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How ESG Investing Has Impacted the Asset Pricing in the Equity Market

Research
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ESG investing has gained considerable traction over the past few years and, alongside smart beta, factor investing and alternative risk premia, is one of the current hot topics for the asset management industry. Nevertheless, even though large institutions such as insurance companies, pension funds and sovereign wealth funds have invested significantly in ESG strategies over recent years and we are observing a substantial and increasing interest from other investors such as wealth management or retail investors, the question of performance remains a controversial issue and a puzzle for the financial community. Indeed, academic findings have been mixed and have revealed a U-shape pricing of stocks in the equity market, meaning that both best-in-class and worst-in-class ESG stocks have been rewarded by the equity market in the past.

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The main drawback of these studies is that they are based on long-term historical data, typically the last 25 years. However, the tools that have been developed for the extra-financial analysis of listed companies are relatively recent. In a similar way, we may consider that ESG investing was more of an anecdotal and exploratory investment idea, and was limited to a small number of players before the 2008 Global Financial Crisis. This is why we are strongly convinced that the academic research on ESG asset pricing must focus on the more recent years in order to benefit from higher confidence in the ESG data used; thereby avoiding the production of noisy and non-robust results that do not reflect the current behavior of the financial market.

As a result, we have focused our analysis on the period from January 2010 to December 2017. Regarding the ESG data, we have used the metrics provided by the Amundi ESG Research department. For each company and each date, we access the **ESG** score and its three components: **E** (environmental), **S** (social) and **G** (governance). The drawback of this research is that we use proprietary data, because public data are not always satisfactory. The great benefit is that the scoring system depends on the data of four external providers, the data have been cleaned, normalized and checked by data analysts, and the final score has been reviewed and validated by ESG analysts. It is also important to stress that the scores are sector-neutral. In this study, we have considered five investment universes covered by MSCI indices: MSCI North America, MSCI EMU, MSCI Europe ex EMU, MSCI Japan and MSCI World. Moreover, we define three types of strategies that correspond to the main approaches of ESG investing: active management (or stock picking portfolios), passive management (or optimized index portfolios) and factor investing (or multi-factor portfolios). In order to be realistic, each strategy's portfolio is rebalanced on a quarterly basis in order to obtain an acceptable turnover.

From a general standpoint, the results show that the impact of ESG screening on return, volatility and drawdown is highly dependent on the time period, the investment universe or the strategy. In particular, we observe a radical change in the behavior of ESG-based stock picking portfolios during the study period January 2010 – December 2017. More specifically, the first half of the period is less favorable to ESG investors than the second half. We find no evidence of a consistent reward of ESG integration in stock prices between 2010 and 2013. On the contrary, we observe that introducing ESG scores in stock picking strategies would have led to neutral or negative results. Our results also confirm the U-shape behavior of ESG investing in the Eurozone. In North America, being an ESG investor would have been a handicap in terms of return generation during this period. In the other regions (Europe ex EMU and Japan), the

results are more favorable or neutral. From a risk management perspective, we observe a negative impact of ESG screening on drawdowns in the Eurozone¹ and a neutral impact in North America. Only the integration of the environmental component seems to reduce the portfolio's risk in North America during the 2010 – 2013 period.

The recent period marks a radical break, as most indicators turned positive between 2014 and 2017. In North America, buying the best-in-class stocks and selling the worst-in-class would have generated an annualized excess return of 3.3%. We observe similar results for the three pillars, especially for the environmental pillar. For **ESG** and **E** components, the positive excess return is explained by outperformance of best-in-class stocks and underperformance of worst-in-class stocks. For **S** and **G** components, the positive excess return clearly comes from the poor performance of worst-in-class stocks. The results are even more convincing for the Eurozone. Indeed, buying the best-in-class stocks and selling the worst-in-class would have generated an annualized excess return of 6.6% during the 2014 – 2017 period! The most important trend reversal concerns the governance pillar, both in terms of excess return and drawdown reduction. Nevertheless, we also notice that the integration of the social pillar in stock prices is different from what we observe for **E**, **G** or **ESG** screening. Indeed, the **S** screening seems to have only been rewarded since 2016 in the Eurozone as well as in North America. The results are mixed when it comes to Europe ex EMU and Japan. In Europe outside the Eurozone, the excess return due to ESG screening is not significantly different from zero. In Japan, the excess return is slightly negative despite Abenomics reforms, and the risk-return tradeoff is not stable over time during the 2014 – 2017 period.

While active managers are more focused on stock picking portfolios, a large number of institutional investors prefer to implement ESG investing using optimized benchmarking portfolios in order to fit their strategic asset allocation (SAA) policy. For instance, they generally define a SAA portfolio based on market-capitalization indices, and monitor their investments by computing the tracking error between the invested portfolio and the strategic portfolio. In this case, they accept a maximum level of tracking error. This is why we have built ESG-based optimized portfolios by minimizing the tracking error with respect to the cap-weighted index for a given **ESG** excess score². In the case of the MSCI World Index, we show

¹ During this period, sovereign risk dominated other forms of risk. To a certain extent, this factor may explain this result.

² We also require the allocation to be region-neutral. Since the scores are sector-neutral, the optimization performs a selection effect, and not a region/sector allocation effect.

that improving the **ESG** score³ by 0.5 implies accepting a tracking error of 32 bps on average. This result clearly demonstrates that there is no free lunch. Being an ESG investor requires taking on a tracking error risk. This result highlights the need to develop ESG-based SAA policy and ESG-based equity indices. This is the only way to avoid being constrained by the traditional cap-weighted benchmarking framework.

The performances of optimized portfolios are in line with those obtained with the stock picking framework. For instance, ESG-based benchmarking portfolios have an excess return with respect to the cap-weighted index, that is negative for the 2010 – 2013 period and positive for the 2014 – 2017 period. This result is valid for the MSCI North America, MSCI Europe and MSCI World index investment universes. If we consider the three pillars, we observe large differences. During the 2010 – 2013 period, optimized portfolios result in a negative excess return whatever the scoring system (**E**, **S** or **G**) in North America. In Europe, the excess return is positive for the environmental pillar, neutral for the governance pillar and negative for the social pillar. The story is completely different during the 2014 – 2017 period, since all pillars produced a positive excess return except for the social score which presents more neutral results. In North America, the big winner is undoubtedly the environmental score while governance in Europe largely dominates the two other pillars (**E** and **S**).

