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ESG Investing and Fixed Income: It's Time to Cross the Rubicon

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This research is the companion study of three previous research projects conducted at Amundi that address the issue of ESG (Berg et al., 2014; Bennani et al., 2018; Drei et al., 2019). These studies, which were focused on the stock market, showed that 2014 marks a turning point for ESG screening and the performance of active and passive management in developed equities. Indeed, ESG investing tended to penalize both passive and active investors between 2010 and 2013. Contrastingly, ESG investing has been a source of outperformance since 2014 in Europe and North America. Moreover, it appears that ESG investing and factor investing are increasingly connected. In particular, Bennani et al. (2018) and Drei et al. (2019) concluded that ESG is a new risk factor in the Eurozone.

The case of fixed income is particular since it has been little studied by academics and professionals. It is true that implementing an ESG investment policy in the bond market is less obvious than in the stock market. For example, in the case of sovereign bonds using ESG filters may dramatically change the profile of the bond portfolio, particularly in terms of liquidity. In fact, it seems that ESG investors pursue two different goals when they consider equities and bonds. They invest in stocks with good ESG ratings in order to avoid extra-financial long-term risks, whereas they consider that fixed income is the

field of impact investing. This explains the high demand for green and social bonds, and this also explains why ESG screening is less widely implemented in fixed income markets than in equity markets.

The objective of this new study is to explore the impact of ESG investing on asset pricing in the corporate bond market. For that, we apply the methodologies that have been used by Bennani et al. (2018) for testing ESG screening in active and passive management. In particular, we consider the sorted portfolio approach of Fama and French (1992), and the index optimization method that consists in minimizing the active risk with respect to the benchmark while controlling for the ESG excess score. Three investment universes are analyzed: euro-denominated investment grade bonds, dollar-denominated investment grade bonds, and high-yield bonds. Results differ from one universe to another. In the case of EUR IG bonds, we retrieve some common patterns observed by Bennani et al. (2018) in the case of equities. Indeed, from 2010 to 2013, ESG screening has produced a negative alpha, whereas we observe an outperformance since 2014 when we implement ESG scoring in active and passive management. In the case of USD IG bonds, the results are disappointing since ESG screening produces negative alpha for the entire period. Results on high-yield bonds are difficult to interpret since ESG coverage of this market is not satisfactory.

We also test how ESG has impacted the cost of corporate debt. Our results show that there is a positive correlation between ESG and credit ratings. This is normal since credit rating agencies also incorporate extra-financial risks in their default risk models. Using the approach developed by Crifo et al. (2017), we propose an integrated credit-ESG model in order to understand the marginal effects of ESG on the cost of capital. We find that there is a negative relationship between ESG scores and yield spreads. The better the ESG rating, the lower the yield spread. For instance, we estimate that the cost of capital difference is equal to 31 bps between a worst-in-class corporate and a best-in-class corporate in the case of EUR IG corporate bonds. In the case of USD IG corporate bonds, the difference is lower but remains significant at 15 bps. Moreover, the impact of ESG is more pronounced for some sectors, for instance Banking and Utility & Energy. These results are important because ESG investing and ESG financing are two sides of the same coin. In order to tackle environmental and social issues, ESG must be a winning bet for both investors and issuers.

Keywords: SRI, ESG investing, environmental, social, governance, asset pricing, active management, bond picking, passive management, credit rating, yield spread, cost of debt.

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1 Introduction

Why does ESG investing in the bond markets differ from in the equity markets? For the latter, investors have largely implemented ESG investment principles such as exclusion, negative screening, best-in-class strategies, stock picking with ESG integration, etc. In the case of fixed income, investors are less advanced when managing their bond portfolios. This is particularly true for sovereign bonds where there are few initiatives on this market. Nevertheless, we must confess that implementing a sovereign ESG policy is not neutral for an insurance company or an institutional investor since it may lead to excluding or underweighting some countries that provide high liquidity. More generally, implementing ESG in fixed income may be an issue because it reduces the investment universe and can have a significant liquidity impact. In corporate bonds, ESG investing is more advanced, but remains limited overall. It is not unusual to see some investors that have implemented ESG screening in their stock portfolios, but not in their bond portfolios with the exception of a global exclusion policy because of moral values.

In fact, it seems that investors pursue two different goals when they consider ESG principles. In the case of stocks, they would like to invest in firms that have lower extra-financial risks than the average in the long run. For instance, governance scoring can be used to avoid or reduce reputational risks, environmental scoring can help to reduce exposure to transition and climate risks while social scoring is a way to identify firms with good corporate social performance. In this case, extra-financial analysis is a way to complete and enhance traditional security analysis and stock picking processes based on financial ratios. In other words, the integration of ESG is natural for equity analysts and portfolio managers that can now use new dimensions and variables to assess the future performance of a stock. And this way of thinking is particularly relevant over a long time horizon. This explains why long-term institutional investors are on the cutting edge when it comes to implementing ESG in the equity markets.

In the case of bonds, the development of ESG investing is less advanced, and for many reasons. First, credit agencies pretend to incorporate ESG risks in their ratings, even if it is only one component among others. By the way, we can expect a convergence between credit rating agencies and **ESG** rating agencies in the future[1] (Nauman, 2019). Second, bond scoring systems are mainly driven by three factors: duration, credit spread and liquidity. In a diversified investment grade portfolios, duration and credit risk are the two main active bets and there is less room to play some idiosyncratic risk than in a portfolio of

[1]The convergence has already begun with the purchase of the ESG research firm Vigeo Eiris by Moody's and the acquisition by Standard and Poor's of RobecoSAM **ESG** ratings.

large cap stocks. Third, liquidity issues imply that a significant part of bond portfolios is managed using a buy-and-hold strategy. Therefore, systematic rebalancing is less obvious implying that active bond management with **ESG** signals is complex. Fourth, there is a big difference between investing in stocks or bonds in terms of capital structure. The stock holder is the owner of the firm, and his concern is that the firm is well-managed in the short run in order to prepare the long-term business. The return on equity is then unknown and stochastic. The goal of the bond holder is different. He receives a known and constant return on debt, and faces the risk that the firm defaults before the bond maturity. His primary objective is then to manage the default risk of the firm (Merton, 1974). If the long-term business of the firm gets worse, the stock holder is impacted, but not the bond holder as long as the firm fulfills all its credit obligations. Therefore, it makes sense that equities are more sensitive to extra-financial risks than bonds. Finally, the fifth reason concerns the mindset of investors. Generally, they incorporate **ESG** scoring directly in the management of their equity portfolio and this integration becomes increasingly comprehensive as the investors develop their ESG expertise. They do not dramatically change how they manage their fixed income portfolio[2]. In fact, ESG investing in fixed income is more identified with pure play securities such as green, social or sustainability (GSS) bonds. Therefore, it seems that ESG investing is more related to impact investing in the bond universe.

