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Corporate ESG News and The Stock Market

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Abstract

ESG investing's popularity has continually increased in the past five years. ESG data is increasingly integrated into investment processes. However, the information contained in ESG-related news for corporates has not been entirely exploited by institutional and long-only investors. The objective of this paper is to identify the benefits of ESG news information for active and factor-based investors. Indeed, one of the issues with ESG is the low frequency of scores updates. For active management, we analyze ESG-sorted portfolios in investment universes filtered by ESG news volume. Metrics of ESG-related news are sourced from Truvalue Labs, a provider of Artificial Intelligence powered ESG insights and analytics. We find that the approach of a universe focused on ESG news of corporates has been efficient in the early 2010s on the lower ESG-ranked side of the universe, but also on the higher ESG rank. More recently, it has positively contributed to more dynamic approaches of ESG investing. Finally, increasing the sensitivity to the highly visible SDGs significantly improves the return of ESG long-short portfolios.

Keywords: ESG, ESG sentiment, ESG materiality, SASB, SDG, multi-factor models, NLP.

JEL classification: C38, M14, Q56

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Walid Taleb joined Amundi in April 2020 in the Quantitative Research department. He worked on the analysis of the added value of ESG news related metrics and on the possibilities to intersect ESG frameworks. He is currently a student at the University of Paris Diderot in the Master of Random modelling, Finance and Data science (M2MO). Prior to that, Walid was a student at Ecole Centrale Marseille with a specialization in Mathematics, Management, Economics and Finance. He holds a Master degree in Quantitative Finance and Insurance from Aix-Marseille University.

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Fréderic Lepetit was appointed Head of Equity Quantitative Research at Amundi in January 2016. He joined SGAM in 2006 as Quantitative analyst on the Equity side and expanded the scope of his activity to the volatility asset class area after the SGAM-CAAM merge in 2010.

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Lauren Stagnol

Lauren Stagnol joined Amundi in 2014 as a Fixed-Income Quantitative Researcher for three years. From 2017 to 2020, she was a bond portfolio manager at Candriam in Belgium managing assets in euro aggregate and smart beta. In 2020, Lauren re-joined Amundi as a Quantitative Researcher. Her areas of research cover smart beta, factor investing and sustainable investing in both fixed-income and equities.

Lauren was awarded a PhD in Economics from Université Paris-Nanterre in 2017. She also holds a Master of Science in Applied Economics and Econometrics from Université Paris-Nanterre and a Bachelor of Science in Business Economics from Cardiff University (UK).

Key takeaways

Integrating ESG related news volume provides the following benefits for active management:

- In the 2010-2013 period, complementing ESG sorted portfolios with a filter on the number of ESG news volume was a very successful approach, mainly on the sorting in the lower 'edge' (Q_5 vs. Q_4) but also on the higher 'edge' (Q_1 vs. Q_2)
  - The most important effect of ESG news filtering is on the reversal of the ranking of the Q_5 vs. Q_4 performances for the non-sector-neutral ESG score in Eurozone.
  - The performance of Q_1 vs. Q_2 for non-sector-neutral ESG score in Eurozone is also improved with ESG news filtering.
  - In North America, we also have a significant improvement for the non-sector-neutral ESG for the Q_5 vs. Q_4 sorting.
- In the 2014-2019 period, complementing ESG sentiment sorted portfolios with a filter on ESG news was a successful active management approach also on the 'edges' (Q_1 vs. Q_2 & Q_5 vs. Q_4). In North America, filtering by news is preferred on reasonable news counts as increased spotlight brings stock price overreactions. We do not see this overreaction in Eurozone.
- With a filter on ESG news volume, we solve the Q_4 abnormal strong return puzzle[1] by filtering-out companies with low ESG news volume from the investment universe.
- Overlaying an SDG consistency filter on an ESG framework dramatically improves the financial materiality of ESG sentiment, with strong contribution from short selling.

We do not yet qualify ESG Sentiment as a factor, neither in EMU nor in North America.

[1] We mention the puzzle in Drei *et al.* (2019): the abnormal strong performance of the penultimate quintile sorted on Environment in Eurozone in the 2018-2019 period

Contents

1 Introduction

We have initiated a series of studies relative to the integration of ESG in asset pricing for both equities (Bennani *et al.*, 2018) and credit (Ben Slimane *et al.*, 2019). These studies are motivated by our findings on the stronger presence of ESG within asset pricing after 2014. In Drei *et al.* (2019), we note that in addition to the increasing *transatlantic divide* and the emergence of the Social pillar, there has been a recent shift from *static* to *dynamic* views of ESG scores. Indeed, we left our analysis with a puzzle where sorted portfolios representing ranked quintiles on ESG criteria displayed a significant return from the Q_4 quintile in excess of the other quintiles, therefore giving way to the assumption that investors had benefited from ESG improvers and/or momentum strategies which are by nature dynamic. In order to try to figure out determinants of such a puzzle, we extend our ESG quantitative analysis series by investigating if equity markets are sensitive to ESG news. News based data can have intra-day or daily frequency, which is higher than the update frequency of the ESG score dataset that we have been analyzing. This dataset is a description of corporates' ESG features which are assessed over the long-term and is updated in average on a monthly basis. We are keen to explore the added-value of higher-frequency ESG data for ESG investors.

News, financial markets and the continuing technological progress have long been intertwined. Before winning the Pulitzer Prize in 1996 for his editorials on environmental issues, Semple (1976) anecdotally reported in the New York Times that Paul Reuter who used a fleet of two hundred carrier pigeons would not recognize his news agency. News volume has grown exponentially and its impact spread to growing diverse range of areas. To illustrate, in the early 1990s, studies such as Mitchell and Mulherin (1994) brought advances on the relation between daily news announcements and securities' market activity. A decade later, Tumarkin and Whitelaw (2001) tested the relation between an internet financial forum activity and stock returns. Baker and Wurgler (2006) challenged the classical financial theory by integrating a *sentiment* index in the cross-section of stock returns to improve their predictions. The index was composed of six technical market derived proxies: the closed-end fund discount, the New York Stock Exchange share turnover, the average and first-day returns on Initial Public Offerings, the equity share in new issues and the dividend premium. But investor's attention would later focus on the Chicago Board Options Exchange's Volatility Index (Whaley, 2009), as the Global Financial Crisis (GFC) of the 2008-2009 period brought VIX to record levels. Both *sentiment* and VIX are indices which are market-wide and are not specific to given securities. More recently research has gone towards the security or corporate-specific dimension. Nassirtoussi *et al.* (2014) describe the multi-disciplinary framework at the intersection of linguistics, machine learning and behavioral-economics of '*market prediction based on online-text-mining*' in their reviewed works. They cover equity in the index form but also in the industry or single stock form. This area of research is adapting to its time as Shu *et al.* (2017) define the emerging *fake news detection* research field. It is worth noting that these new techniques are researched actively. The Federal Reserve for instance hosted a conference on *Nontraditional Data, Machine Learning, and Natural Language Processing in Macroeconomics* on October of 2019[2].

These news-related data have long been present in the ecosystem of ESG investors for E, S

[2] https://www.federalreserve.gov/conferences/nontraditional-data-machine-learning-natural-language-processing-in-macroeconomics-20191001.htm

and G aspects. Wright *et al.* (1995) show positive effects of announcements of U.S. Department of Labor awards for exemplary affirmative action on stock returns. Lorraine *et al.* (2004) find a significant relation in the U.K. between stocks and news on environmental fines. Carretta *et al.* (2011) find evidence that corporate governance news published in Italy's major financial newspaper has an effect on stocks in the Italian market. In recent literature, Aouadi and Marsat (2018) determine that ESG controversies have an impact on company value for high-attention firms while Dorfleitner *et al.* (2020) introduce controversy data within a Fama-French framework. Both studies however rely on a controversy dataset updated on a rather low frequency (annual) which might not be adapted to such metrics. Cui and Docherty (2020) draw on an event study methodology of market reaction to ESG news on a given day. The progress of artificial intelligence and machine learning techniques for natural language processing have also brought an entirely new potential to this family of ESG data sourced on unstructured (news) data.

The remainder of this paper is structured as follows. In Section 2 we will explore the effects of ESG news information for active management in the European Economic and Monetary Union (EMU) and North America regions. We will first use the sorted portfolio analysis and test if an increased visibility of ESG through its related news volume improves ESG quintile rankings. Then, we will measure if the overlay of the high-visibility Sustainable Development Goals (SDG) framework over the ESG news information improves ESG long-short portfolio profiles. In Section 3 we will test if ESG Sentiment has integrated yet into a traditional multi-factor framework.

2 Effects of ESG news in active management

2.1 Data

News based ESG Similar to Consolandi *et al.* (2020), we use an ESG metrics dataset from Truvalue Labs which encompasses the materiality issues of the Sustainability Accounting Standard Board (SASB). SASB is one of the main voluntary[3] reporting frameworks adopted by corporates to report on ESG issues. It aims to identify the key issues that are material for companies depending on their industry classification. If an issue is likely to affect the financial condition or the operational performance of a company, it is considered financially material. On the one hand, SASB classifies extra-financial issues into five dimensions – environment, social capital, human capital, business model & innovation and leadership & governance – composed of twenty-six general issue categories. On the other hand, SASB created the Sustainable Industry Classification System (SICS) which can be split in eleven sectors and seventy-seven industries. Having the issues and the sectors, SASB uses its Sector vs. Issue *Materiality Map*[4].

As precised in Malinak *et al.* (2019), Truvalue Labs applies AI-driven technology to over 115,000 unstructured text sources in 13 languages, including news, trade journals, and nongovernmental organizations and industry reports, to provide daily signals that identify positive and negative ESG behavior. Its coverage spans over 19,000 public and private companies and generates short-term,

[3] As indicated by the Unites States Government Accountability Office (2020), the U.S. Securities and Exchange Commission (SEC) requires disclosure for all *material* information, but the reporting of material ESG information is not regulated as of the date of writing.

[4] https://materiality.sasb.org/

long-term, and momentum scores derived from hundreds of signals. These signals are mapped against the SASB standards allowing investors to evaluate ESG risk factors and real-world actions and impacts for quantitative analysis and backtesting. For each SASB issue, the Truvalue Labs score for a corporation is composed of:

- *Pulse*, which is a measure of near-term performance changes that highlights opportunities and controversies, enabling ongoing monitoring of companies. It focuses on events of the day and provides a responsive signal to alert investors to dynamic moves.[5]
- *Insight*, the measure of a company's longer-term ESG track record, similar to a rating system. Scores are less sensitive to daily events and reflect the enduring performance record of a company over time. Scores are derived using an exponentially weighted moving average of the Pulse and the half-life of an event's influence of the overall score is six months.
- *Volume*, which measures the total number of unique articles captured over a twelve month trailing (TTM) period. It is a measure of information flow.

By aggregating over all available or only material[6] SASB issues daily scores for each corporate, we obtain Pulse, Insight and Volume as displayed in Figure 1. As the Truevalue Pulse (and therefore Insight) scores are not trained on price or return information, they reflect the *sentiment* on ESG topics and are not designed to be predictive on stock market indicators[7]. For the sake of clarity, when mentioning Truvalue Insight Score, we will be referring to the score with the SASB Materiality framework. This score is our proxy for ESG Sentiment. Likewise, Truvalue Volume is our proxy for ESG news volume. As illustrated on a given date, the cross-section distribution of Truvalue Volumes in Appendix A.2 on page 34 could be fitted to the sum of two Weibull or two Gamma distributions with different parameters. In other words, they are not Gaussian. We identify with Figure 9 that after 2013, we can achieve acceptable coverage for the North America and Eurozone universes filtered by the number of material news in the past twelve months (over 70% of capitalization for North America with a minimum of 15 news and over 60% of capitalization for Eurozone with a minimum of 15 news). As for SASB issues, the average market cap covered across the issues has improved significantly - between January 2008 and September 2019 - from 28% to 80% in EMU and from 42% to 86% in North America. Environmental issues are more reported in EMU while Social issues are more reported in North America. We report the top and bottom SASB issues for coverage in the month of September 2019 and their levels in January 2008 in Table 1 and Table 2 while the full Tables are reported in Appendix A.1 on page 30.

