

APPLIED DATA SCIENCE

Sustainable Finance & Investment



McS Finance & Big Data
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Introduction

The importance of social, environmental and governance (ESG) issues in the world is now considered by firms, investors, and all stakeholders. This has led to an explosion in the number of sustainable funds and investors considering ESG factors in their analyses. With, the natural disasters, political upheaval, corruption scandals and other kind of shocks that global investors have had to deal with in recent years. ESG Ratings are designed to help assess these factors and consider them in the portfolio allocation.

The objective of this work is to try to obtain an ESG rating criteria classification that can help to get a link between sustainability and trend in world prices & CDS

Then we will try to build an optimized equity portfolio using the extra-financial data provided.

1. CRITICAL ANALYSIS OF DATA

In the financial market history, ESG is a relatively new topic in investment environment. Due to the climate change and the willingness from investors to consider ethic aspects in their investment, Environmental, Social or Governance (ESG) criteria have become, with the traditional financial analysis (EPS, P/E Ratio, Cash Flow analysis, Valuation, etc.), a key point in investment cases, especially in the stock and corporate bonds market. As a consequence of this new trend and also because investment professionals needed tools to analyze and understand these factors, a lot of new so called “ESG” data have flood the market with many different providers.

But as the publishing of this kind of data is quite recent, investors cannot trust them blindly. Indeed, there’s no real consensus about the methodology to use when evaluating a company on their extra-financial criteria. So, each data provider can use his own methodology for the rating of a company and, without any standard, there can be some “bias” in the ratings. By the way, the implementation of ESG standard is the subject of a fierce battle between the UE commission and US regulators, some experts saying that UE don’t want the US to impose ESG rules like they impose IFRS standard.

Lack of market standard in ESG evaluation, let, to investment professionals a huge part of interpretation and sometimes, even regulators are not sure about their answer to some specific point.

Moreover, in the recent news flow, we have many examples of company that were wrongly rated by ESG notation provider. In France, “Orpea”, a nursing homes company, was accused to mistreat their occupant. After the publishing of this news, ESG analyst downgraded the rating of the company. So they failed to adjust correctly the rating before the scandal.

With the current Ukrainian crisis, we have also seen a new debate in the ESG framework. Some asset manager claiming that arms industry, which is currently excluded by most of Asset Managers in their sustainable funds, should be considered as an ESG sector because it helps to ensure the peace... And according to citywire, most of the European SFDR Article 9 funds, which are supposed to be the most “sustainable”, are holding Tesla stocks despite the social controversy. Examples are many but they illustrate that there is still a huge part of interpretation in the implementation of ESG rules.

This are the “philosophical” limits of ESG rating.

But having said that, from a more practical side, when you’re trying to apply a sustainable investment policy, you need to ensure that the data you are using are relevant, accurate and complete

In our case, we have shed light different limits that need to be considered when we are using ESG Data:

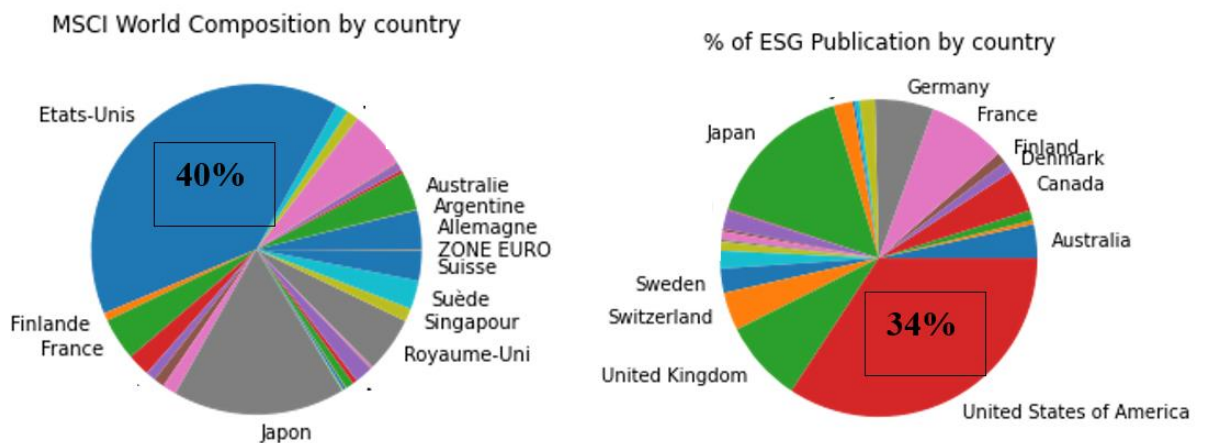
- In the table 1 of the appendix 1, we can see that companies have different ESG publication period: some are published on annual basis while some others are evaluated on quarterly basis. It means that when you are trying to build a sustainable investment strategy, it’s difficult to have a full historical data to correctly analyze a company on his extra financial aspect. Moreover, these discrepancies of the publication pace means that it is not possible to compare the ESG framework between companies. This lack of complete value makes also difficult the monitoring of the portfolio. The portfolio or asset manager cannot really know whether the stock he held is still compliant with his sustainable investment policy and strategy and have to wait for the next publication. When the publication is on annual basis, it can change a lot between the time the portfolio manager buys the stock and ensure the ESG analysis.