This way of thinking leads to an issue. Indeed, in this approach, ESG investing does not really imply a change to how the portfolio is managed, but is more related to the concept of portfolio completion. It is like managing two fixed income portfolios: a traditional portfolio of bonds, with a merely financial objective, and another independent portfolio of bonds, that aims to implement an impact investing policy. Nevertheless, the market for green, social and sustainability bonds is small despite its impressive growth rate. This is why we observe a supply/demand imbalance of ESG fixed income securities. There is a high demand from investors, but the supply is limited in particular if we exclude projects coming from the financial sector. Moreover, this market is relatively young and much development needs to take place before it matures. For example, Cochu *et al.* (2016) identify some bottlenecks concerning the development of the green bond market: lack of project pipelines, lack of definition and framework, lack of information and knowledge, lack of clear risk profile, etc. Regarding the bond definition, the High-Level Expert Group (HLEG) established by the European Commission developed an EU roadmap on sustainable finance in 2018. In addition, the Technical Expert Group (TEG) has also published a report on a green bond standard. A survey of European investors by the Climate Bond Initiative (Almeida *et al.*, 2019) in-

[2]Most of the time, they implement an exclusion policy.

dicates that investments have not reached their potential. There is a mismatch between the bonds on offer and the preferred bond profile. Indeed, investors are seeking bonds with climate impact from non-financial institutions (and sovereign issuers) while development banks are currently leading the issue of green bonds. This lack of supply of non-financial corporate bonds leads to green bonds not being able to be represented in portfolios of large institutional investors. Another survey by ICMA (2018) points out that a majority of investors have not received sufficient research on the added financial value of green and social bonds. In this context, a lot of progress is expected in order to develop the alternative market of green, social and sustainability bonds. However, this market will only broaden gradually, meaning that the imbalance between supply and demand will certainly continue for several years.

While investors will have to wait for the GSS bond market to broaden, what can they do in the meantime? They can do exactly the same thing as they have done for their equity portfolios. They have the opportunity to invest their fixed income portfolios with an integrated ESG approach which will differentiate bonds according to the issuer's ESG characteristics. And a shift of large institutional investors will certainly send a strong signal to corporations and promote the development of ESG at all levels, not only from the side of debt investors, but also from the side of debt issuers. Indeed, there is the feeling that two independent debt markets co-exist, and the development of the green market has little impact on the traditional debt market. In order to observe real disruption, issuers with bad **ESG** ratings must face a financing cost that is much higher than issuers with good **ESG** ratings. A supply/demand imbalance on the market of green and social bonds is not enough. This is why a supply/demand imbalance on the traditional debt market for good ESG securities is also necessary[3].

In this article, we focus on corporate bonds, which correspond to the traditional debt market of large corporations. We investigate the performance of bond portfolios with ESG screening. Like Bennani *et al.* (2018a), we consider both active and passive management. In the case of active management, we use the approach of Fama and French (1992), which consists in building sorted portfolios based on **ESG** scores. The objective is to compare best-in-class and worst-in-class portfolios in order to test whether or not ESG screening creates alpha. In the case of passive management, we tilt the benchmark index in

[3]The dynamics of investment flows can also be accelerated if central banks and supervisory bodies participate in the ESG debate and become proactive. For instance, academics have already called for the consideration of green quantitative easing. Nevertheless, green QE is currently unrealistic if it only concerns green (and social) bonds. It can be implemented only if it also concerns the traditional bond markets with ESG criteria. In a similar way, it is important that regulation policies help to promote ESG fixed income by differentiating capital treatment for example.

order to obtain optimized portfolios with a better **ESG** score than the index portfolio. We can then verify if the ESG integration helps to outperform the benchmark index. Active and passive management processes based on ESG screening mainly interest investors or the demand side of ESG investing. We also consider the supply side of ESG investing by analyzing the impact of **ESG** scoring on the cost of capital. For that, we test an integrated credit-ESG model to explain the yield spread of bonds and understanding how the cost of debt can be affected by ESG.

Since there is not just one corporate bond market, we first focus on euro-denominated investment grade corporate bonds. Indeed, due to the mobilization of European investors, it is certainly the most active fixed income market where ESG screening is implemented[4]. Then, we consider investment grade corporate bonds denominated in dollar. The distinction between EUR IG and USD IG is not arbitrary. Indeed, Drei *et al.* (2019) showed that ESG has impacted the stock markets differently on either side of the Atlantic. Finally, we explore ESG screening in high-yield bonds. Again, we can expect some significant differences, because the big challenge in this type of market is to avoid the default risk.

2 The Performance of ESG Investing in the Case of Euro Investment Grade Corporate Bonds

In this section, we consider the impact of ESG screening on euro-denominated IG corporate bonds. We first describe the data, then we test ESG screening from an active management point of view, and finally we consider the implementation of **ESG** scoring in passive management. In this discussion paper, we use the terminology of Bennani *et al.* (2018b). However, the sorted portfolio approach is far to represent an active bond strategy. It measures more the performance of the ESG factor. Concerning passive management and optimized portfolios, the frontier with active management is less pronounced than in stock markets. Indeed, bond active management generally implements active risk with respect to a benchmark. It may concern duration, credit, sector or country risks. Nevertheless, we keep this terminology because the sorted portfolio approach is related to alpha generation whereas the optimized portfolio approach is implemented by ESG passive managers.

[4]The figures of ESG assets under management reported by GSIA (2019) do not give a true picture of ESG investing in the world. Indeed, they indicate that the North American market is comparable to the European market. However, there is a consensus that Europe is leading the ESG market and the initiatives in ESG investing (CBI, 2019).