By analyzing the relationship between excess score, tracking error and excess return, we obtain an interesting by-product finding. Indeed, we observe that infinitely increasing the **ESG** score of the optimized portfolio could be detrimental. For instance, when the excess score is above 1.0, we observe a decreasing relationship between the performance and the **ESG** score during the 2014 – 2017 period. The main reason is the diversification impact on optimized benchmarking portfolios. By imposing a too strong ESG excess score, the optimized portfolio is increasingly constrained, implying that the diversification decreases. Therefore, there is an optimal cut-off under which ESG investing really adds value with little impact on the diversification. Above this cut-off, ESG investing transforms an optimized index portfolio into a constrained active portfolio.

The relationship between ESG and diversification translates into the factor investing framework and raises the fundamental question of whether ESG is a new risk factor. Traditionally, factor investing portfolios are built around five risk factors: size, value, momentum, low-volatility and quality. By analyzing the cross-section variance of stock returns, the single-factor approach shows that ESG has challenged market, value and quality risk factors since 2014 in North America and the Eurozone.

³ The scores are normalized in order to have a range between -3 and +3.

If we consider the time-series analysis of MSCI indices, the multi-factor approach underlines that ESG is significant in the Eurozone, but not in North America for the same period. In order to confirm these results, we used a statistical selection method for ranking the style factors. In the Eurozone, the factor picking approach shows that ESG appears to be the first selected factor before value and momentum risk factors. In North America, ESG is the second selected factor behind quality, but before momentum. By introducing more factors, ESG's involvement in the time-series variance breakdown is reduced. This analysis demonstrates the interaction between ESG and traditional risk factors. Finally, a correlation study confirms that ESG helps to enhance the diversification of multi-factor portfolios in the Eurozone. In North America, the results are ambivalent.

All the previous results show that the stock market integrated extra-financial metrics differently over the 2010 – 2017 period. In particular, we observe a clear change during these eight years, implying that the 2010 – 2013 period cannot be compared with the 2014 – 2017 period. During the first sub-period (2010 – 2013), we found little evidence that ESG investing really adds value in terms of return, risk and drawdown. It's quite the opposite in North America and in the Eurozone. These results contrast with those we obtained for the second sub-period (2014 – 2017). Indeed, ESG investing would have been rewarded by the market during this period, especially in the Eurozone followed by North America. The results are both positive for stock picking portfolios and optimized portfolios with a benchmark. It follows that ESG investing does make a lot of sense for both active and passive management. The integration of ESG in a factor investing framework is more puzzling. Backward looking, ESG seems not to be a new risk factor in North America whereas ESG could improve the diversification of multi-factor portfolios in the Eurozone⁴. Forward looking, ESG appears to be a very serious candidate to join the very exclusive club of risk factors that explain the cross-section of stock returns.

Our results can be related to the ESG landscape and the regional importance of ESG investing. According to the Global Sustainable Investment Alliance (2017), Europe is the first ESG market and represents more than half of global assets that are managed using ESG strategies. It is followed by North America, and these two regions are far ahead of Japan, Australia and Asia Pacific ex Japan. It is no coincidence that our results reflect the mindset of investors. Since ESG

⁴ In other words, ESG investing remains an alpha strategy in North America, whereas it has become a beta strategy in the Eurozone.

is an important issue for European investors and ESG investing has been largely integrated by European institutional investors, European stock prices must be influenced by this tremendous trend. In North America, our study shows that the trend has clearly begun. In other regions, ESG investing is not yet sufficiently important to impact asset pricing. Since we observe a feedback loop between extra-financial risks and asset pricing, we may also wonder whether the term “extra” is relevant, because ultimately, we can anticipate that these risks may no longer be extra-financial, but simply financial.

Finally, our results can also be related to the question of impact investing. While it is extremely difficult to measure the impact of one institution or one investor, we can nevertheless extend this issue by considering the whole community of ESG investors. Does ESG investing have an impact on corporate firms? For the financial market, the answer is definitively yes.

Keywords: SRI, ESG investing, environmental, social, governance, asset pricing, active management, stock picking, passive management, optimized benchmarking portfolio, factor investing, factor picking, impact investing.

1 Introduction

ESG investing is part of the rising awareness regarding sustainable development. For instance, the United Nations General Assembly defined 17 sustainable development goals (SDGs) in September 2015 that each country must implement and achieve by 2030. In October 2018, the International Panel of Climate Change released a special report that calls for the limitation of global warming to 1.5°C in order to reduce the occurrence of future extreme risks for human, nature and ecological systems. In this environment, governments, corporate firms and people are the three layers necessary to change the development path.

From a financial perspective, asset owners and asset managers have also a role to play. Thus, the United Nations-supported Principles for Responsible Investment (PRI) initiative is an international network of investors that promote ESG investing. Since its creation in April 2006, the PRI have been signed by 400 asset owners, 1 500 investment managers and 250 service providers. After the 2008 global financial crisis, the concept of green finance has rapidly developed, and has increasingly impacted the landscape of the financial world. While green finance is a generic term to designate the financing¹ of green assets (infrastructure for low-carbon transition, renewable energies, water management, biodiversity protection, etc.), ESG investing is a more comprehensive term, and is not limited to the environmental challenge, but also encompasses social and governance considerations.

The reasons for ESG investing are generally two-fold. First, it can be motivated by ethical values, with an impact on the economy. For instance, investors may wish to promote gender equality, reduce carbon footprint or not be part of anti-personnel mines and chemical weapons financing. Second, it can be motivated by the need to manage and mitigate long-term risks. The latter can be operational, reputational, but also regulatory and financial. By definition, these two objectives are interconnected. For example, investors may not want to participate in controversial industries for ethical reasons, or risk motivations, or both.

However, we may wonder about the impact of being an ESG investor on an investor's performance. Discussions of this issue remain taboo both for asset owners and asset managers. The initial reaction is generally not to answer to this question. Indeed, some investors will say that this is not a relevant question, because the main objective of ESG investing is to have a positive impact on the economy, rather than to improve the performance of managed portfolios. Nevertheless, the fiduciary duty of an institutional investor, a pension fund for example, could go beyond extra-financial objectives. By definition,

¹Green assets can be directly financed by banks and investors, or by issuing green bonds.

its fiduciary responsibility is also financial.

If we consider academic research on the performance of ESG, we obtain mixed results. Theoretical economic models strongly support ESG integration. It is no coincidence that William Nordhaus has won the Nobel Prize this year for integrating climate change into long-term macro-economic analysis. We also find micro-economic models that explain the benefits of ESG integration on the different levels of the economy, in particular by enabling better management of corporate firms, negative economic externalities and moral hazard. Nevertheless, the results are less convincing when we consider empirical models. On the one hand, we can find academic works that show a positive relationship, but they are more corporate finance studies. On the other hand, there are also academic studies that exhibit a negative or non-positive relationship². For example, Barnett and Salomon (2006) observed a U-shaped profile between screening intensity and risk-adjusted performance. This implies that both ESG best-in-class and worst-in-class stocks outperform the other stocks on average. In a similar way, Renneboog *et al.* (2008) found no significant effect of socially responsible investment and concluded that “*the existing studies hint but do not unequivocally demonstrate that SRI investors are willing to accept suboptimal financial performance to pursue social or ethical objectives*”.