[5]The daily Pulse score ranges from 0 to 100 with 50 considered neutral.
[6]materiality is defined by SICS sector
[7]discussion with Truvalue Labs

Table 1: Top and Bottom SASB issues for coverage in Market Cap - EMU

SASB criteria	2008-01	2019-09
Business Ethics	48.6	94.8
Product Quality and Safety	35.6	94.0
GHG Emissions	49.8	93.1
⋮	⋮	⋮
Business Model Resilience	23.2	65.7
Physical Impacts Of Climate Change	13.7	64.3
Systemic Risk Management	4.2	28.7

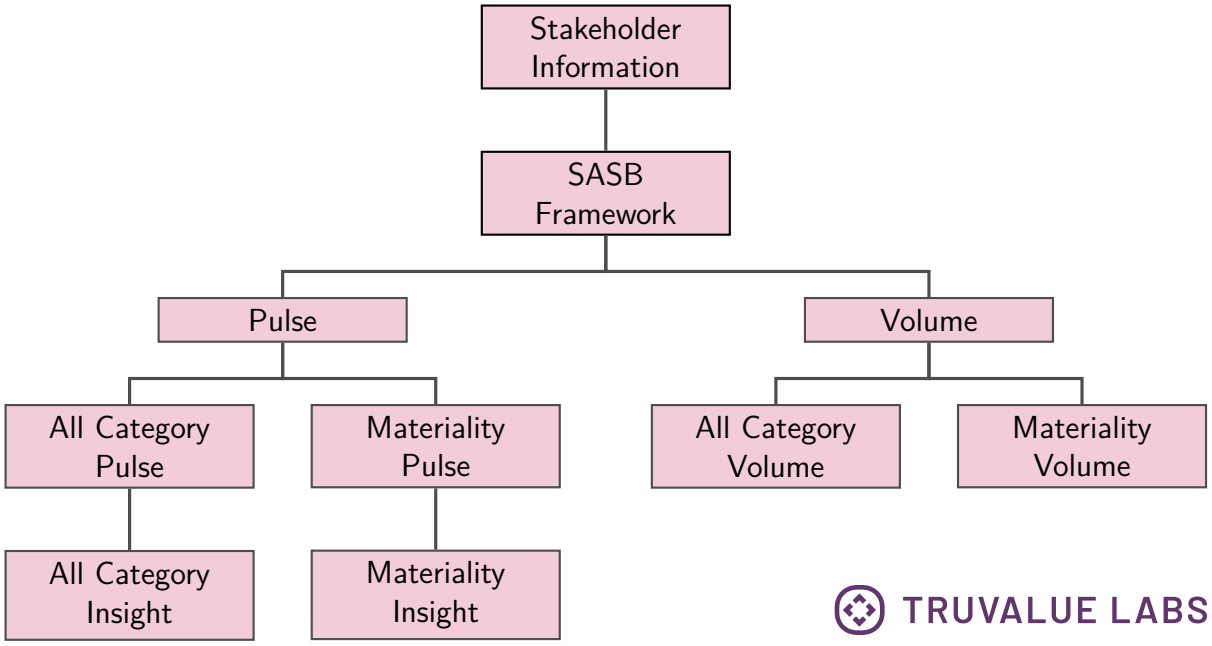
Source: MSCI, Truevalue Labs. Authors' calculations

Table 2: Top and Bottom SASB issues for coverage in Market Cap - North America

SASB criteria	2008-01	2019-09
Business Ethics	61.4	98.7
Labor Practices	59.3	97.9
Employee Engagement Diversity and Inclusion	52.6	97.4
⋮	⋮	⋮
Human Rights and Community Relations	26.5	76.8
Business Model Resilience	27.6	71.8
Systemic Risk Management	12.2	32.0

Source: Truvalue Labs. Authors' calculations

Figure 1: Truvalue Labs data - from Stakeholder Information to data

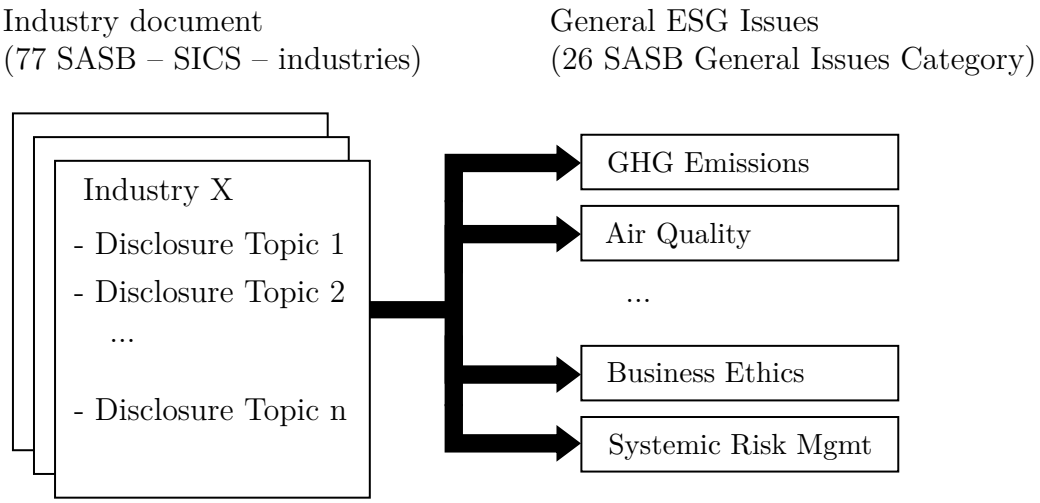


Source: Truvalue Labs

ESG score For this research article, we use the ESG scores which are provided by Amundi's ESG Scoring & Methodology team. For each company, monthly scores are assessed for ESG, the three E, S and G pillars as well as sub-components and additional special scores such as the Energy Transition score. These scores are based on data from four external providers as well as specialized providers for specific ESG metrics (for eg. electric cars in the automobile industry)[8]. The scores are normalized sector-by-sector and have a range between -3 and +3. In addition, in the case of specific ESG events, our analysts can decide to adjust the ESG scores for corporations within the month. The advantage of Amundi's ESG score is that it provides us with a true *point-in-time*[9] ESG score since 2010.

ESG frameworks For the mapping exercise between the two ESG frameworks (SASB issues and SDGs), documents are obtained from the United Nations and SASB's websites. Text about the twenty-six general ESG issues considered by the SASB is formed by aggregating for each issue the text summary of each disclosure topic in each industry related to this issue[10]. For illustration purposes, Table 3 shows the disclosure topics and the associated general issues for the coal operations industry. Text regarding the SDGs is comprised of the target and metric description from the United Nations website.

Figure 2: Illustration of data forming process



Source: SASB

[8]Internal ESG analyst who are sector specialists review and validate the quality of providers for their sectors.

[9]The point-in-time concept is critical in a backtest framework because it ensures that when we retrieve past data, it is the data without the look-ahead bias which is accessed.

[10]The topics described for each industry are considered material. There are 492 instances of material topics across the 77 industries.

Table 3: Example of the Coal Operations Industry

Disclosure Topic	**Associated General Issue**
Greenhouse Gas Emissions	GHG Emissions
Biodiversity Impacts	Ecological Impact
Right of Indigenous People	Human Right and Community Relations
Community Relations	Human Right and Community Relations
Reserves of Valuation & Capital Expenditures	Business Model Resilience
...	...

Source: SASB

2.2 Methodology

In our previous research on the integration of ESG in asset pricing and portfolio management [11], we described active management with the Fama and French (1993) sorted portfolio approach. We ranked stocks by their score and we form (sector neutral) buckets of 20% with Q_1 being the best ranked bucket and Q_5 being the worst ranked one. We used a quarterly rebalancing frequency of these buckets to simulate an active management approach with a reasonable turnover.

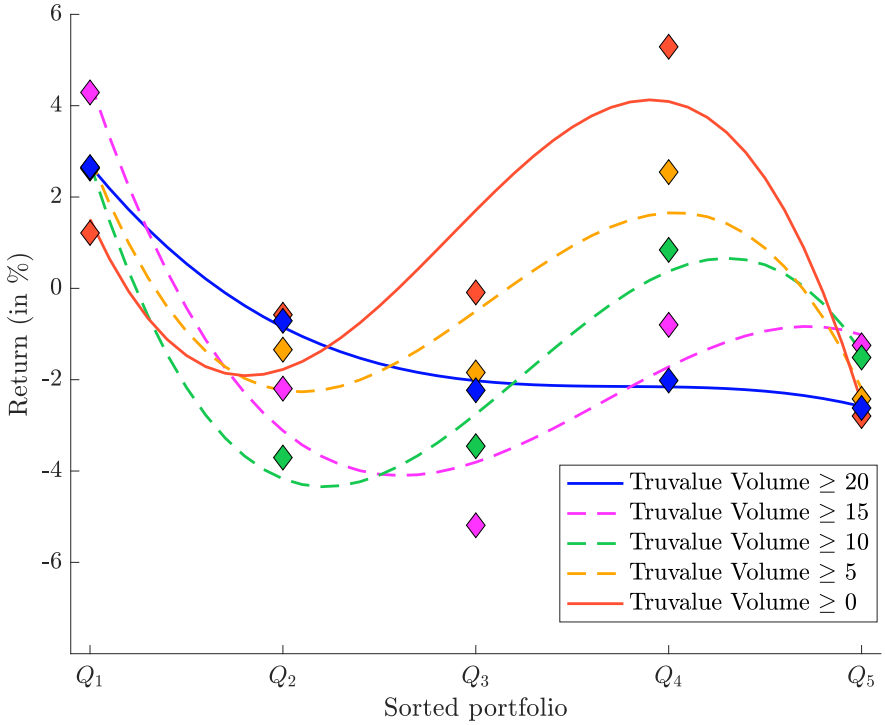
For the short 2018-2019 period, we had identified[12] that although we had an interesting Q_1 over Q_5 performance difference, the Q_4 quintile was displaying abnormal returns. We called this abnormality our Q_4 *puzzle*. ESG news volume indicates an increased attention brought to investors, lenders, employees and all stakeholders. If the *Efficient Market Hypothesis* (EMH) holds, differences in news volumes should not bring changes in asset returns as the hypothesis is based on all available information being integrated in the asset prices. The *EMH* dates back to the 1960s – Fama (1965) and Samuelson (2016) – but is not an obsolete concept and is still being studied currently Delcey (2019). However, in the case of ESG news we are in the particular situation where these ESG news – which were explicitly considered *extra-financial* – are migrating to the mainstream of financial news. Thus, we argue that there are still opportunities for active managers as long as ESG news are not fully mainstreamed. We can also interpret this conclusion within the paradigm of the *Adaptive Markets Hypothesis* (Lo, 2004). We have an *ecology* with two *species* (a.k.a market participants): our first species are ESG-driven investors while our second species consist in investors who consider that ESG is and remains extra-financial. In the current *context* of deep changes in business conditions, we can witness that the population is transitioning from the second to the first ESG-driven species.

We measure how the sorted portfolios react when we filter our universe by number of news, focusing on the firms with a higher ESG visibility for good or bad publicity. More specifically, we filter out the firms with low Truvalue Volume and we test different thresholds. By doing so at the most stringent level (20 in the trailing twelve months) we keep a very decent firm coverage as displayed in Figure 9 in page 32. By increasing the Truvalue Volume in the last twelve month period and with monthly rebalance, we find *strong* results illustrated in Figure 3:

[11] Bennani *et al.* (2018) and Drei *et al.* (2019)
[12] Drei *et al.* (2019)

- The Q_1 to Q_5 return difference remains stable
- The Q_4 anomaly is flattened out
- The Q_1 to Q_5 quintiles are better sorted with increased news volume in the universe filter

Figure 3: Annualized return of sorted portfolios (Eurozone, Environmental, 2018-2019) - Universe filtered from Truvalue Volume ≥ 0 to Truvalue Volume ≥ 20



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

For the active management perspective, we will explore how the filtering universes by volume of news improves the sorted portfolio results over the longer term. As we had identified[13] we keep a period break before and after 2013. Our findings are consistent with the report from the Investment and Enterprise Division of the United Nations Conference on Trade and Development (2020) on the 'explosion' (both in the number and assets under management of ESG ETFs). The integration of such news filter implies that we introduce a difficulty to create sector neutral quintiles especially in Eurozone as displayed in Figure 10 on page 33. We therefore analyze the effect of Truvalue Volume filters on Truvalue Insight Score, sector-neutral ESG and non-sector-neutral ESG. Regarding the mapping between SASB issues and SDGs, we will use a routine using the simpler of NLP techniques that we have tested[14]. From this mapping, we can analyze a SDG focused long-short investment strategy.

[13] Bennani *et al.* (2018)

[14] definition of distances is discussed in Appendix B.2 on page 42.