We consider the euro-denominated universe of corporate bonds from the Intercontinental Exchange Bank of America Merrill Lynch (ICE BofAML) Large Cap (investment grade) Corporate Bond Index on a monthly basis from January 2010 to August 2019. For each bond, we use the total/credit return, the modified duration, the credit spread, the yield-to-maturity and the sector classification provided by the index sponsor. We filter the universe by excluding distressed bonds[5] in order to overcome their fanciful credit spreads or returns. To each issuer, we associate the **ESG** score provided by Amundi when they are available. We notice that the coverage ratio is satisfactory since it exceeds 85% for all periods reaching 95% in August 2019.

We consider the scoring system provided by the Amundi ESG Research department. For each company and each month, we assess the **ESG** score and its three components: **E** (environmental), **S** (social) and **G** (governance). These scores are based on the data of four external providers and are reviewed and validated by internal ESG analysts. The scores are normalized sector by sector in order to obtain a z-score shape, implying that they generally have a range between -3 and $+3$. This also means that the scores are sector-neutral and they are approximatively distributed as a standard Gaussian probability distribution.

2.2 Active management and ESG sorted portfolios

For testing ESG screening in active management, we use the Fama-French sorted portfolios method. Every month, we rank the bonds with respect to their score, and form five quintile portfolios[6]. Portfolio Q_1 corresponds to the 20% best-rated bonds, whereas Portfolio Q_5 corresponds to the 20% worst-rated bonds. The selected bonds are equally-weighted within a sector, whereas sorted portfolios are sector-neutral, implying that the weight of each sector in a quintile portfolio corresponds to the weight in the benchmark index. Moreover, each portfolio is rebalanced on a monthly basis, meaning that the portfolio is invested the first trading day of the month and is held for the month.

The results are reported in Figure 1. For each sorted portfolio, we indicate the annualized credit return. Following Bennani *et al.* (2018b), we split the entire period between two subperiods: 2010–2013 and 2014–2019. During the first period, the best-in-class portfolio slightly underperforms the worst-in-class portfolio (2.52% versus 2.57%), which has the largest performance among the five sorted portfolios. If we consider the 2014–2019 period, we obtain another story. Indeed, we observe an increasing relationship between the **ESG** score

[5]They mainly have a rating below CCC.

[6]Given a universe of bonds, each portfolio is comprised of 20% bonds.

Figure 1: Annualized credit return in bps of **ESG** sorted portfolios (EUR IG, 2010–2019)

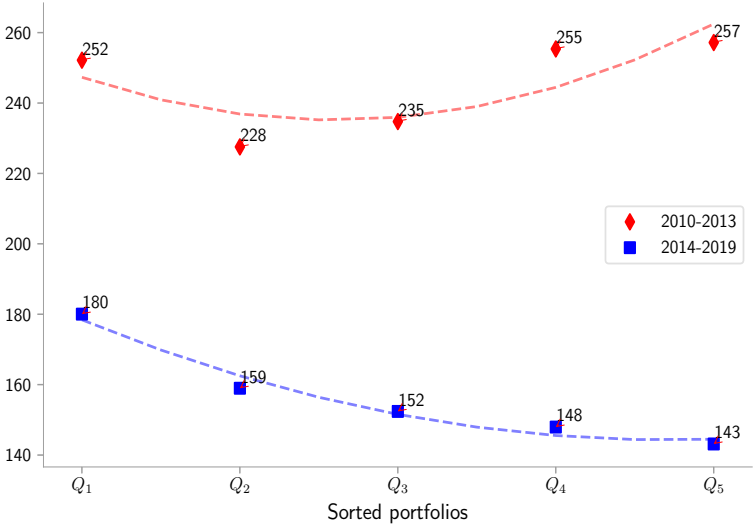
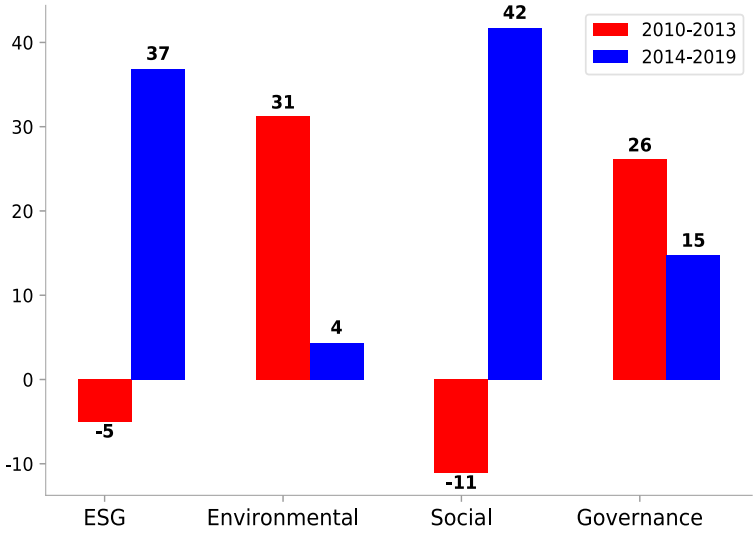


Figure 2: Annualized credit return in bps of the long/short $Q_1 - Q_5$ strategy (EUR IG, 2010–2019)



and the return of quintile portfolios. Portfolio Q_1 displays a credit return of 1.80% whereas Portfolio Q_5 shows a performance of 1.43%. If we consider the individual pillars, results are very similar. The recent period is generally more favorable to ESG investors, and the shape of the relationship is more apparent between 2014 and 2019 than between 2010 and 2013.

If we now consider the strategy that consists of being long in Portfolio Q_1 and short in Portfolio Q_5, we obtain results reported in Figure 2. We can see the change in integration of ESG and its pillars in the EUR IG corporate bond market. In terms of credit return, all $Q_1 - Q_5$ portfolios exhibit positive performances in 2014–2019, which was not the case in 2010–2013. We also see an improvement for **ESG** and **S** scores, making the **S**ocial the new winning pillar whereas the winning pillar was **E**nvironmental during the previous period 2010–2013.

These results are particularly remarkable because Portfolio Q_1 has generally a lower carry than portfolio Q_5 as shown in Table 1. This means that market-to-market effects success to compensate this short carry exposure.