It is also more or less the message of the discussion paper published by Amundi in 2014 (Berg *et al.*, 2014). The conclusion of this study was neutral. Being an ESG investor has no significant cost in terms of risk and return. For Europe or the world, the tracking errors of optimized portfolios are low, while they are high for the US and the Pacific. The authors concluded that ESG investing is a cost-free process. Since this research was conducted on the period January 2005 – May 2013, we may wonder whether these results still hold for the recent period. This is why we have conducted a similar study³ on the period January 2010 – December 2017, because we think that the ESG data used might not have been relevant and robust in the 2000s. In what follows, we summarize the results obtained by Bennani *et al.* (2018), who analyzed the impact of ESG on three portfolio management approaches: active management, passive management and factor investing.

²Some articles are famous because of their catchy title: “*To Sin or Not To Sin*” (Chong *et al.*, 2006), “*Sin Stock Returns*” (Fabozzi *et al.*, 2008) or “*The Price of Sin*” (Hong and Kacperczyk, 2009).

³The comprehensive research of Bennani *et al.* (2018) is available on the Amundi Research Center.

2 The performance of ESG active management

Before explaining the portfolio construction process, we describe the ESG data that have been used for this study. We consider the scoring system provided by the Amundi ESG Research department. For each company and each date, we access 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 have a range between -3 and $+3$. This also means that the scores are sector-neutral and distributed as a standard Gaussian probability distribution.

For building the active management strategy, we use the Fama and French (1992) method of sorted portfolios. Every quarter, we rank the stocks with respect to their score, and form five quintile portfolios⁴. Portfolio Q_1 corresponds to the 20% best-ranked stocks, whereas Portfolio Q_5 corresponds to the 20% worst-rated stocks. The selected stocks are then equally-weighted and each portfolio is invested the first trading day of the quarter and is held for three months. Quarterly rebalancing is implemented in order to limit the turnover⁵.

We consider five investment universes using the corresponding MSCI indices: North America, Eurozone (or EMU), Europe ex EMU, Japan and Global DM (or World). For each universe and each quintile portfolio, we calculate the gross performance without taking into account transaction costs⁶. By analyzing the results, we observe a break during the 2010 – 2017 study period. Typically, the first half of the period is less favorable to ESG screening than the second period. This is why we have decided to split the period between 2010 – 2013 and 2014 – 2017. In Figure 1, we have reported the annualized return of the five sorted portfolios in North America in which we integrate the **ESG** score. During the period 2010 – 2013, Portfolio Q_1 displays a return of 14.6% whereas Portfolio Q_5 shows a return of 17.8%. We observe an increasing function between the return and the quintile. During this period, best-in-class stocks underperformed worst-in-class stocks. The story is different when we focus on the 2014 – 2017 period. Portfolio Q_1 displays a performance of 13.0% whereas Portfolio Q_5 shows a performance of 9.4%. Clearly best-in-class stocks outperformed worst-in-class stocks during the recent period. If we consider individual components, we obtain very similar results: **E/S/G** stock picking negatively impacted performance between 2010 and 2013, whereas the impact

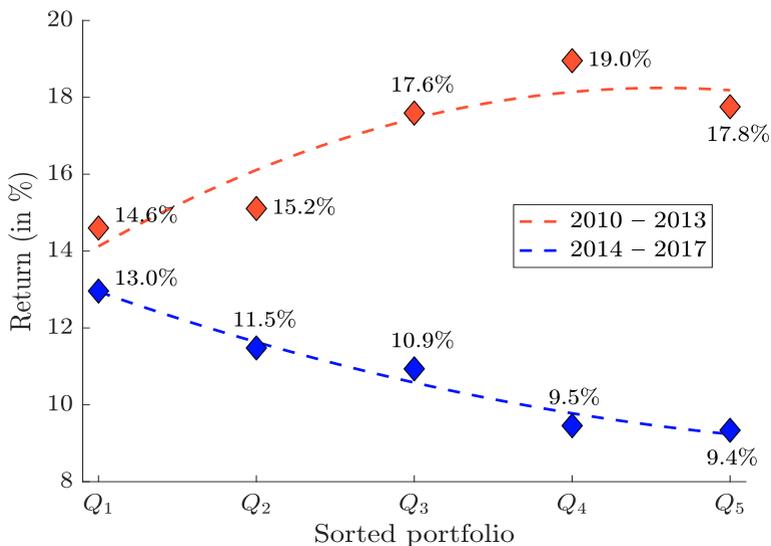
⁴Given a universe of stocks, each portfolio is composed of 20% of assets.

⁵The average one-way turnover is 80% for the Eurozone and 65% for North America.

⁶On average, the turnover of Portfolios Q_1 and Q_5 is comparable and is smaller than for Portfolios Q_2 , Q_3 and Q_4 . Therefore, transaction costs have little impact on the overall results.

of **E/S/G** stock picking on performance is positive between 2014 and 2017. During the 2014 – 2017 period, the environmental screening produces the best result, followed by the governance scoring. However, for the governance component, the performance difference between Portfolios Q_1 , Q_2 , Q_3 and Q_4 is not significant. Only Portfolio Q_5 underperforms substantially, meaning that worst-rated stocks are penalized, but best-rated stocks are not necessarily rewarded.

