality Map® hand mapping, Business Model and Innovation

Asset4 item	Datatype	Description	Correspondig SASB item
Hybrid Technology	ENPIDP028	Is the company developing hybrid technology?	Environmental and social impacts on assets and operations
Clean Technology	CGBFO07V	Is the company developing clean technology (wind, solar, hydro, geothermal and biomass power)?	
ESG Screened AuM	ENPIDP034	Does the company report on ESG screeened Assets Under Management?	
Environmental Investments Initiatives	ENERDP095	Does the company report on making environmental investments to reduce future risks or increase opportunities?	
Environmental Partnerships	ENERDP070	Does the company report on partnerships or initiatives with specialized NGOs, industry organizations, governmental or supra-governmental organizations, which are focused on improving environmental issues?	
Environmental Project Financing	ENPIDP037	Does the company claim to use ESG criteria as part of its investment or lending or underwriting decisions?	
Equator Principles	ENPIDP036	Is the company a signatory of the Equator Principles?	
Ethical Trading Initiative ETI	SOHRDP027	Is the company a member of the Ethical Trading Initiative (ETI)?	
Eco-Design Products	ENPIDP069	Does the company report on specific products which are designed for reuse, recycling or the reduction of environmental impacts?	Lifecycle impacts of products and services
Environmental Products	ENPIDP019	Does the company report on at least one product line or service that is designed to have positive effect on the environment or which is environmentally labeled and marketed?	
Organic Products Initiatives	ENPIDP045	Does the company report or show initiatives to produce or promote organic food or other products?	
Product Environmental Responsible Use	ENPIDP048	Does the company report about product features and applications or services that will promote responsible and environmentally preferable use?	
Take-back and Recycling Initiatives	ENPIDP047	Does the company report about take-back procedures and recycling programs to reduce the potential risks of products entering the environment?	
Toxic Substances Reduction Initiatives	ENRRDP031	Does the company report on initiatives to reduce, reuse, substitute or phase out toxic chemicals or substances?	
Sustainable Packaging	ENRRDP0124	Does the company have a policy to improve its use of sustainable packaging?	Product packaging
Healthy Food or Products	SOPRDP029	Does the company reportedly develop or market products and services that foster specific health and safety benefits for the consumers (healthy, organic or nutritional food, safe cars, etc.)?	Product quality and safety
Product Recall	SOPRDP060	Has the company announced a mass recall of products or has completely withdrawn a product due to defects or safety reasons?	

Table 4 Thomson Reuters Asset4- SASB Materiality Map® hand mapping, Business Model and Innovation. This table illustrates how I mapped the Asset4 datatypes to the SASB's items related to the Business Model and Innovation sustainability dimension.

Table 5. Thomson Reuters Asset4- SASB Materiality Map® hand mapping, Leadership and Governance

Asset4 item	Datatype	Description	Correspondig SASB item
Policy Employee Health & Safety	SOHSDP0121	Does the company have a policy to improve employee health & safety?	Accident and safety management
Employee Health Safety Training	SOHSDP0081	Does the company train its executives or key employees on health & safety	
Employees Health & Safety Team	SOHSDP004	Does the company have an employee health& safety team?	
Health & Safety Management Systems	SOHSDP014	Does the company have health and safety management systems in place like the OHSAS 18001?	
CSR Sustainability External Audit	CGVSDP030	Does the company have an external auditor of its sustainability report?	Business ethics and transparency of payments
Policy Business Ethics	SOCODP0069	Does the company describe in the code of conduct it strives to maintain the highest business ethics?	
Community Reputation Improvement Tool	SOCODP0109	Does the company have appropriate communication tools to improve general business ethics?	
Extractive Industries Transparency Initiative	SOCODP015	Is the company a supporter of the "Extractive Industries Transparency Initiative (EITI)"?	
OECD Guidelines for Multinationals	SOCODP013	Does the company claim to follow the OECD Guidelines for Multinational Enterprises?	
Policy Fair Competition	SOCODP0066	Does the company describe in the code of conduct that it strives to be a fair competitor?	Competitive behavior
Policy Shareholder Engagement	CGSRDP0013	Does the company have a policy to facilitate shareholder engagement, resolutions or proposals?	
Policy Bribery and Corruption	SOCODP0067	Does the company describe in the code of conduct that it strives to avoid bribery and corruption?	Regulatory capture and political influence
Global Compact	CGVSDP020	Has the company signed the UN Global Compact?	
Environmental Supply Chain Partnership Termination	ENRRDP059	Does the company report or show to be ready to end a partnership with a sourcing partner, in the case of severe environmental negligence and failure to comply with environmental management standards?	Materials sourcing
Human Rights Breaches Suppliers	SOHRDP029	Does the company show to be ready to end a sourcing partnership if human rights criteria are not met?	
Supply Chain Selection Management	ENRRDP058	Does the company use environmental or sustainable criteria in the selection process of its suppliers?	
Materials Sourcing Environmental Criteria	ENRRDP029	Does the company claim to use environmental criteria to source materials?	
Policy Supply Chain Health & Safety	SOHSDP0123	Does the company have a policy to improve employee health & safety in its supply chain?	Supply chain management
Supply Chain Health & Safety	SOHSDP0183	Does the company provide evidence that it is improving the level of employee health & safety in its supply chain?	
Environmental Supply Chain Monitoring	ENRRDP066	Does the company conduct surveys of the environmental performance of its suppliers?	
Human Rights Suppliers	SOHRDP026	Does the company use human rights criteria in the selection or monitoring process of its suppliers?	
Policy Fair Trade	SOPRDP0128	Does the company have a policy on fair trade?	
Policy Environmental Supply Chain	ENRRDP0125	Does the company set a policy for its supply chain partners to lessen its environmental impact?	
Supplier ESG training	SOTDDP030	Does the company provide training in environmental, social or governance factors for its suppliers?	
Audit Committee	ECSLDP005	Does the company have an audit committee?	Systemic risk management
Crisis Management Systems	SOCODP053	Does the company report on crisis management systems or reputation disaster recovery plans to reduce or minimize the effects of reputation disasters?	
Policy Board Independence	CGBSDP0012	Does the company have a policy regarding the independence of its board?	

Table 5 Thomson Reuters Asset4- SASB Materiality Map® hand mapping, Leadership and Governance. This table illustrates how I mapped the Asset4 datatypes to the SASB's items related to the Leadership and Governance sustainability dimension.

Table 6. Thomson Reuters Asset4- SASB Materiality Map® hand mapping, Human Capital

Asset4 item	Datatype	Description	Corresponding SASB item
Compensation Committee	CGCPDP005	Does the company have a compensation committee?	Compensation and benefits
Policy ESG Related Compensation	CGCPDP0013	Does the company have an ESG related compensation policy?	
Policy Executive Retention	CGCPDP0014	Does the company have a compensation policy to attract and retain executives?	
Performance Compensation Policy	CGCPDP0012	Does the company have a performance-oriented compensation policy?	
Sh/hos Approval of Stock Based Compensation	CGCPDP056	Does the company require that shareholder approval is obtained prior to the adoption of any stock-based compensation plans?	
Shareholders Vote on Executive Pay	CGSRDP038	Do the company's shareholders have the right to vote on executive compensation?	
Compensation Committee Independence	CGBFO05V	Does the company report that all compensation committee members are non-executives?	
Day Care Services	SODODP027	Does the company claim to provide day care services for its employees?	
Flexible Working Schemes	SODODP026	Does the company provide flexible working schemes?	
Policy Board Diversity	CGBSDP0013	Does the company have a policy regarding the diversity of its board?	Diversity and inclusion
Targets Diversity, Opportunity	SODODP0151	Does the company have a policy to drive diversity and equal opportunity?	
Lost Time Injury Rate	SOHSDP033	Total number of injuries that caused the employees and contractors to lose at least a working day relative to one million hours worked.	Employee health, safety and wellbeing
Accidents Total	SOHSDP027	Number of injuries and fatalities reported by employees and contractors while working for the company.	
Policy Freedom of Association	SOHRDP0101	Does the company have a policy to ensure the freedom of association of its employees?	Fair labor practices
Strikes	SOEQDP037	Has there has been a strike or an industrial dispute that led to lost working days?	Labor relations
Internal Promotion	SOTDDP023	Does the company claim to favor promotion from within?	Recruitment, development and retention
Management Training	SOTDDP024	Does the company claim to provide regular staff and business management training for its managers?	
Nomination Committee	CGBSDP005	Does the company have a nomination committee?	
Succession Plan for Executives	CGBFDP030	Does the company have a succession plan for executive management in the event of unforeseen circumstances?	
Policy Career Development	SOTDDP0092	Does the company have a policy to improve the career development paths of its employees?	
Policy Skills Training	SOTDDP0091	Does the company have a policy to improve the skills training of its employees?	
Nomination Committee Independence	CGBFO06V	Are the majority of the nomination committee members non-executives?	

Table 6 Thomson Reuters Asset4- SASB Materiality Map® hand mapping, Human Capital. This table illustrates how I mapped the Asset4 datatypes to the SASB's items related to the Human Capital sustainability dimension.

Table 7. Thomson Reuters Asset4- SASB Materiality Map® hand mapping, Social Capital

Asset4 item	Datatype	Description	Corresponding SASB item
Bottom of Pyramid Pricing	SOCODP040	Is the company selling some products or services at a discount to normal retail prices in emerging markets?	Access and affordability
Product Access Low Price	SOPRDP025	Does the company distribute any low-priced products or services specifically designed for lower income categories?	
Noise Reduction	ENPIDP026	Does the company develop new products that are marketed as reducing noise emissions?	Customer welfare
Product Responsibility Monitoring	SOPRDP016	Does the company monitor the impact of its products or services on consumers or the community more generally?	
Policy Customer Health & Safety	SOPRDP0121	Does the company have a policy to protect customer health & safety?	
Policy Data Privacy	SOPRDP0124	Does the company have a policy to protect customer and general public privacy and integrity?	Data security and customer privacy
GRI Report Guidelines	CGVSDP028	Is the company's sustainability report published in accordance with the GRI guidelines?	Fair disclosure and labeling
Product Responsibility Controversies	SOPRDP0546	Number of controversies published in the media linked to the company's marketing practices, such as over marketing of unhealthy food to vulnerable consumers.	
Policy Responsible Marketing	SOPRDP0126	Does the company have a responsible marketing policy ensuring protection of children?	
Corporate Responsibility Awards	SOCODP074	Has the company received an award for its social, ethical, community, or environmental activities or performance?	Human rights and community relations
Diseases of the Developing World	SOCODP047	Does the company claim to conduct research and development on drugs for diseases in the developing world?	
Employees Community Work	SOCODP037	Does the company foster employee engagement in voluntary community work?	
Fundamental Human Rights ILO or UN	SOHRDP012	Does the company claim to comply with the fundamental human rights convention of the ILO or support the UN declaration of human rights?	
Policy Child Labor	SOHRDP0102	Does the company have a policy to avoid the use of child labor?	
Policy Forced Labor	SOHRDP0103	Does the company have a policy to avoid the use of forced labor?	
Policy Human Rights	SOHRDP0105	Does the company have a policy to ensure the respect of human rights in general?	
Stakeholder Engagement	CGVSDP023	Does the company explain how it engages with its stakeholders?	

Table 7 Thomson Reuters Asset4- SASB Materiality Map® hand mapping, Social Capital. This table illustrates how I mapped the Asset4 datatypes to the SASB's items related to the Social Capital sustainability dimension.

The way I matched SASB and Asset4 data items represents a methodological change with respect to Khal *et al.* (2015). As I reported above, they do not restrict the KLD database to make it fit into SASB Materiality Map, but rather use all data items available in KLD; every sustainability issue defined as material by SASB for a given industry is matched to a KLD item and all the remaining KLD items are *tout court* considered as immaterial. The reason why I do not follow this metholdogy is both logical and practical. On one hand, the sample of immaterial issues may be biased and not consistent to SASB framework, which is the very core of this study. In particular, such an approach would be only partially consistent with the scheme suggested by SASB. There would be a full adherence to SASB classification for material issues only, whereas immaterial ones would represent a residual category, non-necessarily aligned with SASB's map. On the other hand, some of the Asset4 active datatypes do not fit at all with the 30 sustainability issues identified by SASB, hence exacerbating the problem just described. In regard to this second point, consider the examples of some of the Asset4 datatypes excluded from this analysis, in Table 8.

Table 8. A few examples of Thomson Reuters Asset4 datatypes not matched with SASB sustainability issues

Datatype	Asset4 item	Description
ENPIDP040	Nuclear	Does the company construct nuclear reactors, produce nuclear energy or extract uranium?
SOPRDP047	Pornography	Does the company produce or distribute pornography?
SOPRDP041	Gambling	Does the company generate revenues from gambling?
SOPRDP064	Gambling 5% Revenues	Are revenues generated from gambling activities larger than 5% of the total net revenues?
SOPRDP031	Embryonic Stem Cell Research	Is the company directly or indirectly involved in embryonic stem cell research?
SOPRDP043	Tobacco	Does the company produce tobacco?
SOPRDP065	Tobacco 5% Revenues	Are revenues generated from tobacco production larger than 5% of the total net revenues?
ENPIDP052	Agrochemical Products	Does the company produce or distribute agrochemicals like pesticides, fungicides or herbicides?
ENPIDP053	Agrochemical 5 % Revenues	Are the revenues generated by the company from agrochemicals 5% or more of company sales?
SOPRDP039	Alcohol	Does the company produce alcoholic beverages?
SOPRDP066	Alcohol 5% Revenues	Are revenues generated from alcohol production larger than 5% of the total net revenues?
SOPRDP062	Armaments 5% Revenues	Are revenues generated from armaments larger than 5% of the total net revenues?
ECSLDP052	Earnings Restatement	Is the company in the process of a material earnings restatement?
CGSRDP050	Poison Pill	Does the company have a poison pill (shareholder rights plan, macaroni defense, etc.)?
CGSRDP055	Golden Parachute	Does the company have a golden parachute or other restrictive clauses related to changes of control (compensation plan for accelerated pay-out)?
CGVSDP018	Integrated Strategy in MD&A	Does the company explicitly integrate financial and extra-financial factors in its management discussion and analysis (MD&A) section in the annual report?

Table 8. A few examples of Thomson Reuters Asset4 datatypes not matched with SASB sustainability issues, hence excluded from my analysis. This table illustrates some of the Thomson Reuters Asset4 datatypes which have not been used in my analysis because of their irrelevance. As you can see, many of them are built to allow for the implementation of so-called exclusion startegies i.e. where certain classes of investment are excluded from the investible universe if the relative entities result involved in certain irresponsible activities (see the literature review for a more precise definition). This sort of data items is not relevant for my study whose aim is to investigate a broader and more sophisticated ESG integration strategy. Other datatypes are not included in my study as simply not relevant according to the SASB Materiality Map (for instance, the ones I reported on Golden Parachutes or Poison Pills). Finally, the vast majority of Asset4 items are not used in my study because of the limited data availability for the companies I focus on.

As regards the second type of paring, for the sake of time optimization, I do not match all Thomson Reuters industry codes to the SASB's Sustainable Industry Classification System®, but rather focus on the only industry codes of the companies within my sample, each year. Many companies whose industry is only vaguely defined by Thomson Reuters are excluded from the sample as they cannot be precisely matched with the SICS®. In particular, I restrict the sample by excluding all companies belonging to the Service Organizations industry (Industry Code: 8580; Macro-category: Miscellaneous), which includes all sort of service companies such as highways and airport operators, facility management, security services, business consulting and software and IT firms. This leads to the removal of a total of 38 companies. Table 9 lists all companies that are removed and provides a short description of their businesses, as per their websites. Since my sample varies year by year, only 25 of these companies are removed from the constituents of the STOXX Europe 600 index in the entire period considered for this study (i.e. from 2007 to 2017). As a consequence of the index annual rebalancings, the remaining 13 firms are not part of the sample each year over the decade 2007-2017, therefore they are excluded from it only in certain years in an inconsistent way.