Regarding the ESG publication, there are some gaps in the data publication, some companies don't have data for some years, or quarters. In the table 1 of the appendix 1, we can see for example that for the ISIN AEA000201011, there is no ESG value for 2017 and 2019. And, for this ISIN, we can notice that historical prices start from 2009 while the company is rated for the first time in 2016. During this lap of time, there is no possibility for the investors to monitor the company on ESG side.

All this kind of examples are listed in the table 1 of Appendix 1

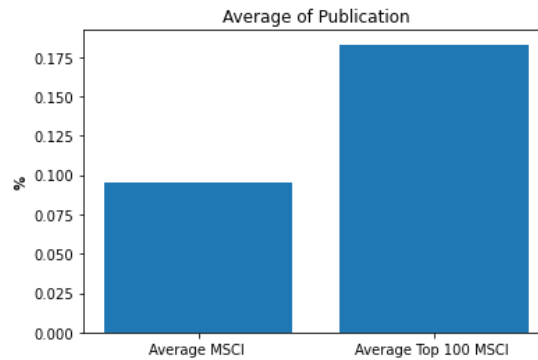
If we analyze the data with a more granular point of view, we can also see that:

In the database there are some geographical discrepancies. Depending on the country where the company is located, a company will not have the same amount of ESG publication (with equivalent market cap). The two main geographical area where we see the large amount of ESG publication are Europe and USA, which is quite logic because of their importance in terms of the market cap they represent in worldwide market. But if you want to invest in specific region or geographical areas (like the emerging countries) it can be more difficult to access to some data and, again, to monitor them. As we can see in the below graph, there's a difference between the composition of the MSCI and the number of publications by countries:



While the USA represent 34% of the index, they represent 40% of the ESG publications.

We can also note that the most the stock is weighted in the MCSI World, this suggest that there is a “lag” between the ESG rating and the real extra financial situation of the company : the top 100 of MSCI component have an average number of publication of 18 while the average of the whole MSCI is 9 publication by company.



- This inequality of publication can be also observed with the size of company. Depending on whether the company is a large, mid or small cap. The number of publication and the following of the stock by ESG analyst is more important when the company is a large cap. Which can consider as normal: large cap published more accurate information about their extra financial result than the small cap.
- Number of factors not consistent: all the company are not rated the same way due to their activities (a financial company will not have the same (sub) criteria in their global score as an energy company). But inside a same sector, we can notice that some companies are rated on certain criteria while others aren't. This leads to a bias in the rating because some are rated with more criteria than others.

Moreover, if we analyze the “alert publication”, which are mostly due to a controversy, we see that most of the time, the controversy was not « priced » in the rating by the ESG notation companies. This suggests that there is a “lag” between the ESG rating and the real extra financial situation of the company.

To sum up, ESG data need to be analyzed with a very critical eye and should be considered as not fully reliable. therefore, all of the conclusion established in this document are subject to this warning.

2. ESG RATING CRITERIA CLASSIFICATION:

2-1 ESG rating criteria classification

In the last decade, the development of responsible investment has moved into high gear and has shifted from an exercise involving a relative handful of investors to a mainstream focus. While ethical convictions were particularly emphasized at first, financial aspects are increasingly used

in their arguments. Considering the extra-financial risks to which the companies in which one invests are exposed would make it possible to limit losses when a crisis breaks out. Some actors argue that, during the health crisis, the most virtuous companies in terms of ESG have achieved better financial performance, their development reflects a recent but now almost a general trend. The classification, as well as the graphs will be provided in the appendices.