2.3 Trailing Twelve Month Truvalue Volume

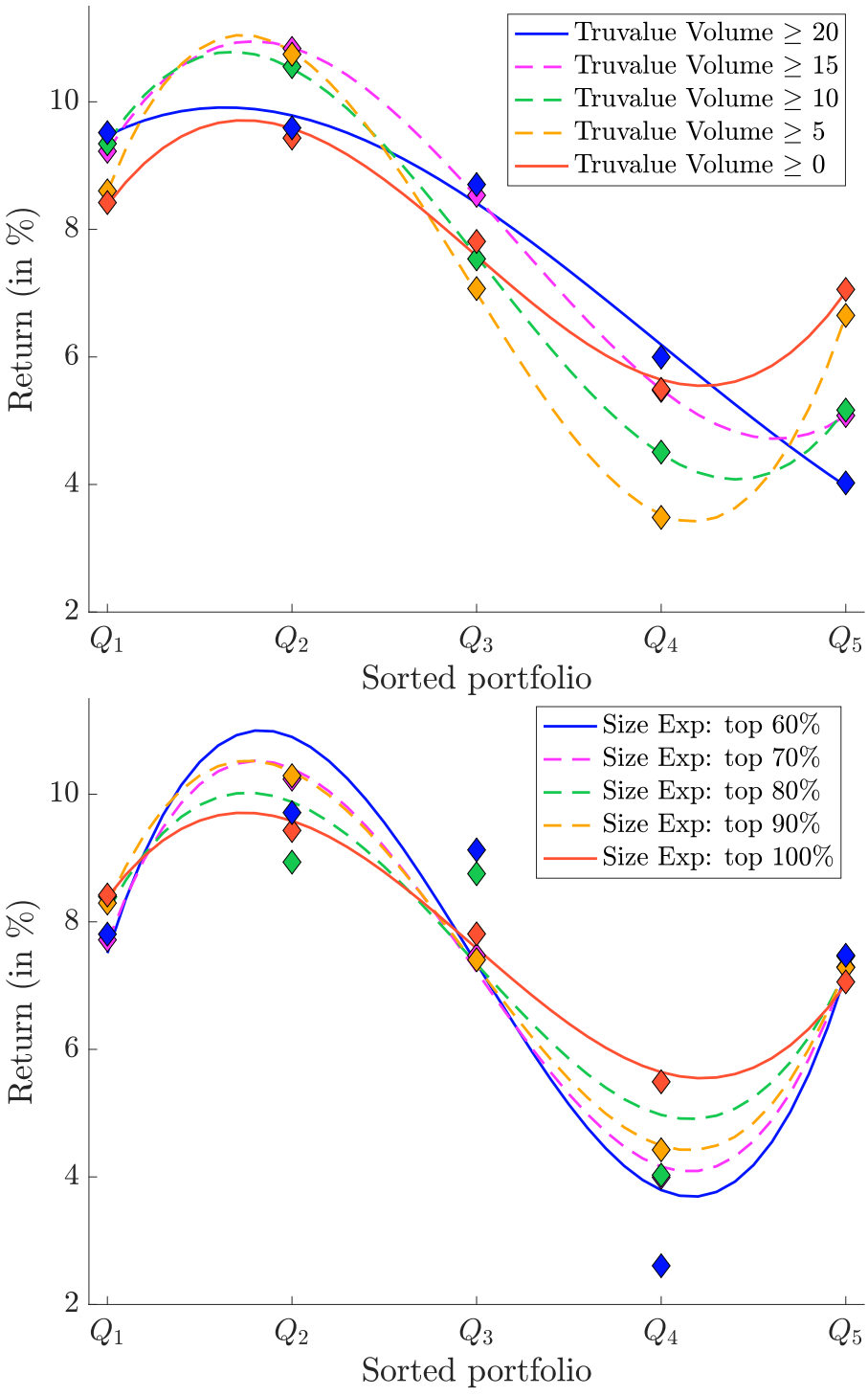
ESG Volume is not Size Drempetic *et al.* (2019) find positive relations between ESG scores from an ESG provider[15] and company size. More specifically they study the inter-relations between size, resources and improvement in resources for providing ESG data, ESG data availability and ESG score. We also expect Truvalue Volume and Size to be strongly related as in average larger corporates have larger resources for ESG reporting and communication as well as larger media coverage. A very simple average of Spearman correlation in Figure 13 and Figure 14 on page 35 calculated on monthly data between January of 2008 and September of 2019 indeed indicates a positive relation between Truvalue Volume and Size[16]. As we will engage in news filtering we are interested *to confirm or to debunk the assertion that filtering by increasing ESG news volume (Truvalue Volume) is equivalent to filtering by increasing Size.* As displayed in Figure 4, we implement the sorted portfolio approach for the EMU region of the Truvalue Insight Score. There is a slight difference between the 'no Truvalue Volume filter' and the 'top 100% for Size' as the universe for the volume filter analysis on Figure 4 (top) is also bound to the coverage of the Truvalue data, while the universe for the size filter on Figure 4 (bottom) is exactly MSCI EMU. However with the increase of the news volume, we see a positive effect for the ranking of the returns of the Q_4 vs. Q_5 quintiles. The more the universe is filtered on increased news coverage, the lower the returns of the last quintile relative to the Q_4 quintile. We observe that with a *Truvalue Volume* $\geq$ *20* filtering, the return difference between Q_1 and Q_2 is flattened. We do not have such desired effects when we simply filter our universe on higher Size as the return of Q_1 remains under the return of Q_2 in the size filter analysis on Figure 4 (bottom). We therefore conclude that Truvalue Volume contains information which is not strictly Size.

Truvalue Volume filter We find that Truvalue Volume is relevant to improve the Quintile Rankings on the 'edges' (Q_1 vs. Q_2 & Q_5 vs. Q_4):
For the EMU region, maintaining sector-neutrality when increasing the Truvalue Volume filter is a strong constraint as it reduces the universe in given sectors, thus limiting the capacity to split all sectors in quintiles. *The strong effect of ESG news filtering is on the ranking of* Q_5 *vs.* Q_4 *for non-sector-neutral ESG score in EMU in the 2010-2013 period* which is displayed in Figure 17 (left) on page 37. The initial non filtered situation is significantly negative with a strong outperformance of Q_5 which is inverted by the effect of ESG news filtering. On the other side of the spectrum, Q_1 vs. Q_2 is also improved but the initial situation was not as negative as the Q_5 vs. Q_4 situation. In North America, as displayed in Figure 20 (left) on page 38 we also have a significant improvement for the non-sector-neutral ESG for the Q_5 vs. Q_4 ranking in the 2010-2013 period, although the initial situation was not as bad as for the EMU situation. We reiterate that the evolutions of market cap coverage of news volume filtered universe in EMU and in North America in Figure 9 on page 32 remain at a decent level with universes after 2013 for Truvalue Volume larger than fifteen remaining over sixty percent in market cap for EMU and seventy percent for North America.

As previously mentioned, filtering with volume has a positive effect for the ranking of Q_1 vs. Q_2 and Q_5 vs. Q_4. for Truvalue Insight Score in EMU. *In North America, however we identify that*

[15] Asset4 - Thomson Reuters
[16] the relation is negative as we invert the Size exposure to seek the small caps factor effect

Figure 4: Annual return of sorted portfolios (EMU, Truvalue Insight Score, 2014-2019) - Truvalue Volume filter (top) and Size filter (bottom)



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

both in the 2010-2013 and the 2014-2019 periods, the filtering with volumes improves when reducing the universe only slightly (Truvalue Volume ≥ 10) as displayed in Figure 18 on page 37. When we keep increasing the ESG news volume and reducing the universe to stocks heavily covered by ESG news, the improvement disappears as displayed in Figure 18 (right). This finding, though counter-intuitive is consistent with the hypothesis of Cui and Docherty (2020) of overreaction to ESG controversies for stocks listed in the NY Stock Exchange, NYSE MKT, NASDAQ and NYSE Arca Stock Exchange.

In addition, we identify that including ESG news coverage has a positive effect for the Q_5 vs. Q_4 ranking for sector-neutral ESG sorted portfolios both in 2010-2013 and in 2014-2019 in North America. The second 2014-2019 period is interesting because the initial out-performance of Q_5 is flattened as displayed in Figure 19 (right) on page 38. As for the sector-neutral ESG sorted portfolios in EMU, we note an improvement for the Q_1 vs. Q_3 sorted portfolios return difference in Figure 16 (right) on page 36. Our findings are summarized in the Table 4 and Figure are available in Appendix A.4 on page 36.

Table 4: Impact of universe filtering by Truvalue Volume on sorted portfolio returns

EMU	2010-2013	2014-2019
Truvalue Insight Score (not-sector-neutral)		+ Q_1-Q_2 & Q_4-Q_5
Amundi ESG (sector-neutral)	+ Low Volume*	+ Q_1-Q_3
Amundi ESG (not-sector-neutral)	++ Q_4-Q_5 + Q_1-Q_2	

North America	2010-2013	2014-2019
Truvalue Insight Score (not-sector-neutral)		+ Low Volume*
Amundi ESG (sector-neutral)	+ Q_4-Q_5	++ Q_4-Q_5
Amundi ESG (not-sector-neutral)	++ Q_4-Q_5	

Source: Amundi

*: *Low Volume: positive effect when we filter the universe with low Truvalue Volume thresholds*

2.4 An SDG overlay

We run a simple routine to find common keywords between SASB issues and SDGs. We have raw text for each issue and goal on which we remove stop-words and that we lemmatize. On these processed texts, we run a Term Frequency-Inverse Document Frequency (TF-IDF) score. We create a dictionary of the five words with the highest TF-IDF in each text. We enrich our dictionary with supplemental keywords obtained from UNCTAD's Trade and Development Board[17]. We then intersect the keywords for the SASB issues and the SDGs to obtain the array of common keywords displayed in Figure 5.

Based on a simple row wise mean and ranking, we select the issues that relate the most to the SDGs. Then, within the selected issues from B.3 on page 44, we drop industries which have strictly less than three common issues between both frameworks. Figures 26 and 27 on page 45 indicate that with three common issues or more, we still cover between thirty and forty percent of the EMU universe and about thirty percent of the North America universe in market cap. As a consequence, we are dropping the twenty-nine industries out of seventy-seven where there are two or less common keywords between SASB issues and SDGs as explicited in Table 5 on page 19. As SDGs target countries primarily, we accept this imperfect matching. We split the filtered universe (representing between thirty and forty percent of the EMU universe and about thirty percent for the North America universe) in two halves (H_1 of higher sentiment and H_2 of lower sentiment) and run a long-short strategy. We identify that since 2012 in North America and 2013 in Eurozone, this strategy based on ESG sentiment filtered on consistency between SASB materiality issues and SDGs has been outperforming the ESG sentiment long-short strategy. The cumulative returns are displayed in Figure 6 (top for EMU and bottom for North America) on page 21. The returns are displayed against the returns for the Q_1 - Q_5 long-short strategy for All Categories ESG Sentiment and (Material) ESG Sentiment for the corresponding regions. Unfortunately for long-only investors, most of the return has been driven by the short side. Indeed the same analysis with only the effect of the higher half H_1 as displayed in Appendix B.5 on page 46 does not yield the same returns. As a matter of fact, that does not mean that this opportunity has been lost. Indeed the United Nations Principles for Responsible Investment (2012) has established a PRI Hedge Funds Working Group which highlights in a Discussion Paper that in 2012 the integration of ESG factors in the hedge fund industry was *'only now emerging as a practice'*. Regarding the specific practice of short selling, the Working Group considers that it is part of a well functioning market, with no interest in a manicheistic view on the practice.

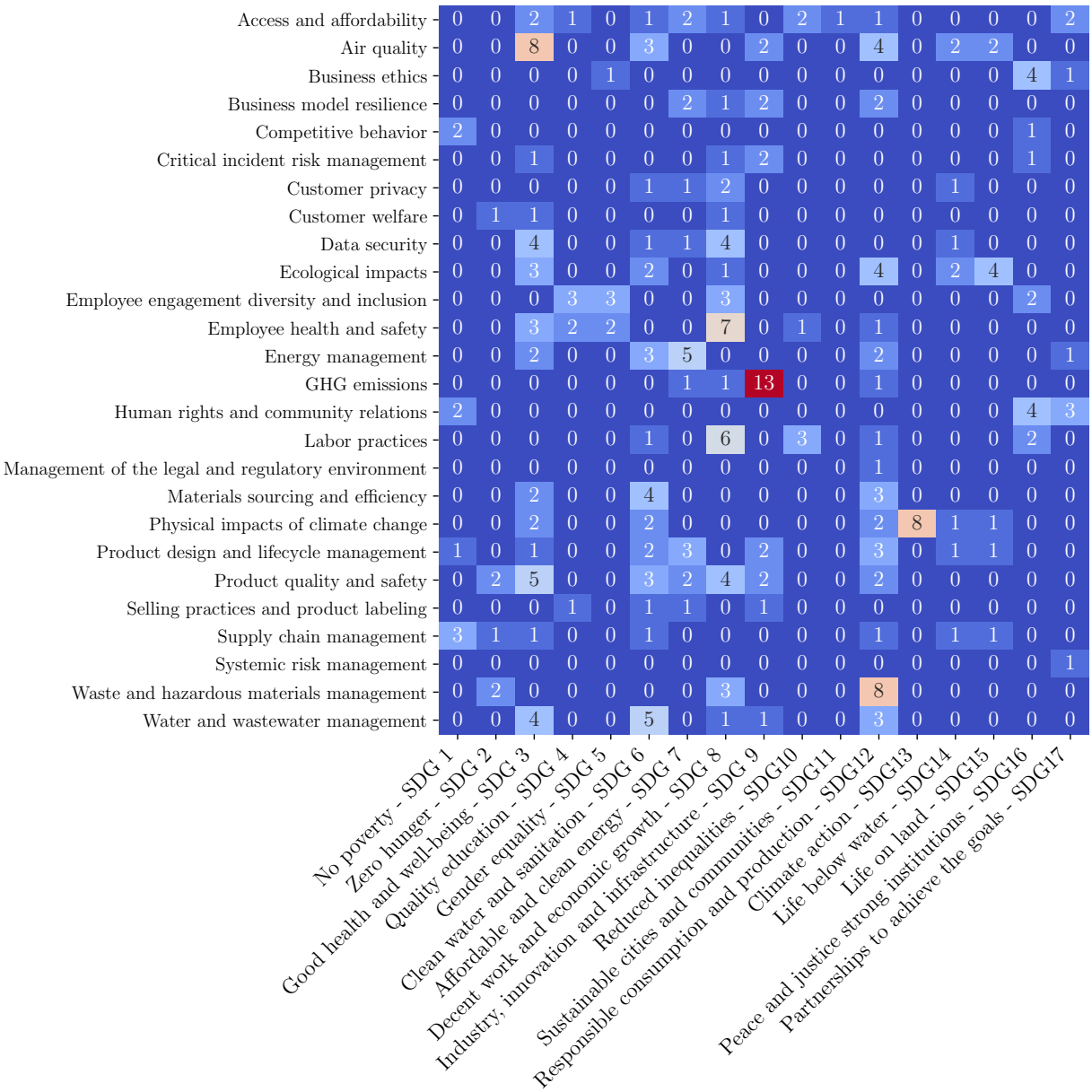
Table 5: number of industries vs. the number of material issues

Number of material issues	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Number of industries	*6*	*12*	*11*	*16*	*10*	*10*	*7*	*3*	*2*

Source: Amundi, Authors' calculations

[17]Core Indicators for Company Reporting on the Contribution Towards the Attainment of the Sustainable Development Goals: https://isar.unctad.org/wp-content/uploads/2017/12/ISAR-34-non-paper-31102017.pdf

Figure 5: Number of common Keywords between SASB issues and SDGs



Source: SASB, UN. Authors' calculations

Figure 6: Cumulative relative performance of long-short H_1 vs. H_2 - EMU (top) and North America (bottom)

Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

3 Factor Investing: towards an ESG sentiment factor ?

3.1 Investment universe, return and fundamental data

The point-in-time consistency of the investment universe is ensured by considering that the end-of-month MSCI regional indices are the investment universes for both EMU and North America[18]. In this paper, we aim to understand the effects of both ESG sentiment and ESG news related metrics on a well understood factor-mix. We consider Truvalue Insight Score as proxy for ESG sentiment. Therefore for the factor analysis, we will build a five-factor framework from the main factors identified in the literature. Indeed, since Markowitz (1952) proposed the modern portfolio theory and the subsequent introduction of the CAPM in the next decade by Treynor (1961), Sharpe (1964), Lintner (1965) and Mossin (1966), factors have been extensively studied in the literature going well beyond the first *alpha vs. beta* dichotomy. The 1970s shed the light on the low volatility anomaly and the first multi-factor models (Haugen & Heins, 1972; Ross, 1976). Size and value have been identified by Banz (1981) and Basu (1983) in the following years. Fama and French (1992) formalized these two factors within a broader framework, the well-known Fama-French 3-factor model, augmenting the sole market factor. Carhart (1997) followed, and developed a 4-factor model, adding a momentum factor. Last but not least, the quality factor was brought forward by Novy-Marx (2013) and complements well the previous framework: this will constitute our baseline 5-factors model. We extract the five factors from the MSCI Barra Global Equity Model GEM3 (Morozov *et al.*, 2012) while considering *earnings yield* as a proxy for value and *growth* as a proxy for quality[19]. Then, regional universes, security returns and security exposure to the factors are extracted also from BarraOne (MSCI, 2019).