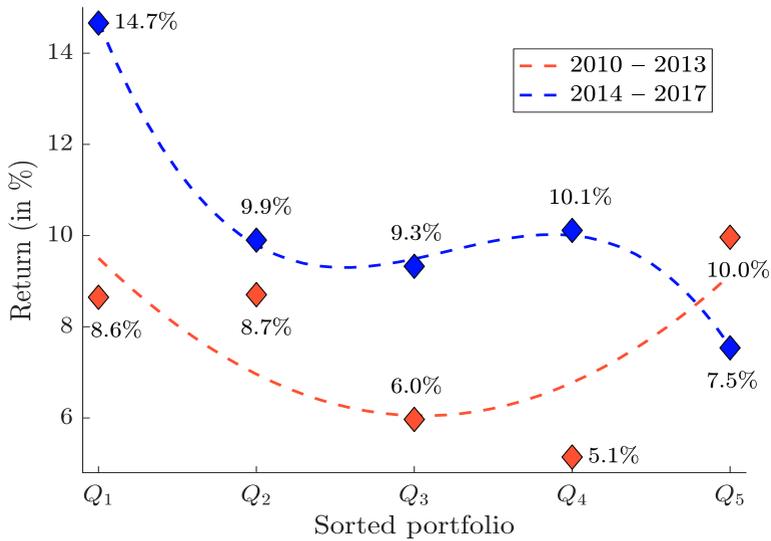
Figure 1: Annualized return of **ESG** sorted portfolios (North America)



These results clearly show that ESG active management was penalized during the 2010 – 2013 period, whereas it created an excess performance in more recent years. In the case of the Eurozone, the conclusion is the same for the **ESG** score, and its three components. For instance, Portfolio Q_1 generated a return of 8.6% whereas Portfolio Q_5 generated a return of 10.0% between 2010 and 2013 (Figure 2). On the contrary, the performance was respectively 14.7% and 7.5% for Portfolios Q_1 and Q_5 during the 2014 – 2017 period. Therefore, the first period is characterized by a U-shape, whereas best-in-class stocks far outperformed worst-in-class stocks over the second period. We notice that the performance difference mainly concerns Portfolios Q_1 and Q_5 , but not Portfolios Q_2 , Q_3 and Q_4 , implying that worst-in-class stocks are penalized and best-in-class stocks are rewarded. If we consider the individual pillars, governance is the most discriminant component⁷. The difference between Q_1 and

⁷It may be surprising that the environmental pillar in North America and the governance

Figure 2: Annualized return of ESG sorted portfolios (Eurozone)



Q_5 Portfolios exceeds 7% during the last period. For the **E** score, we observe a U-shape behavior between 2010 and 2013. Since 2014, the relationship between the quintile portfolios and their returns is clearly decreasing. It is less impressive than for the **G** score, but it affects all the portfolios⁸. The integration of the social pillar is the least convincing, but we see a break since 2016 like in North America.

For the other investment universes, the results are more heterogeneous. In the case of the Europe ex EMU universe, ESG integration is country specific, meaning that the performance is highly dependent on the overweight or underweight of each country. For example, the **G** screening largely overweights UK stocks if we consider a $Q_1 - Q_5$ long/short portfolio. On the contrary, **E** or **S** screenings promote Swedish stocks. The case of Japan is puzzling.

pillar in the Eurozone performed the strongest over the recent years. Indeed, we generally think that governance is an important topic in Anglo-Saxon countries, while environment is more relevant in European countries. However, a well-accepted factor does not necessarily differentiate corporate firms and higher regional standards do not always imply more impact on stock returns. In this case, investors seem to proceed the other way around and select pillars that are differentiating within the region. This is certainly why the market considered that environment in North America and governance in the Eurozone were more selective than governance in North America and environment in the Eurozone.

⁸For the **G** score, the difference mainly concerns Portfolios Q_1 and Q_5 , and less so the median portfolios.

Indeed, ESG screening was more favorable during the 2010 – 2013 period than recently. Moreover, we observe that the returns of sorted portfolios depend on the weighting scheme, and there is some performance inconsistency over time. When we consider a global DM universe, the results are similar to those obtained for North America and the Eurozone. These different results are summarized in Table 1, where we have reported the impact of ESG screening (**E**, **S**, **G** and **ESG**) on the returns of sorted portfolios. Again, we illustrate the contrast between the two periods.

Table 1: Impact of ESG screening on sorted portfolio returns

2010 – 2013					
Factor	North America	Eurozone	Europe ex EMU	Japan	Global DM
ESG	--	-	0	+	0
E	-	0	+	-	0
S	-	-	0	-	-
G	-	0	+	0	+
2014 – 2017					
Factor	North America	Eurozone	Europe ex EMU	Japan	Global DM
ESG	++	++	0	-	+
E	++	++	-	+	++
S	+	+	0	0	+
G	+	++	0	+	++

A risk/return analysis also implies the need to investigate the risk dimension. Since investors are more sensitive to portfolio losses than portfolio volatility in the equity market⁹, we report the maximum drawdown in Table 2. We notice that ESG screening does not necessarily reduce the risk. This is true for all scores (**E**, **S**, **G** and **ESG**) for the 2010 – 2013 period¹⁰. We observe similar but less marked results for the 2014 – 2017 period. Portfolio Q_1 dominates Portfolio Q_5 only for the **E** score in North America, and the **ESG** and **G** scores in Eurozone. Therefore, the use of ESG screening has not enabled improved drawdown management. Certainly, the reason is that long-term risk management and drawdown management must reconcile two different time horizons.

⁹For instance, volatility of 18% instead of 20% does not make a lot of difference for a portfolio of stocks.

¹⁰The only exception is the social pillar in North America, where Portfolio Q_5 experienced a larger drawdown than Portfolio Q_1 . However, Portfolio Q_1 is dominated by Portfolios Q_3 and Q_4 .

Table 2: Maximum drawdown of sorted portfolios

	ESG			Environmental			Social			Governance		
	2010-2013	2014-2017	2010-2013	2014-2017	2010-2013	2014-2017	2010-2013	2014-2017	2010-2013	2014-2017	2010-2013	2014-2017
	North America											
Q_1	-23.64%	-19.89%	-22.89%	-18.70%	-22.84%	-21.30%	-23.38%	-23.74%				
Q_2	-22.10%	-21.29%	-22.34%	-18.13%	-22.75%	-18.58%	-23.90%	-19.75%				
Q_3	-24.23%	-22.59%	-23.35%	-23.84%	-21.69%	-20.42%	-22.69%	-18.96%				
Q_4	-21.83%	-22.35%	-22.23%	-22.00%	-21.13%	-22.81%	-21.36%	-20.13%				
Q_5	-21.60%	-20.30%	-22.61%	-22.24%	-25.44%	-22.39%	-21.82%	-23.32%				
	Eurozone											
Q_1	-36.28%	-20.58%	-36.20%	-26.43%	-33.78%	-25.60%	-36.32%	-21.64%				
Q_2	-34.42%	-26.55%	-32.71%	-23.54%	-33.03%	-27.12%	-33.23%	-22.19%				
Q_3	-31.85%	-27.11%	-32.58%	-27.74%	-31.51%	-28.28%	-35.30%	-27.25%				
Q_4	-33.61%	-26.88%	-34.32%	-30.20%	-36.18%	-22.90%	-27.31%	-29.87%				
Q_5	-26.36%	-25.89%	-27.74%	-26.43%	-28.56%	-23.99%	-30.17%	-26.68%				