Our methodology: ESG Scores and Stock returns

Concerning the methodology that we have chosen to adopt; we grouped the stocks by sector and assign to each sector its average annual return. We obtained average annual sector ESG scores that underlie the MSCI ESG Ratings and classified the companies in the MSCI World Index. Our study period was from January. 01, 2012, through December. 31, 2021.

The objective is to study the correlation between the returns of each sector and its related ESG sub-criteria scores. We are interested therefore in the positive correlation that imply a positive impact of the sub criteria on the return, which is obviously an evolution of the returns by sector. The selection of the ESG sub-criteria that we will be studying among all sub-criteria is made relying on a theoretical analysis that suggests that the following scores are having the greatest impact on companies:

-Global Risk Human Capital Score

- Global Risk Legal Score

- Global Risk Operations Score

-Global Risk Reputation Score

We analyzed simultaneously the correlation of the Environmental, social, and Governmental ESG global scores with the annual average sector returns. Let's detail the significant results found, in fact we can classify three kinds of correlations between sector returns and ESG scores:

High positive correlation

Regarding **the discretionary consumer sector returns**, the coefficient of correlation was very high, reaching 0,91 with **the Global Risk Reputation** ESG sub score. The sector did make some interesting progress over the year in important topics. For instance, 47% of the sector now has a recently updated materiality analysis for example Liverpool and Nemak become a UN's Sustainable Development Goals signatory in 2021, whereas more companies are starting their ESG Strategy development process.

For the **Finance sector return**, the latter was highly correlated with **the Global Risk Reputation** ESG sub score with a coefficient of 0,91 and the **Global Risk Operations** ESG sub score with 0,84. Societal challenges consistently change and create new threats. The impact of the social component of ESG scores is therefore obvious. There are issues, that also offer

tremendous opportunities for the financial services industry to play an impactful and profitable role.

For the **Health industry returns**, they are highly correlated with the **Global Legal Risk ESG** sub score with a coefficient of correlation of 0,62 as well as the Environmental ESG score with a 0,76. In fact, Providers, and pharmaceutical and life sciences organizations have historically embraced the social pillar of environmental, social and governance (ESG) efforts, caring for patients and creating medications, vaccines and devices that improve human health and save lives.

Finally, the **Real estate industry returns**, are also highly correlated with **the Global Risk Reputation** ESG sub score with a coefficient of 0,70. In fact this can be explained, many studies have shown that Real Estate assets, have incurred higher operating costs while following an ESG process strategy due to implementing sustainable technologies. But achieving a higher rental income compensated for the increased expenses and resulted in higher cash flows for distributions.

Medium positive correlation

The **Technology sector** returns is correlated with the **Global Risk Reputation** within a coefficient of 0,48. For instance, U.S. tech giants have all made net-zero or carbon neutral pledges to eliminate their carbon emissions by as early as 2030 in some cases and 2050 in others. Moreover, ESG capital allocations have swelled to record levels, and lack of a clear ESG strategy may hinder tech companies' ability to attract investors.

The **Telecom sector** on the other hand, is mainly impacted by the Global Risk Human Capital score, with a coefficient of 0,54. In fact, The sector's disclosure to security risks and megatrends like demographic changes, social medias, and increased connectivity means that the social risk is the most meaningful and most impacting the sector.

Low positive correlation

Concerning the **Energy sector** returns, they are correlated with a coefficient of 0,14 with the main ESG social sub criteria, the Global Risk Human Capital score. With, Companies that support ESG initiatives are more likely to attract from investors interest who are aware about environmental and social responsibility. This can lead to cost savings as well as goodwill with the public.

Whereas the **Industry and Materials sector** returns are the least sectors impacted. In fact, the coefficient of correlation is no more than 0,19 for both. This implies that Some companies within these sectors continue to be at odds with the communities where they operate, while others are leading transformative innovations and partnerships.