Table 9. STOXX Europe 600 companies belonging to the Thomson Reuters' industry Service Organizations (8580)

Company	Description
Aa	AA plc is a British motoring association. It provides car insurance, driving lessons, breakdown cover, loans, motoring advice, road maps and other motoring-related services.
Abertis	Abertis Infraestructuras, S.A. is a Spanish corporation in toll road management, headquartered in Madrid in Spain which runs over 8,600km of roads in the world.
Atlantia	Atlantia S.p.A. is an Italian holding company operating toll motorways and airports. Its primary asset is Autostrade per l'Italia.
Adp	Groupe ADP is an international airport operator based in Paris. It owns and manages Charles de Gaulle, Orly and Le Bourget airports.
Amadeus IT	Amadeus IT Group is a major Spanish IT provider for the global travel and tourism industry.
Ashtead	Ashtead Group plc is a British industrial equipment rental company.
Atos	Atos is a French IT services corporation. It specialises in hi-tech transactional services, unified communications, cloud, big data and cybersecurity services.
Capita	Capita is a leading provider of technology enabled business services.
Dksh Holding	DKSH is a Swiss Market Expansion Services Group which offers any combination of sourcing, marketing, sales, distribution and after-sales-services.
Edenred	Edenred is a French company specialised in prepaid corporate services. Edenred is the inventor of Ticket Restaurant and a leading distributor of meal vouchers.
Flughafen ZH	Flughafen Zürich AG is the owner and operator of Zürich Airport. The largest individual shareholder is the Canton of Zürich, with one third of the share capital.
Fraport	Fraport AG is the owner and operator of Frankfurt Airport and its activities span other 30 airport worldwide.
G4S	G4S provides security systems (such as access control, CCTV, intruder alarms, fire detection, video analytics and security) as well as manned security services.
Hays	Hays plc is a leading British company providing recruitment and human resources services across 33 countries globally.
Intertek	Intertek Group is a British multinational assurance, inspection, product testing and certification company.
ISS	ISS is a Danish Facility Services company. Its core business regards: cleaning, property, catering, security and facility management services.
IWG	IWG is a multinational corporation that provides a global workplace. It has 2300 Business Center in 106 countries and 8,700 employees.
Randstad	Randstad is a Dutch multinational human resource consulting firm headquartered in Diemen, Netherlands.
Securitas AB	Securitas AB is a security services monitoring, consulting and investigation group, based in Stockholm, Sweden.
SGS	SGS is a Swiss multinational company with 95,000 employees which provides inspection, verification, testing and certification services.
Sodexo	Sodexo is a French food services and facilities management company headquartered in Paris, with 420k employees on 34k sites in 80 countries.
Software AG	Software AG is the second largest software vendor in Germany with 10k enterprise customers in over 70 countries.
Sopra Steria	Sopra Steria Group SA is a European information technology consultancy established in September 2014 upon the merger of Sopra Group SA and Groupe Steria SCA.
Temenos	Temenos AG is a company specialising in enterprise software for banks and financial services, headquartered in Geneva, Switzerland.
United Internet	United Internet AG is a global Internet services company headquartered in Germany. The company is structured in two areas, Access and Applications.
Adecco	The Adecco Group, based in Zurich, is the largest temp staffing firm in the world and a Fortune Global 500 company.
Berendsen	Berendsen was a major British provider of textile maintenance services, acquired by the French company Elis in September 2017.
Bureau Veritas	Bureau Veritas is a B-to-B-to-Society company. It provides innovative laboratory testing, inspection and certification solutions.
Page Group	PageGroup is a British-based recruitment business, constituent of the FTSE 250 Index.
CGG	CGG is a fully integrated Geoscience company providing geological, geophysical and reservoir capabilities.
Fugro	Fugro is a Dutch multinational company that provides geotechnical, survey, subsea, and geoscience services.
Mitie	Mitie Group is a British company providing infrastructure consultancy, facilities management, property management, energy and healthcare services.
Homeserve	HomeServe is a home emergency repairs business, established as a joint venture by South Staffordshire Water and Richard Harpin and later publicly listed.
Royal Imtech	Royal Imtech N.V. was a European technical services provider in the fields of electrical solutions, ICT.
Solocal	Solocal Group S.A. provides digital local communication services in Europe. The company operates through two segments, Internet and Print & Voice.
Misys	Finastra is the third largest financial technology company in the world. The firm was formed in late 2017 through the combination of D+H and Misys.
Hibu	Hibu is a multinational directories and internet services company headquartered in Reading, UK.
TNS	Kantar TNS is a market research and market information group. The firm was acquired by WPP Group in October 2008.

Table 9. STOXX Europe 600 companies belonging to the Thomson Reuters' industry Service Organizations (8580). This table lists and describes the companies included in the STOXX Europe 600 index at least one time over the period 2007-2017 whose industry is classified by Thomson Reuters as Service Organizations (8580). As you can read, the core business of these companies is extremely heterogeneous, making it impossible to find a univocal match to one of SICS' industries. In light of this critical issue, they were all excluded from my sample.

Given the inherent sustainability-driven approach through which SICS® was defined, it has, in some specific cases, a much greater granularity than Thomson Reuters codes: for instance, it meticulously differentiates firms included in the Renewable Resources and Alternative Energy into six different industries (see Table 2). This implies that it is not possible to find a good match for all SICS® industries and 11 of them are not paired with any Thomson Reuters industry code: Biofuels, Solar Energy, Wind Energy, Fuel Cells and Industrial Batteries, Forestry and Logging (included in the Renewable Resources and Alternative Energy sector); Waste Management, Real Estate Owners, Real Estate Services and Developers and Investment Trusts, (part of the Real Estate sector); Household and Personal Products (Consumption sector); Health Care Distribution and Managed Care (Healthcare sector).

Additional companies are excluded from the sample because of missing key sustainability and financial data. More precisely, 14 and 68 firms on average are removed from the sample every year because of incomplete Asset4 data and financial metrics, respectively. The greater impact of missing financial metrics is due to a mere methodological aspect: whereas when an Asset4 datum is missing it is still possible to derive the aggregate material (immaterial) sustainability performance for a given year – which is the sum of all available Asset4 datatypes in that year, as I will soon explain – the same does not hold for financial data, which are used without further calculations that help bypass potential non existing data. Such exclusions reduce the sample size to on average 485 firms' datapoints each year, ranging from 501 in 2011 to 458 in 2017. See Table 10 to have more colour on the number of companies removed each year and the relative reason.

Table 11 illustrates the differences pertaining to some financial metrics (market capitalization, ROA, market-to-book ratio, leverage) of the sample I use in my study and the reference sample (STOXX Europe 600). Deviations are minimal, also in light of the

relatively low number of companies excluded, overall. However, some key trends emerge when considering the average, the interquartile range and the median of these variables. First, companies in my sample have a *circa* €500m bigger market cap than in the STOXX Europe 600. This difference is consistent when looking at the average, the interquartile range, the median and does not come at surprise. The literature identified as major causes underlying it: i) a greater attention to sustainability issues for large firms and ii) a consequent greater extra-financial rating agencies' coverage.
Leverage is slightly higher for companies in my sample: the D/E ratio is about 5% and 0.40% greater when comparing the average and the median values, respectively. ROA is slightly smaller, ranging from ca.0.20% to 0.10% depending on the statistics considered. No significant differences appear when it comes to the market-to-book ratio.

Khan *et al*. (2015) also present how their sample deviates from the reference Compustat universe. The comparison suggests that the magnitude of these differences is significantly higher, in their case.

Companies included in their study have a higher average and median market capitalization of about $5bn and $1bn, respectively.
Furthermore, as opposed to my data, both their market-to-book ratio and ROA are higher than the one characterizing the Compustat sample, whereas leverage is slightly smaller.

Such divergent results are likely to be due to the differential size between the used and the reference sample in my and their study. As I reported above, my sample is some 120 smaller than STOXX Europe 600, each year. In their case, this difference is significantly greater, ranging, on average, from 1,800 to 10,000 fewer datapoints each year.

Table 10. Summary Statistics, initial and final sample size and reasons for exclusions

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Initial number of companies	600	600	600	600	600	600	600	600	600	600
Exclusions due to unfeasible industry pairings	38	37	37	35	34	32	32	29	29	25
Exclusions due to missing Asset4 data	20	13	13	8	6	7	6	5	9	52
Exclusions due to missing financial data	71	66	58	56	61	92	64	70	76	65
Final number of companies	472	484	492	501	499	469	498	496	486	458
Total number of firms					**4,855**					

Table 10 Summary Statistics, initial and final sample size and reasons for exclusions. This table tracks the changes from the initial and the final sample size, every year, and the reasons for companies' exclusions. Missing financial data is the most common reason for a company's exclusion. This stems from a mere methodologicalal fact. Whereas if an Asset4 datum is missing, it is still possible to derive a company's aggregate material (immaterial) sustainability performance for a given year, the same does not hold for financial data. This second type of data are used as proxies for specific financial metrics and are not summed up to derive an aggregate score. Therefore, if a financial data item is missing, the relative company must be excluded from the sample as it is not possible to rely on all the necessary proxies describing its financial condition.

Table 11. Summary statistics, financial metrics of the sample used in my study *vs* the reference sample (STOXX Europe 600)

	Sample used in this study					Reference sample (STOXX Europe 600)				
	Market Cap	ROA	MTB	Leverage	N	Market Cap	ROA	MTB	Leverage	N
Mean	17,597.3	6.35%	2.97	81.50%	4,855	16,081.5	6.50%	2.96	76.56%	6,600
Q1	3,920.5	1.98%	1.10	18.74%	4,855	3,574.4	2.08%	1.11	18.25%	6,600
Median	7,434.5	5.20%	1.88	36.83%	4,855	6,844.3	5.27%	1.93	36.39%	6,600
Q3	17,488.8	8.72%	3.21	79.72%	4,855	15,910.3	8.91%	3.27	76.58%	6,600
St Dev	27,507.7	10.95%	27.25	587.99%	4,855	25,889.6	10.79%	26.05	751.78%	6,600

*Table 11 Summary statistics for the sample used in my study and the reference sample (STOXX Europe 600). Market capitalization is the share price multiplied by the number of ordinary shares in issue and is expressed in USD millions. ROA is calculated as follows: (Net Income + (Interest Expense - Interest Capitalized) * (1-Tax Rate)) / Average of Last Year's and Current Year's Total Assets * 100. MTB is computes as the market value of the ordinary (common) equity divided by the balance sheet value of the ordinary (common) equity in the company. Leverage is calculated as (Long Term Debt + Short Term Debt) / Common Equity * 100.*

Table 12 displays the relative weights of companies across sectors and industries, in the sample. The SABS' SICS® is used to classify each company's industry and sector.

Table 12. Sample weights by sector and industry

Sector	Sector weights	Industry	Industry weights
Financials	22%	Commercial Banks	8%
		Investment Banking and Brokerage	2%
		Asset Management Activities	5%
		Security and Commodity Exchanges	1%
		Insurance	6%
Resources Transformation	15%	Chemicals	5%
		Aerospace and Defense	2%
		Electrical and Electronic Equipment	2%
		Industrial Machinery and Goods	5%
Consumer Goods	13%	Containers and Packaging	1%
		Processed Foods	2%
		Alcoholic Beverages	1%
		Tobacco	1%
		Food Retailers and Distributors	1%
		Multiline and Specialty Distributors	4%
		Apparel Accessories and Footwear	2%
		Appliance Manufacturing	1%
Non-Renewable Resources	11%	Oil and Gas - Exploration and Production	3%
		Oil and Gas - Refining and Marketing	1%
		Iron and Steel Producers	1%
		Metals and Mining	4%
		Construction Materials	1%
Infrastructure	11%	Electric Utilities	3%
		Gas Utilities	1%
		Water Utilities	1%
		Construction Services	5%
		Home Builders	1%
Technology and Communications	9%	Electronic Manufacturing Services	2%
		Hardware	2%
		Semiconductors	1%
		Telecommunications	4%
Transportation	7%	Automobiles	2%
		Automobiles	2%
		Auto Parts	0%
		Airlines	1%
		Air Freight & Logistics	1%
Services	6%	Hotels & Lodging	1%
		Casinos & Gaming	1%
		Advertising & Marketing	1%
		Media Production & Distribution	2%
		Cable & Satellite	2%
Health Care	6%	Pharmaceuticals and biotechnology	3%
		Medical Equipment and Supplies	2%
Renewable Resources	1%	Pulp and Paper Products	1%

Table 12 Sample weights by sector and industry. Weights are calculated over the 4,855 firm-years

Weights are determined by dividing the number of firm-years belonging to a certain sector and industry by the total number of firm-years (N=4855). The three most relevant

sectors are Financials (22%), Resources Transformation (15%) and Consumer Goods (13%), whereas the least represented sectors are Services (6%), Health Care (6%) and Renewable Resources (1%). Focusing on the industry breakdown, 8% of the companies in my sample are commercial banks, 6% insurers and 5% asset managers, cheamicals, construction services firms and industrial machinery and goods manufacturers. It is not possible to conduct a precise comparison between these figures and the one of Khan *et alia*'s sample as their study includes six industries only. However, the financial sector is even more overweighted in their case, reprensenting 28% of the firm-years considered.

3.2 Materiality (Immateriality) score construction

Before describing the calclulations that lead me to derive the materiality (immateriality) score, I need to describe Asset4 data and the way I standarsise them to be able to use a score similar to the one set up by Khan *et al*. (2015).

Asset4 contains both trinary and quantitative data. The former indicates the presence or absence of certain sustainability practices, as per companies non-financial reporting. The latter describes the way a company faces sustainability issues by means of key quantitative metrics. Table 13 illustrates some examples of these two classes of data.

Sustainability information is not reported in a homogeneous way by Asset4. This is a major difference with respect to KLD database, upon which Khan *et al.* (2015) rely for their study. As I explained earlier, KLD classifies sustainability data into two macro categories, strengths and concerns and indicates in binary way (0, 1) the presence or absence of certain sustainability matters for each of them. Many scholars studying the relation between ESG and financial performance derive a net company ESG score by subtracting the concerns from the strengths. Given the different type of data available on Asset4, some adjustments are needed to obtain the same net score as in Khan *et al.* (2015).

I use a trinary system to homogenize Asset4 data. In particular, I first classify all active datatypes as either concerns or strengths and then, depending on their nature, I attribute a +1, 0 or -1 score to each issue. Such trinary rating system is eventually based on the same idea of subtracting concerns from strengths.

This process is straightforward for trinary Asset4 datatypes: "TRUE" and "YES" become +1 (-1) for strengths (concerns); "NA" is converted in 0 for both of them; "FALSE" and "NO" becomes -1 (+1) for strengths (concerns).

A similar but slightly more sophisticated approach is used in case of non-trinary data. When only either a number or "NA" is provided, I calculate the median of all companies not displaying "NA" and then I rate +1 (-1) if a company performance is above the reference median for strengths (concerns) and -1 (+1) otherwise. I prefer to use the median rathen than the average not to incur in the distorisve effect of outliers given the ever-changing number of firms over which this measure is to be computed – which is rather low, in some cases. The reference median is calculated either on the entire sample of companies or by industry, according to the sustainability issue examined. Given the necessary discretionary decisions that the additional steps to derive a trinary score from non-trinary datatypes entails, I rely on this type of non-trinary datatypes only in 5 out of 97 cases. I report in Table 14 an example of how I modify the reference sample according to the nature of the sustainability issue considered. As showed, the rationale for such distinction is whether or not a certain sustainability issue regards all firms, or it is peculiar of some specific industries.