Table 1: Carry exposure in bps of the long/short $Q_1 - Q_5$ strategy (EUR IG, 2014–2019)

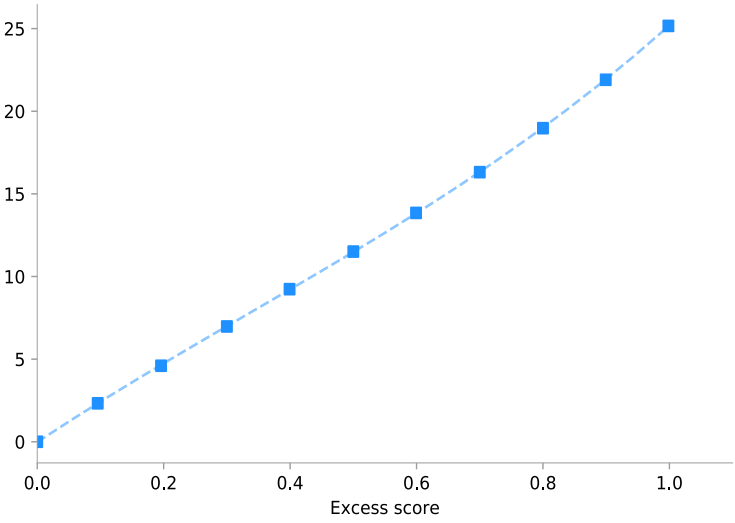
Metric	**ESG**	**E**	**S**	**G**
DTS	−75	−54	−78	−50
OAS	−15	−15	−14	−11

2.3 Passive management and ESG optimized portfolios

The goal of **ESG** investing is to select assets that have a better **ESG** score than the investment universe. For instance, the long/short $Q_1 - Q_5$ strategy represents a pure alpha strategy without any reference to a benchmark. In the case of passive management, the portfolio manager faces a constraint on the active risk that he could take with respect to the benchmark index. In what follows, the active risk measure is a weighted average of the duration and credit risks. Then, we implement an optimization program, which consists in minimizing the active risk while controlling the **ESG** excess score of the tilted portfolios.

Starting from an **ESG** excess score equal to zero, we progressively increase the **ESG** score of the optimized portfolio until we reach one. In Figure 3, we report the relationship between the **ESG** excess score and the ex-post tracking error (TE). We verify that the increase in the **ESG** excess score leads to an

Figure 3: Tracking error in bps of **ESG** optimized portfolios (EUR IG, 2010-2019)



increase in the ex-post tracking error. For instance, targeting an excess score of one requires accepting a tracking error of 25 bps. We retrieve the results we have found for equity indices (Bennani *et al.*, 2018a; Drei *et al.*, 2019): "*Investors must accept a tracking error risk if they want to implement ESG in a passive management framework, where the benchmarks correspond to market capitalization-weighted indices*".

Figures 4 and 5 show the impact of the ESG integration on the excess credit return of optimized portfolios for both periods 2010–2013 and 2014–2019. During the first period, the excess return of **ESG** optimized portfolios is negative, meaning that ESG passive investors were penalized. This is particularly true when optimized portfolios targeted high excess scores. For instance, an **ESG** excess score of +1 has produced underperformance of −35 bps per year. Since 2014, we observe slight positive outperformance that peaks at +4 bps when the **ESG** tilt is set to +1. We also notice that the relationship between the **ESG** excess score and the excess credit return is increasing.

If we now consider the individual pillars, **E**, **S** and **G** optimized portfolios underperform during the 2010–2013 period. Among the three pillars, **E**nvironmental is the best pillar and its excess return slides down until −22 bps when the targeted excess score is set to +1. **G**overnance is the worst pillar, and its excess return reaches −49 bps for the same tilt. After 2014,

Figure 4: Excess credit return in bps of optimized portfolios (EUR IG, 2010–2013)

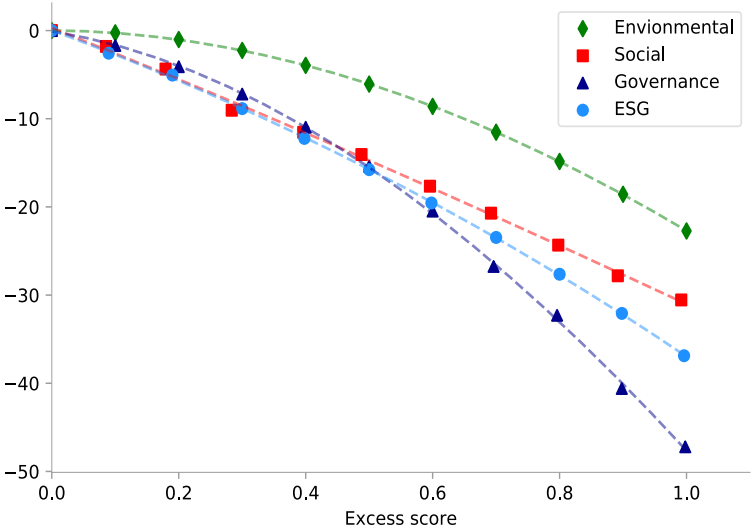
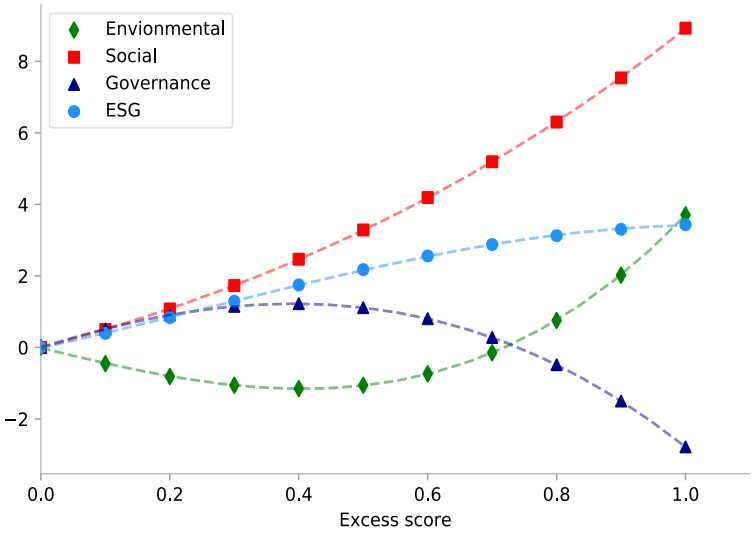


Figure 5: Excess credit return in bps of optimized portfolios (EUR IG, 2014–2019)



excess credit returns are between −3 and +9 bps. **S**ocial is the winning pillar and exhibits significant outperformance that peaks at +9 bps. Excess credit returns of **E**nvironmental and **G**overnance seem to be negatively correlated.