The figures below represent the correlations between sector returns and ESG scores:

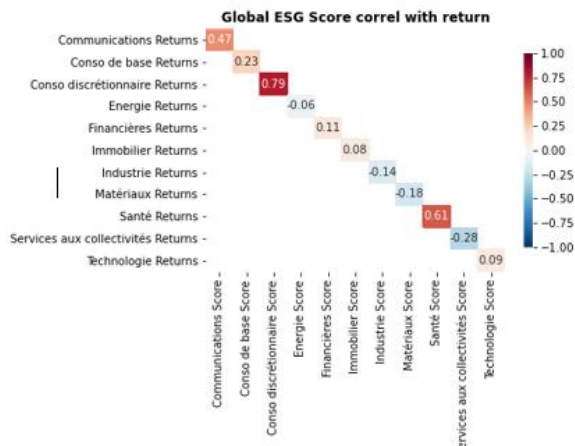


Figure1: Correlation with the Global ESG score

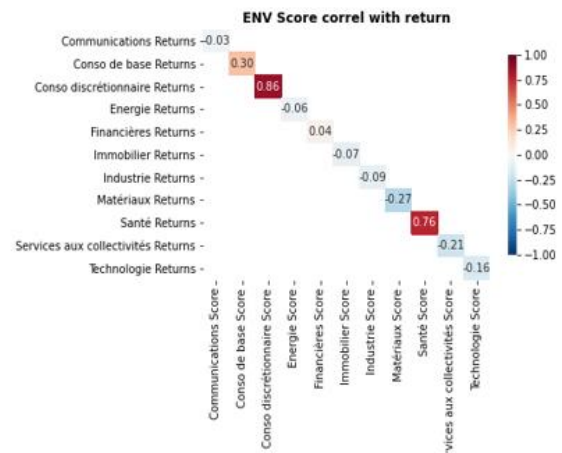


Figure2: Correlation with the Global Environmental score

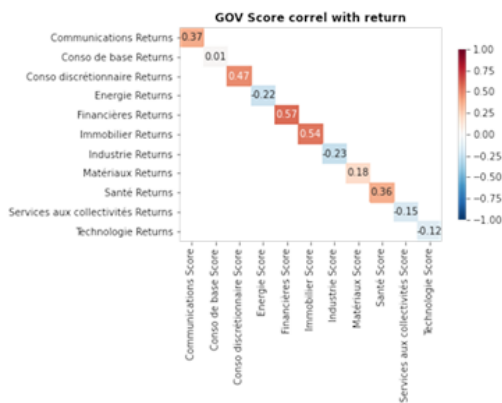


Figure3: Correlation with the Global Governmental score

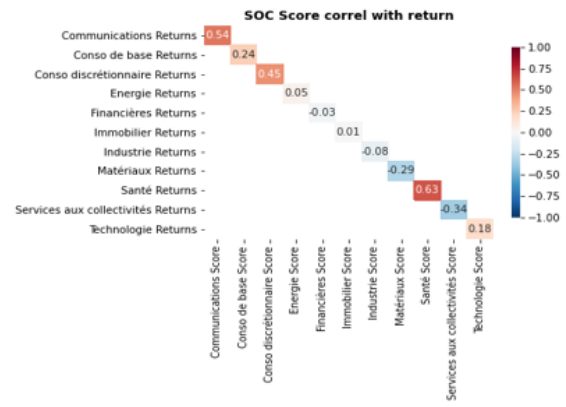


Figure4: Correlation with the Global Social score



Figure5: Correlation with the Risk Human Capital score

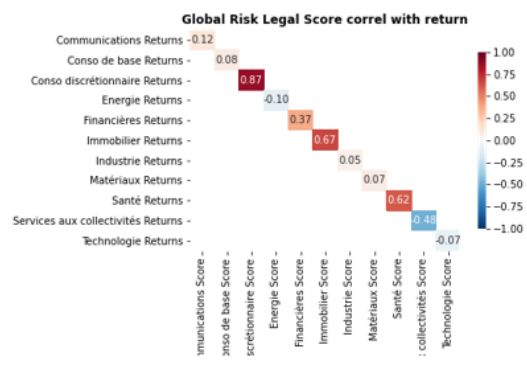


Figure6: Correlation with the Risk Legal score



Figure7: Correlation with the Risk Operations score



Figure8: Correlation with the Risk Reputation score

Another perspective: ESG Scores and Cost of equity:

Other studies suggested on the other hand, that the positive impact of the ESG scores could be measured differently, by examining the cost of equity. This approach concludes that companies with high ESG scores (ESG leaders) on average, encountered lower costs of capital in comparison with companies with poor ESG scores (ESG laggards). Moreover, companies with a lower cost of capital would also likely have a higher valuation, in the consensus of corporate financial theory. Besides having a lower financing cost, high-ESG-scoring companies could also have benefited from the competitive advantage that stems from better management of resources, human capital, and company-specific operational risks.