3.2 Towards an ESG sentiment factor?

To determine if ESG sentiment is a factor, we use the multi-factor regression and factor picking framework developed in Bennani *et al.* (2018).

Multi-factor regression We interpret the arbitrage pricing theory (Ross, 1976) for long-only factors with excess performances following Equation 2 with F_i^* being the market beta adjusted value of Factor i.

$$(R_i - R_M) = \alpha_i + \sum_{j=1}^{n_F} \beta_i (F_j^* - R_M) + \varepsilon_i \tag{1}$$

For all stocks from EMU and North America we perform the regression for CAPM, the five-factor framework aforementioned, two six-factor models with the addition of ESG[20] and ESG sentiment and finally a seven-factor model with the five-factors augmented by ESG and ESG sentiment. Table 6 shows the average R^2 of each model. Both the addition of ESG and of ESG sentiment (one-by-one or together) bring marginal value if we start from the five-factor model.

[18] https://www.msci.com/equity-fact-sheet-search

[19] MSCI Barra Global Equity Model GEM3 style factors are beta, momentum, size, earnings yield, residual volatility, growth, dividend yield, book-to-price, leverage, liquidity and non-linear size

[20] For this ESG candidate factor, we use proprietary Amundi ESG scores which are described on page 13

Table 6: Cross-section regression (average R^2) on long-only risk factor

	EMU		North America	
Period	*2010–2013*	*2014–2019*	*2010–2013*	*2014–2019*
CAPM	33.6%	31.0%	33.4%	26.5%
5F	51.8%	48.4%	49.3%	43.7%
6Fa (5F + TVL)	54.4%	50.9%	51.8%	47.2%
6Fb (5F + ESG)	54.1%	50.4%	51.2%	46.0%
7F (5F + TVL + ESG)	56.0%	52.4%	53.5%	49.4%

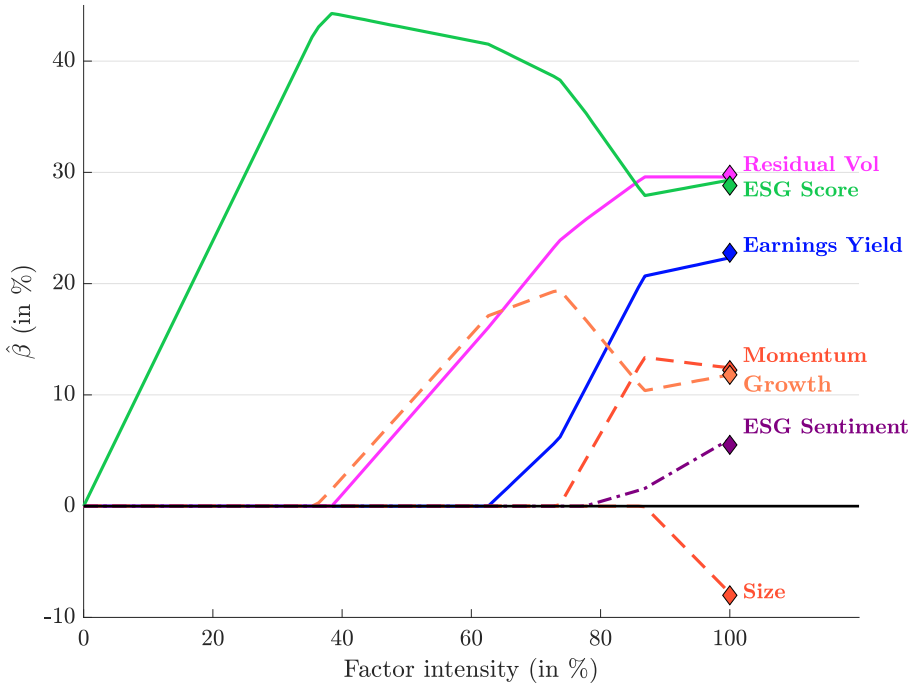
Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

Factor picking in the 2014-2019 period We run a lasso penalized regression (Tibshirani, 1996) with Equation 2 to identify within the seven factors (five factors, sector neutral ESG and ESG sentiment) the order in which factors are picked to explain the performances of an equaly-weighted MSCI EMU and MSCI North America index returns.

$$R_m^{EW} = c + \sum_{j=1}^{n} \beta_j F_j^{Q1} + \varepsilon_m \tag{2}$$

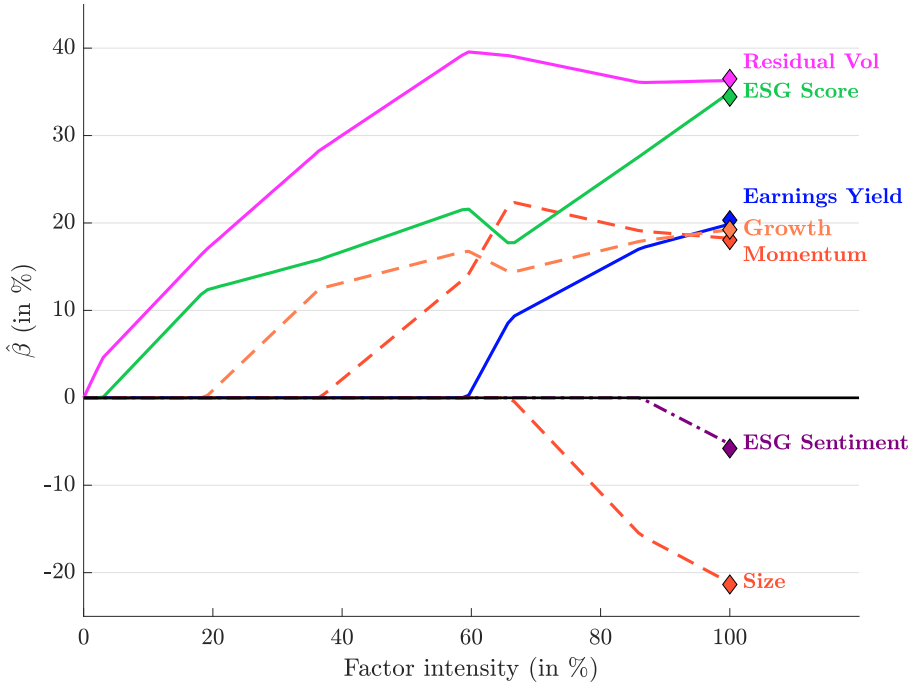
We use the regulation parameter α that controls the strength of the penalty and the constraint $\sum_{j=1}^{n_F} |\beta_i| < \alpha$. The size adjusted benchmark R_m^{EW} is calculated by equally weighting the return of the stocks in the benchmark. It appears that in North America, as displayed in Figure 8 on page 24 ESG sentiment is the last factor to be selected by the penalized regression. As for EMU, ESG sentiment is the second to last factor to be selected as displayed in Figure 7. For the scope of this study, we conclude that ESG sentiment has not yet cracked the 'factor' status.

Figure 7: Factor selection (Eurozone)



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

Figure 8: Factor selection (North America)



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

4 Conclusion

We have been studying the integration of ESG in asset pricing for equities[21] and we have highlighted that ESG investors were taking a dynamic view of ESG investing[22]. For this study, we explore the dataset of Truvalue Labs which extracts ESG sentiment and highlights ESG news volume information, both on a daily basis. Filtering our investment universes with increasing Truvalue Volume has allowed us to solve our Q_4 *puzzle*.

This filtering technique yielded strong results for active ESG conscious investors as it enables to keep the last quintile Q_5 below Q_4 both in Eurozone and in North America before 2013 (2010-2013). The truly strong result is for Eurozone as the sorting of Q_4 and Q_5 is successfully inverted when increasing the filtering on the Truvalue Volume information. The positive effect on quintile sorting was also visible on the positive ESG side with an improvement on the ranking between Q_1 and Q_2. When we introduced ESG as a factor in Bennani *et al.* (2018), we received a strong feedback on the way we should handle ESG information: mainly for exclusion of worst-in-class stocks. Indeed our remark is that ESG is being integrated in a factor framework since 2014: once information is disclosed, investors still choose to favour positive ESG vs. negative ESG stocks. It seems that there is a partial issue with the Efficient Market Hypothesis where investors interested in ESG could be considered as 'insiders' to ESG news while other participants to the markets choose to keep qualifying ESG as 'extra-financial'. We confirm that Truvalue Volume is still relevant in the 2014-2019 period to better sort Q_1 vs. Q_2 and Q_5 vs. Q_4 when necessary. Furthermore, an engagement activity with corporates would keep us ahead of ESG news dissemination.

We decide to intersect the SASB issues that are used by the Truvalue Labs metrics with the Sustainable Development Goals. SDGs have been adopted in 2015 after having been in discussion since 2012. They are a powerful framework for sustainability investing because beyond their wording, they represent required investments. The United Nations Commission of Trade and Development estimates that meeting the SDGs in developing countries alone would require an annual average investment of USD$3.9 trillion from 2015 to 2030 (United Nations Conference on Trade and Development, 2018). Thirty-six percent of this amount is covered by public investment plans which leaves a USD$2.5 trillion annual investment gap which could be addressed by the private sector. Banks, pension funds, insurance companies, mutual funds sovereign wealth funds, endowment funds, private equity, venture capital and impact investors are key actors of the investment chain for the SDGs. We propose an NLP technique that could be considered primitive but which is highly interpretable to map SASB issues and SDGs. This overlay improves significantly an active management long-short strategy's return based on ESG sentiment. We note that the improvement is contributed by the short-side of the long-short strategy but that is not inconsistent with the efforts of United Nations Principles for Responsible Investment (2012) to bring hedge funds into the Principles for Responsible Investment.

Finally, we are left at odds with our analysis of ESG sentiment as a factor. For the moment, we analyze that for both Eurozone and North America, ESG sentiment does not qualify as a factor. We are tempted to augment the ESG sentiment measure with Truvalue Volume for our factor family, but this does not fit with our conviction that a factor should not bring abnormal returns from available information.

[21] Bennani *et al.* (2018) and Ben Slimane *et al.* (2019)
[22] Drei *et al.* (2019)

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Appendix

A Complementary analysis of Truvalue data

A.1 Coverage of ESG issues

Table 7: SASB issues for coverage in Market Cap - EMU

SASB criteria	2008-01	2019-09
Business Ethics	48.6	94.8
Product Quality and Safety	35.6	94.0
GHG Emissions	49.8	93.1
Competitive Behavior	55.0	93.0
Energy Management	40.3	91.9
Labor Practices	52.0	91.9
Product Design and Lifecycle Management	41.7	91.3
Supply Chain Management	42.7	90.7
Data Security	27.2	87.7
Ecological Impacts	25.3	86.9
Employee Engagement Diversity and Inclusion	30.1	86.7
Employee Health and Safety	26.3	86.0
Management of the Legal and Regulatory Environment	38.7	82.4
Water and Wastewater Management	23.1	79.8
Selling Practices and Product Labeling	24.1	78.5
Access and Affordability	24.0	77.1
Materials Sourcing and Efficiency	14.3	76.0
Waste and Hazardous Materials Management	18.2	75.9
Critical Incident Risk Management	15.2	75.4
Human Rights and Community Relations	17.0	73.5
Air Quality	17.3	73.5
Customer Privacy	12.0	72.7
Customer Welfare	15.5	68.8
Business Model Resilience	23.2	65.7
Physical Impacts Of Climate Change	13.7	64.3
Systemic Risk Management	4.2	28.7