Overall, these results from passive management confirm the results from active management. The recent period is more favorable to ESG investors than before 2014. However, we observe a big difference between active and passive management. Indeed, our results show curiously that **G**overnance is not really rewarded in passive management even for the recent period. This means that imposing a benchmark is not neutral when implementing an ESG investment policy.

3 Another Transatlantic Divide

While Bennani *et al* (2018b) observe eight years of parallel development in the performance of ESG investing in the stock market between North America and the Eurozone before 2018, Drei *et al.* (2019) find a contradictory trend during the recent period. Since 2018, the performance of **ESG** scoring continues to be positive and remains at the same level in the Eurozone, whereas it is reduced and even slightly negative for the **E**nvironmental pillar in North America.

Figure 6: Annualized credit return in bps of the long/short $Q_1 - Q_5$ strategy (USD IG, 2010–2019)

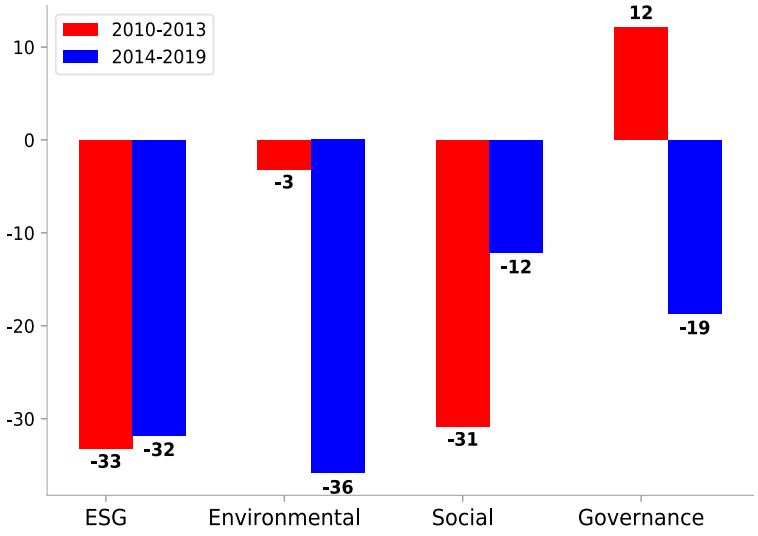


Figure 7: Excess credit return in bps of optimized portfolios (USD IG, 2010–2013)

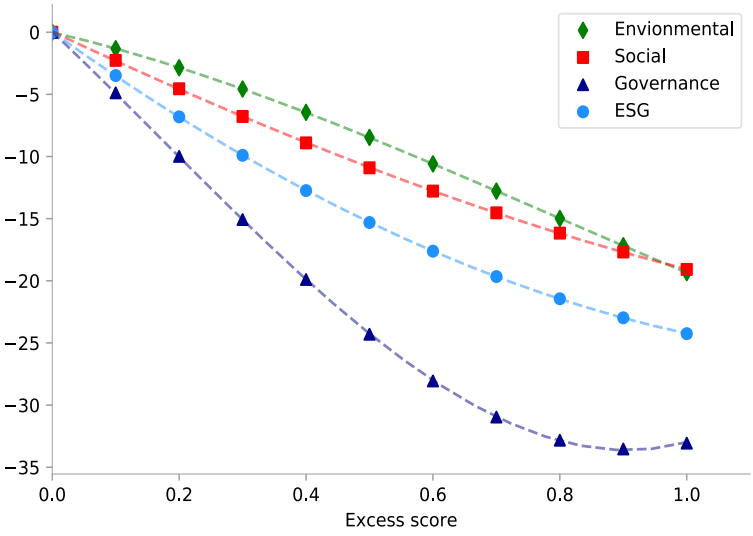
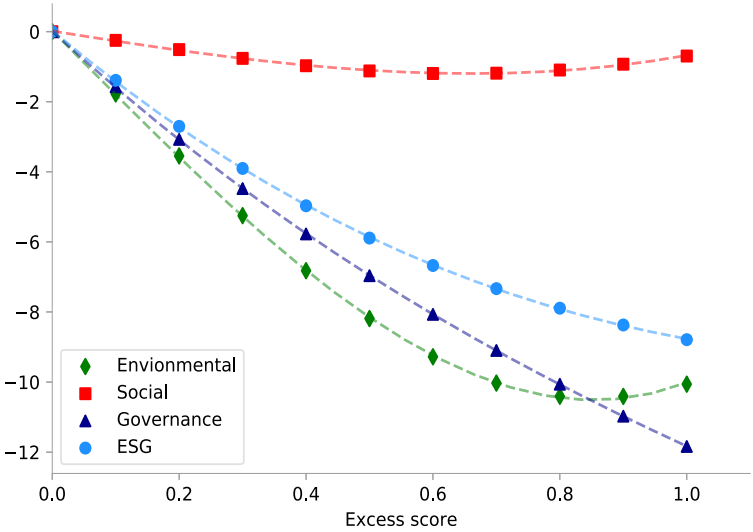


Figure 8: Excess credit return in bps of optimized portfolios (USD IG, 2014–2019)



If we consider the universe of USD investment grade corporate bonds, we observe another transatlantic divide. If we consider sorted portfolios, we do not observe a clear ranking between the quintile portfolios for both periods. For instance, Portfolio Q_1 is ranked third on average if we consider the four scores (**ESG**, **E**, **S** and **G**) and the two periods. In Figure 6, we report the annualized credit return of the long/short $Q_1 - Q_5$ strategy. We notice that Portfolio Q_5 outperforms Portfolio Q_1 except for the **G**overnance pillar between 2010 and 2013. From an active management point of view, ESG investing has therefore not created alpha for the entire 2010–2019 period.

These results are confirmed if we consider passive management (see Figures 7 and 8). Nevertheless, the substantial underperformance during the 2010-2013 period has been dramatically reduced since 2014. For instance, the excess return is close to zero for **S**ocial optimized portfolios between 2014 and 2019. Another interesting remark is the behavior of the **G**overnance pillar. In many academic studies, linkage between ESG and corporate financial performance is generally justified by the governance transmission channel. Our results show that the **G**overnance pillar is not necessarily the most important factor, and investing in bonds with a good **G**overnance score is not fundamentally better than using the other pillars.