Impact of ESG practices on corporate credit spreads

When talking about ESG from a credit risk perspective, there are a lot of factors to consider while examining the dynamics of each variable on the other. In fact, as awareness around ESG investing and related financial market issues grew bigger, a lot of confusion started surrounding the difference between a company's sustainability record and the ESG derived financial risks it incurs. During the last few years sustainable debt issuances gained a lot of popularity in financial markets and witnessed a huge growth year after another. This pushes us to examine the impact of ESG practices on credit cost of a company through analyzing related ESG credit Risk factors.

ESG credit Factors are different from the sustainability component of ESG. In fact, When ESG sustainability factors focus on the various ways the company may impact the world and society at large, ESG credit risk factors are more inward looking in the sense that they represent the

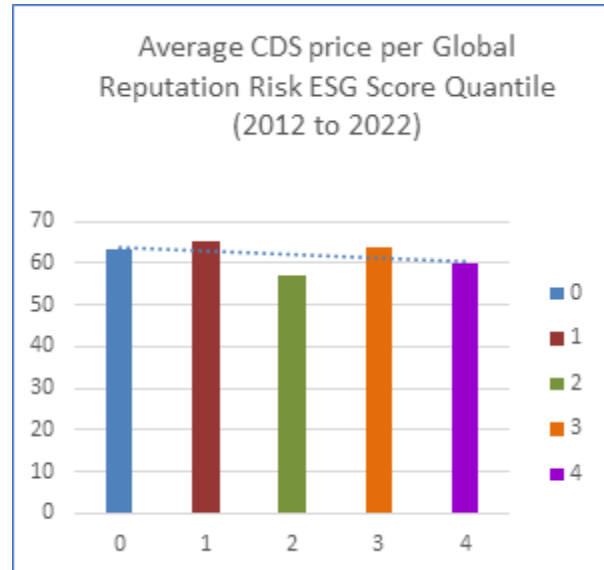
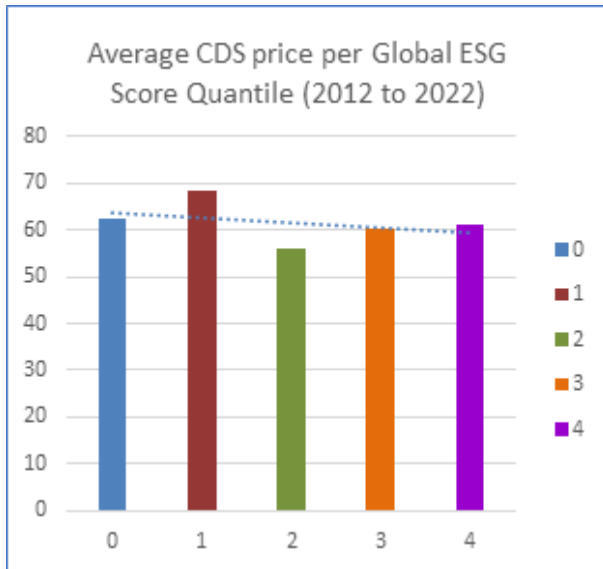
way the world or society may impact the company. The various ESG themes are thus examined through the way they impact the operations of a company, its costs, its solvency and most importantly its credit strength.

ESG credit risk analysis will try to assess a company's vulnerability to various ESG criteria, and the costs generated to fortify the weaknesses if there exists any. In this section we try to investigate the implications of ESG practices on the pricing of firm CDS. The intuitive hypothesis would stipulate that as firms develop their global ESG scores and improve their overall ESG performance, their financial performance will be expected to improve as long as their operations become more stable, and their risks shrink. If this is true, then firm leaders have all the incentivizing reason to start adopting more environmentally and socially acceptable practices. However, in most cases, a company's environmentally or socially conscious initiatives are said to have little material impact on the company's credit profile.