Table 13. Trinary and non-trinary Asset4 datatypes

Variable	Name	Datatype	Description	Output
Trinary	Animal testing	ENPIDP057	Is the company involved in animal testing?	Y; N; NA
Trinary	Hybrid technology	ENPIDP028	Is the company developing hybrid technology?	TRUE; FALSE; NA
Non-trinary	ISO 14000 or EMS	ENERDP073	Does the company claim to have a certified Environmental Management System?	ISO, EMS, BOTH, NO, NA
Non-trinary	Fuel Management	ENPIDP027	Total fleet's average fuel consumption in l/100km.	Number; NA
Non-trinary	Lost Time Injury Rate	SOHSDP033	Total number of injuries that caused employees/contractors to lose at least a working day relative to one million hours worked	Number; NA

Table 13. Trinary and non-trinary Asset4 datatypes. This table distinguish two types of Asset4 data items on the basis of their possible outputs. Such distintinction is relevant as I use a different approach to standardize Asset4 data according to their nature (i.e. trinary and non-trinary). A consistent, numerical output is pivotal to derive an aggregate, firm-specific sustainability score.

Table 14. All- or By industry- median calculation sample for non-trinary Asset4 datatypes

Name	Datatype	Description	Median calculation sample
Lost Time Injury Rate	SOHSDP033	Total number of injuries that caused the employees and contractors to lose at least a working day relative to one million hours worked	By industry
Fuel Management	ENPIDP027	Total fleet's average fuel consumption in l/100km.	By industry
Accidents Total	SOHSDP027	Number of injuries and fatalities reported by employees and contractors while working for the company	By industry
Wages or Working Condition Controversies	SOEQDP045	Number of controversies linked to the company's relations with employees or relating to wages or wage disputes published since the last fiscal year company update	All sample
Nomination Committee Independence	CGBFO06V	Percentage of members of the nomination committee who are non-executives	All sample

Table 14. All- or By industry- median calculation sample for non-trinary Asset4 datatypes. The rationale is whether or not a sustainability issue regards all firms, or some specific industries.

As mentioned above, not all non-trinary Asset4 datatypes are defined by either a number or "NA". Focusing on the specific non-trinary datatype ENERDP073 (*"Does the company claim to have a certified Environmental Management System?"*), I convert: "BOTH" into +2, to reward companies compliant to both ISO and other certified environmental management systems; "ISO" or "EMS" into +1; "NO" into -1 and "NA" into 0. This is the only datatype (out of 97) where I use a non-trinary conversion.

Following the completion of this standardization procedure, each company's ESG yearly performance is described by 97 datapoints matched to 30 SASB sustainability issues which may be material or immaterial depending on the industry the company belongs to. I refer to the i^{th} sustainability issue as "std_A4_i" (i=97) and to the binary materiality (immateriality) judgment provided by SASB for the i^{th} issue as "$Mat(std\_A4_i)$" ("$Immat(std\_A4_i)$"). As a reminder, $StdA4_i$ can only take value +1, 0, -1, apart from the datatype ENERDP073, which can also be +2, whereas $Mat(std\_A4_i)$ ($Immat(std\_A4_i)$) is 1 when an issue is material (immaterial) and 0 otherwise – clearly if $Mat(StdA4_i)$ =1, then $Immat(StdA4_i)$ = 0 and *vice versa*. The way I derive the net materiality (immateriality) performance for company *c*, in year *t*, is explained below:

$$Material\ Performance\ (MP)_{t,c} = \sum_{i=1}^{97} (std\_A4_{t,c_i}) * Mat(std\_A4_{t,c_i}) \qquad (5)$$

$$Immaterial\ Performance\ (IP)_{t,c} = \sum_{i=1}^{97} (std\_A4_{t,c_i}) * Immat(std\_A4_{t,c_i}) \qquad (6)$$

The idea underlying the binary variable $Mat(std\_A4_i)$ (or $Immat(std\_A4_i)$) is to account for std_A4_i only when it is material (or immaterial) for *c*. If *c* is characterized by a positive MP (IP), then the number of well-managed material (immaterial) sustainability issues is greater than the number of material (immaterial) sustainability issues where improvements are needed and *vice versa*. To put it differently, a positive MP (IP) suggests

that company *c*, net net, is not exposed towards material (immaterial) sustainability issues and *vice versa*.

The way MP and IP are construted is particularly convenient. First, given that they are net scores, calculated subtracting the number of sustainability issues a company is not properly coping with, from the number of well-managed sustainability issues, they allow for the summation of *N* companies' scores: in this case, the resulting MP and IP represent the aggregate (net) exposure of those *N* companies towards sustainability issues. Even if such a cumulative figure might be biased by outliers (i.e. companies with either a very strong or weak sustainability performance), it is nonetheless a significant metric to understand the overall sustainability performance of a certain group of companies. Second, in light of the Asset4 datatypes I rely on, MP and IP are both a backward- and forward-looking proxies of firms' material and immaterial sustainability performance. On the one hand, items such as *ENPIDP028* ("*Is the company developing hybrid technology?*") describe the future ability to properly manage certain sustainability issues. On the other hand, datatypes like *SOHSDP027* ("*Number of injuries and fatalities reported by employees and contractors while working for the company*") suggest the current and past effectiveness of a company's sustainability policies.

Table 15 reports summary statistics of MP and IP over the period 2007-2017. MP is characterized by a significantly lower variability than IP as both the standard deviation and the interquartile range are smaller – 10.2 *vs* 23.8 and 13 *vs* 33, respectively. Furthermore, MP's average (1.7) is positive and higher than IP's (0.7). This suggests that companies are, on average, more careful when deal with material issues than with immaterial ones. However, the opposite holds when we look at the median which is slightly higher for IP than MP, implying that the concrete difference between MP and IP is due to outliers – with either a extraordinary MPs or a poor IPs.

Table 15. Summary Statistics, Material (MP) and Immaterial Performance (IP)

	Mean	Q1	Med.	Q3	Std. dev.	N
Material Performance (MP)	1.70	-5	2	8	10.19	5,326
Immaterial Performance (IP)	0.70	-15	3	18	23.81	5,326

Table 15. Summary Statistics, Material Performance (MP) and ImmaterialPerformance (IP). All the descriptive statistics presented here are calculated on a sample of 5,326 datapoints (N=5,326,). This sample is larger than the one I previously focused on as it is based on an eleven-year – rather than a ten-year – period. This is due to the fact that, although the study is investigates ESG materiality over a ten-year period, my analysis required an eleven-year time series to derive, both for sustainability and financial data, year-over-year changes (deltas).

Chart 1, 2, 3 provide a graphical evidence of what emerges from descriptive statistics of the ESG material and immaterial performance.

In particular, Chart 1 compares the evolution of the yearly aggregate MPs and IPs – derived by summing all companies' material and immaterial scores. Both lines are upward sloped with IP being significantly steeper (as a proof of a higher volatility). Such a positive trend is consistent with the increased relevance of sustainability among consumers and the civil society at large, as described in the literature review. In both cases, improvements of the sustainability performance are more evident in the period from 2007 to 2008 and from 2015 to 2017. As a matter of fact, Chart 1 suggests that the overall commitment of Europen companies towards sustainability themes dropped in in the biennium 2012-2013, where the second derivative of both lines is negative. Considering that from late 2008 to 2014, European markets were hit by the global financial and the sovereign debt crises, such a common slowdown suggests that attention towards sustainability themes was perceived by European companies as a non-strategic investment, consistently with neoclassical economists' view according to which sustainability is a waste of financial resources. Adverse market conditions had a stronger effect over IP than MP: the former dropped by 36%, from 2012 to 2013 the worst period, whereas the latter by 22% only. The high elasticity of total IP over the overall economic context recalls the behavior of advertising spending, in line with the view that sustainability is often used for

communication purposes, rather than as an actual risk mitigation tool, as mentioned in the literature review.

Chart 2 and 3 present the evolution of MP and IP yearly mean, median and interquartile range. Two aspects are worth-highlighting. First, MP's interquartile range is remarkably lower than IP one: a further confirmation of limited variability of MP with respect to IP. Second, whereas MP median and mean overalps for almost the entirety of the period considered, IP median is consistently higher than its average, suggesting the presence of outliers, i.e. firms with a very low commitment towards immaterial sustainability issues which drive the average value down. This explains the reason why, although IP's mean is lower than MP's one, its median is higher, as highlighted while commeting Table 15.

These findings are only partially consistent with those found by Khal *et al*. (2015) in the US market. On one hand, the average sustainability performance is negative for both material and immaterial issues, in their sample (-0.10 and -0.18, respectively). This may be due to the fact that they studied the behavior of these variables over a longer time period: as Chart 1, 2, 3 document, MP and IP were both negative, in 2007. On the other hand, MP is, on average, larger than IP and IP is more volatile (IP's standard deviation is 1.953 while MP's is 0.905).

Chart 1. Total yearly MP vs IP

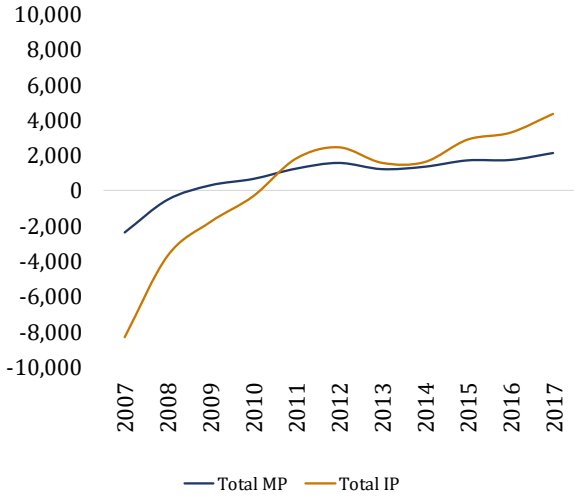

Chart 1 Total yearly MP vs IP. These two metrics are calculated by summing all companies' MP and IP, each year. Given that company-specific MP and IP are derived in a merely additive way, their relevance also holds at an aggregate level, hence the sense of comparing total MP and IP.

Chart 2. MP: mean, median and IQR

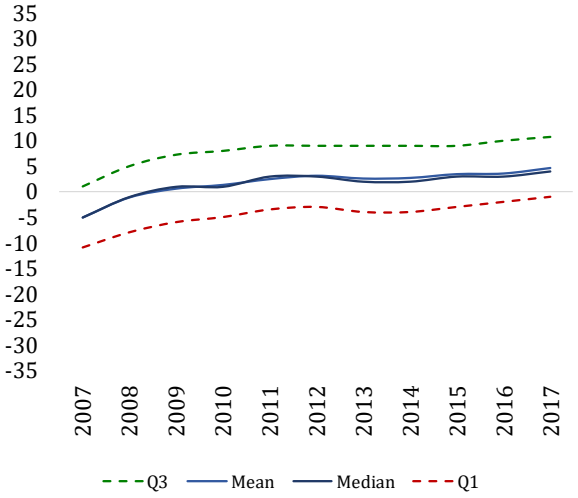

Chart 2 MP: mean, median and IQR. This chart reports the the mean, median and interquartile range of the MP characterizing the companies included in my sample, each year. The mean's trend does not diverge much from the median's. This confirms the absence of significant outliers in my sample.

Chart 3. IP: mean, median and IQR

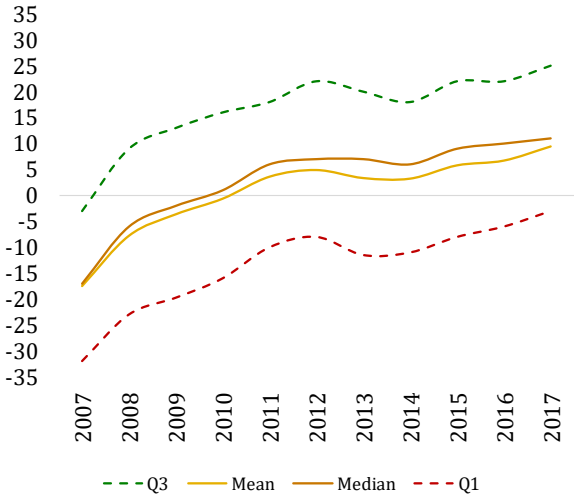

Chart 3 IP: mean, median and IQR. This chart reports the the mean, median and interquartile range of the IP characterizing the companies included in my sample, each year. The mean's line is consistently below the median's. This suggests the presence of outliers which drive the average value down.

3.3 Portfolios formation

To investigate the implications of material and immaterial sustainability over financial performance, I need to construct portfolios according to the just derived MP and IP scores. Rather than forming them by ranking the MP and IP, I follow Khan *et al.* (2015) in orthogonalizing yearly changes in MP and IP with respect to industry fixed effect (f_s) as well as yearly changes in firms' proxies for size (total assets, *Assets*), future growth opportunities (market-to-book ratio, *MTB*), profitability (return on assets, *ROA*) and leverage (total debt-to-common equity ratio, *D/E*). This procedure leads me to estimate, cross-sectionally, every year, the following regressions:

$$\Delta(MP)_{c,t} = b_1 + b_2\Delta\text{Ln}(Assets)_{c,t} + b_3\Delta(MTB)_{c,t} + b_4\Delta(ROA)_{c,t} + b_5\Delta(D/E)_{c,t} + f_s + e_{c,t} \quad (7)$$

$$\Delta(IP)_{c,t} = b_1 + b_2\Delta\text{Ln}(Assets)_{c,t} + b_3\Delta(MTB)_{c,t} + b_4\Delta(ROA)_{c,t} + b_5\Delta(D/E)_{c,t} + f_s + e_{c,t} \quad (8)$$

Notice that (7) and (8) differ from (3) and (4) only in the way they account for yearly changes in size. The use of total assets rather than market capitalization stems from the fact that total assets are a more stable and a less market-driven proxy, consistently with Bates *et al.* (2009). I take the natural logarithm before calculating the change in total assets as it allows to dumpen outliers in a less extreme way than windsorization.

As Khan *et al.* (2015), I collect the residuals from (7) and (8) and sort them by different percentile cutoffs to form the portfolios whose financial performance is studied. Portfolios are created on the basis of deciles, quintiles, quartiles and tertiles cutoffs. The firms with the highest (lowest) residuals – in absolute terms – are considered as material or immaterial sustainability outperformers (underperformers) and allocated to the most (least) materially or immaterially sustainable portfolios.

This methodology aims at i) mitigating concerns about correlated firm characteristics and ii) isolating the unexpected level of sustainability performance to make sure such

performance is not biased by firm-specific features. It is important to highlight that the use of change, rather than level variables, is intented to differentiate firms on a best-effort basis – to eventually determine whether such an effort pays off in financial terms[4]. Table 16 reports the main summary statistics of the variables included in regression (7) and (8).