3 The performance of ESG passive management

Many institutional investors implement ESG policy through passive management. In this case, they use two techniques: exclusion and optimization. The first approach consists in reducing the universe of the stock index by excluding the worst rated stocks, and then applying a capitalization-weighted scheme to form the investment portfolio. The second approach consists in improving the score of the investment portfolio with respect to the score of the benchmark portfolio, while controlling the tracking error risk. Since the first solution can be approximated by using the second method, we focus on optimized portfolios. In Figure 3, we have represented the relationship between the excess score and the tracking error for the Global DM universe. For example, improving the score of the index portfolio by 0.5 implies accepting a tracking error of 32 bps on average, and an excess score of 1.0 leads to a tracking error of 85 bps. Using a risk attribution analysis, we can also show that the governance pillar generates more tracking error than the environmental and social pillars¹¹. These results mean that ESG passive management requires taking on a significant tracking error risk with respect to capitalization-weighted benchmarks. This clearly raises the issue of defining a strategic asset allocation (SAA). The fundamental question is how to reconcile ESG investing and SAA based on capitalization-weighted indices when institutional investors are sensitive to the tracking error risk. And, most of the time, they are!

Figure 4 presents the performance of ESG optimized portfolios with respect to the excess score. We notice that the integration of ESG in passive management reduced its performance between 2010 and 2013, whereas it improved its annualized return between 2014 and 2017. For instance, an excess score of 1.0 led to an excess return of -34 bps during the first period and $+45$ bps during the second period. We also notice that the relationship between excess score and excess return is not necessarily monotonous. For instance, targeting an excess score of 1.5 instead of 1.0 results in reducing the excess return from 45 bps to 19 bps in the recent period. This is most likely due to the diversification effect. Indeed, by increasing the excess score, we reduce the number of positions in the invested portfolios. There comes a threshold where the gains from the ESG screening are offset by the losses resulting from the diversification reduction. If we consider the individual pillars, we retrieve the main conclusions that we have found for active management. For the Global DM universe, all the scores destroyed value between 2010 – 2013, except the environmental pillar for which results are neutral or slightly positive. This is particularly true

¹¹On average, optimized portfolios with the **G** score have a 50% larger tracking error than with **E** and **S** scores.

Figure 3: Efficient frontier of ESG optimized portfolios (Global DM)

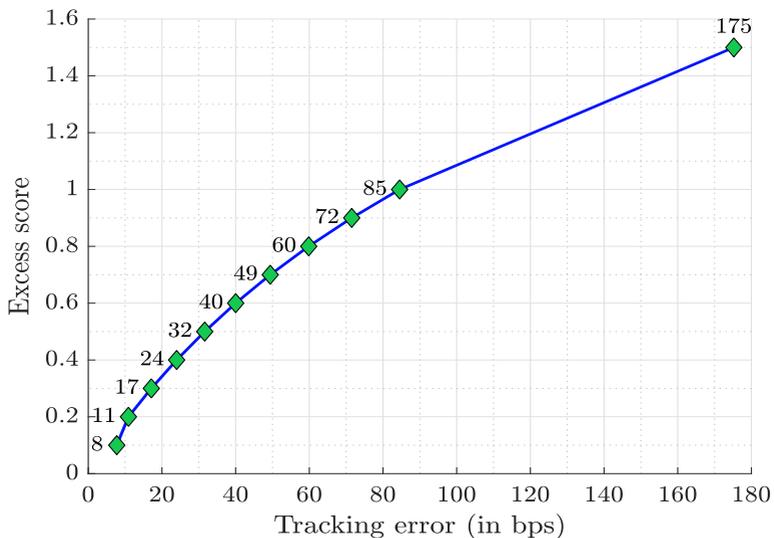
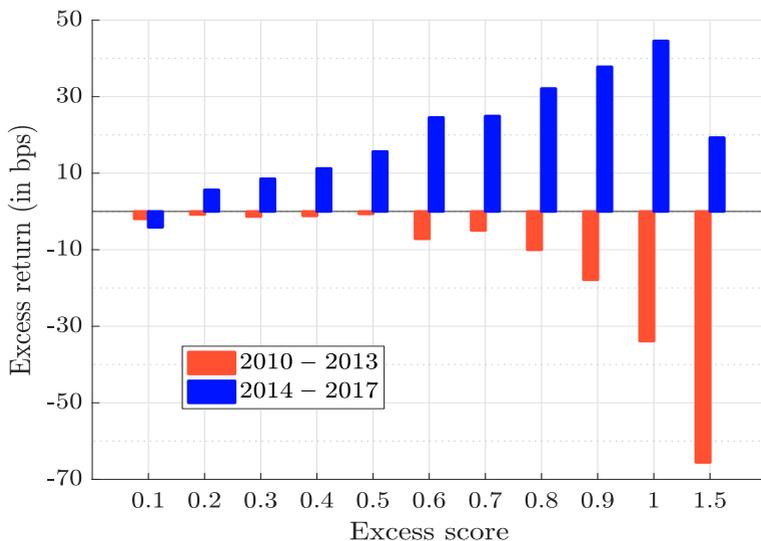


Figure 4: Annualized excess return of ESG optimized portfolios (Global DM)



for the governance pillar, whose underperformance is about two/three times greater the underperformance of the overall **ESG** score. For the 2014-2017 period, the story changes. Every score creates an outperformance, except the **S** score.

If we consider the North America and Europe universes¹², the performance of optimized portfolios is in line with the performance of stock picking portfolios. During the 2010 – 2013 period, only the **E** score would have generated outperformance in Europe. In this region, our results find that the performance of the **ESG** score was also neutral when targeting low tracking error risk (less than 60 bps) or low excess score (less than 0.8). In all other cases, we observe a negative excess return, especially in North America. Between 2014 and 2017, we obtain opposite results. All the scores generate an outperformance, except the social pillar. The results are more significant in Europe than in North America. The two big winners are the environmental pillar in North America and the governance pillar in Europe.

4 Is ESG a new risk factor?

The story of ESG investing is similar to other situations that we have experienced in the stock market. This is not the first time that a new paradigm of investment emerges and changes the landscape of asset management. It was also the case with the emergence of smart beta and factor investing after the 2008 Global Financial Crisis. In the two previous sections, we have shown that ESG investing has an impact on the market structure of stock prices. Therefore, we may wonder if ESG has become a new risk factor and must be integrated into a factor investing framework. In a nutshell, there are two main criteria for ESG to be eligible as a new risk factor: (1) generating extra performance or reducing risk; (2) being a complement to traditional risk factors.