Source: Truvalue Labs. Authors' calculations

Table 8: SASB issues for coverage in Market Cap - North America

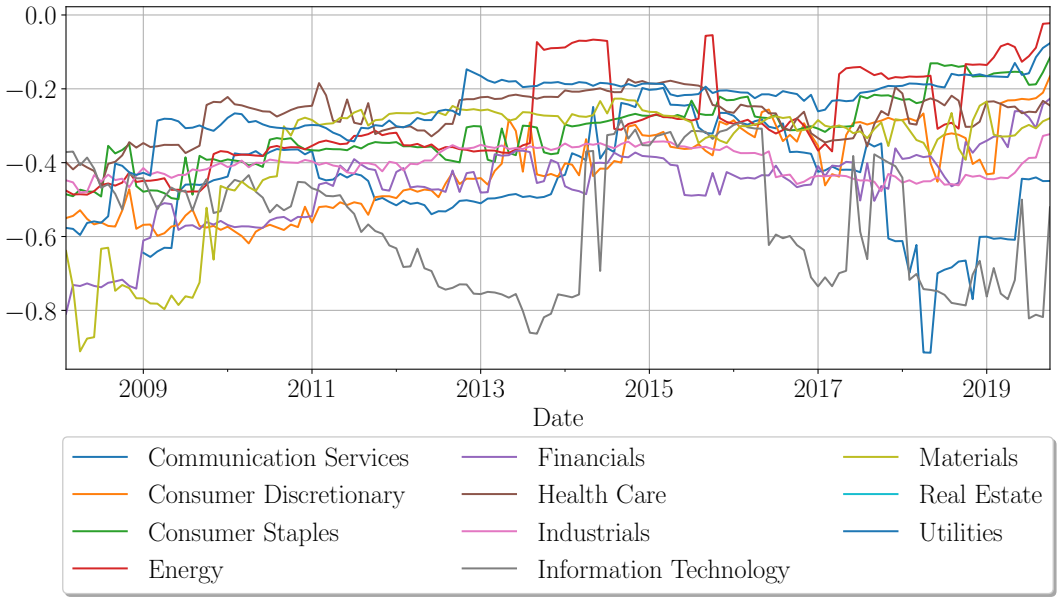
SASB criteria	2008-01	2019-09
Business Ethics	61.4	98.7
Labor Practices	59.3	97.9
Employee Engagement Diversity and Inclusion	52.6	97.4
Supply Chain Management	50.9	96.3
Energy Management	52.2	95.5
Competitive Behavior	52.9	95.4
Product Quality and Safety	52.5	95.4
Employee Health and Safety	51.2	95.1
Management of the Legal and Regulatory Environment	56.5	94.0
GHG Emissions	57.7	93.9
Data Security	45.9	93.9
Ecological Impacts	43.7	91.1
Product Design and Lifecycle Management	45.5	91.0
Selling Practices and Product Labeling	44.7	90.3
Access and Affordability	47.0	89.7
Water and Wastewater Management	43.9	87.7
Critical Incident Risk Management	35.7	85.0
Customer Privacy	35.6	84.2
Waste and Hazardous Materials Management	31.2	82.0
Materials Sourcing and Efficiency	31.7	81.1
Air Quality	28.0	79.0
Customer Welfare	32.3	77.2
Physical Impacts of Climate Change	25.4	76.9
Human Rights and Community Relations	26.5	76.8
Business Model Resilience	27.6	71.8
Systemic Risk Management	12.2	32.0

Source: Truvalue Labs. Authors' calculations

Figure 9: Evolution of Market coverage: EMU (top) and North America (bottom)

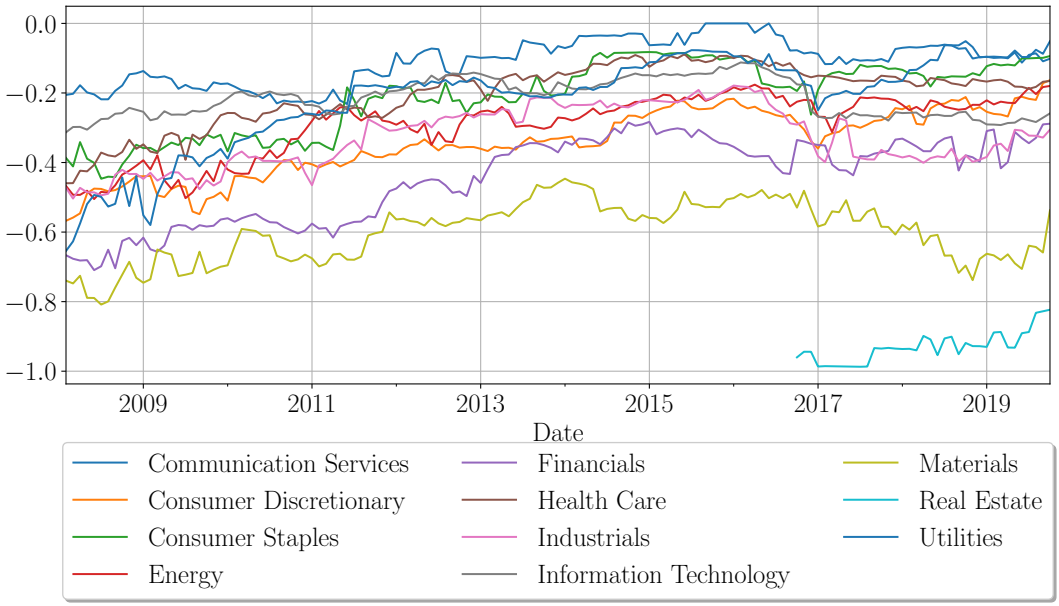
Source: MSCI, Truvalue Labs. Authors' calculations

Figure 10: Difference in Capital weighted Market coverage between Truvalue Volume 0 and Truvalue Volume 20: EMU



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

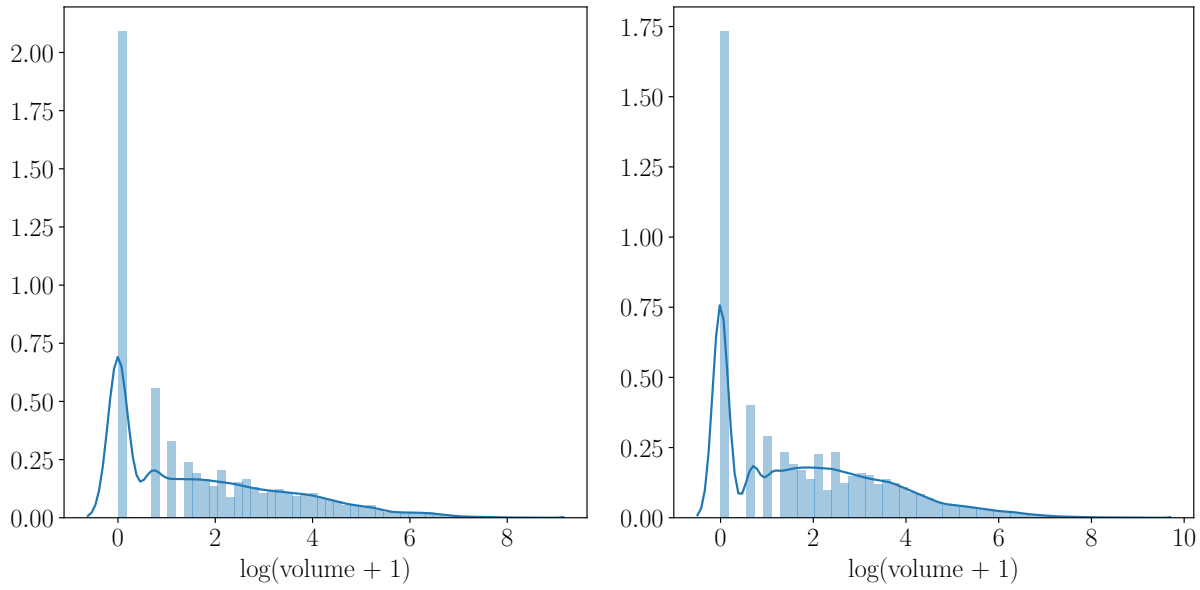
Figure 11: Difference in Capital weighted Market coverage between Truvalue Volume 0 and Truvalue Volume 20: North America



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

A.2 Distribution of Truvalue Volume

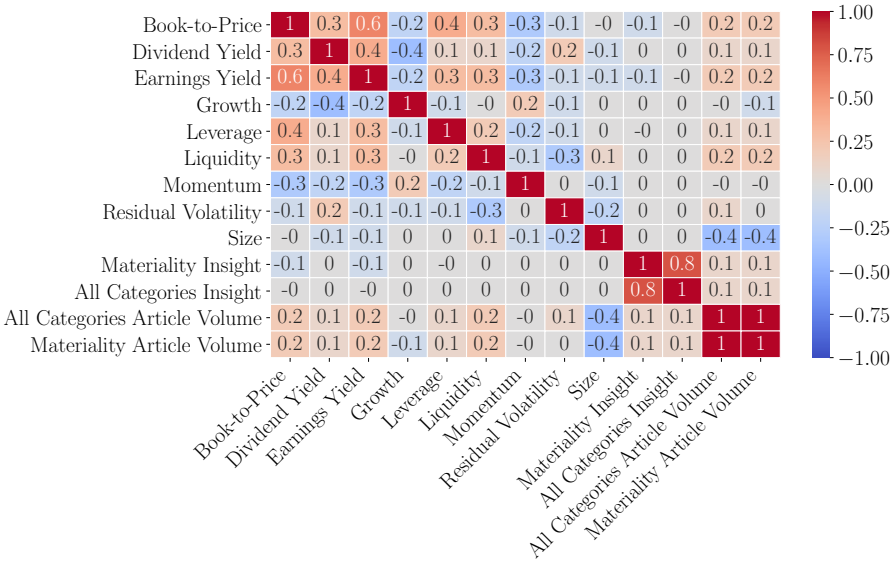
Figure 12: Distribution of log of Truvalue Volume - EMU (left) and North America (right)



Source: MSCI, Truvalue Labs. Authors' calculations

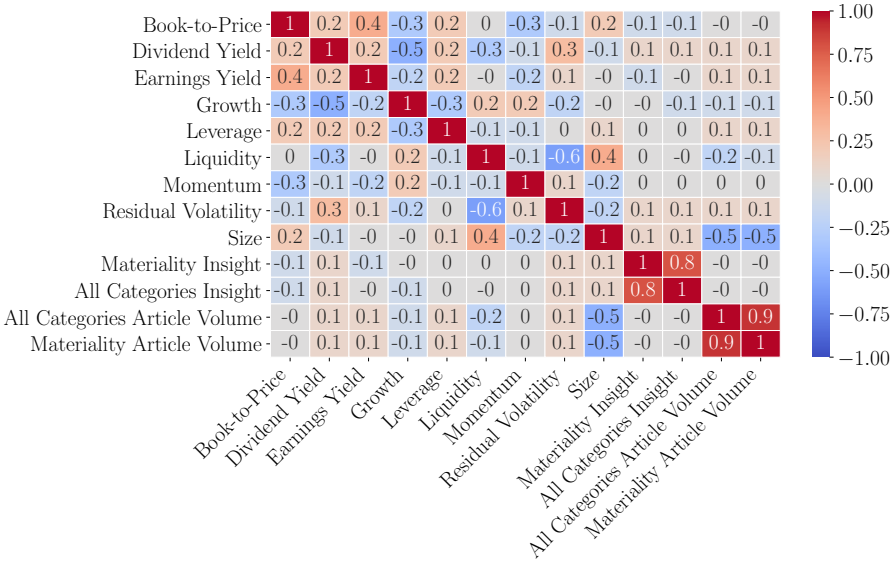
A.3 Rank correlation between Truvalue indicators and fundamental factors

Figure 13: Spearman Rank Correlation - Average between Jan 2008 and Sep. 2019 (EMU)



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

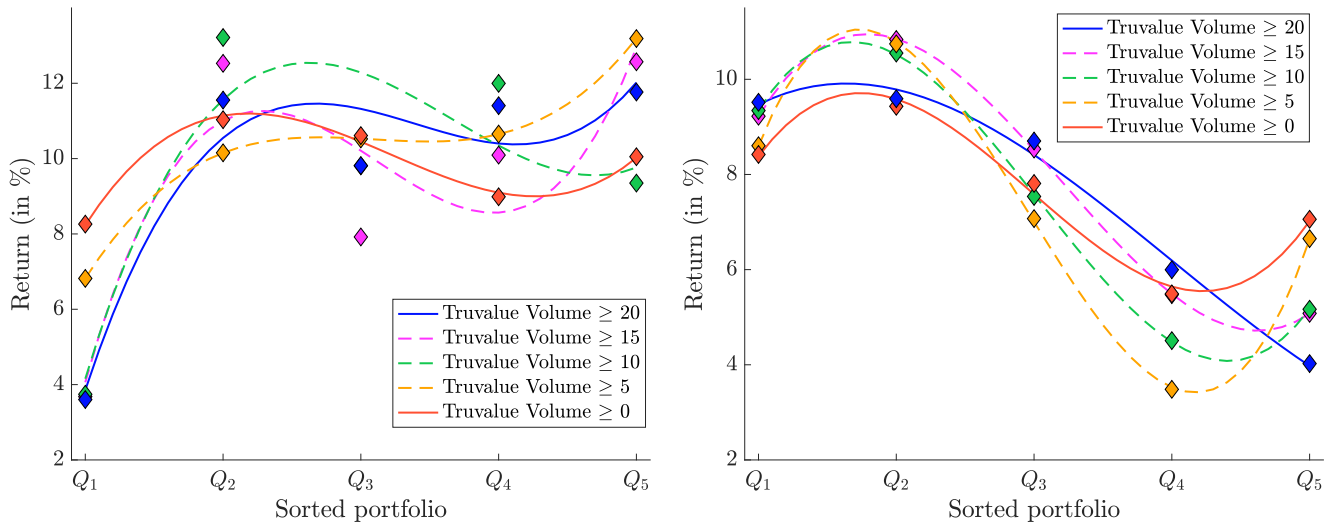
Figure 14: Spearman Rank Correlation - Average between Jan 2008 and Sep. 2019 (North America)