Table 17 illustrates the correlation matrix among these variables. Notice that, in light of a significant positive correlation (0.39) between the dependent variables ΔMaterial and ΔImmaterial of (7) and (8), the nature of their correlation with the independent variables used as proxies for companies' financial condition – Δln(Total Assets), ΔROA, ΔMTB and ΔLeverage – is quite similar. Both of them are positively related to changes in size – as well-documented by the literature – and negatively to changes in profitability and market-to-book ratio, while mixed results characterize their relation with changes in leverage – negative with ΔMat and positive with ΔImmat. The rationale on the negative relation with ΔROA, is that an increase in a company's sustainability performance may come, in the short-term, at the expense of profitability, consistently with the evidence emerged while describing the heterogenous results of Waddock and Graves (1994), Robinson and Dechant (1997) and Berman *et al*. (1999). This may also explain the reason why ΔMat and ΔImmat are negatively correlated with changes in market participants' perception of a firm's growth opportunities. Focusing on the relation with ΔLeverage, in light of the fact that ΔMat (ΔImmat) is calculated considering proxies for both investments in/the exposure towards certain sustainability issues, the negative (positive) relation between ΔD/E and ΔMat (ΔImmat) remarks the strategic effectiveness of material sustainability only in decreasing firms' relative liabilities – likely employed to cope with those issues.

[4] See section 2.1.3 for the definition of Best-Effort ESG screening

Table 16. Summary Statistics, variables included in regressions (7) and (8)

	Independent (sustainability) variables		Explanatory (financial) variables				N
	ΔMP	ΔIP	ΔLn(Total Assets)	ΔROA	ΔMTB	ΔLeverage	
Mean	1.11	3.18	0.0507	-0.44%	-0.3349	-18.43%	4,855
Median	0.00	2.00	0.0384	-0.12%	0.0100	-0.81%	4,855
Std. dev.	3.35	7.14	0.1894	7.08%	25.1635	698.62%	4,855

Table 16. Summary Statistics, Regression 1 variables. This table presents key summary statistics of the variables used in regressions (7) and (8). All variables are year-over-year delta values. The reason why I calculated ΔLn(Total Assets), rather than Δ(Total Assets), is that the natural logarithm allows to dumpen outliers – which have a significant impact on a variable like Total Assets – in a way that is less extreme than windsorization. The nature of the other variables (ROA, MTB and Leverage) does not require such adjustment.

Table 17. Correlation matrix, variables included in regressions (7) and (8)

	ΔMat	ΔImmat	ΔLn(Total Assets)	ΔROA	ΔMTB	ΔLeverage
ΔMat	1					
ΔImmat	0.39 (0.00)	1				
ΔLn(Total Assets)	0.04 (0.00)	0.04 (0.01)	1			
ΔROA	-0.06 (0.00)	-0.04 (0.00)	0.05 (0.00)	1		
ΔMTB	-0.09 (0.00)	-0.07 (0.00)	-0.04 (0.00)	0.10 (0.00)	1	
ΔLeverage	-0.09 (0.00)	0.04 (0.00)	0.19 (0.00)	-0.27 (0.00)	0.18 (0.00)	1

Table 17. Correlation matrix, variables included in regressions (7) and (8). This table illustrates the Spearman's correlation between the variables included in regressions (7) and (8), with the relative p-values in brackets. I use Spearman's correlation as it is able to detect a perfect correlation when X and Y are related by any sort of monotonic function – as opposed to Pearson's which finds it only when X and Y are related by a linear function. All p-values are statistically significant at 1% significance level.

3.4 Alphas estimation

In order to determine whether or not stock picking on material and immaterial sustainability issues leads to abnormal returns, in Europe, I use two asset pricing models: Fama and French (1993) three-factor model and Carhart (1997) four-factor model.

In this section of my research I go through these models and describe the variables I use to estimate them.

3.4.1 Risk-adjusted measures

According to the most basic foundations of finance, the return of an asset is always related to its inherent risk. Risk-adjusted measures allow to take into account these two dimensions and grasp their mutual interdependencies. Common risk-adjusted measures are the Sharpe ratio and the Jensen's alpha.

The Sharpe Ratio is defined as the average return earned by a certain portfolio p in excess of the risk-free rate, per unit total risk – i.e. the standard deviation of p returns. The greater this ratio the better it is. The idea underlying the use of the excess return is to allow investors to isolate the actual profits associated with risk-taking activities. However, since σ_p captures both the systematic and specific risk, the denominator is not fully consistent with the numerator. Furthermore, the Sharpe ratio is a ranking criterion only and does not indicate the added return earned owning of a certain portfolio with respect to a reference portfolio. Jensen's alpha tackles these disadvantages. In particular, it quantifies the difference between the actual and expected financial performance of a portfolio or security. Different models can be used to define the expected financial performance of a portfolio.

The Capital Asset Pricing Model (CAPM), described in Sharpe (1964), is based on three assumptions: i) investors can trade all securities at market prices without paying taxes or

dealing with transactions costs and can all borrow and lend at the same risk-free interest rate; ii) investors hold only efficient portfolios of traded securities; iii) investors have the same expectations on the volatilities, correlations and expected returns of securities. In this framework, the optimal portfolio corresponds to the market portfolio, combined with borrowing or lending at the risk-free rate. When the CAPM holds, security *i* expected excess return $E(R_i) - r_f$ is equal to:

$$E(R_i) - r_f = \beta_{im} \left[E(R_m) - r_f\right] \qquad (9)$$

where r_f is the risk-free rate, $E(R_m)$ is the expected return over the market portfolio and β_{im} is the sensitivity of security *i* excess return over the market portfolio's excess return. Notice that (9) suggests the existence of a linear relation between security *i* excess return and the market portfolio's excess return, the so-called Security Market Line (SML). The SML tracks the expected return of security *i* and Jensen's alpha measures the average difference of security *i* 's actual return R_i from the SML, as follows:

$$\alpha_i = R_i - E(R_i) = R_i - [\, r_f + \beta_{im}\big(E(R_m) - r_f\big) \,] \qquad (10)$$

If $\alpha > 0$, then security *i* financial performance is greater than what expected by the CAPM, and *vice versa*. As the CAPM assumes that the efficient portfolio is the market portfolio, β_{im} is deemed to capture the entirety of systematic risk (Berk, De Marzo 2014). Such an assumption was found oversimplistic and multi-factor models were developed.

Multi-factor models aim at obtaining the efficient portfolio by adding to the market portfolio other complementary portfolios whose purpose is to detect a larger fraction of systematic risk. This implies that multi-factor models assume the behavior of security *i* excess return to be explained in a non-linear way.

I follow Khan *et al.* (2015) in relying on such models to determine the alphas of top and bottom material and immaterial portfolios. In the next sections, I explain the multi-factor models I use and provide summary statistics of the relative variables.

3.4.2 Fama and French model

Fama and French (1993) provide evidence that firms' market-to-book ratio and size contribute to proxy for common risk factors in returns. This is due to the fact that both variables are related to economic fundamentals and, in particular, to companies' relative profitability. Low book-to-market equity firms tend to have a persistently high ROA, and *vice versa*. Likewise, small capitalization firms are associated with lower earnings and are exposed to longer earnings depression in case of recessions than large cap firms (Fama and French, 1993). In light of these considerations, they expanded the CAPM by adding two variables to equation (9):

$$E[R_i] - r_f = \beta_i^{Mkt}\big(E[R_{Mkt}] - r_f\big) \; + \; \beta_i^{SMB}E[R_{SMB}] \; + \; \beta_i^{HML}E[R_{HML}] \qquad (11)$$

Hence the alpha associated with security *i* is calculated as:

$$\alpha_i = R_i - E[R_i] = R_i - \Big[r_f \; + \beta_i^{Mkt}\big(E[R_{Mkt}] - r_f\big) \; + \; \beta_i^{SMB}E[R_{SMB}] \; + \; \beta_i^{HML}E[R_{HML}]\Big] \qquad (12)$$

where:

- $E[R_{SMB}]$ is the expected return of a portfolio which mimics the risk factor in returns related to size. It is calculated by taking the difference, each month, between the returns on small- and large-stock portfolios adjusted for the weighted average book-to-market ratio values;
- $E[R_{HML}]$ is the expected return of a portfolio which mimics the the risk factor in returns related to book-to-market ratio, instead. It is calculated by taking the difference, each month, between the simple average of the returns on high book-

to-market ratio portfolios and low book-to-market ratio portfolios, adjusted for weighted average sizes.

3.4.3 Carhart model

Carhart (1997) constructs a model of market equilibrium with four risk factors, improving Fama and French's one (1993) which is found to poorly explain cross-sectional variation in momentum-sorted portfolio returns (Fama and French, 1996).

Carhart (1997) uses Jegadeesh and Titman's (1993) one-year momentum factor to fix this shortcoming. He sorts mutual funds returns into decile portfolios according to their previous calendar year's return. Returns are calculated every month in an equally weighted way so that weights are automatically readjusted if a fund is shut down. Top and bottom portfolios are further divided into thirds on the same measure. Finally, the Momentum factor is created by subtracting the equal-weighted average return of firms in the lowest third of the bottom portfolio from the average return generated by firms in the highest third of the top portfolio. The resulting four-factor model is:

$$E[R_i] - r_f = \beta_i^{Mkt}\big(E[R_{Mkt}] - r_f\big) + \beta_i^{SMB}E[R_{SMB}] + \beta_i^{HML}E[R_{HML}] + \beta_i^{MOM}E[R_{MOM}] \qquad (13)$$

Therefore the alpha associated with security *i* is calculated as:

$$\alpha_i = R_i - E[R_i] = R_i - \Big[r_f + \beta_i^{Mkt}\big(E[R_{Mkt}] - r_f\big) + \beta_i^{SMB}E[R_{SMB}] + \beta_i^{HML}E[R_{HML}] + \beta_i^{MOM}E[R_{MOM}]\Big] \quad (14)$$

3.4.4 Regressive analysis

I use (12) and (14) to estimate the alphas associated with the portfolios I ranked according to their material and immaterial performance. The reason why I decide to primarily focus on these two models is that Carhart (1995) finds that three-factor model estimates of funds' performance are usually more accurate but not economically divergent from the CAPM, while coefficients derived through the four-factor model differ more because of the loadings on the momentum factor. Furthermore, I intend to rely on

models as close as possible to the ones used by Khal *et al.* (2015), to ease the comparability of our studies. Khal *et al.* (2015), estimated portfolios' alphas with Fama and French three-factor model, Carhart four-factor model and as well as Pastor and Stambaugh (2005) five-factor model. The latter adds to Carhart model the so-called liquidity factor, whose data are not available and hardly estimable for the European market. I downloaded data to estimate Fama-French and Carhart models from the personal website of Dr. French[5].

All returns are computed in US dollars, include dividends and capital gains and are discretely compounded. The market excess return is calculated by taking the value-weighted average return of the European market portfolio (including the UK) minus the one-month T-bill rate.

SMB and HML factors are constructed by ranking stocks into two market capitalization and three market-to-book ratio groups, at the end of June, each year. Large (small) stocks are those in the top (bottom) decile of June market cap. The book-to-market ratio breakpoints are the 30th and 70th percentiles for the large stocks. The 2x3 groups formed according to market capitalization and book-to-market ratio allow to set up six value-weight portfolios: SG, SN, SV, BG, BN, and BV, where S and B indicate small or big and G, N, and V indicate growth (low book-to-market ratio), neutral, and value (high book-to-market ratio) stock portfolios.

SMB is the equal-weighted average return on the three small capitalization stock portfolios minus the same average of the returns on the three large capitalization stock portfolios, more precisely:

$$\text{SMB} = \frac{R_{SV} + R_{SN} + R_{SG}}{3} - \frac{R_{BV} + R_{BN} + R_{BG}}{3} \quad (15)$$

[5] Please visit http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

HML is the equal-weighted average return for the two high book-to-market ratio portfolios minus the same average of the returns on the two low book-to-market ratio portfolios, as specified below:

$$\text{HML} = \frac{R_{SV} + R_{BV}}{2} - \frac{R_{SG} + R_{BG}}{2} \qquad (16)$$

The MOM factor is similarly calculated every month starting from 2x3 sorts on size and lagged momentum. The lagged momentum returns at the end of month t–1, are the cumulative returns from month t–12 to month t–2. This means that not to be excluded in a portfolio for month *t* (formed at the end of the month *t–1*), a stock must have a price for the end of month *t–13* and a return for *t–2*. The 30th and 70th percentiles of large cap stocks' lagged momentum returns are used as breakpoints. The independent 2x3 sorts on size and momentum produce six value-weighted portfolios, SL, SN, SW, BL, BN, and BW, where S and B indicate small and large cap stocks and L, N, and W indicate loser, neutral, and winner stocks (i.e. bottom 30%, middle 40%, and top 30%). MOM corresponds to the equal-weighted average returns for the two winner portfolios minus two loser portfolios:

$$\text{MOM} = \frac{R_{SW} + R_{BW}}{2} - \frac{R_{SL} + R_{BL}}{2} \qquad (17)$$

The average return of portfolios ranked according to their material and immaterial sustainability performance is computed both with equal- and value-weights. To be consistent with data available on Dr. French's website, I download firms' price-series by means of the Datastream's function "*X(RI)~U$*" where RI – *Return Index* which outputs a stock's price series, including dividend-yields and capital gains – is converted across the entire sample from the local currency to the USD. Data on firms' market capitalization, necessary for the calculation of value-weighted returns, are likewise downloaded through "*X(MV)~U$*". In light of the timing through which Asset4 data items are available in the

European region – by the end of the June each year – and the way Dr.French defines SMB, HML, MOM factors, I form portfolios at the end of June with portfolios held from the beginning of July to the end of June of the following year, to allow for a theoretically realistic trading strategy.

Given the hypotheses I am testing, three types of portfolios are formed, according to three different criteria. The first ranks firms based on their material sustainability performance, as per residuals of (7). The second sorts companies into their immaterial sustainability performance, as per residuals of (8). The third criterion relies on residuals from both (7) and (8) to group companies in two portfolios:

- High Material & Low Immaterial (HM&LI), which gathers companies whose material performance is in the the upper quartiles of residuals' distribution and whose immaterial performance is concurrently in the the lower quartiles of the distribution;
- Low Material & High Immaterial (LM&HI), which includes companies whose material performance is in the the lower quartiles of residuals' distribution and whose immaterial performance is concurrently in the the upper quartiles of the distribution.

HM&LI is formed to test whether the stock performance of companies that rationalize their investments in only the most ESG material issues, neglecting the immaterial ones, beats other portfolio strategies based on the material and immaterial sustainability performance – in particular, the one which picks companies with a poor performance on material issues and concurrently good performance on immaterial ones. In order to be consistent with Khan *et al*. (2015) – hence enhancing the comparability's potential of this analysis – the abnormal returns generated by HM&HI and LM&LI portfolios are studied too. I use quartile and tertile portfolios as cutoff values both for bad and good

performance, as quintile and decile portfolios would lead to very few stocks in portfolios – fewer than ten companies per year, on average – as a consequence of the positive correlation between the residuals of (7) and (8). As a matter of fact, contrarily to what experienced by Khan *et al.* (2015) – where the correlation between the residuals of (3) and (4) (0.13) is lower than the one between raw indices (0.30) – the correlation between the residuals of (7) and (8) increases from the correlation between ΔMP and ΔIP by 2 basis points, on average (from 0.34 to 0.36).

Chart 4 reports the average number of firms available to form HM&LI, LM&HI, HM&HI and LM&LI portfolios, according to the cutoffs used. The chart suggests that tertile cutoffs would guarantee a larger pool of companies from which to form portfolios (circa 35 per year). However, considering that Hypotheses 1 and 2 are primarily tested via decile and quintile cutoffs, I preferred to rely on the strictest possible cutoff, which is, excluding quintiles and deciles, the one based on quartiles and use tertile cutoffs as robustness test. Quartile cutoffs allow me to use an average of 16 firms' data per year for both HM&LI and LM&HI. Nonetheless, such cutoff yields a less strict distinction of companies' material and immaterial sustainability than in Hypothesis 1 and 2, therefore results should be weighed against this aspect. Notice that the positive correlation between the residuals of (7) and (8) leads to a potentially higher number of available firms for the creation of HM&HI and LM&LI, than for HM&LI and LM&HI. The number of companies displaying a high performance on one index and low performance on the other is lower compared to companies that score well or poorly on both, across all cutoffs.