To answer this question, we consider three approaches based on factor models: single-factor, multi-factor and factor picking. We consider the standard factors derived from a factor investing framework: size, value, momentum, low-volatility and quality. These factors are built using the same methodology as the sorted portfolios¹³. Contrary to the academic literature, we consider a long-only framework, which is the usual approach of institutional investors. This means that the factors correspond to Q_1 portfolios¹⁴. Moreover, we consider

¹²We have merged Eurozone and Europe ex EMU stocks into the same universe because the tracking error optimization forces us to be more or less country-neutral.

¹³In order to obtain tradable risk factors, the weights are proportional to the square root of stock capitalizations, and are not uniform.

¹⁴In a long/short approach, risk factors correspond to $Q_1 - Q_5$ portfolios.

the traditional market factor, which corresponds to the capitalization-weighted portfolio. All the analyses use weekly returns.

We first estimate single-factor models with a cross-section methodology¹⁵. For that, we regress stock returns on a constant and each single factor. For each stock, we can then calculate the proportion of the return variance explained by the factor. We find that since 2014 the ESG factor has been a challenging factor insofar as it competes with the market risk factor¹⁶. Moreover, it has more explanatory power than the other risk factors both in North America and the Eurozone during the 2014 – 2017 period.

Table 3: Results with long-only risk factors (cross-section regression, average R^2)

Period	North America		Eurozone	
	2010 – 2013	2014 – 2017	2010 – 2013	2014 – 2017
CAPM	40.8%	26.2%	42.8%	37.7%
5F	46.1%	35.4%	49.5%	45.3%
6F (5F + ESG)	46.7%	36.8%	50.1%	46.0%

What do these results become if we consider a multi-factor model in place of single-factors? In this approach, we compare the CAPM¹⁷, the standard five-factor (5F) model¹⁸ and the six-factor (6F) model, which consists in adding the ESG factor to the universe of the five alternative risk factors. In Table 3, we verify that the 5F model increases the proportion of systematic risk with respect to the CAPM¹⁹. Adding the ESG factor has a minor impact between 2014 and 2017: 36.8% versus 35.4% in North America and 46.0% versus 45.3% in the Eurozone. This means that the ESG factor does not significantly improve the 5F model. However, if we apply statistical tests of significance to the 6F model, we find that ESG is statistically significant in the Eurozone, but not in North America. We may conclude that ESG could be a risk factor in the Eurozone, but not in North America.

In order to better understand these results, we consider a factor picking (or a factor selection) approach. This approach is similar to the multi-factor approach, but we run a lasso penalized regression in place of the traditional

¹⁵Results are reported in Table 4 on page 29.

¹⁶On average, the market risk factor explains 26.2% of the cross-section variance, whereas the ESG factor has an explanatory power of 25.1% in North America. In the Eurozone, these figures are respectively 37.7% and 37.3%.

¹⁷This model corresponds to the single-factor model with the traditional market factor.

¹⁸The five-factor model uses size, value, momentum, low-volatility and quality risk factors.

¹⁹For example, the CAPM and the 5F model explain respectively 26.2% and 35.4% of the cross-section variance in North America during the recent period.

least squares regression. The advantage is that we can control the factor intensity of the multi-factor portfolio. Therefore, we obtain a factor selection procedure. Beginning with a low factor intensity, we can determine which risk factors are the most important. Then, we increase the factor intensity in order to establish an ordering between risk factors. When the factor intensity reaches 100%, we obtain exactly the same results calculated previously with the linear regression.

The results are reported in Figures 5 and 6 for the period 2014 – 2017. In North America, we notice that quality is the first selected factor, followed by ESG, momentum, value, and finally low-volatility²⁰. Therefore, ESG is the second selected factor in North America. We may think that ESG is then a significant factor when building a multi-factor portfolio. However, we observe that the ESG beta first increases and then decreases when we increase the factor intensity. When the factor intensity reaches 100%, ESG represents a low exposure. Therefore, a part of the ESG exposure has been replaced by an exposure to other risk factors. This means that ESG has a high contribution in a low-diversified portfolio, but it is somewhat redundant in an already well-diversified portfolio. In the case of the Eurozone, we face a different situation. ESG is the first selected factor, and remains an important factor even if we increase the factor intensity. In particular, it is more significant than momentum and low-volatility.

These different results (single-factor, multi-factor and factor picking) show that the ESG strategies remain alpha strategies in North America. They have generated outperformance, they are diversifying, but they cannot explain the dispersion of stock returns better than the standard 5F risk model. This implies that introducing ESG in a multi-factor portfolio, which is already well-diversified, adds very little value. This is clearly the definition of an alpha strategy. On the contrary, we notice that ESG is a significant factor in a Eurozone multi-factor portfolio. We may then improve the diversification of multi-factor portfolios by integrating an ESG factor. As such, in the Eurozone, it seems that an ESG strategy is more a beta strategy than an alpha strategy.

These last observations can be related to the development of factor investing, in particular to low-volatility and quality risk factors. Low-volatility (and minimum-variance) strategies have been known for many years, but they primarily emerged in the asset management industry between 2003 and 2004 after the dot.com bubble. Initially, low-volatility strategies were considered alpha strategies. After the 2008 Global Financial Crisis, they were massively implemented thereby becoming beta strategies. The case of the quality anomaly is

²⁰We do not include the size factor since it is implicitly embedded in the other risk factors. Indeed, the risk factors are exposed to the size factor by construction, because of the portfolio weighting scheme.

Figure 5: Factor picking (North America, 2014 – 2017)