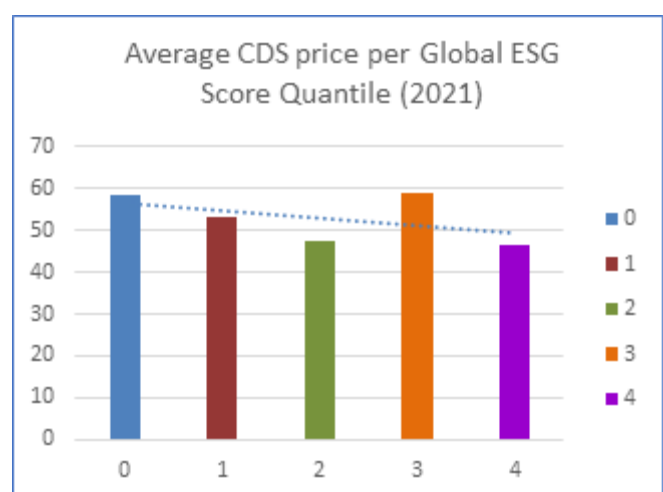
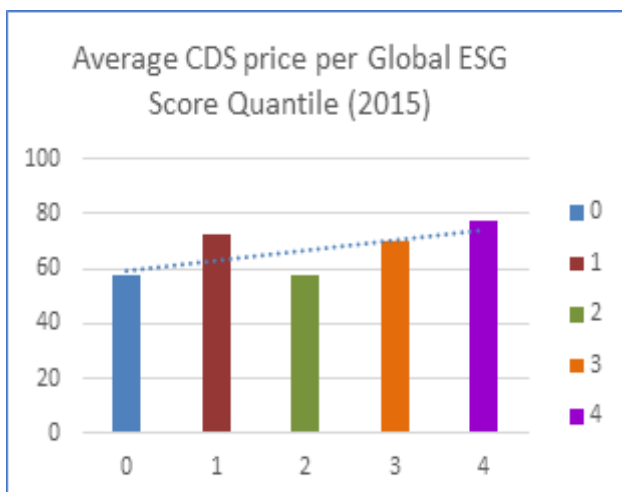
A lot of papers tried to study the impacts of ESG practices on the cost of capital in general and focused mainly on the cost of equity. However, analyzing the cost of equity would be very hard because technically speaking, we can only observe the realized return of a firm's shares not but their expected return. And we know that investors don't always get what they are expecting. Interpreting the results would thus be quite ambiguous because it can be interpreted either way. If the relationship is found to be positive than we can say that ESG performance has a positive impact on financial performance, and if it's the opposite than we could also say that ESG practices help a company lower its cost of equity as it took less for investors to hold on to the stock.

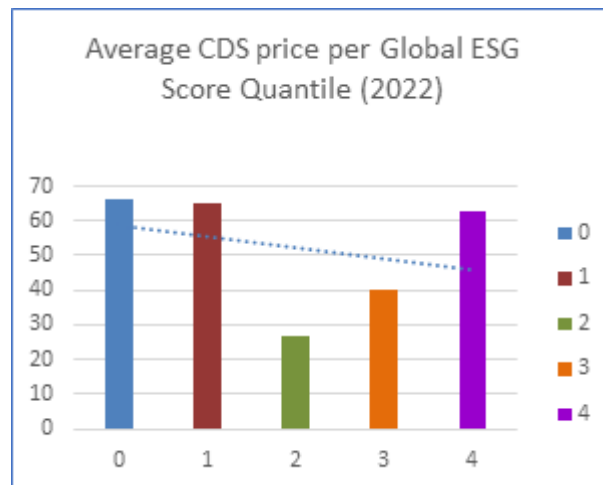
A better way to avoid this kind of issue is to look at debt rather than equity. If a relationship exists between the two variables than we would be able to directly see its impact on the cost of debt of the company, which is more straightforward in computational terms than the cost of equity.

Using 5-year CDS spreads of a cross sectional panel, we tried to explore the link existing between CDS spreads and ESG Global and Reputation risk factors. Using yearly average global and reputation risk ESG scores, we group our companies by quantile and average their corresponding CDS spread. The results obtained through this preliminary examination are plotted below:



The first quantile contains the one fifth of our firm universe with the lowest ESG scores and the last quantile contains the group of firms with the highest ESG scores of the year. We can see that the relationship between CDS spreads and ESG performance is rather low. It is however clear that we are talking about a negative relationship rather than a positive one. This negative relationship seems to be more consistent for the Global ESG scores than it is for the Global reputation risk score. These findings join many more in concluding that the link between ESG performance and credit cost is rather insignificant.