Chart 4. Average number of firms available to form HM&LI, LM&HI, HM&HI and LM&LI portfolios, according to the cutoffs used

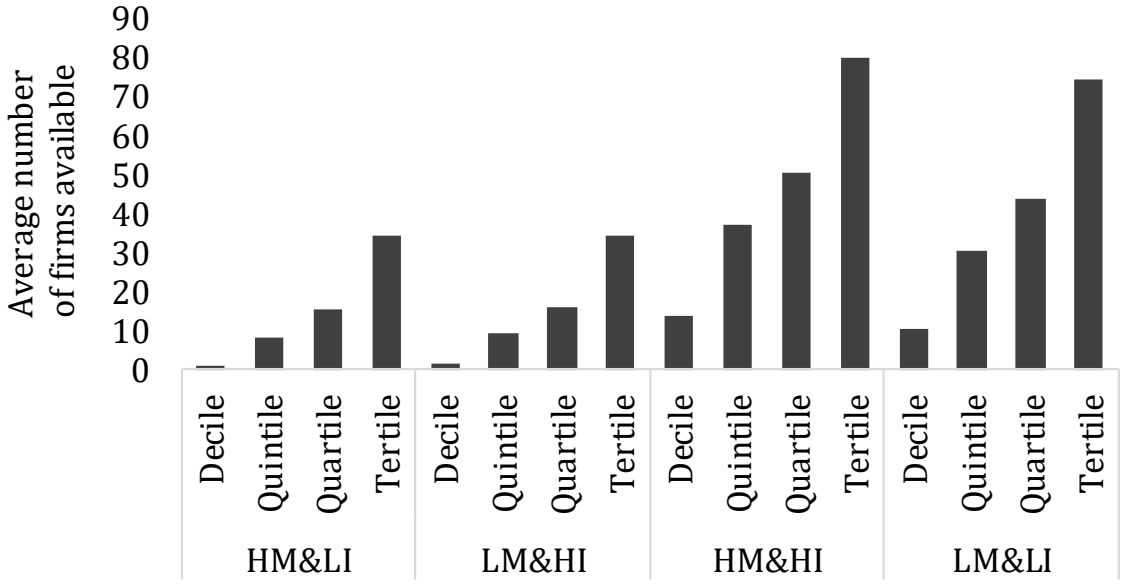

Chart 4. Average number of firms available to form HM&LI, LM&HI, HM&HI and LM&LI portfolios, according to the cutoffs used. Notice that the positive correlation between the residuals of (7) and (8) – 0.36 – leads to a potentially higher numberof companies for the construction of HM&HI and LM&LI, than for HM&LI and LM&HI, across all the different cutoffs.

Consistently with Khal *et al.* (2015), I do not just only estimate the alphas generated by portfolios with different cutoffs, but I also assess whether the differential alpha between outperformers (firms with a high material or immaterial sustainability performance) and underperformers (firms with a low material or immaterial sustainability performance) is statistically significant. This is done by means of a slightly different specificantion of regressions (11) and (13). In particular, in order to get the p-value associated with the differential alphas generated by outperformers with respect to underperformers, I do not estimate two separate regressions – the former for outperformers, the latter for underperformers, but I rather estimate one regression only where I include both sorts of data and distinguish one from the other through a dummy variable, D_H, which takes value 1 for outperformers and 0 for underperformers. This implies that (11) and (13) are estimated with twice as many datapoints (N=240, rather than 120) and the three- and four-factor models become:

$$E[R_i] - r_f = D_H + \beta_i^{Mkt}\left(E[R_{Mkt}] - r_f\right) \; + \; \beta_i^{SMB}E[R_{SMB}] \; + \; \beta_i^{HML}E[R_{HML}]$$

(11b)

$$E[R_i] - r_f = D_H + \beta_i^{Mkt}\left(E[R_{Mkt}] - r_f\right) + \beta_i^{SMB}E[R_{SMB}] + \beta_i^{HML}E[R_{HML}] + \beta_i^{MOM}E[R_{MOM}]$$

(13b)

The same methodology is used to compare the differential alphas generated by HM&LI portfolio over LM&HI and the remaining mixed ones – HM&HI and LM&LI. Here, the dummy variable takes value 1 for HM&LI and 0 for the other portfolios.

For the sake of completeness, this analysis is repeated by constructing portfolios through both equal- and value-weighted criteria.

Table 18 reports the summary statistics of all the portfolios I constructed to test Hypothesis 1, 2, 3.

Table 18. Summary statistics, excess returns (%)

Panel A. Equal-weighted portfolios

	Portfolios ranked on material sustainability								Portfolios ranked on immaterial sustainability								Mixed portfolios			
	Top 10th	Btm 10th	Top 5th	Btm 5th	Top 4th	Btm 4th	Top 3rd	Btm 3rd	Top 10th	Btm 10th	Top 5th	Btm 5th	Top 4th	Btm 4th	Top 3rd	Btm 3rd	HM &LI	LM &HI	HM &HI	LM &LI
Mean	0.69	0.45	0.58	0.56	0.59	0.58	0.55	0.59	0.71	0.61	0.73	0.63	0.71	0.61	0.64	0.58	0.61	0.88	0.72	0.59
Median	0.42	-0.05	0.33	0.17	0.33	0.45	0.36	0.38	0.61	0.51	0.57	0.41	0.62	0.36	0.46	0.32	0.45	0.38	0.45	0.50
Std. dev.	6.56	6.55	6.58	6.23	6.58	6.24	6.49	6.23	6.66	6.92	6.51	6.55	6.57	6.58	6.59	6.46	6.87	6.43	6.84	6.58
T-stat	1.94	1.25	1.60	1.73	1.64	1.79	1.58	1.81	1.91	1.52	2.06	1.76	1.98	1.68	1.77	1.67	1.54	2.56	1.84	1.64

Table 18.A. Summary statistics, excess returns (%) equal-weighted portfolios. This table reports summary statistics on the ten-year monthly equal-weighted excess returns over the one-month T-bill rate – consistently with the way the market excess returns have been calculated by Dr. French. The first and the second type of portfolios include stocks ranked according to either their material or immaterial sustainability performance, as per residuals of (7) and (8). The third type uses residuals from both (7) and (8) to form the four mixed portfolios. For each type of portfolio, the columns to the left contains statistics on the data I primarily use to test H1, H2 and H3, whereas the columns to the right are used as robustness checks. T-stat is calculated as: $(x-\mu)/\sqrt{s^2/n}$ where x is the sample mean, s^2 is the sample variance, n is the sample size, μ is the specified population's mean (H_0: μ=0)

Panel B. Value-weighted portfolios

	Portfolios ranked on material sustainability								Portfolios ranked on immaterial sustainability								Mixed portfolios			
	Top 10th	Btm 10th	Top 5th	Btm 5th	Top 4th	Btm 4th	Top 3rd	Btm 3rd	Top 10th	Btm 10th	Top 5th	Btm 5th	Top 4th	Btm 4th	Top 3rd	Btm 3rd	HM &LI	LM &HI	HM &HI	LM &LI
Mean	0.70	0.27	0.48	0.46	0.45	0.39	0.42	0.39	0.69	0.33	0.58	0.22	0.61	0.27	0.56	0.31	0.31	0.44	0.57	0.35
Median	0.95	0.33	0.51	0.48	0.21	0.34	0.43	0.36	0.57	0.00	0.58	0.12	0.80	0.11	0.54	0.12	0.12	0.60	0.39	-0.02
Std. dev.	6.46	5.21	6.34	5.37	6.17	5.36	6.17	5.44	6.63	6.49	6.16	6.14	6.22	6.06	6.18	5.96	5.96	7.15	6.36	6.08
T-stat	2.02	1.21	1.43	1.93	1.43	1.64	1.32	1.56	1.88	0.94	1.85	0.71	1.90	0.89	1.77	1.06	1.06	1.03	1.67	1.13

Table 18.B. Summary statistics, excess returns (%) value-weighted portfolios. This table reports summary statistics on the ten-year monthly value-weighted excess returns over the one-month T-bill rate – consistently with the way the market excess returns have been calculated by Dr. French. .

3.5 Results

As I wrote above, I test Hypothesis 1 and 2 by means of both equal- and value-weighted portfolios and abnormal returns are estimated through two asset pricing models across four cutoffs. Furthermore, I use regressions (11b) and (13b) to provide more colour on the potential advantage of being a material or immaterial sustainability outperformer rather than underperformer.

This implies that, for each of these two hypotheses, I need to comment 48 alphas. Such a large number of estimates requires me to define a consistent criterion to judge the evidence these figures provide.

For this reason, I reject (or not) Hypothesis 1, 2 by mainly looking at the alpha's estimates: i) derived through the Carhart four-factor model – as well as its augmented version, (13b); ii) related to both equal- and value-weighted portfolios; iii) constructed by means of the two strictest cutoffs – deciles and quintiles.

This criterion is sensible once the F-tests and adjusted R^2 of the estimated regressions are compared (see Table 19 and 20). Notice that both of them are higher for the Carhart rather than the Fama-French models, which justifies i). Furthermore, their comparison suggests that using equal- rather than value-weighted portfolios does not improve the regressions' fit, consistently with ii). Finally, they tend to be higher for weaker cutoffs as the less strict the cutoff, the more firms are included in each portfolio. Given the 486 average number of firms considered each year, as per Table 10, decile portfolios only include some 50 firms each year, hence the need to also look at quintile cutoffs – as said in iii).

All the remaining alphas – i.e. the ones associated with less strict cutoffs or estimated through the Fama and French original or augmented model – are used as robustness checks, to reinforce (or not) the conclusions drawn on the basis of i), ii), iii).

A similar criterion is used when analyzing alphas to test Hypothesis 3: its rejection is mainly decided looking at the alphas derived through the Carhart – original and augmented – model, estimated both on equal- and value-weighted portfolios. This decision follows the same rationale explained above. There is a consistent evidence that the four-factor model better approximates the behavior of portfolios and nothing supports the idea that a higher importance should be given to results referred to either equal- or value-weighted portfolios. Finally, I take into equal consideration quartile and tertile portfolios as alphas related to the former may be biased since they include an extremely low number of firms and the ones characterising the latter may be a little diluted by the generous cutoff.

Abnormal returns estimated by means of Fama and French three factor model are used as robustness tests. To conclude, I also track the abnormal performance of HM&HI and LM&LI portfolios in order to allow for a full comparison with Khan *et al.* (2015) results.

3.5.1 Hypothesis 1, HM *vs.* LM

Table 19 illustrates the abnormal returns generated by both equal- and value-weighted portfolios, formed according to companies' material sustainability performance.

Panel A reports the results related to decile and quintile cutoffs. For the sake of completeness, Panel B presents the estimates related to quartile and tertile cutoffs. Estimates in both Panel A, B are derived through the Carhart four-factor model as well as its augmented version, regression (13b). Finally, you can find the estimates related to Fama and French three-factor model and regressions (11b) in Panel C.

Focusing on the decile cutoff (Panel A), both equal- and value-weighted HM (High Material) portfolios generate a positive and significant annualized abnormal return. Such return is 3.55% for the equal-weighted portfolio (significant at 5%) and 4.00% for the value-weighted one (significant at 10%). This suggests that material sustainability affects more large cap companies' financial performance – consistently with the relevance of the pressure exercised by public scrutiny over multinationals, as highlighted in the literature review. The same abnormal returns referred to the LM (Low Material) equal- and value-weighted portfolios, obtained through decile cutoff, are not statistically different from zero instead. Regression (13b) provides evidence on the overperformance of HM only for the value-weighted case where the coefficient related to the dummy (Dummy H) taking value +1 for HM firms is positive (0.43%, i.e. an annualized 5.24%) and significant at 10% confidence level.

This is fully consistent with the results obtained in the US market by Khal *et al.* (2015). Quintile cutoffs lead to slightly less clear-cut results. Starting from equal-weighted portfolios, HM generates a 2.56% annualized alpha (significant at 10%) whereas the abnormal return associated to the LM portfolio is lower (2.48% *per annum*) but, contrarily to what emerged with decile cutoffs, significant at 10%. Value-weighted portfolios never generate a significant alpha.

Abnormal returns related to portfolios formed by means of quartiles and tertiles cutoffs do not always support the overperformance of HM (see Panel B).

More precisely, equal-weighted portfolios generate positive and significant abnormal returns both in the HM and in the LM case. Whereas HM's abnormal return beats LM's in the quartile cutoff (3.04% vs 2.71% *per annum*, significant at 5%), the opposite holds when tertile cutoffs are considered (2.63% vs 2.72% *per annum*, significant at 5%).

On the contrary, abnormal returns of value-weighted portfolios are never statistically significant. With reference to these results, whereas a positive and significant abnormal return of LM portfolios sometimes emerged in Khal *et al.* (2015) too, the non-significance of the abnormal returns associated to the value-weighted portfolios is not mirrored by an analogous evidence in the US market. Furtheremore, as a reminder, Khal *et al.* (2015) do not estimate the abnormal returns of portfolios constructed on the basis of tertile cutoffs, which is not considered as a strict enough criterion to establish a firm's material sustainability therefore, the evidence brought by tertile portfolios is to be weighed against this aspect.

Conducting the same analysis using the Fama and French (1993) three-factor model leads to a rather different conclusion.

In both equal- and value-weighted portfolios, the alpha associated with the top decile is positive, while the alpha associated with the bottom decile is negative. However, such alphas are not statistically significant in either case.

This trend is confirmed across the different cutoffs used. In particular, the alpha associated with HM portfolio is usually greater than the one associated with the LM one, both for equal- and value- weighted portfolios and the non-significance of alphas emerges in all the cutoffs considered.

Although the HM *vs.* LM differential alpha estimated by means of (11b) is never significant for equal-weighted portfolios, it is so when considering the value-weighted portfolio formed through the decile cutoff. Being included in the HM portfolio guaranteed an annualized abnormal return 5.24% greater than in the LM portfolio (significant at 10% confidence level), confirming the intuition emerged with the four-factor model: material sustainability performance is more financially relevant for large firms. To conclude, robustness checks performed through a different asset pricing model suggest the

generally non-significant financial impact of a portfolio strategy based on firms' material sustainability.

All in all, when abnormal returns are computed via Carhart (1997) four-factor model and the strictest cutoffs are considered, the beneficial effect of a high material sustainability over firms' financial performance emerges. In these cases, HM portfolios generate a positive and significant abnormal return, whereas I cannot reject the null hypothesis ($\alpha=0$) for LM ones, consistently with the evidence provided by Khan *et al*. (2015). However, robustness checks do not always support these results: on one hand, LM portfolios constructed by means of more accommodating cutoffs generate a positive and significant abnormal return – which exceeds the one refered to the symmetric HM portfolios in the tertile case; on the other hand, the vast majority of abnormal returns estimated through the Fama-French model are not significant.

Please see below Table 19: Panel A, B, C.