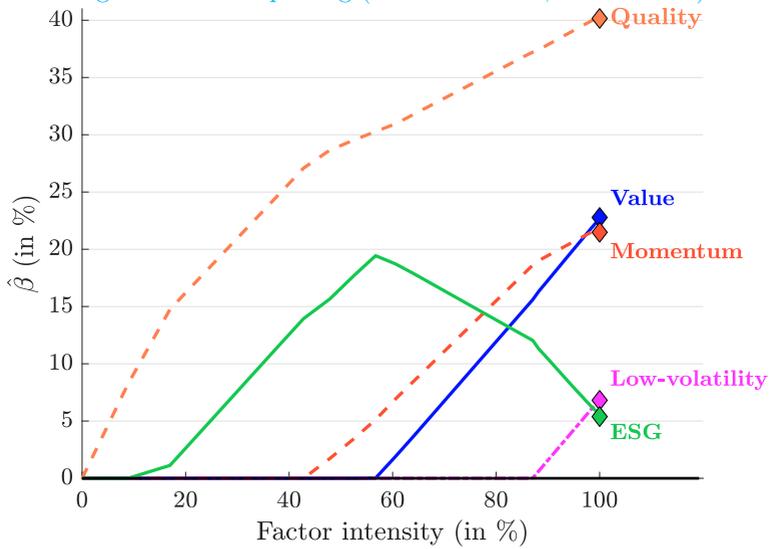
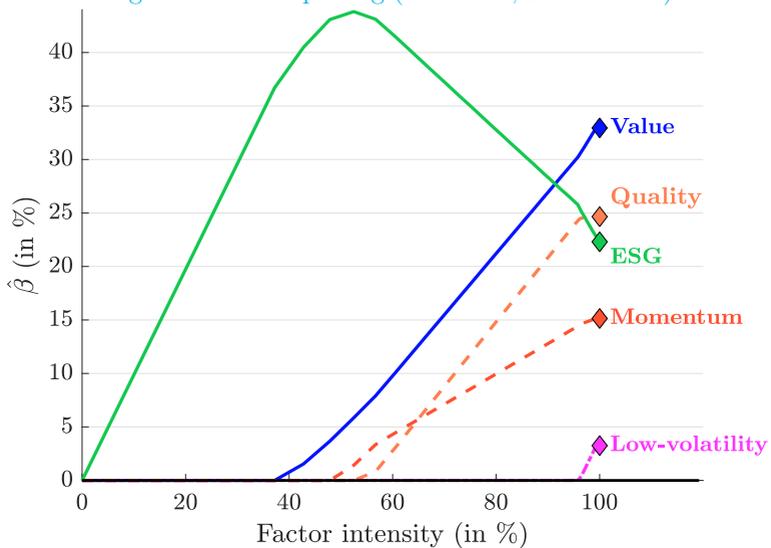


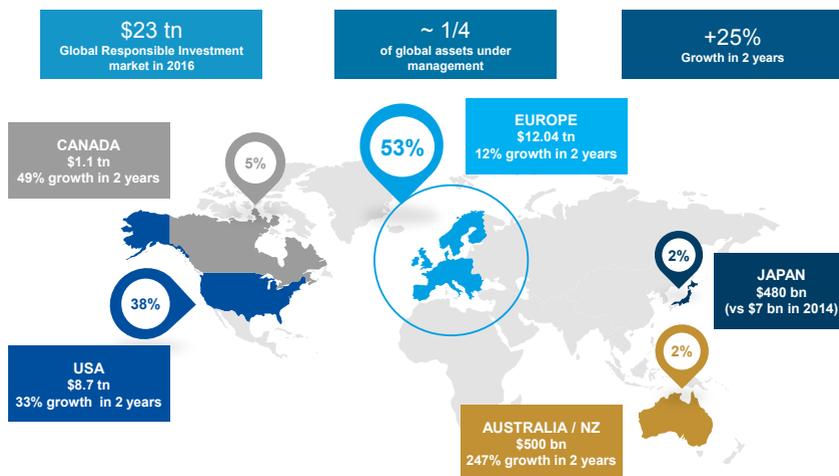
Figure 6: Factor picking (Eurozone, 2014 – 2017)



similar²¹. This shows that there is not a clear demarcation between alpha and beta. When an alpha strategy is massively invested, it has a sufficient impact on the structure of asset prices to become a risk factor.

In Figure 7, we have reported the market for ESG investing in 2016 (Global Sustainable Investment Alliance, 2017). We see that the European market dominates the other regional markets. It is followed by North America, and far behind by Japan and Asia Pacific, even though the growth of these two regions has been impressive for the past few years. By definition, the alpha/beta status of ESG strategies is related to investment flows. Indeed, an alpha strategy becomes a common market risk factor once it represents a significant part of investment portfolios and explains the cross-section dispersion of asset returns. Backward looking, we have shown that ESG was not a risk factor in the stock market with the possible exception of the Eurozone. Forward looking, we can anticipate that ESG will become a common risk factor over the coming years if the growth of ESG investing continues at this pace.

Figure 7: The ESG investing market in 2016

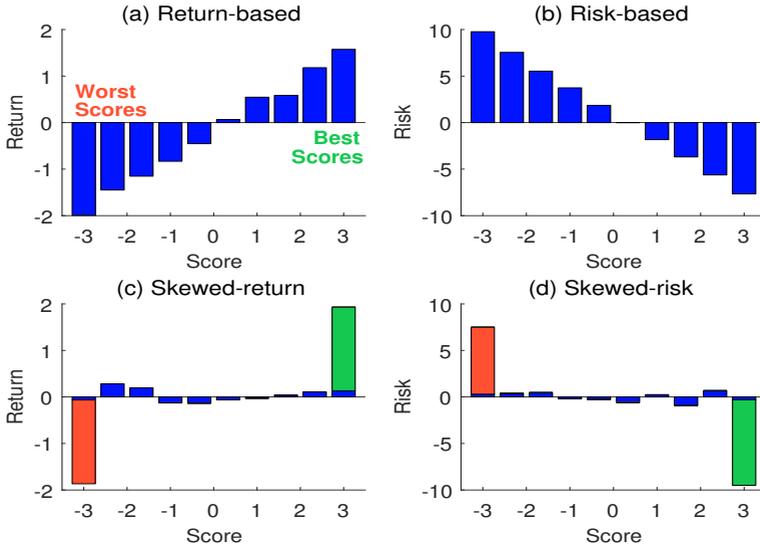


Source: Global Sustainable Investment Alliance (2017).

²¹Quality strategies date back to the seminal academic paper of Piotroski (2000). However, they really become popular after 2009-2010. According to Google Scholar, this paper was cited only 158 times between 2000 and 2008 by Academia, but 800 times between 2009 and 2018.

5 On the optimal design of ESG investing

Figure 8: Return-based, risk-based or skewness-based premium?



Since we have shown that there is a relationship between ESG scores and stock prices, it is interesting to characterize the asset pricing implications in order to better identify and understand the drivers of performance. In Figure 8, we report the different market configurations that we can face between ESG scores (**E**, **S**, **G** and **ESG**) and risk/return patterns:

- We can postulate a positive relationship between ESG screening and asset returns. In this case, we assume that the expected excess return is an increasing function of the score. The more selective the screening, the better the performance.
- We can assume that ESG has an impact on the risk (volatility or draw-down). Here, we can expect to reduce the risk by selecting assets with better ESG scores.
- Another explanation could be that ESG only impacts the extreme scores. In this case, the ESG score has no impact on the performance except for best or worst scores. For example, we can imagine that the market rewards only the assets with the best scores or it penalizes only the assets with the worst scores. We can also imagine that the two effects co-exist.

- (d) Finally, we can observe a variant of the previous market configuration, where the impact on excess return is replaced by an impact on risk.