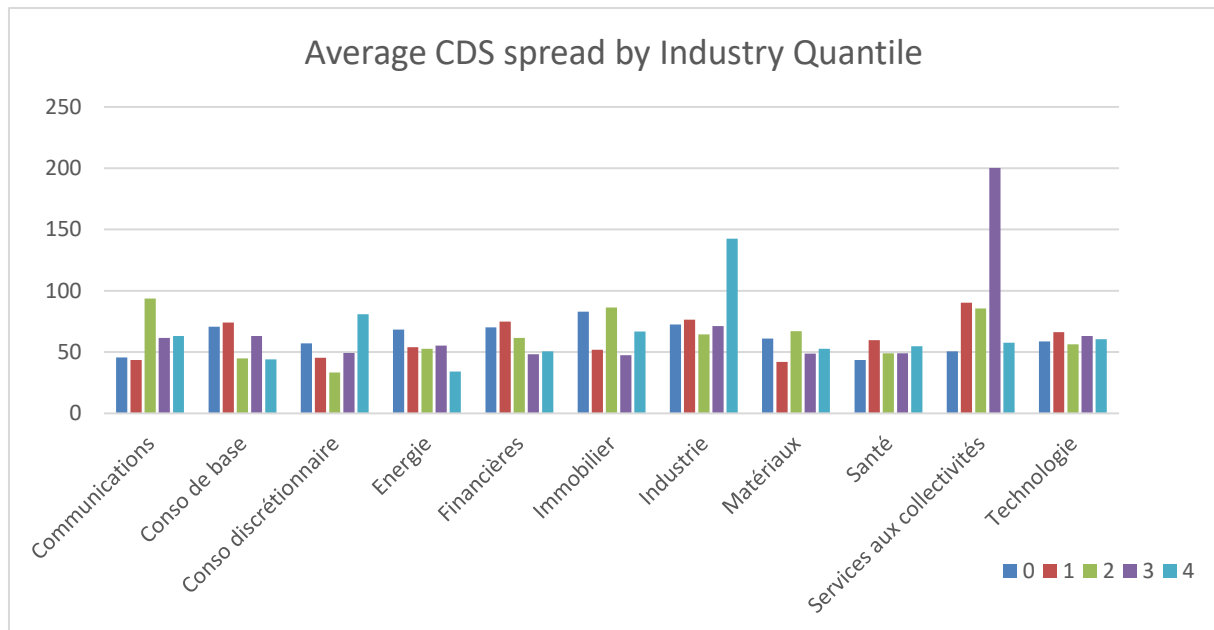


When we look at the time evolution of this relationship, we can see that the dynamics between the two variables have changed with time. When the correlation was of positive between ESG scores and credit cost in 2015, the dynamics changed during 2021 where we see a rather downward sloping trend line between the two variables. In 2022, this correlation is even more negative than it was the previous year.

This highlights the importance of the time horizon in such type of analyses and shows that the perception of firm ESG investing by the market participants has changed trough the years where it was no longer perceived as an investment cost, but rather as an investment opportunity. We still notice some inconsistencies between quantiles where the most rewarded quantile in terms of credit risk pricing is always the median quantile. This suggest that underinvesting as well as overinvesting in ESG practices can be penalized by the market.

This analysis could be completed by a cross sector examination of the dynamics between credit cost and ESG performance to see if the latter still holds or if there are some sectors which are more exposed to ESG credit risk factors more than other.

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This graph shows that there are indeed some sectors which are more sensitive to ESG credit risk factors such as:

- Industry
- Consumer discretionary
- Health

Some other sectors seem to be immune to this type of dynamic to the example of:

- Technology
- financial services
- Energy
- Communication
- Basic consumption

3. OPTIMIZING THE RISK/RETURN PROFILE

Portfolio optimization is a theme of central importance in finance. The application of this optimization criterion in a socially responsible investment universe raises a completely different approach. Even today, the thesis of a possible financial underperformance generated in particular by the voluntary reduction of the investment universe holds a predominant position in the most dubious discourses on socially responsible investment. However, the findings of the scientific literature have tended, for several decades, to invalidate this hypothesis.

We must therefore recognize that investing according to ESG criteria does not mean degrading portfolio performance. On the contrary, a selection strategy based on ESG scores can increase the ESG profile of passive and active portfolios, without necessarily reducing returns.

The optimization objective we were faced with was to succeed in building a strategy based on a systematic approach that would optimize the risk/return trade-off, with the ultimate goal of trying to approach the performance of the MSCI World Index. We therefore constructed 2 portfolios:

- The first approach was based on selecting the 100 best returns under certain constraints:

We therefore sought to maximize the return of our portfolio while minimizing the risk, under a volatility constraint. The aim was not to exceed 13.30% volatility, which is the MSCI world index's volatility.