Table 19. Abnormal returns, companies ranked according to their material sustainability performance

Panel A. Carhart four-factor model: decile and quintile cutoffs

	Decile cutoffs									Quintile cutoffs								
	High			Low			High vs Low			High			Low			High vs Low		
	Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value		Estimate	p-value	
Equal-weighted portfolios																		
α	0.2914	0.0286	**	0.0938	0.5066		0.0680	0.6134		0.2113	0.0678	*	0.2045	0.0658	*	0.1988	0.0746	*
Dummy H							0.2492	0.1843								0.0181	0.9070	
MKT	1.0821	0.0000	***	1.0409	0.0000	***	1.0615	0.0000	***	1.0606	0.0000	***	1.0029	0.0000	***	1.0317	0.0000	***
SMB	0.1790	0.0115	**	0.2792	0.0003	***	0.2291	0.0000	***	0.1486	0.0160	**	0.1941	0.0012	***	0.1713	0.0001	***
HML	-0.2276	0.0008	***	-0.2665	0.0003	***	-0.2470	0.0000	***	-0.0890	0.1252		-0.0812	0.1454		-0.0851	0.0348	**
MOM	-0.2152	0.0000	***	-0.3159	0.0000	***	-0.2656	0.0000	***	-0.2110	0.0000	***	-0.2002	0.0000	***	-0.2056	0.0000	***
N	120			120			240			120			120			240		
Adj. R^2	0.9551			0.9482			0.9513			0.9661			0.9650			0.9652		
F-test	634.01	0.0000	***	546.01	0.0000	***	934.81	0.0000	***	847.66	0.0000	***	822.07	0.0000	***	1327.15	0.0000	***
Ann. α	**3.55%**		**	**1.13%**			**0.82%**			**2.56%**		*	**2.48%**		*	**2.41%**		*
Ann. Δα							**3.03%**									**0.22%**		
Value-weighted portfolios																		
α	0.3276	0.0576	*	-0.0645	0.6274		-0.0818	0.6129		0.1451	0.2184		0.1145	0.2603		0.1217	0.3212	
Dummy H							0.4268	0.0590	*							0.0162	0.9242	
MKT	1.0795	0.0000	***	0.8843	0.0000	***	0.9819	0.0000	***	1.0432	0.0000	***	0.9112	0.0000	***	0.9772	0.0000	***
SMB	-0.1083	0.2342		-0.1714	0.0163	**	-0.1399	0.0239	**	-0.0762	0.2226		-0.2414	0.0000	***	-0.1588	0.0008	***
HML	-0.4411	0.0000	***	-0.1903	0.0051	***	-0.3157	0.0000	***	-0.2347	0.0001	***	-0.0344	0.5002		-0.1345	0.0026	***
MOM	-0.2385	0.0000	***	-0.0635	0.1068		-0.1510	0.0000	***	-0.2271	0.0000	***	0.0025	0.9334		-0.1123	0.0000	***
N	120			120			240			120			120			240		
Adj. R^2	0.9218			0.9276			0.9124			0.9618			0.9603			0.9498		
F-test	351.69	0.0000	***	382.21	0.0000	***	498.71	0.0000	***	749.68	0.0000	***	720.24	0.0000	***	904.85	0.0000	***
Ann. α	**4.00%**		*	**-0.77%**			**-0.98%**			**1.76%**			**1.38%**			**1.47%**		
Ann. Δα							**5.24%**		*							**0.19%**		

*Table 19.A. Abnormal returns, companies ranked according to their material sustainability performance. Carhart four-factor model: decile and quintile cutoffs. This table reports alphas, factor loadings, p-values, adjusted R^2 and F-tests, from monthly calendar-time Carhart regressions. The upper (lower) part of the table displays results for equal- (value-)weighted portfolios. The regressions are estimated over 120 months from July 2008 to June 2018. MKT is the market excess return; SMB and HML are the Fama and French (1993) size and book-to-market factors; and MOM is the Carhart (1997) momentum factor. "High vs Low" columns refer to estimates from regressions 14(b) where "Dummy H" differentiates high material firms. ***, **, * indicate p-value lower than 1, 5, 10%, respectively.*

Panel B. Carhart four-factor model: quartile and tertile cutoffs

	Equal-weighted portfolios						Value weighted portfolios					
	Quartile cutoff			Tertile cutoff			Quartile cutoff			Tertile cutoff		
	High	Low	HvsL	High	Low	HvsL	High	Low	HvsL	High	Low	HvsL
α	0.2501	0.2230	0.2299	0.2170	0.2238	0.2357	0.1620	0.0496	0.0765	0.1270	0.0362	0.0640
	**	**	**	**	**	**						
Dummy H			0.0134			-0.0307			0.0585			0.0353
MKT	1.0478	1.0084	1.0281	1.0301	1.0113	1.0207	0.9998	0.9119	0.9559	1.0026	0.9321	0.9674
	***	***	***	***	***	***	***	***	***	***	***	***
SMB	0.1199	0.1791	0.1495	0.1435	0.1669	0.1552	-0.1751	-0.1825	-0.1788	-0.1884	-0.1992	-0.1938
	**	***	***	**	***	***	***	***	***	***	***	***
HML	-0.0542	-0.0990	-0.0766	-0.0316	-0.0646	-0.0481	-0.1562	-0.0971	-0.1267	-0.1342	-0.1029	-0.1186
		*	*				***	**	***	***	***	***
MOM	-0.2249	-0.2042	-0.2145	-0.2207	-0.1830	-0.2019	-0.2198	-0.0444	-0.1321	-0.2050	-0.0464	-0.1257
	***	***	***	***	***	***	***		***	***	**	***
N	120	120	240	120	120	240	120	120	240	120	120	240
Adj. R^2	0.9675	0.9675	0.9670	0.9707	0.9744	0.9723	0.9697	0.9646	0.9607	0.9728	0.9780	0.9697
F-test	886.05	887.93	1403.30	987.57	1133.54	1679.81	954.44	811.52	1168.03	1065.64	1322.18	1528.20
	***	***	***	***	***	***	***	***	***	***	***	***
Ann. α	**3.04%**	**2.71%**	**2.79%**	**2.63%**	**2.72%**	**2.87%**	**1.96%**	**0.60%**	**0.92%**	**1.53%**	**0.44%**	**0.77%**
	**	**	**	**	**	**						
Ann. Δα			**0.16%**			**-0.37%**			**0.70%**			**0.42%**

*Table 19.B. Abnormal returns, companies ranked according to their material sustainability performance. Carhart four-factor model: quartile and tertile cutoffs. This table reports alphas, factor loadings, p-values, adjusted R^2 and F-tests, from monthly calendar-time Carhart regressions. The upper (lower) part of the table displays results for equal- (value-)weighted portfolios. The regressions are estimated over 120 months from July 2008 to June 2018. MKT is the market excess return; SMB and HML are the Fama and French (1993) size and book-to-market factors; and MOM is the Carhart (1997) momentum factor. "HvsL" columns refer to estimates from regressions 14(b) where "Dummy H" differentiates high material firms. ***, **, * indicate p-value lower than 1, 5, 10% respectively.*

Panel C. Robustness test. Fama-French three-factor model: all cutoffs

	Equal-weighted portfolios												**Value-weighted portfolios**											
	Decile			Quintile			Quartile			Tertile			Decile			Quintile			Quartile			Tertile		
	H	L	HL	H	L	HL	H	L	HL	H	L	HL	H	L	HL	H	L	HL	H	L	HL	H	L	HL
α	0.16	-0.09	-0.09	0.09	0.09	0.08	0.12	0.10	0.10	0.09	0.12	0.12	0.19	-0.10	-0.17	0.01	0.12	0.06	0.03	0.02	0.00	0.01	0.01	-0.01
Dummy H			0.25			0.02			0.01			-0.03			0.43 *			0.02			0.06			0.04
MKT	1.12 ***	1.10 ***	1.11 ***	1.10 ***	1.04 ***	1.07 ***	1.09 ***	1.05 ***	1.07 ***	1.07 ***	1.05 ***	1.06 ***	1.13 ***	0.90 ***	1.01 ***	1.09 ***	0.91 ***	1.00 ***	1.04 ***	0.92 ***	0.98 ***	1.04 ***	0.94 ***	0.99 ***
SMB	0.23 ***	0.35 ***	0.29 ***	0.19 ***	0.24 ***	0.22 ***	0.17 **	0.22 ***	0.20 ***	0.19 ***	0.21 ***	0.20 ***	-0.06	-0.16 **	-0.11 *	-0.03	-0.24 ***	-0.13 ***	-0.13 *	-0.17 ***	-0.15 ***	-0.14 **	-0.19 ***	-0.17 ***
HML	-0.09	-0.06	-0.07	0.05	0.05	0.05	0.09	0.03	0.06	0.11 *	0.06	0.08 **	-0.28 ***	-0.15 **	-0.22 ***	-0.09	-0.04	-0.06	-0.01	-0.07	-0.04	0.00	-0.07 **	-0.04
N	120	120	240	120	120	240	120	120	240	120	120	240	120	120	240	120	120	240	120	120	240	120	120	240
Adj. R^2	0.94	0.92	0.93	0.95	0.95	0.95	0.95	0.96	0.95	0.96	0.97	0.96	0.91	0.93	0.91	0.95	0.96	0.95	0.96	0.96	0.96	0.96	0.98	0.96
F-test	664 ***	476 ***	839 ***	842 ***	821 ***	1241 ***	839 ***	862 ***	1265 ***	909 ***	1097 ***	1488 ***	390 ***	502 ***	573 ***	723 ***	969 ***	1047 ***	861 ***	1067 ***	1271 ***	974 ***	1714 ***	1632 ***
Ann. α	**1.99 %**	**-1.1 %**	**-1.1 %**	**1.04 %**	**1.04 %**	**0.93 %**	**1.41 %**	**1.23 %**	**1.24 %**	**1.04 %**	**1.39 %**	**1.40 %**	**2.26 %**	**-1.2 %**	**-2.0 %**	**0.13 %**	**1.40 %**	**0.66 %**	**0.38 %**	**0.28 %**	**-0.0 %**	**0.07 %**	**0.10 %**	**-0.1 %**
Ann. Δα			**3.03 %**			**0.22 %**			**0.16 %**			**-0.4 %**			**5.24 % ***			**0.19 %**			**0.70 %**			**0.42 %**

*Table 19.C. Abnormal returns, companies ranked according to their material sustainability performance. Robustness test. Fama-French three-factor model: all cutoffs. This table reports alphas, factor loadings, adjusted R^2 and F-tests, from monthly calendar-time Fama-French regressions. The LHS (RHS) of the table displays results for equal- (value-)weighted portfolios. The regressions are estimated over 120 months from July 2008 to June 2018. MKT is the market excess return; SMB and HML are the Fama and French (1993) size and book-to-market factors. "HL" columns refer to estimates from regressions 14(b) where "Dummy H" differentiates high material sustainability firms from low ones. ***, **, * indicate p-value lower than 1, 5, 10% respectively.*

3.5.2 Hypothesis 2, HI *vs.* LI

Table 20 reports the estimates of the regressions run to derive the abnormal returns of both equal- and value-weighted portfolios ranked according to companies' immaterial sustainability performance.

As when describing the results regarding Hypothesis 1, Panel A illustrates the estimates related to decile and quintile cutoffs whereas Panel B includes the ones related to quartile and tertile cutoffs. In both cases, alphas are derived through the Carhart four-factor model as well as its augmented version, regressions (13b). Panel C presents the results derived by means of the Fama and French three-factor model and regressions (11b), instead.

Panel A shows how the equal-weighted HI and LI decile portfolios generate both a positive annualized abnormal return equal to 3.69% and 3.31% (significant at 5% and 10%, respectively). The estimation of regression (13b) however does not detect any significant differential alpha between HI and LI. The same holds when quintile portfolios are considered. In this case, the annualized alpha associated with HI is 4.67% (significant at 1%) and the one associated with LI is 3.40% (significant at 5%) and the estimate of Dummy H – as per (13b) – is not statistically significant.

Focusing on value-weighted HI and LI decile (quintile) portfolios, abnormal returns' estimates tell a different story. Here only HI generates a significant annualized alpha of 3.97% (3.51%) and the estimate related to "*Dummy H*" suggests that HI firms have an incremental alpha with respect to LI ones of a 4.40% (4.43%) *per annum*.

Therefore, the core of my analysis leads to mixed results for what concerns the contribution of a low immaterial sustainability to a company's financial performance.
On one hand, equal-weighted LI portfolios generate a positive and significant alpha, although such abnormal return is always lower than, but not significantly different as per

(13b) from, the one characterizing HI portfolios. This suggests that neglecting immaterial issues is value-enhancing from the shareholders' perspective but anyway less beneficial than outperforming on those issues. On the other hand, when looking at value-weighted portfolios constructed with both decile and quintile cutoffs, only HI is characterized by a significant positive alpha and the "*High vs Low*" differential abnormal return – as per "*Dummy H*" – is likewise positive and significant.

Khan *et al.* (2015) obtain similarly mixed results on the impact of a low immaterial sustainability over companies financial performance, which is positive and significant for equal-weighted portfolios and not significant for value-weighted ones. However, in their case, a high immaterial sustainability does not lead to a significant, superior financial performance. Quartile and tertile cutoffs do not help solve such the conflictual evidence between Europe and the US but rather reinforce the differences emerged with the two stricter cutoffs (see Panel B).

The reason behind my results may lie in the methodlogy I use to classify immaterial issues, which is deemed to be more accurate than the one followed by Khan *et al.* (2015), as explained in section 3.1.

To sum up, Carhart regressions suggest that, provided that having a high immaterial sustainability performance always leads to positive and significant abnormal returns (higher for larger firms), if larger firms neglect immaterial sustainability issues this does not bring any financial advantage. On the contrary, smaller firms should not focus on immaterial issues as this leads to superior financial returns. This interpretation, similarly to what said while commeting Hypothesis 1, is consistent with the idea of Ciciretti *et al.* (2015) on the need of large multinationals' self-regulation due to public scrutiny: the large companies' advantage of neglecting sustainability issues is lower than the one of small companies.

As for Hypothesis 1, the significance of the abnormal returns derived through the Fama and French three-factor model diverges from the one emerged when the Carhart four-factor model is considered.

Robustness tests conducted on the basis of Fama and French three-factor model output homogeneous results when considering the strictest (decile) cutoffs: neither HI nor LI lead to abnormal returns significantly different from zero in the equal- and value-weighted case. The overall irrelevance of immaterial sustainability over firms' financial performance is reinforced by the estimation of regression (11b) whose coefficient associated with the dummy variable is not significant both for the equal- and the value-weighted portfolios.

This is consistent with Khal *et alia*'s results in the US market and is generally speaking confirmed by the majority of the other cutoffs. This does not happen in a few cases only. In particular, on one hand, HI portfolios generate a positive and significant annualized alpha of 3.02% and 2.79% when quintiles and quartile cutoffs are considered in equal-weighted portfolios. On the other hand, LI value-weighted portfolio computed on quintiles suffers a -2.6% annualized abnormal return (significant at 10% confidence level). The financial advantage of a high immaterial sustainability also emerges when estimating (11b) on value-weighted cutoff formed according to the quintile, quartile and tertile cutoffs. In these cases, HI are characterized by a differential annualized abnormal return of 4.43% and 4.19% and 3.04%, respectively. See Panel C.

Although robustness tests based on Fama and French model consistently suggest throughtout all specifications that there is no significant outperformance related to either a high or low immaterial sustainability performance – in line with the evidence in the US market – results in Panel A, the most relevant ones given the criterion I adopt to primarily test Hypothesis 2, are strongly in favour of the significant outperformance of HI *vs* LI –

and are further reinforced by estimates in Panel B. In this respect, the European equity market appears to factor in companies' immaterial sustainability performance in a very different way than the North American one.