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

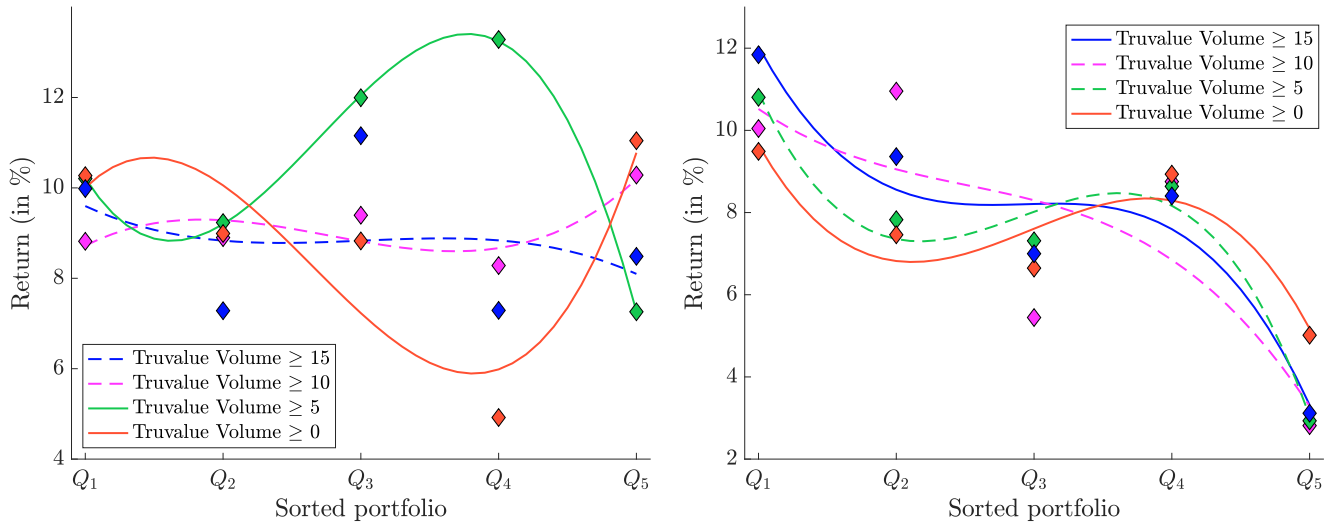
A.4 Sorted Portfolios - results

Figure 15: Annual return of sorted portfolios (EMU, Truvalue Insight Score with Truvalue Volume filter) - 2010-2013 (left) and 2014-2019 (right)



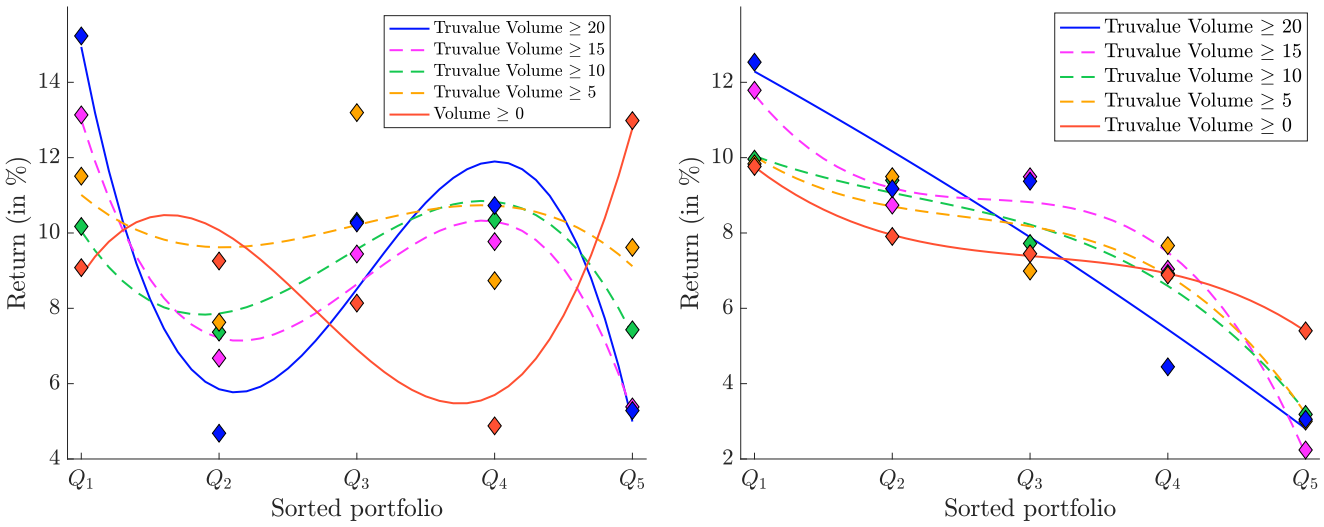
Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

Figure 16: Annual return of sorted portfolios (EMU, sector-neutral ESG with Truvalue Volume filter) - 2010-2013 (left) and 2014-2019 (right)



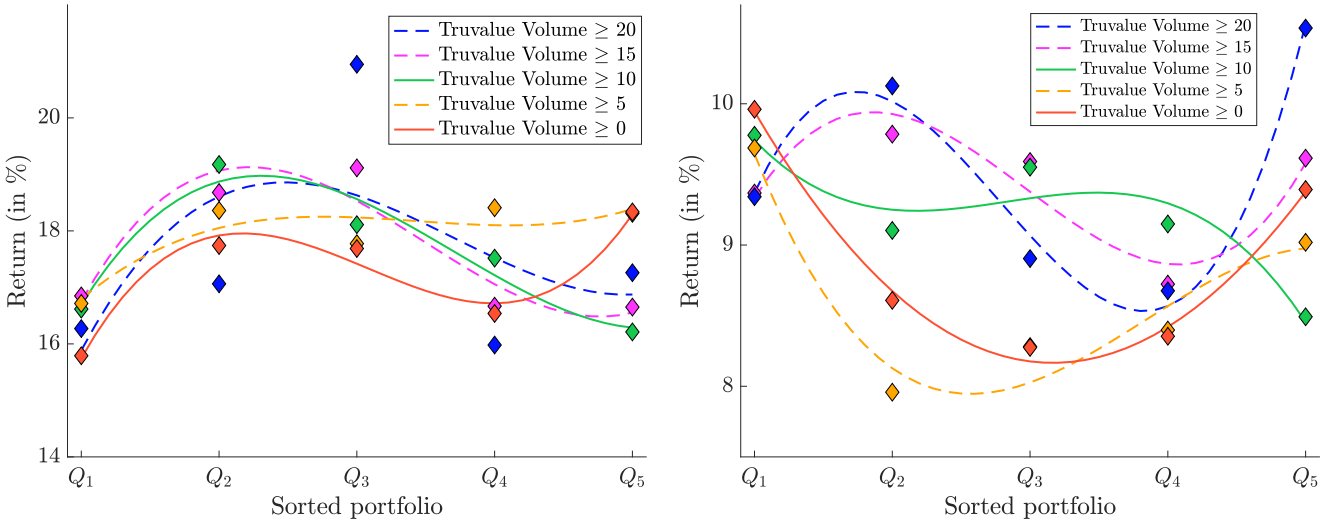
Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

Figure 17: Annual return of sorted portfolios (EMU, not-sector-neutral ESG with Truvalue Volume filter) - 2010-2013 (left) and 2014-2019 (right)



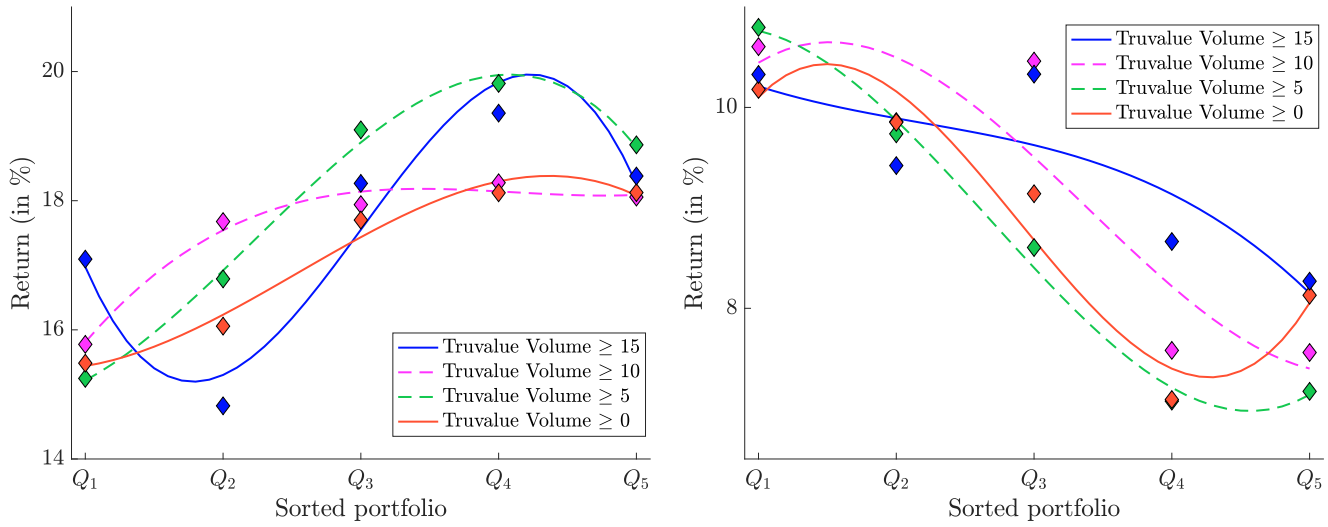
Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

Figure 18: Annual return of sorted portfolios (North America, Truvalue Insight Score with Truvalue Volume filter) - 2010-2013 (left) and 2014-2019 (right)



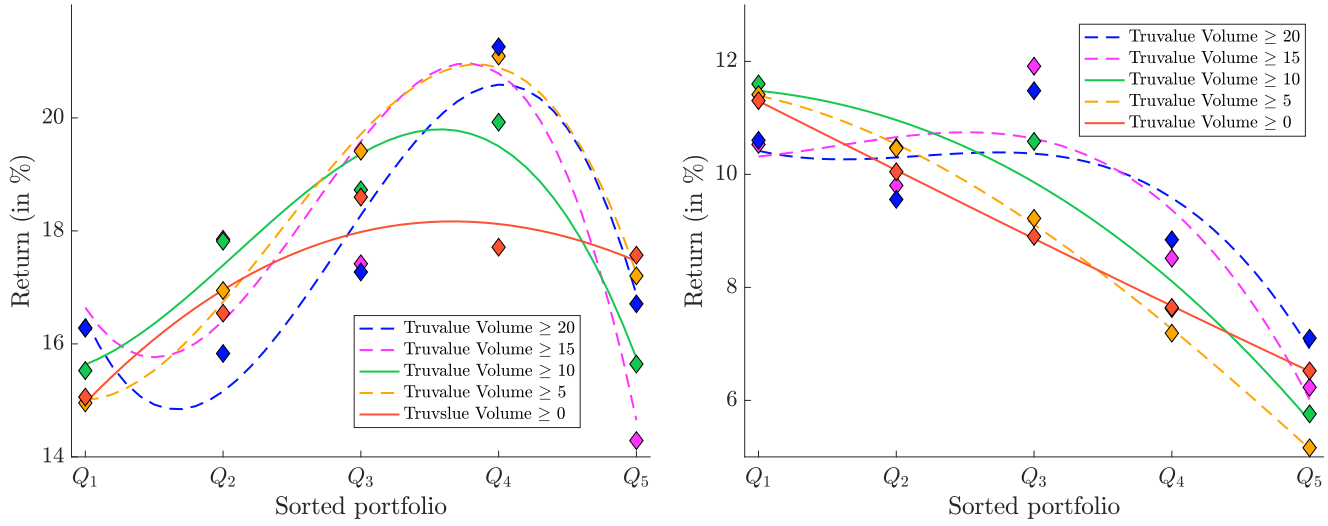
Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

Figure 19: Annual return of sorted portfolios (North America, sector-neutral ESG with Truvalue Volume filter) - 2010-2013 (left) and 2014-2019 (right)



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

Figure 20: Annual return of sorted portfolios (North America, not-sector-neutral ESG with Truvalue Volume filter) - 2010-2013 (left) and 2014-2019 (right)



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

B Mathematical results

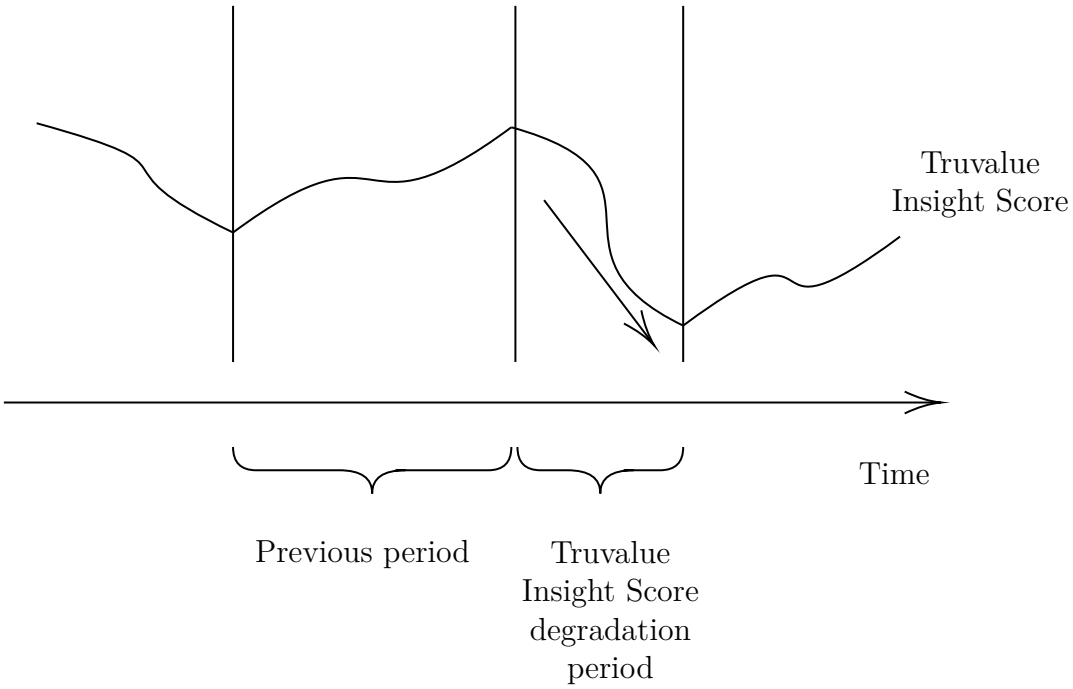
B.1 Truvalue Insight Score deterioration and average Truvalue Volume differences

News volume when ESG sentiment decreases *Is a decrease in the Truvalue Insight Score (a deterioration in the Material ESG sentiment) equivalent to an increase in Truvalue Volume?* The algorithm 1 fits the Truvalue Insight Score time series and enables the identification of periods of deteriorating Truvalue Insight Score.