We may wonder if the transatlantic divide really concerns the currency of issued bonds or if it is more a regional issue. For instance, a EUR-denominated bond can be issued by an European corporate, but also by a firm which is located outside Europe. In a similar way, a USD-denominated bond can be issued by an American corporate, but also by a firm which is located outside America. In Figures 9 and 10, we have calculated the contribution to credit return of the different regions (Europe, Noth America and others) for the long/short $Q_1 - Q_5$ strategy. We notice that Europe had a systematic positive contribution whereas North America has a systematic negative contribution whatever the currency (EUR and USD). If we consider optimized portfolios instead of sorted portfolios, results are similar. Therefore, this transatlantic divide shows that ESG investing is a source of outperformance when it concerns IG bonds of European issuers, but a source of underperformance when it concerns IG bonds of American issuers.

Figure 9: Contribution in bps to credit return (EUR IG, 2014–2019, $Q_1 - Q_5$ strategy)

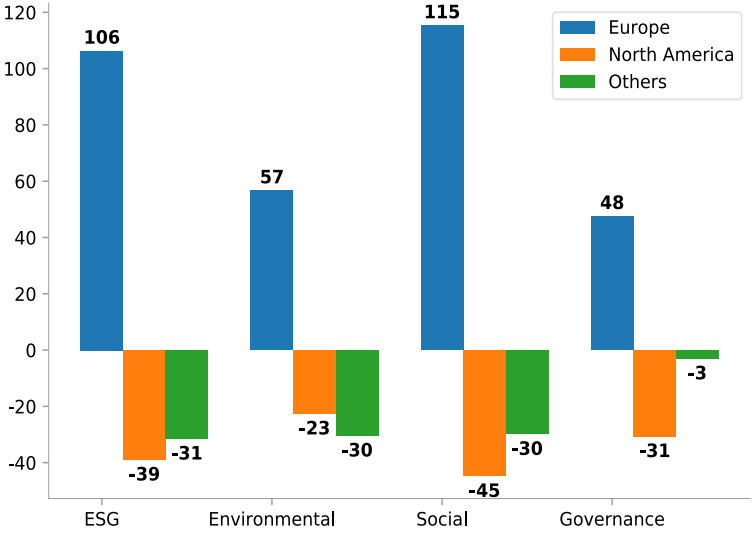
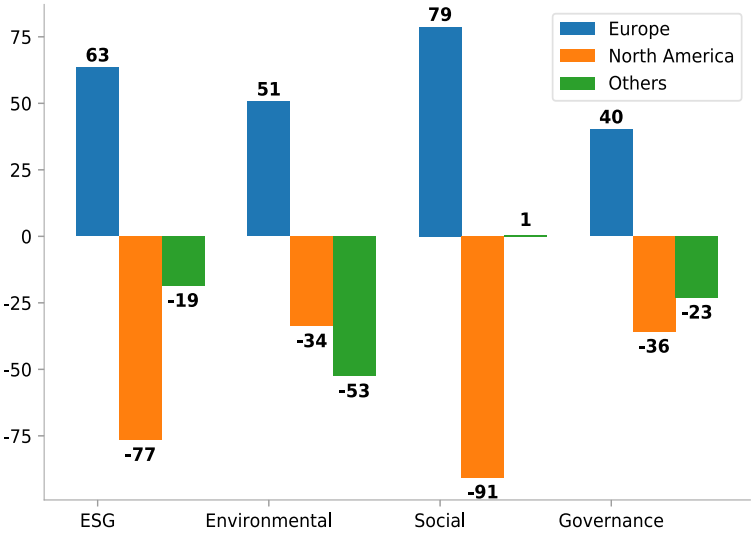


Figure 10: Contribution in bps to credit return (USD IG, 2014–2019, $Q_1 - Q_5$ strategy)



4 Impact of ESG Investing on the Cost of Capital

As explained in the introduction, there is some evidence that ESG impacts the cost of capital. A bad **ESG** rating can then increase the cost of equity or the cost of debt. However, the relationship between **ESG** rating and the cost of debt is not straightforward. Indeed, demonstrating that ESG impacts the cost of borrowing requires the marginal effects of ESG to be isolated from other explanatory variables. For example, it is obvious that credit ratings also influence the cost of debt. As such, the big challenge is to build an integrated model that considers all the dimensions that can affect the cost of debt.

4.1 The interconnectedness between ESG ratings and credit ratings

We first illustrate that there is a relationship between **ESG** ratings and credit ratings. For instance, Figure 11 shows the average **ESG** score by rating classes. Therefore, bonds with a good credit rating have a better **ESG** score than bonds with a bad credit rating. We reiterate that **ESG** scores are z-scores between -3 and $+3$, implying that the mean of **ESG** scores is equal to zero whereas the standard deviation is equal to one. A Student's t test shows that **ESG** scores by ratings are statistically different from zero. Therefore, **ESG** scores and credit ratings are not independent. This is normal since credit rating agencies also incorporate extra-financial risks into their evaluations.

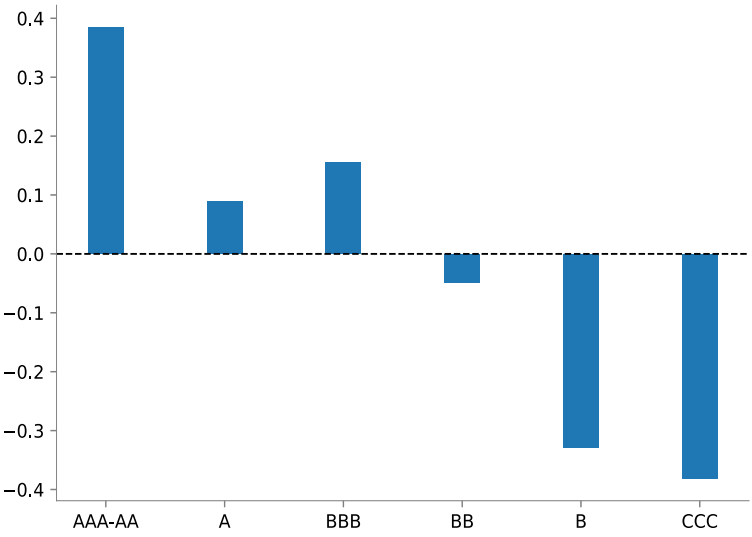
4.2 An integrated credit-ESG model

To investigate the relationship between ESG and credit spread, we adopt the model introduced by Crifo *et al.* (2017). We run a panel data regression model with fixed time effects using all the **ESG** rated bonds in the 2010–2019 period. Let $\text{OAS}_{i,t}$ be the option adjusted spread of Bond i at time t. We assume that the logarithm of the yield spread depends on the **ESG** score and other control variates:

$$\begin{aligned}\ln \text{OAS}_{i,t} &= \alpha_t + \beta_{esg} \cdot \mathcal{S}_{i,t} + \beta_{md} \cdot \text{MD}_{i,t} + \sum_{j=1}^{N_{Sector}} \beta_{Sector}(j) \cdot Sector_{i,t}(j) + \\ &\quad \beta_{sub} \cdot \text{SUB}_{i,t} + \sum_{k=1}^{N_{Rating}} \beta_{Rating}(k) \cdot \mathcal{R}ating_{i,t}(k) + \varepsilon_{i,t} \qquad (1)\end{aligned}$$

where $\mathcal{S}_{i,t}$ is the **ESG** z-score of Bond i at time t, $\text{SUB}_{i,t}$ is a dummy variable accounting for subordination of the bond, $\text{MD}_{i,t}$ is the modified duration,

Figure 11: Average **ESG** score with respect to the credit rating (2010–2019)



$\mathcal{S}ector_{i,t}(j)$ is a dummy variable for the j^{th} sector.

In Table 2, we report several statistics of the regression model for the EUR IG universe[7]. The coefficient of determination R^2 calculates the explanatory power of the model. R^2 is relatively high at around 60% while the number of observations is equal to 191 579! We also notice that it has increased during the 2014–2019 period by 6% on average. The VIF statistic is the acronym of the variance inflation factor, a measure of multi-collinearity of two exogenous variables. As a rule of thumb, a VIF lower than 5 indicates a low dependence between the independent variables. We verify that VIF is relatively low in both periods and pillars, even though it has slightly increased in the second period. The excess contribution stands for the difference in R^2 between the regression with the **ESG** score and the regression without the **ESG** score. We observe that this excess contribution becomes significant after 2014. For instance, it is equal to +4.0% for the **ESG** score.

Testing that the **ESG** score has a significant impact on the yield spread is equivalent to assuming hypothesis $\mathcal{H}_0 : \beta_{esg} < 0$. In Table 2, we report the value taken by $\hat{\beta}_{esg}$ and the corresponding t-statistic for the **ESG** score and its three pillars. All the betas are negative and significant at the 99% confidence level. The negative relationship between the score and the yield spread has

[7]By construction, the dummy variables for the BB, B and CCC ratings are deleted because

Table 2: Results of the panel data regression model (EUR IG, 2010–2019)

	2010–2013				2014–2019			
	ESG	**E**	**S**	**G**	**ESG**	**E**	**S**	**G**
R^2	60.0%	59.4%	59.5%	60.3%	66.3%	65.0%	65.2%	64.6%
VIF	2.50	2.49	2.49	2.53	3.14	3.15	3.13	3.13
Excess R^2	0.6%	0.0%	0.2%	1.0%	4.0%	2.6%	2.9%	2.3%
$\hat{\beta}_{esg}$	-0.05	-0.01	-0.02	-0.07	-0.09	-0.08	-0.08	-0.08
t-statistic	-32	-7	-16	-39	-124	-98	-104	-92

also increased during the 2014–2019 period. On average, one unit of the **ESG** score implies a reduction of 9 bps after having neutralized the effects of credit rating, subordination, duration and sector. This means that the yield spread difference between a best-in-class corporation and a worst-in-class corporation is equal to 31 bps. Whereas **G**overnance was the most discriminant pillar between 2010 and 2013, we do not observe that a pillar discriminates more than another for the recent period.

If we consider the USD IG corporate bond universe, we obtain the results given in Table 3. First, we notice that the excess R^2 is low even for the recent period. Second, only the **G**overnance pillar has a negative sign during the first period. This is not the case for the recent period. Indeed, the relationship between the **ESG** score and the yield spread is negative and significant, except for the **S**ocial pillar. Nevertheless, the relationship for USD IG corporate bonds is weaker than the one observed for EUR IG corporate bonds. For example, the cost of debt between a best-in-class corporation and a worst-in-class corporation is equal to 15 bps, which is the half of the yield spread difference we have observed for EUR IG corporate bonds.

Table 3: Results of the panel data regression model (USD IG, 2010–2019)

	2010-2013				2014-2019			
	ESG	**E**	**S**	**G**	**ESG**	**E**	**S**	**G**
R^2	52.7%	52.8%	52.8%	53.4%	60.6%	60.5%	60.3%	60.9%
VIF	2.64	2.67	2.62	2.58	2.97	3.00	2.99	2.94
Excess R^2	0.0%	0.2%	0.2%	0.7%	0.3%	0.2%	0.0%	0.7%
$\hat{\beta}_{esg}$	-0.00	0.03	0.03	-0.07	-0.04	-0.03	-0.00	-0.06
t-statistic	-2	19	21	-43	-48	-40	-0	-73

5 Conclusion

This article summarizes the main conclusions found by Ben Slimane *et al.* (2019). The results on the EUR IG bond market share many common points with those obtained by Bennani *et al.* (2018) and Drei *et al.* (2018) with the stock market. Indeed, we observe that the 2014–2019 period is more favorable to ESG investors than the 2010–2013 period. In the first period, we generally observe a negative alpha in terms of active management when ESG investors implement best-in-class versus worst-in-class bond selection, and underperformance of **ESG** tilted portfolios. In the second period, the active management strategy creates a positive alpha and **ESG** optimized portfolios have positive excess returns with respect to the benchmark index. Among the different pillars, **S**ocial is the winning pillar. This is also one of the main conclusions reached by Drei *et al.* (2019) when analyzing the recent behavior of the stock market.