We have set a maximum weight for our stocks that is equal to 5% and a minimum weight equal to 0.50%.

The results that we managed to get are detailed hereunder:

Total Return	20,16%
Total Volatility	13,30%
Total weight	72,47%
Max weight	5,00%
Min weight	0,50%
Max volaltility	13,30% <--- 10Y Annualized Volatility of MSCI World

Our optimal portfolio has therefore a total return of 20,16% and a volatility of 13,30% which is equal to that of MSCI World Index.

- In the second portfolio, we took the 100 best ESG ratings with the same volatility and weights constraints as before.

It should be noted that with this portfolio, we have obtained a return of 224,76% , which is noticeably greater than the first portfolio's return that is equal to 20,16% , despite the fact that we did not take into account the best returns but rather the best equities rated in terms of ESG criteria. This only confirms the performance of portfolios built under socially responsible constraints.

Total Return	224,76%
Total Volatility	13,30%
Total weight	72,47%
Max weight	5,00%
Min weight	0,50%
Max volatility	13,30% <--- 10Y Annualized Volatility of MSCI World

**The composition of the two portfolios is available in appendix*

To conclude, questioning the financial performance of SRI would mean verifying whether taking CSR and ethics into account generates a financial cost or, on the contrary, generates financial value. At first glance, the terms SRI and performance seem paradoxical and reveal disparities. However, it should be noted that SRI, beyond its ethical aspect, remains above all a financial investment that uses the same principles of financial analysis (the risk/return ratio) as non-SRI investments. From a general point of view, the criteria on the basis of which the performance of SRI could be evaluated are based on the following three points:

- The value of the securities in SRI portfolios and funds
- Performance indicators linked to portfolio management (diversification, duration)
- The role played by the investor

"In order for a stock with the "SRI" label to perform well, the socially responsible company must itself perform well. The stakeholder theory (Freeman, 1984) and the Porter hypothesis (1991) can explain the better performance of SRIs.

4. LINK BETWEEN THE STRATEGY'S METHODOLOGY AND AN SRI INVESTMENT

Any responsible investment approach involves looking at how issuers consider environmental, social and governance issues. Our investment objective is to allocate capital to sustainable economic models with environmental and social benefits by investing companies that offer solutions primarily against environmental problems. Our approach is considering the possibility of building an active portfolio that achieves the goals associated with ESG investing but still generates alpha, a measure of performance, which is the excess return of an investment relative to the return of a benchmark index, consistent with fiduciary duties. To fit an SRI strategy to our portfolio allocation done before, we can evaluate the SDG (Sustainable Development Goals) effect of the resulting active portfolio relative to the benchmark while considering the MSCI World index as the benchmark to beat.

Among the roughly 600 stocks in the index, we will suggest creating an active portfolio of about 50 stocks using the MSCI ESG ratings which show positive ESG momentum, to measure ESG completion and track its performance relative to the index. The expected results are such that the portfolio significantly outperforms the index when relative momentum is used. We, therefore, will try to evaluate this outperformance persistence when controlling for the Fama French three-/five-factor models.

The SDG 'footprint', which stands for an indicator of the pressure put on the environment to support economic growth and to satisfy the material needs of people, present for investors the value of questioning the resilience of their assets to ongoing transformations and therefore, the exposure of investments to the development of new solutions and new economic models to respond to these transformations. Generally, it is confirmed that ESG Momentum portfolios all outperform the index. We assume, the positive connection between ESG, alpha, and SDG footprint is fully consistent with asset owners' trusts, and that there is no trade-off between financial returns vs. positive societal footprint and that these elements emphasize each other.

Other alternative strategies that can be considered, are:

- ***‘Best in class’***: Adjusting the composition of our portfolio by the active selection of only those companies that meet a defined ranking hurdle established by environmental, social and governance criteria, or
- ***‘Best efforts’***: favoring issuers that demonstrate an improvement or good prospects in their ESG practices and performance over time
- ***‘Exclusions strategy’***: adopting a sectoral and/or normative type of exclusions, for instance almost all sustainable funds today exclude the tobacco, thermal coal, and unconventional weapons sectors, as well as nuclear, alcohol, gambling, etc. As well as firms that do not respect the UN Global Compact.