We combine two regression parameters to balance a highly reactive and a less reactive L_1 trend fittings (Kim *et al.*, 2009). Once we have identified a period of degradation as pictured in Figure 21, we can measure the ratio between the *average Truvalue Volume in the identified period of deterioration* and the *average Truvalue Volume in the preceding calm or increasing Truvalue Insight Score period*.

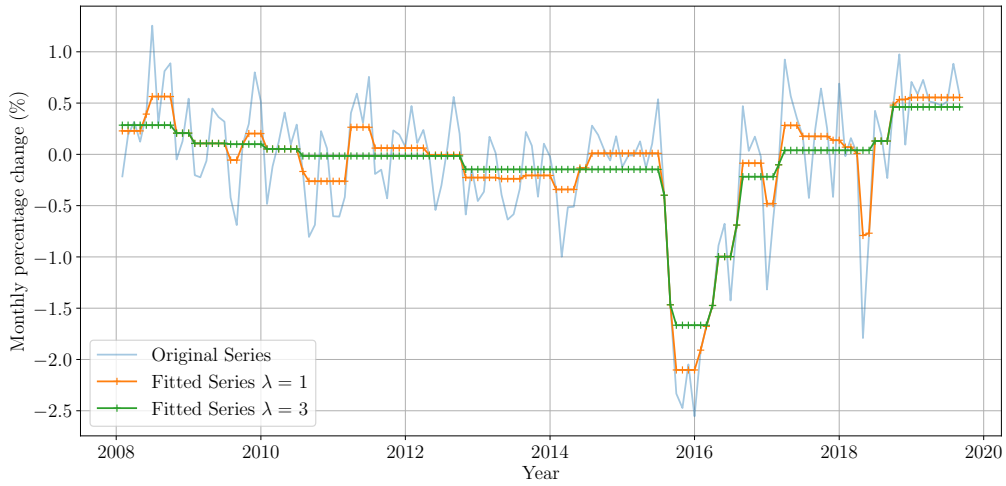
With a combination of regression parameters, we illustrate the fitting with the example of Volkswagen in Figure 22. With our log(ratio) vs. Truvalue Insight Score variation plots for EMU in Figure and North America (Figure 23 and Figure 24 on page 41), we identify that our fitting with two regression parameters captures Truvalue Insight Score decreases reasonably. Indeed, there are only a few cases of Truvalue Insight Score increases (dots above the $y = 0$ line). Also as the dots are not significantly in the x $\geq$ 0 & y $\leq$ 0 quadrant, we confirm that a decrease in Truvalue Insight Score is not necessarily synchronized with a Truvalue Volume increase.

Figure 21: Identifying an Truvalue Insight Score degradation period



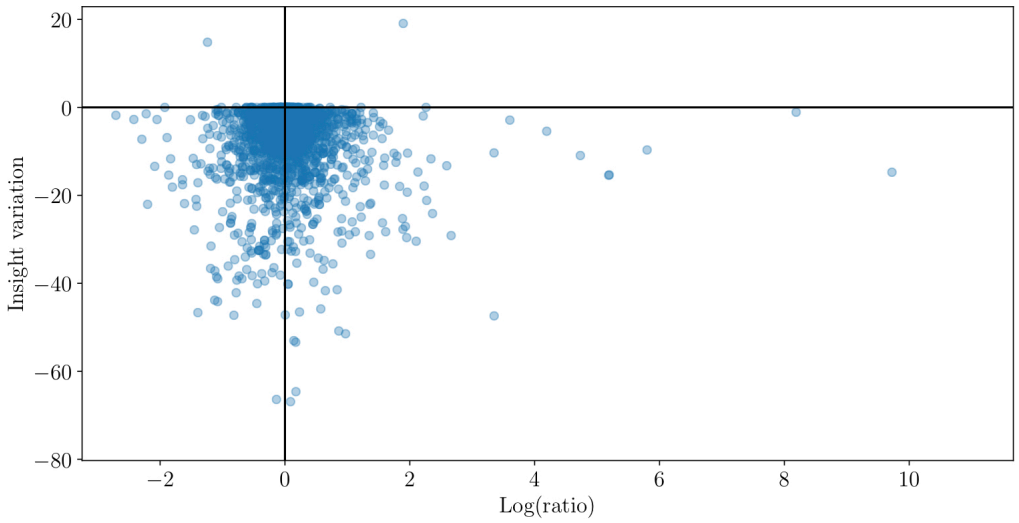
Source: Amundi

Figure 22: Trend filtration: Volkswagen



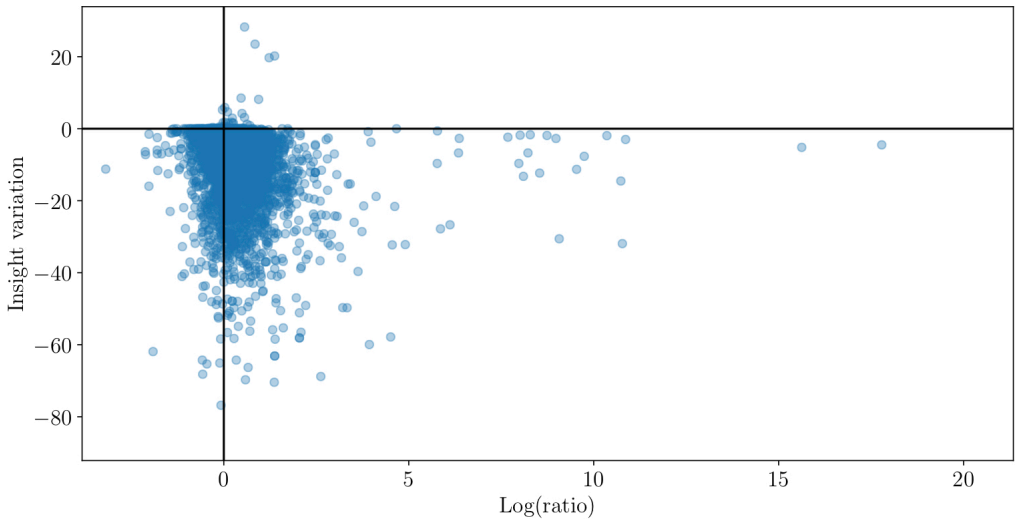
Source: Truvalue Labs. Authors' calculations

Figure 23: Truvalue Insight Score drops and Truvalue Volume variations: EMU



Source: Truvalue Labs. Authors' calculations

Figure 24: Truvalue Insight Score drops and Truvalue Volume variations: North America



Source: Truvalue Labs. Authors' calculations

Algorithm 1: Plot Truvalue Volume in **Truvalue Insight Score degradation** vs. Truvale Volume **before Truvalue Insight deterioration ratio**

for *Company in Universe* **do**

l_1 Fitting of Truvalue Insight Score time-series with two regression parameters $\lambda \in \{1, 3\}$

$$\beta^* = argmin_{\beta \in R^n} \{\frac{1}{2}\|y - \beta\| + \lambda \sum_{i=1}^{n-1} \|\beta_i - \beta_{i+1}\|\}$$

the fitted series is $\beta_f = max(\beta_1, \beta_2)$;
identify Truvalue Insight Score degradation period where $\beta_f < 0$;
calculate the ratio

$$ratio_{two\ consecutive\ periods} = \frac{average\ Truvalue\ Volume\ on\ degradation\ period}{average\ Truvalue\ Volume\ on\ previous\ stable\ or\ up\ period}$$

end

Result: Identify if the ratio is abnormally higher than 1 on the log(ratio) vs. Truvalue Insight Score variation plot

B.2 Distance between ESG issues and SDGs

We test a natural language processing technique consisting of vectorizing words to map SASB issues to SDGs. This technique known as Word2vec (w2v) produces vectors based on word association. Before using this technique, raw text should be reduced to it essence, for instance with the Latent Dirichlet Allocation (LDA) topic extraction statistical model. However, given the small corpus, the extracted topics are not of high quality: they overlap considerably and fail to point at the essence of each subject.

A second technique can be used. The text can be reduced to their essence with a term frequency-inverse document frequency (TF-IDF) technique. It consists in using weighted words in processed texts in a way that gives more weights to the words that are more present in a document compared to the rest of the corpus. After running this technique we can select top words by TF-IDF weight in each text. We refer to these top words as keywords and each SASB or SDG text is reduced to a group of keywords.

With these keywords, we could create a vector form of the documents by averaging the vectors of keywords of each text. Afterwords to determine a mapping we can calculate distances between the vector form of the texts. We expect a given SASB issue that maps well to a certain SDG to have close vector forms compared to other SASB issues.

We calculate the distance $d_{i,j}$ between a SASB issue i and a SDG j as follows:

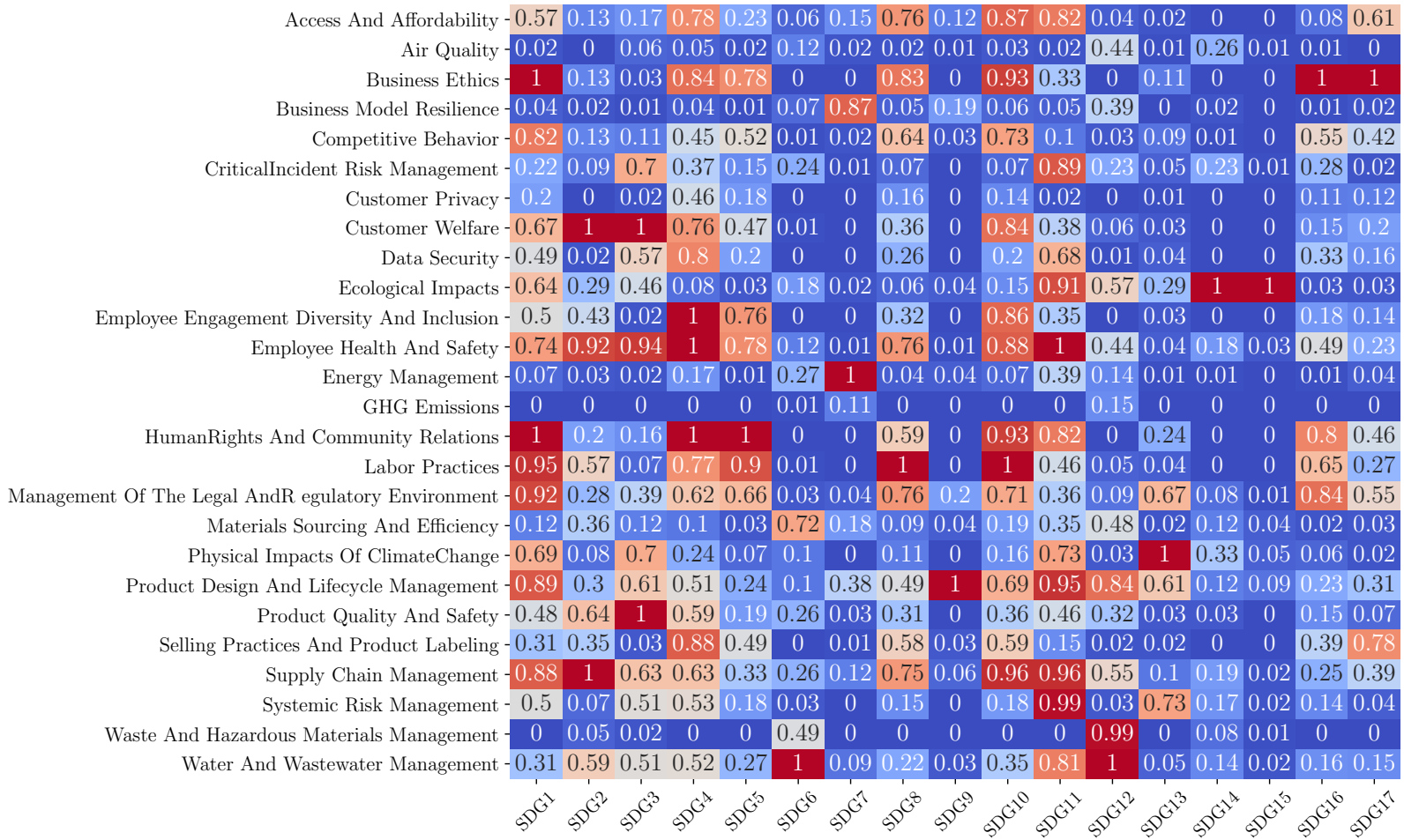
$$d_{i,j} = \sqrt{\sum_{t=1}^{dim} \left(v_t^i - v_t^j\right)^2}$$

where v^i and v^j is the vector of the subject i and j. To differentiate between the SASB issues by proximity, we calculate the following modified measure. For a SASB issue i and a SDG j we calculate the modified measure $m_{i,j}$ we call proximity index:

$$m_{i,j} = \exp\left(-\frac{d_{i,j} - d_j^{min}}{2\sigma_j^2}\right)$$

where $d_j^{min} = \min_{i \epsilon SASBs}\{d_{i,j}\}$ and σ_j is the standard deviation of the distances of the set of distances $(d_{i,j})_{i \epsilon SASBs}$. Unfortunately, this distance measure also point to overlaps between SDGs. As displayed in the Figure 25 on page 43, the SASB criteria for GHG Emissions appears to have small distance with all SDGs. We therefore turn to a simplified approach with algorithm **??** on page **??**.