Market configuration (a) is associated with a return-based pattern, whereas market configuration (b) is driven by a risk-based pattern. Market configurations (c) and (d) are said to be skewness-based, because they only impact the extreme scores. If we consider our empirical results between 2014 and 2017, we find that there is no consensus, but the different scores (**E**, **S**, **G** and **ESG**) respond to several patterns. For instance, the market configuration (b) is not observed in North America and the Eurozone whatever the score used. However, we observe a skewed-risk market configuration for the environmental pillar in North America. Indeed, Portfolios Q_1 and Q_2 present a lower drawdown. We observe the market configuration (a) in the case of the **ESG** score in North America. However, the most frequent market configuration is undoubtedly the skewed-return pattern (c). This is for example the case of the **ESG** score in the Eurozone or the **G** screening both in North America and in the Eurozone. This means that ESG investing has only an impact on best-in-class and worst-in-class assets.

The identification of the market configuration is important for designing optimal ESG strategies. It is obvious that Pattern (a) is more favorable to a diversified active fund than a concentrated fund, which will prefer Pattern (c). In the same way, drawdown management is more efficient in the case of Patterns (b) or (d). The identification of the market configuration also helps answer the selection/exclusion question: is it better to implement an exclusion investment policy or does a selection policy make sense? Most ESG investors have chosen to implement an exclusion investment policy. Our results show that a selection investment policy is also fully relevant. This can explain the results of Eurosif (2018): *“The main strategy is exclusion, but in the last two years the growth rate of this strategy slowed down. In contrast, best-in-class and ESG integration have had a high growth rate”*.

6 Conclusion

The previous results undoubtedly show that whether or not an investor is an ESG investor has an impact on the performance of her investment portfolio. In rough terms, ESG investing seems to have penalized the investor between 2010 and 2013, while it was much more beneficial between 2014 and 2017. In fact, ESG investing impacts investment performance in two different ways.

First, ESG can be viewed as an alternative risk assessment model of corporate firms. In this case, investors manage their portfolio risk in a different way than a traditional risk factor model, because criteria are not the same

(extra-financial versus financial risks), and time horizons are different (long-term versus medium-term). If we assume that the ESG risk model is doing a good job, the portfolio will be better managed, implying that ESG screening has a positive impact on portfolio returns and subsequently on asset returns²². Because of the long-term time horizon, ESG screening can also impact negatively the performance because of the lead-lag effects on the market dynamics. Similarly, pricing a risk too soon or overestimating a risk can impact negatively the performance of investment portfolios.

Second, ESG is an investment style, not only a risk model. This implies that ESG generates investment flows that can impact asset prices, and subsequently portfolio returns. Generally, positive investment flows generate a price increase, while negative investment flows generate a price decrease, because of the law of supply and demand. However, ESG investing is very special and cannot be compared to other investment styles. Indeed, usually, the first motivation of investors when implementing a particular investment strategy is purely financial. This is not the case for ESG investing since the first motivation is extra-financial²³. This is why ESG investing could not be compared to low-volatility, value, trend-following or contrarian investment styles. Currently, ESG investment flows are driven by demand, and we have reason to believe that the demand pressure will continue over the coming years. Contrary to the previous mechanism, this second factor clearly operates in favor of ESG investors.

The dynamics of investment flows can also be accelerated if central banks and supervisory bodies participate in the green finance debate and become proactive. Over the last year, several initiatives suggest that they could and certainly will move. For example, the Network for Greening the Financial System (NGFS) was launched on 12 December 2017, and is an initiative of 18 Central Banks and Supervisors. In their first report published in October 2018, they recognize that climate and environmental risks may impact financial stability even though the integration of these risks into macro-economic surveillance is facing methodological challenges. In a similar way, the speech of Benoît Cœuré, Member of the Executive Board of the ECB, asks whether or not monetary policy mandates should integrate extra-financial risks. There are some reflections at the European Banking Federation, European Commission and the European Parliament to consider a “green supporting factor”

²²The financial theory of risk premium tells us that systematic risks and not specific risks are rewarded. If we consider that the performance between brown assets and green assets is driven by a systematic risk, and not by idiosyncratic risks, this implies that investors would require a larger risk premium for brown assets than for green assets. Here, we assume ESG risks are realized by specific risks.

²³For example, because of ethical values or having a positive impact on sustainable development or managing long-term risks due to climate change (Andersson *et al.*, 2016).

that might affect capital requirements and the computation of risk-weighted assets. These issues are not new, since some academics have already called for considering green quantitative easing, a green Basel IV Accord and green accounting standards (Aglietta *et al.*, 2015; Campiglio *et al.*, 2018). We know that regulation is a key element for business development, and has been disruptive in the case of the financial industry these last twenty years. It can be a powerful leverage tool for promoting green finance, and to impact the relative cost-of-capital of green and brown assets. Anticipating these possible future trends is not neutral when choosing and how to be an ESG investor.

Given that our study has been focused on stocks, the impact of ESG on corporate bonds is an open issue. What is the link between ESG scores²⁴ and credit ratings? What is the link between ESG scores and credit spreads? Certainly, we can expect that ESG investing in corporate bonds is different to ESG investing in equity markets. Beyond these concerns, our results suggest that ESG investing has an impact on asset prices. Therefore, we can anticipate that it will also have an impact on credit spreads, and the supply/demand balance dynamics will sooner or later promote the market of green assets against the market of brown assets by increasing their cost-of-capital. In fact, the question of impact investing is related to the economic efficiency of ESG investing. At the micro-economic level, it is difficult for an ESG investor to measure its impact on a particular company. At the macro-economic level, our study shows that ESG investors have already had an impact on the financial market.

²⁴ESG scores can be easily cast into ESG ratings. We can expect that there is a correlation between ESG and credit ratings. but the correlation of rating migration is an open issue.

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Appendix

A Additional results

Table 4: Results of cross-section regressions with long-only risk factors (average R^2)

Factor	North America		Eurozone	
	2010 – 2013	2014 – 2017	2010 – 2013	2014 – 2017
Size	39.3%	23.6%	37.1%	20.9%
Value	38.9%	24.4%	41.6%	35.2%
Momentum	39.6%	23.8%	40.8%	35.8%
Low-volatility	35.8%	22.2%	38.7%	34.9%
Quality	39.1%	24.1%	42.4%	36.5%
ESG	40.1%	25.1%	42.6%	37.3%
Market	40.8%	26.2%	42.8%	37.7%
5F model	46.1%	35.4%	49.5%	45.3%
6F model	46.7%	36.8%	50.1%	46.0%

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