If we consider USD IG corporate bonds, results are mainly negative. However, we observe a trend that the cost of ESG investing has decreased over time. In recent years, the alpha of ESG active and passive management remains negative, but it is lower. In the case of high-yield bonds[8], results are less convincing and we also face some robustness issues. One of the problems is the coverage ratio of high-yield bonds by ESG rating agencies, which is much lower than for investment grade bonds. There has been a lot of progress recently, and future years will be critical for developing ESG investing in these types of markets[9].

Our study also exhibits an increasing relationship between ESG and credit ratings, demonstrating that there is an interconnectedness between extra-financial and financial risks. We also notice that ESG has a positive impact on the cost of debt and this relationship has become stronger in recent years. For instance, we estimate that the cost of capital difference is equal to 31 bps between a worst-in-class corporate and a best-in-class corporate in the case of EUR IG corporate bonds. The relationship between ESG and the cost of debt is less strong if we consider USD IG corporate bonds. Nevertheless, it remains significant. For instance, the previous cost of capital difference becomes 15 bps for USD IG corporate bonds, which is the half of the figure calculated for EUR IG corporate bonds.

All these findings are interesting for ESG investors. On the positive side, ESG investing in corporate bonds has created alpha in both active and passive management in the case of EUR investment grade bonds. Disappointingly,

[8]The results are not reported in this study, and they can be found in Ben Slimane *et al.* (2019).

[9]We face a similar issue with emerging markets, both in the stock and bond markets.

ESG investing is challenging in the universe of high-yield bond, and USD-denominated investment grade bond universes. But the most important finding is the impact of ESG on the cost of capital. It is obvious that this result is related to the supply/demand balance and the dynamics of investment flows. We must not forget that ESG investing and ESG financing are two sides of the same coin. Many ESG investors consider that the debt market is the right channel through which to make a green and social impact. At the micro-economic level, green and social bonds can be viewed as the right answer. However, our study shows that it can be complemented by incorporating ESG into the traditional debt market. At the macro-economic level, it can then be an alternative solution if the supply/demand imbalance is sufficiently high. This implies that the mobilization of ESG investors must be greater in fixed income markets.

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A Appendix

Figure 12: Annualized credit return in bps of **E** sorted portfolios (EUR IG, 2010–2019)

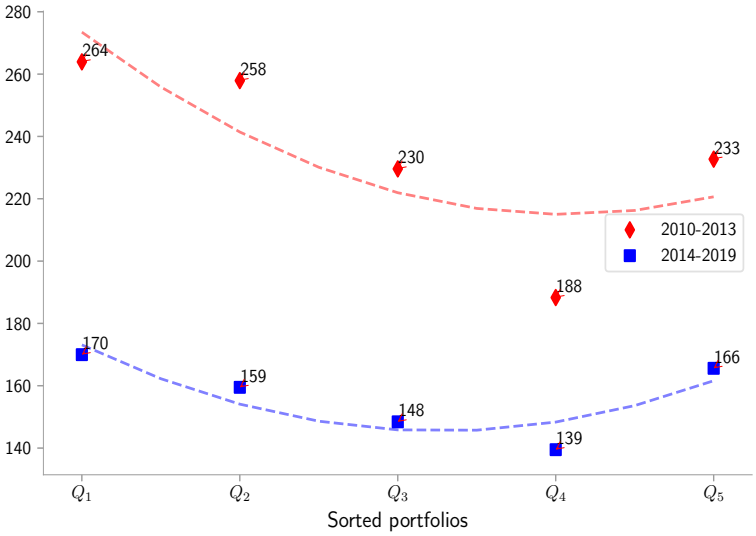


Figure 13: Annualized credit return in bps of **S** sorted portfolios (EUR IG, 2010–2019)

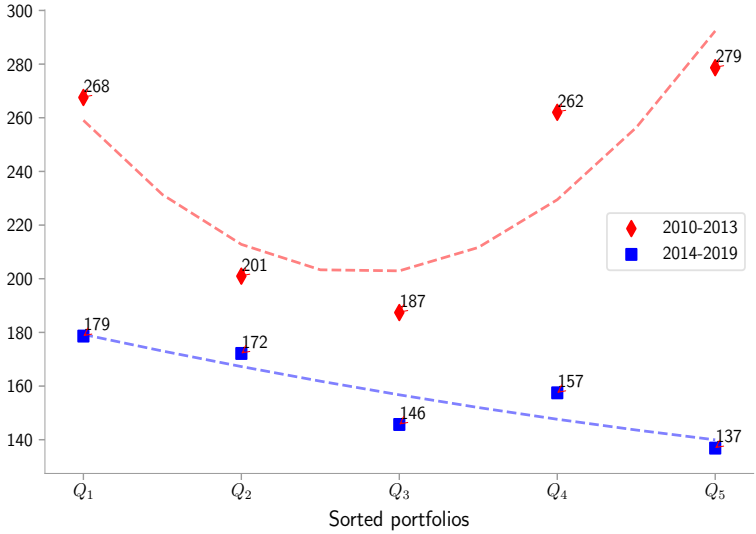
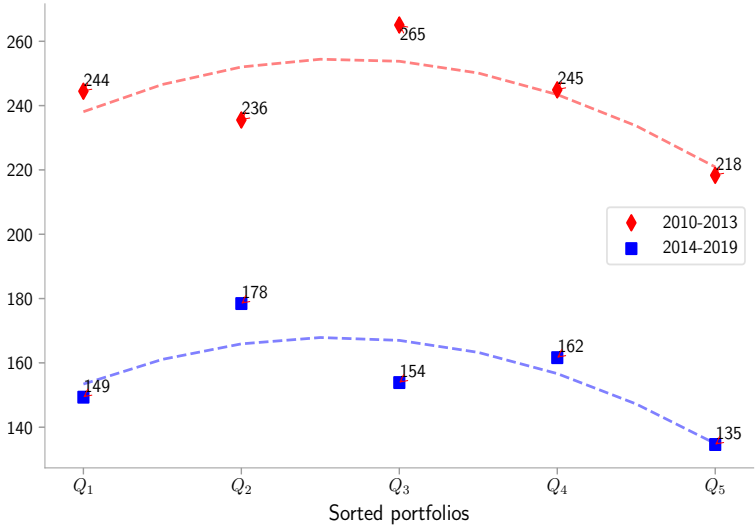


Figure 14: Annualized credit return in bps of **G** sorted portfolios (EUR IG, 2010–2019)



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