Figure 25: Proximity index



Source: SASB, UN. Authors' calculations

B.3 Intersection of SASB and SDGs

We intend to keep the top ten criteria. We keep twelve because of equal values of the common keywords count averaged across the seventeen SDGs.

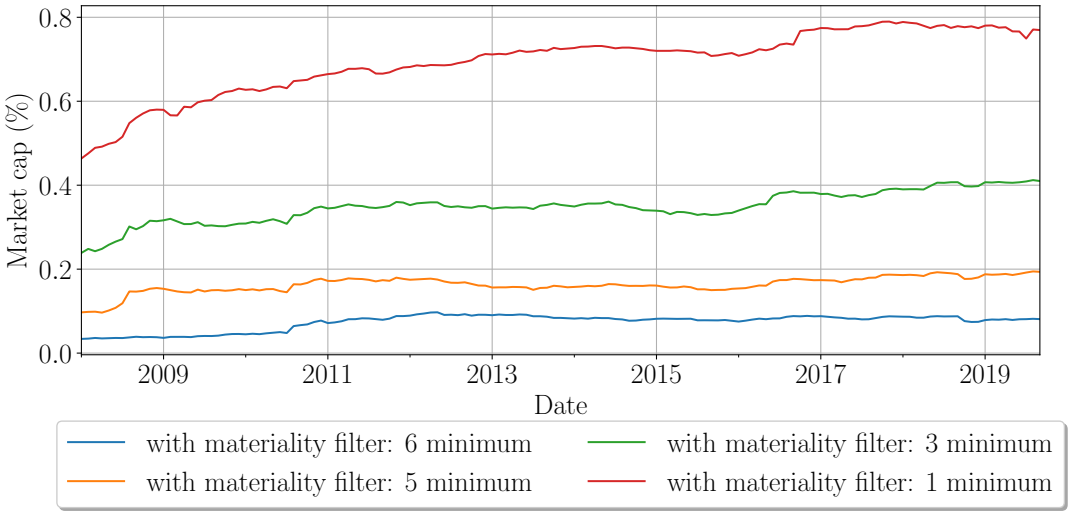
Table 9: Ranked average of common keywords issued from TF-IDF

SASB criteria	Average of common keywords across SDGs
Air quality	1.235
Product quality and safety	1.176
Ecological impacts	0.941
Employee health and safety	0.941
Physical impacts of climate change	0.941
GHG emissions	0.941
Water and wastewater management	0.824
Product design and lifecycle management	0.824
Labor practices	0.765
Waste and hazardous materials management	0.765
Energy management	0.765
Access and affordability	0.765
Employee engagement diversity and inclusion	0.647
Data security	0.647
Human rights and community relations	0.529
Materials sourcing and efficiency	0.529
Supply chain management	0.529
Business model resilience	0.412
Business ethics	0.353
Customer privacy	0.294
Critical incident risk management	0.294
Selling practices and product labelling	0.235
Customer welfare	0.176
Competitive behaviour	0.176
Management of the legal and regulatory environment	0.059
Systemic risk management	0.059

Source: Authors' calculations

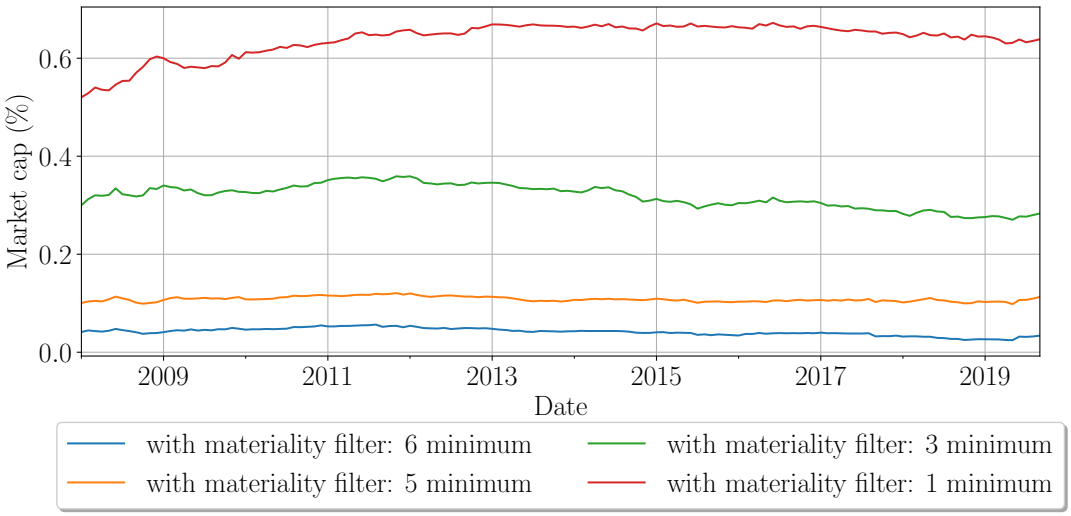
B.4 Market Coverage for intersection of ESG frameworks

Figure 26: Market Coverage of the SDG focused score (EMU)



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

Figure 27: Market Coverage of the SDG focused score (North America)



Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

B.5 H_1 vs. Market return for the intersection of ESG frameworks

Figure 28: Cumulative relative performance of long-short H_1 vs. market - EMU (top) and North America (bottom)

Source: MSCI BarraOne, Truvalue Labs. Authors' calculations

C Keywords from ESG frameworks

Table 10: SASB Keywords

Access And Affordability	Air Quality	Business Ethics	Business Model Resilience	Competitive Behavior	Critical Incident Risk Management
energy	production emerging	client trust	waste	transparency	event
pricing	active management	money laundering	emission	regulatory	result
rate structure	odor	business ethic	electric	sometimes	preparedness
customer	emission	governance	landfill	competitive behavior	leak
return	air emission	ethic	electric utility	competition	emergency preparedness
income	iron	money	economy	industry	plant
efficiency	iron steel	conflict	reserve	market	risk
care	pollution	law	ghg	intellectual property	culture
low income	air quality	conflict interest	customer	monopoly	gas leak
access	pollutant	payment	energy efficiency	intellectual	gas
rate	air pollution	corruption	recycling	pricing	emergency
uninsured	steel production	business	demand	protection	incident
water	air pollutant	transparency	utility	patent	nuclear
utility	steel	anti	efficiency	ip protection	accident
affordability	air	professional	energy	ip	safety

Customer Privacy	Customer Welfare	Data Security	Ecological Impacts	Employee Engagement Diversity And Inclusion	Employee Health And Safety
privacy concern	consumer	cyber attack	discharge	recruitment	expose employee
consumer	care	cyber	sensitive	retention	facility
hand	nutritional	record	ecologically	industry	workforce
information	industry	security threat	ecologically sensitive	recruit	hazardous
demographic	food	use electronic	reserve	skilled employee	health safety
use	patient	threat	environmental	employee engagement	labor
data privacy	pathological	electronic	biodiversity	workforce diversity	employee
freedom	drug	health record	waste	talent shortage	casino
advertising	student	electronic health	construction	diverse	smoke
service	antibiotic	information	land	workforce	worker
customer	problem	health information	impact	shortage	farm
user	pluralism	health	ecosystem	diversity	smoking
customer data	tobacco	security	project	skilled	wind farm
privacy	health	data	ecological impact	talent	wind
data	gambling	data security	ecological	employee	safety

Table 10: SASB Keywords (continued)

Energy Management	GHG Emissions	Human Rights And Community Relations	Labor Practices	Management Of The Legal And Regulatory Environment
alternative	expenditure	adopt	right	time engagement
electricity	capital expenditure	may	waste management	impacting industry
hardware infrastructure	methane	community engagement	conflict worker	result material
hardware	energy	socioeconomic	bargaining	regulation impacting
grid	greenhouse	community right	collective bargaining	rapidly changing
energy management	greenhouse gas	human right	labor relation	participate regulatory
energy supply	waste	right interest	wage	legal
energy water	fleet	clinical	working condition	regulation
data	landfill	clinical trial	worker right	engagement
efficiency	ghg	trial	strike	may
water	ghg emission	people	metal	legal regulatory
center	landfill gas	indigenous people	mining	industry
energy efficiency	gas	right	metal mining	regulatory
data center	fuel	indigenous	labor	environment
energy	emission	community	worker	regulatory environment

Materials Sourcing And Efficiency	Physical Impacts Of Climate Change	Product Design And Lifecycle Management	Product Quality And Safety
turbine	impact	environmental social	food safety
animal	environmental risk	tenant	water
resource	water	project	drug
input	adaptation	material	risk
machinery	flood	impact	food
resource scarcity	insurance	building	product safety
source	risk	esg factor	concern
price	extreme	efficiency	health
price volatility	extreme weather	sustainability	may
water supply	weather event	emission	industry
volatility	event	esg	recall
scarcity	weather	environmental	quality
supply	change	product	chemical
water	climate change	energy	product
material	climate	fuel	safety

Table 10: SASB Keywords (continued)

Selling Practices And Product Labeling	Supply ChainManagement	Systemic Risk Management	Waste And Hazardous Materials Management
alcohol	social impact	technology	handling
finance	social	infrastructure	hydraulic fracturing
information	sourcing	attack	hydraulic
student	food	grid	chemical
practice	supplier	extreme	fracturing
discriminatory	wood	continuity	food waste
discriminatory lending	palm	cyber	fluid
average	palm oil	cyber attack	hazardous waste
loan	environmental	event	packaging
advertising	labor	disruption	coal ash
labeling	environmental social	extreme weather	food
mortgage	fiber	weather	ash
lending	supply	weather event	coal
product	chain	risk	hazardous
marketing	supply chain	systemic	waste

Water And Wastewater Management
disposal
water management
treatment facility
risk
ultra pure
pure
pure water
non revenue
ultra
process
manufacturing
wastewater
treatment
effluent
water

Table 11: SDG Keywords

SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7
social	child	health	primary	country	drinking	clean
protection	agricultural	birth	child	woman girl	drinking water	energy intensity
social protection	agriculture	death	learning	marriage	water sanitation	renewable energy
disaster	hunger	mortality	education	girl	sanitation	renewable
poverty	food	disease	school	woman	water	energy
poverty	undernourishment	occupational safety	average hour	governance body	water use	energy intensity
fair	agricultural	prevention	category	female	resource	energy product
wages	practices	occupational	employee category	female board	management	energy use
indigenous	child	safety	employee	woman	water resource	energy consumption
rights	agricultural	health	training	board	water	energy
social	agriculture	non-communicable	age	employee	reused	definition
protection	hunger	disease	employee training	managerial position	recycled	study
social protection	food	communicable	training education	woman managerial	flow	green investment
disaster		disease	employee	managerial	wastewater	investment
poverty		air	training	employment	water	green
		pollution	education	gender	ground	consumption
		impact	access	equity	freshwater	energy consumption
		land	primary	country	withdrawal	renewable energy
		water	child	woman girl	water withdrawal	renewable
		pollution	learning	marriage	water	energy
		impact	education	girl	incorporated product	energy
		healthcare	school	woman	water incorporated	access
		access			withdrawn	renewable
		health			water withdrawn	energy
		birth			water	access
		death			water	energy
		mortality			consumption	consumption
		disease			impact	clean
					water	energy intensity
					pollution	renewable energy
					impact	renewable
					drinking	energy
					drinking water	
					water sanitation	
					sanitation	

Table 11: SDG Keywords (continued)

SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 14
labour productivity	manufacturing value	developed	disaster	consumption production	nationally determined	use ocean
unemployment	country	income	slum	domestic material	determined contribution	fishery
employment	value added	inequality	urban population	material consumption	adaptation	coastal
growth	added	developing	urban	consumption	climate change	ocean
labour	manufacturing	country	city	material	climate	marine
wage	ghg reporting	migrant	housing	production	climate	marine
employee wage	scope	worker	access	chemical	change	pollution
wage benefit	ghg emission	rights	disaster	ozone	vulnerability	impact
employee	emission	developed	disaster	substance	adaptation	overfishing
benefit	ghg	income	slum	od	readiness	use ocean
work	indirect	inequality	urban population	basel convention	nationally determined	fishery
day	ghg emission	developing	urban	convention	determined contribution	coastal
lost	scope	country	city	hazardous waste	adaptation	ocean
occupational	ghg			waste	climate change	marine
injury	emission			hazardous	climate	
added	procurement			solid waste		
added defined	purchasing			waste generation		
fixed	location operation			generation		
value	location			hazardous		
purchased	local			waste		
one	expenditure research			waste recycling		
worker	research development			material		
agreement	development			recycled		
employer	knowledge			waste		
collective	research			recycling		
contract	product			material		
transaction	gross			footprint		
obligation	added			land		
performance obligation	value added			water		
revenue	value			pollution		
forced	greenhouse					
labour	gas			impact		
modern	intensity			sustanability		
slavery	research			reporting		
labour	development			sustainability		
rights	investment			awareness		
occupational	manufacturing value			consumption production		

Table 11: SDG Keywords (continued)

SDG 15	SDG 16	SDG 17
land	justice	least
terrestrial	right	partnership
specie	institution	registration
forest	victim	development
biodiversity	country	country
land	fine	public
pollution	conviction	infrastructure
impact	corruption incident	commercial
deforestation	incident	community
land	corruption	investment
terrestrial	position	community
specie	range	charitable
forest	board	charitable donation
biodiversity	number position	contribution
	diversity	donation
	number board	paid
	attendance	payment
	board meeting	income
	meeting	government
	board	tax
	external auditor	fair
	committee	share
	auditor	taxation
	audit committee	least
	audit	partnership
	director	registration
	total compensation	development
	executive	country

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INVESTMENT STRATEGY

October 2020 | Working paper

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