A possible explaination for this contradictory evidence may be due to a mere methodologicalal aspect. Whereas Khan *et al.* (2015) use all data items available in KLD – matching only the KLD items with the sustainability issues defined as material by SASB and classifying as immaterial all the remaining KLD items – I restrict the Asset4 database making it fit to the Materiality Map® and hand-map both its material and immaterial sustainability items. However, such mixed results certainly require further investigations.

Table 20. Abnormal returns, companies ranked according to their immaterial sustainability performance

Panel A. Carhart four-factor model: decile and quintile cutoffs

	Decile						Quintile					
	High		Low		High vs Low		High		Low		High vs Low	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
Equal-weighted portfolios												
α	0.3022	0.0232 **	0.2718	0.0703 *	0.2379	0.0906 *	0.3814	0.0004 ***	0.2790	0.0203 **	0.2797	0.0115 **
Dummy H					0.0982	0.6151					0.1011	0.5093
MKT	1.0818	0.0000 ***	1.0433	0.0000 ***	1.0625	0.0000 ***	1.0487	0.0000 ***	1.0323	0.0000 ***	1.0405	0.0000 ***
SMB	0.2312	0.0012 ***	0.3219	0.0001 ***	0.2766	0.0000 ***	0.1070	0.0563 *	0.2178	0.0008 ***	0.1624	0.0001 ***
HML	-0.1214	0.0688 *	0.1050	0.1631	-0.0082	0.8718	-0.0988	0.0629 *	-0.0202	0.7358	-0.0595	0.1348
MOM	-0.1996	0.0000 ***	-0.2490	0.0000 ***	-0.2243	0.0000 ***	-0.2255	0.0000 ***	-0.2221	0.0000 ***	-0.2238	0.0000 ***
N	120		120		240		120		120		240	
Adj. R^2	0.9565		0.9483		0.9508		0.9711		0.9633		0.9672	
F-test	655.08		546.77		924.827		1001.43		781.61		1412.05	
Ann. α	**3.69%**	**	**3.31%**	*	**2.89%**	*	**4.67%**	***	**3.40%**	**	**3.41%**	**
Ann. HL α					**1.18%**						**1.22%**	
Value-weighted portfolios												
α	0.3250	0.0199 **	-0.0309	0.8569	-0.0327	0.8307	0.2880	0.0056 ***	-0.1253	0.2470	-0.0995	0.3370
Dummy H					0.3593	0.0920 *					0.3617	0.0127 **
MKT	1.0730	0.0000 ***	1.0239	0.0000 ***	1.0485	0.0000 ***	1.0039	0.0000 ***	1.0126	0.0000 ***	1.0082	0.0000 ***
SMB	-0.0232	0.7512	0.0260	0.7751	0.0014	0.9809	-0.2123	0.0001 ***	-0.0497	0.3857	-0.1310	0.0010 ***
HML	-0.0783	0.2607	0.0459	0.5952	-0.0162	0.7690	-0.1462	0.0052 ***	-0.1258	0.0220 **	-0.1360	0.0003 ***
MOM	-0.1698	0.0001 ***	-0.1187	0.0204 **	-0.1443	0.0000 ***	-0.1976	0.0000 ***	-0.1593	0.0000 ***	-0.1785	0.0000 ***
N	120		120		240		120		120		240	
Adj. R^2	0.9517		0.9221		0.9374		0.9694		0.9655		0.9673	
F-test	586.91	***	353.22	***	716.42	***	943.12	***	834.37	***	1413.15	***
Ann. α	**3.97%**	**	**-0.37%**		**-0.39%**		**3.51%**	***	**-1.49%**		**-1.19%**	
Ann. Δα					**4.40%**	*					**4.43%**	**

*Table 20.A. Abnormal returns, companies ranked according to their immaterial sustainability performance. Carhart four-factor model: decile and quintile cutoffs. This table reports alphas, factor loadings, p-values, adjusted R^2 and F-tests, from monthly calendar-time Carhart regressions. The upper (lower) part of the table displays results for equal- (value-)weighted portfolios. The regressions are estimated over 120 months from July 2008 to June 2018. MKT is the market excess return; SMB and HML are the Fama and French (1993) size and book-to-market factors; and MOM is the Carhart (1997) momentum factor. "High vs Low" columns refer to estimates from regressions 14(b) where "Dummy H" differentiates high immaterial firms. ***, **, * indicate p-value lower than 1, 5, 10%, respectively.*

Panel B. Carhart four-factor model: quartile and tertile cutoffs

	Equal-weighted portfolios						Value weighted portfolios					
	Quartile cutoff			Tertile cutoff			Quartile cutoff			Tertile cutoff		
	High	Low	HvsL	High	Low	HvsL	High	Low	HvsL	High	Low	HvsL
α	0.367 ***	0.258 **	0.258 **	0.288 ***	0.228 **	0.227 **	0.3245 ***	-0.0638	-0.0410	0.2686 ***	-0.0265	-0.0038
Dummy H			0.109			0.062			0.3428 **			0.2496 **
MKT	1.053 ***	1.026 ***	1.039 ***	1.057 ***	1.020 ***	1.039 ***	1.0071 ***	0.9868 ***	0.9969 ***	0.9998 ***	0.9846 ***	0.9922 ***
SMB	0.136 **	0.268 ***	0.202 ***	0.142 ***	0.247 ***	0.195 ***	-0.2033 ***	-0.0860 *	-0.1447 ***	-0.1799 ***	-0.0699	-0.1249 ***
HML	-0.079	0.038	-0.020	-0.055	0.011	-0.022	-0.1352 ***	0.0186	-0.0583 *	-0.0999 **	-0.0598	-0.0798 **
MOM	-0.231 ***	-0.218 ***	-0.225 ***	-0.219 ***	-0.209 ***	-0.214 ***	-0.2118 ***	-0.1099 ***	-0.1608 ***	-0.1951 ***	-0.1281 ***	-0.1616 ***
N	120	120	240	120	120	240	120	120	240	120	120	240
Adj. R^2	0.9721	0.9672	0.9694	0.9747	0.9735	0.9740	0.9724	0.9728	0.9717	0.9732	0.9779	0.9750
F-test	1037.22 ***	879.60 ***	1517.69 ***	1145.12 ***	1093.47 ***	1790.52 ***	1049.48 ***	1065.44 ***	1642.96 ***	1083.28 ***	1318.06 ***	1868.94 ***
Ann. α	**4.49% *** **	**3.14% ** **	**3.14% ** **	**3.51% *** **	**2.77% ** **	**2.76% ** **	**3.96% *** **	**-0.76%**	**-0.49%**	**3.27% *** **	**-0.32%**	**-0.05%**
Ann. Δα			**1.32%**			**0.74%**			**4.19% ** **			**3.04% ** **

*Table 20.B. Abnormal returns, companies ranked according to their immaterial sustainability performance. Carhart four-factor model: quartile and tertile cutoffs. This table reports alphas, factor loadings, p-values, adjusted R^2 and F-tests, from monthly calendar-time Carhart regressions. The upper (lower) part of the table displays results for equal- (value-)weighted portfolios. The regressions are estimated over 120 months from July 2008 to June 2018. MKT is the market excess return; SMB and HML are the Fama and French (1993) size and book-to-market factors; and MOM is the Carhart (1997) momentum factor. "HvsL" columns refer to estimates from regressions 14(b) where "Dummy H" differentiates high immaterial firms. ***, **, * indicate p-value lower than 1, 5, 10% respectively.*

Panel C. Robustness test. Fama-French three-factor model: all cutoffs

	Equal-weighted portfolios												**Value-weighted portfolios**											
	Decile			Quintile			Quartile			Tertile			Decile			Quintile			Quartile			Tertile		
	H	L	HL	H	L	HL	H	L	HL	H	L	HL	H	L	HL	H	L	HL	H	L	HL	H	L	HL
α	0.18	0.12	0.11	0.25 **	0.15	0.15	0.23 *	0.13	0.12	0.16	0.10	0.10	0.22	-0.1	-0.1	0.17	-0.2 *	-0.2 *	0.20 *	-0.1	-0.1	0.15	-0.1	-0.1
Dummy H			0.10			0.10			0.11			0.06			0.36			0.36 **			0.34 **			0.25 *
MKT	1.12 ***	1.09 ***	1.11 ***	1.09 ***	1.08 ***	1.08 ***	1.10 ***	1.07 ***	1.08 ***	1.10 ***	1.06 ***	1.08 ***	1.11 ***	1.05 ***	1.08 ***	1.04 ***	1.04 ***	1.04 ***	1.05 ***	1.01 ***	1.03 ***	1.04 ***	1.01 ***	1.02 ***
SMB	0.27 ***	0.38 ***	0.33 ***	0.16 **	0.27 ***	0.21 ***	0.19 ***	0.32 ***	0.25 ***	0.19 ***	0.29 ***	0.24 ***	0.01	0.05	0.03	-0.2 ***	-0.0	-0.1 **	-0.2 **	-0.1	-0.1 ***	-0.1 **	-0.0	-0.1 **
HML	0.01	0.27 ***	0.14 ***	0.05	0.13 *	0.09 **	0.07	0.18 ***	0.13 ***	0.09	0.15 ***	0.12 ***	0.03	0.12	0.08	-0.0	-0.0	-0.0	0.00	0.09 *	0.05	0.03	0.02	0.03
N	120	120	240	120	120	240	120	120	240	120	120	240	120	120	240	120	120	240	120	120	240	120	120	240
Adj. R^2	0.95	0.93	0.94	0.96	0.95	0.95	0.96	0.96	0.96	0.96	0.96	0.96	0.94	0.92	0.93	0.96	0.96	0.96	0.96	0.97	0.96	0.96	0.97	0.97
F-test	709 ***	566 ***	921 ***	908 ***	768 ***	1254 ***	921 ***	849 ***	1322 ***	1024 ***	1008 ***	1526 ***	680 ***	451 ***	824 ***	911 ***	914 ***	1369 ***	948 ***	1258 ***	1615 ***	1017 ***	1429 ***	1772 ***
Ann. α	**2.23 %**	**1.5 %**	**1.27 %**	**3.02 % ** **	**1.78 %**	**1.78 %**	**2.79 % *****	**1.55 %**	**1.51 %**	**1.91 %**	**1.26 %**	**1.21 %**	**2.7 %**	**-1.2 %**	**-1.1 %**	**2.07 %**	**-2.6 % *****	**-2.4 % *****	**2.42 % *****	**-1.5 %**	**-1.6 %**	**1.85 %**	**-1.2 %**	**-1.2 %**
Ann. Δα			**1.18 %**			**1.22 %**			**1.32 %**			**0.74 %**			**4.40 %**			**4.43 % ** **			**4.19 % ** **			**3.04 % *****

*Table 20.C. Abnormal returns, companies ranked according to their immaterial sustainability performance. Robustness test. Fama-French three-factor model: all cutoffs. This table reports alphas, factor loadings, adjusted R^2 and F-tests, from monthly calendar-time Fama-French regressions. The LHS (RHS) of the table displays results for equal- (value-)weighted portfolios. The regressions are estimated over 120 months from July 2008 to June 2018. MKT is the market excess return; SMB and HML are the Fama and French (1993) size and book-to-market factors. "HL" columns refer to estimates from regressions 14(b) where "Dummy H" differentiates high immaterial sustainability firms from low ones. ***, **, * indicate p-value lower than 1, 5, 10% respectively.*

3.5.3 Hypothesis 3, HM&LI *vs*. LM&HI

Table 21 reports the estimates of the regressions run to derive the abnormal returns of equal- and value-weighted portfolios ranked according to companies' concurrent material and immaterial sustainability performance.

Panel A illustrates the estimates related to quartile cutoffs whereas Panel B reports the ones related to tertile cutoffs. In both cases, alphas are derived through the Carhart four-factor model as well as its augmented version, regressions (13b). Panel C presents the results derived by means of the Fama and French three-factor model and regressions (11b), for both cutoffs.

The estimation of the augmented Carhart model for the equal- and value-weighted portfolios constructed by means of both quartile and tertile cutoffs suggests that none of the differential alphas associated to holding the HM&LI portfolio rather than the LM&HI (or the HM&HI and LM&LI) is significant. However, looking at the abnormal returns resulting from the Carhart four-factor model – generated by each individual portfolio – leads to a rather different conclusion. LM&HI portfolios are the best performing ones both when companies' weights are determined on an equal and market capitalization basis. These portfolios generate a significant 6.27% and 6.12% annualized abnormal return, respectively, when using quartile cutoffs; and a significant 3.54% alpha in equal-weighted portfolios defined through tertile cutoffs. The second best portfolio is the HM&HI one, whose relative annualized abnormal return is always significant, when quartile (tertile) cutoffs are used, and equal to 4.23% (3.18%) and 3.07% (3.04%) for equal- and value-weighted portfolios, respectively. HM&LI has a significant annualized alpha of 4.20% in the equal-weighted case only when quartile cutoffs are used whereas is never significant when portfolios are formed by sortinig companies into tertiles. Finally, only the equal-

weighted LM&LI portfolios leads to a significant annualized alpha of 2.93% and 2.95%, when quartile and tertile cutoff are used.

This suggests that all portfolios strategies based on mixed material and immaterial sustainability performance generate positive and significant abnormal returns which span from a maximum of 6.3% *per annum* for LM&IM portfolios, to a minimum 2.9% *per annum* for LM&LI ones. However, given the lower number of firms included in HL portfolios, results referred to HH and LL portfolios are more robust, as demonstrated by a consistently higher adjusted R^2 and F-statistics. Furthermore, notice that, given a certain portfolio, quartile cutoffs always lead to higher significant returns abnormal returns, suggesting that a severe sustainability stock-picking pays off.

Focusing on the estimates derived through the Fama and French three factor model, consistently with the results obtained estimating the abnormal returns by means of the Carhart four-factor model, the differential alpha associated to holding the HM&LI portfolio rather than the LM&HI (or the HM&HI and LM&LI) is never significant both for equal- and value-weighted portfolios. Likewise, the vast majority of alphas are not significant when portfolios are constructed via quartile cutoffs and no abnormal return is significant when they are formed via tertile cutoffs. More precisely, the only mixed portfolio that prove to generate some abnormal return is the equal-weighted LM&HI one, formed through quartile cutoffs. It leads to a 5.04% annualized alpha (significant at 10%). However, the coefficient resulting from the estimation of regression (11b), whose purpose is to assess what is the differential alpha associated to the HM&LI portfolio with respect to the LM&HI one, is not statistically significant.

The evidence across value- and equal-weighted portfolios and the two pricing models employed is that the LM&HI portfolios are the best performing ones, both when quartile

and tertile cutoffs are used. This is against the evidence emerged in the US market, where HM&LI portfolios were the outperformers.

Considering that the abnormal returns characterizing the HM&LI portfolio is significant only in one occasion and is not higher than none of the ones related to the LM&HI, I can strongly reject hypothesis 3. Notice however that, although both the core and robustness tests are in favour of a rejection of Hypothesis 3, the former indicates the presence of significant abnormal returns – hence suggesting such portfolios startegies do generate alphas – whereas the latter mainly leads to non significant estimates. This trend is observed while testing H1 and H2 too.

As a final remarks, it is important to highlight that these portfolios are constructed by relying on quartile and tertile – hence rather accommodating – cutoffs. This is a major difference with respect to the testing of H1 and H2, where decile and quintile cutoffs are used. Furthermore they include a lower average number of firms for than those which formed portfolios to test H1 and H2. In light of these considerations, such results are less robust than the ones related to H1 and H1 and should not be over-emphasised. This issue emerged also in Khan *et al.* (2015) and can only be solved by further investingating the topic, possibily trying to rely on a higher number of firms – hence benefiting, at once, from stricter cutoffs and larger portfolios.

You can find all the estimates just commented in Table 21, Panel A, B, C, in the next three pages.

Table 21. Abnormal returns, companies ranked according to their concurrent material and immaterial sustainability performance

Panel A. Carhart four-factor model: quartile cutoff

	HM&LI			LM&HI			HM&LI vs LM&HI			HM&HI			HM&LI vs HM&HI			LM&LI			HM&LI vs LM&LI		
Equal-weighted portfolios																					
	Est.	p-value		Est.	p-value		Est.	p-value		Est.	p-value		Est.	p-value		Est.	p-value		Est.	p-value	
α	0.3432	0.0664	*	0.5081	0.0164	**	0.5644	0.0046	***	0.3455	0.0226	**	0.4013	0.0167	**	0.2408	0.0997	*	0.285	0.083	*
Dummy HM&LI							-0.278	0.3129					-0.114	0.6235					0.013	0.953	
MKT	1.0047	0.0000	***	1.0157	0.0000	***	1.0102	0.0000	***	1.0949	0.0000	***	1.0498	0.0000	***	1.0372	0.0000	***	1.0210	0.0000	***
SMB	0.1818	0.0667	*	0.1132	0.3083		0.1475	0.0505	*	0.1528	0.0564	*	0.1673	0.0088	***	0.1955	0.0124	**	0.189	0.003	***
HML	0.0210	0.8216		-0.123	0.2430		-0.051	0.4741		-0.145	0.0558	*	-0.062	0.3026		-0.068	0.3554		-0.023	0.694	
MOM	-0.328	0.0000	***	-0.164	0.0086	***	-0.246	0.0000	***	-0.242	0.0000	***	-0.285	0.0000	***	-0.230	0.0000	***	-0.279	0.000	***
N	120			120			240			120			240			120			240		
Adj. R^2	0.9188			0.8824			0.8985			0.9466			0.9318			0.9456			0.9312		
F-test	337.51	0.0000	***	224.25	0.0000	***	424.31	0.0000	***	528.50	0.0000	***	653.99	0.0000	***	518.54	0.0000	***	648.5	0.0000	***
Ann. α	**4.20%**		*	**6.27%**		**	**6.99%**		***	**4.23%**		**	**4.92%**		**	**2.93%**		*	**3.48%**		*
Ann. Δα							**-3.28%**						**-1.36%**						**0.16%**		
Value-weighted portfolios																					
α	0.2930	0.1692		0.4966	0.0683	*	0.5630	0.0245	**	0.2525	0.0861	*	0.3354	0.0691	*	0.0272	0.8599		0.114	0.552	
Dummy HM&LI							-0.336	0.3325					-0.125	0.6246					0.093	0.728	
MKT	1.0141	0.0000	***	0.9025	0.0000	***	0.9583	0.0000	***	1.0233	0.0000	***	1.0187	0.0000	***	0.9702	0.0000	***	0.992	0.000	***
SMB	-0.271	0.0175	**	-0.233	0.1058		-0.252	0.0083	***	-0.13	0.0832	*	-0.203	0.0041	***	-0.124	0.1302		-0.198	0.007	***
HML	-0.069	0.5202		-0.040	0.7707		-0.054	0.5469		-0.162	0.0293	**	-0.115	0.0833	*	-0.016	0.8413		-0.042	0.542	
MOM	-0.420	0.0000	***	-0.115	0.1509		-0.268	0.0000	***	-0.212	0.0000	***	-0.316	0.0000	***	-0.121	0.0086	***	-0.271	0.000	***
N	120			120			240			120			240			120			240		
Adj. R^2	0.9019			0.7833			0.8386			0.9412			0.9148			0.9286			0.9043		
F-test	274.45	0.0000	***	108.52	0.0000	***	249.39	0.0000	***	477.25	0.0000	***	514.10	0.0000	***	387.78	0.0000	***	452.59	0.0000	***
Ann. α	**3.57%**			**6.12%**		*	**6.97%**		**	**3.07%**		*	**4.10%**		*	**0.33%**			**1.37%**		
Ann. Δα							**-3.96%**						**-1.49%**						**1.12%**		

Table 21.A. Abnormal returns, companies ranked according to their concurrent material and immaterial sustainability performance. Carhart four-factor model: quartile cutoff. This table reports alphas, factor loadings, p-values, adjusted R^2 and F-tests, from monthly calendar-time Carhart regressions. The upper (lower) part of the table displays results for equal- (value-)weighted portfolios. The regressions are estimated over 120 months from July 2008 to June 2018. MKT is the market excess return; SMB and HML are the Fama and French (1993) size and book-to-market factors; and MOM is the Carhart (1997) momentum factor. "HM&LI vs xM&xI" columns refer to estimates from regressions 14(b) where "Dummy HM&LI" differentiates HM&LI portfolios from the other mixed ones. ****, **, * indicate p-value lower than 1, 5, 10%, respectively.*

Panel B. Carhart four-factor model: tertile cutoff

	Equal-weighted portfolios							Value-weighted portfolios						
	HM&LI	LM&HI	HM&LI vs LM&HI	HM&HI	HM&LI vs HM&HI	LM&LI	HM&LI vs LM&LI	HM&LI	LM&HI	HM&LI vs LM&HI	HM&HI	HM&LI vs HM&HI	LM&LI	HM&LI vs LM&LI
α	0.142	0.2907 *	0.3467 **	0.2612 **	0.2923 **	0.2427 **	0.2687 **	0.2010	0.3009	0.3260 *	0.2502 **	0.2579 **	-0.023	0.0154
Dummy HM&LI			-0.261		-0.181		-0.153			-0.150		-0.065		0.147
MKT	0.9951 ***	0.9976 ***	0.9963 ***	1.0667 ***	1.0309 ***	1.0024 ***	0.9987 ***	0.9942 ***	0.9092 ***	0.9517 ***	1.0021 ***	0.9981 ***	0.9542 ***	0.9742 ***
SMB	0.1967 ***	0.1346	0.1657 ***	0.1564 **	0.1766 ***	0.1832 ***	0.1900 ***	-0.199 ***	-0.207 *	-0.203 ***	-0.177 ***	-0.188 ***	-0.150 ***	-0.174 ***
HML	0.0262	-0.061	-0.017	-0.078	-0.026	-0.076	-0.025	-0.065	0.0070	-0.029	-0.082	-0.073 *	-0.138 **	-0.102 **
MOM	-0.263 ***	-0.08	-0.171 ***	-0.227 ***	-0.245 ***	-0.205 ***	-0.234 ***	-0.201 ***	-0.030	-0.116 ***	-0.192 ***	-0.197 ***	-0.079 **	-0.140 ***
N	120	120	240	120	240	120	240	120	120	240	120	240	120	240
Adj. R^2	0.9493	0.9198	0.9315	0.9582	0.9537	0.9646	0.9561	0.9532	0.8658	0.9083	0.9579	0.9561	0.9593	0.9521
F-test	558.50 ***	342.26 ***	650.54 ***	682.32 ***	985.20 ***	812.15 ***	1043.2 ***	606.48 ***	192.99 ***	474.55 ***	677.42 ***	1041.0 ***	701.56 ***	951.19 ***
Ann. α	**1.72%**	**3.54% ***	**4.24% ****	**3.18% ****	**3.56% ****	**2.95% ****	**3.27% ****	**2.44%**	**3.67%**	**3.98% ***	**3.04% ****	**3.14% ****	**-0.3%**	**0.19%**
Ann. Δα			**-3.1%**		**-2.2%**		**-1.8%**			**-1.8%**		**-0.8%**		**1.8%**

*Table 21.B Abnormal returns, companies ranked according to their concurrent material and immaterial sustainability performance. Carhart four-factor model: tertile cutoff. This table reports alphas, factor loadings, adjusted R^2 and F-tests, from monthly calendar-time Carhart regressions. The LHS (RHS) part of the table displays results for equal- (value-)weighted portfolios. The regressions are estimated over 120 months from July 2008 to June 2018. MKT is the market excess return; SMB and HML are the Fama and French (1993) size and book-to-market factors; and MOM is the Carhart (1997) momentum factor. "HM&LI vs xM&xI" columns refer to estimates from regressions 14(b) where "Dummy HM&LI" differentiates portfolios with high material and low immaterial firms from the other mixed ones. ***, **, * indicate p-value lower than 1, 5, 10%, respectively.*

Panel C. Fama-French three-factor model: quartile and tertile cutoffs

	Quartile cutoffs							Tertile cutoffs						
	HM&LI	LM&HI	HM&LI vsLM&HI	HM&HI	HM&LI vsHM&HI	LM&LI	HM&LI vsLM&LI	HM&LI	LM&HI	HM&LI vsLM&HI	HM&HI	HM&LI vsHM&HI	LM&LI	HM&LI vs LM&LI
Equal-weighted portfolios														
α	0.1489	0.4107 *	0.4186 **	0.2020	0.2324	0.1049	0.1202	-0.0138	0.2436	0.2453	0.1268	0.1471	0.1213	0.1302
Dummy HM&LI			-0.2776		-0.1139		0.0134			-0.2607		-0.1812		-0.1527
MKT	1.0681 ***	1.0475 ***	1.0578 ***	1.1417 ***	1.1049 ***	1.0816 ***	1.0748 ***	1.0459 ***	1.0129 ***	1.0294 ***	1.1105 ***	1.0782 ***	1.0419 ***	1.0439 ***
SMB	0.2530 **	0.1489	0.2009 **	0.2053 **	0.2292 ***	0.2453 ***	0.2492 ***	0.2538 ***	0.1519 *	0.2028 ***	0.2057 ***	0.2297 ***	0.2277 ***	0.2407 ***
HML	0.2362 **	-0.0152	0.1105	0.0136	0.1249 **	0.0828	0.1595 **	0.1987 ***	-0.0088	0.0950 *	0.0708	0.1348 ***	0.0589	0.1288 ***
N	120	120	240	120	240	120	240	120	120	240	120	240	120	240
Adj. R^2	0.8942	0.8762	0.8839	0.9332	0.9131	0.9326	0.9127	0.9319	0.9186	0.9237	0.9458	0.9388	0.9530	0.9416
F-test	336.31	281.69	456.06	555.01	628.69	550.25	625.55	543.59	448.71	724.09	692.78	917.95	805.28	965.04
Ann. α	**1.80%**	**5.04%** *	**5.14%** **	**2.45%**	**2.83%**	**1.27%**	**1.45%**	**-0.17%**	**2.96%**	**2.98%**	**1.53%**	**1.78%**	**1.47%**	**1.57%**
Ann. Δα			**-3.28%**		**-1.36%**		**0.16%**			**-3.08%**		**-2.15%**		**-1.82%**
Value-weighted portfolios														
α	0.0441	0.4284	0.4044	0.1270	0.1482	-0.0446	-0.0465	0.0818	0.2829	0.2574	0.1363	0.1414	-0.0692	-0.0675
Dummy HM&LI			-0.3364		-0.1253		0.0926			-0.1501		-0.0647		0.1475
MKT	1.0954 ***	0.9247 ***	1.0100 ***	1.0643 ***	1.0798 ***	0.9937 ***	1.0445 ***	1.0331 ***	0.9151 ***	0.9741 ***	1.0393 ***	1.0362 ***	0.9694 ***	1.0012 ***
SMB	-0.1796	-0.2083	-0.1939 *	-0.0892	-0.1344 *	-0.0979	-0.1387 *	-0.1551 **	-0.2001 *	-0.1776 ***	-0.1353 *	-0.1452 ***	-0.1326 **	-0.1438 ***
HML	0.2070 ***	0.0358	0.1214	-0.0229	0.0920	0.0640	0.1355	0.0673	0.0270	0.0471	0.0440	0.0557	-0.0869	-0.0098
N	120	120	240	120	240	120	240	120	120	240	120	240	120	240
Adj. R^2	0.8644	0.7812	0.8216	0.9294	0.8912	0.9248	0.8864	0.9422	0.8667	0.9046	0.9478	0.9454	0.9575	0.9463
F-test	253.94	142.65	276.10	523.30	490.29	488.74	467.25	647.17	258.87	567.80	720.58	1035.59	893.70	1052.95
Ann. α	**0.53%**	**5.26%**	**4.96%**	**1.53%**	**1.79%**	**-0.53%**	**-0.56%**	**0.99%**	**3.45%**	**3.13%**	**1.65%**	**1.71%**	**-0.83%**	**-0.81%**
Ann. Δα			**-3.96%**		**-1.49%**		**1.12%**			**-1.79%**		**-0.77%**		**1.78%**

*Table 21.C Abnormal returns, companies ranked according to their concurrent material and immaterial sustainability performance. Fama-French three-factor model: quartile and tertile cutoffs. This table reports alphas, factor loadings, adjusted R^2 and F-tests, from monthly calendar-time Fama-French regressions. The upper (lower) part of the table displays results for equal- (value-)weighted portfolios. The LHS (RHS) refer to results from quartile (tertile) cutoffs. The regressions are estimated over 120 months from July 2008 to June 2018. MKT is the market excess return; SMB and HML are the Fama and French (1993) size and book-to-market factors. "HM&LI vs xM&xI" columns refer to estimates from regressions 14(b) where "Dummy HM&LI" differentiates HM&LI portfolios from the other mixed ones. ***, **, * indicate p-value lower than 1, 5, 10%.*

4. Conclusion

My analysis contributes to the current literature on the relation between a company's sustainable and financial performance by focusing on an as pivotal as still underrated topic: ESG materiality.

I use the Materiality Map® recently set up by the Sustainability Accounting Standard Board (SASB) and sustainability data available on Thomson Reuters Asset4 to investigate the impact of material and immaterial ESG issues on financial returns in Europe from 2008 to 2018.

Considering that the current literature is limited to the paper written by Khan *et al.* (2015), my thesis increases the evidence provided on this topic. In particular, I investigate ESG materiality in another, large equity market, the European one, and by using another, common sustainability database, Thomson Reuters Asset4.
Furthermore, in light of the fact that Asset4 is significantly more accessible than KLD – used by Khan *et al.* (2015) – other scholars willing to investigate ESG materiality may benefit from the methodology I define to distinguish material and immaterial Asset4 datatypes.

My results show that the evidence emerged in the US market applies to Europe only as long as material portfolios are concerned and only in the strictest – i.e. decile – cutoff. Contrarily to the US, immaterial sustainability leads to a significant positive abnormal returns too and the alpha associated with the LM&HI portfolio is the highest one – even if the evidence provided on the mixed portfolios should not be overemphasized given that weaker cutoffs are used to construct portfolios and a lower number of firms constitute them.

This implies that European market participants do not interpret in a different way whether listed companies engage in material or immaterial issues. Therefore, SASB classification is not successful in separating material from less material sustainability information for investment purposes, in Europe.

Such contradictory results are likely to be due to two reasons: first, the Materiality Map® is not specifically designed to be applied in Europe, given that it is based on the legal framework provided by SEC requirements; second, my methodology introduces a slighty stricter way to match Asset4 data with SASB immaterial sustainability issues, than the one adopted by Khan *et al.* (2015).

An extremely interesting area for future research would be investigating ESG materiality in the US by relying on Asset4 datatypes and comparing the resulting evidence with mine and those of Khan *et al.* (2015). Alternatively, KLD data may be used to conduct a similar study in Europe. Such a double check would allow to understand to which extent the contradictory evidence emerging in this study is due to the inapplicability of SASB Materiality Map® to markets outside the US or to my methodological decision to strictly match Asset4 database with the Materiality Map®.

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