ESG's Evolving Performance:

First, Do No Harm

Abstract

We evaluate the investment performance of ESG, paying particular attention to recent performance and highlighting the difference between ESG scores that overlap with traditional risk model factors and those that don't. Our analysis indicates that, in general, increasing exposure to ESG rarely underperforms the market, and often outperforms the market, especially during the last few years.

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1. Introduction

Environmental, social and governance (ESG) data availability, marketing presence and regulation have increased dramatically in the last few years. As recently as 2011, only 20% of the companies in the S&P 500 Index even reported ESG metrics; the percentage is now over 80% [1]. Recent regulatory and policy changes have been made to either directly or indirectly support ESG investing[2].

Given these marked changes, a natural question to ask is: how has ESG performance changed? Since these changes have occurred over a relatively short period of time, one cannot expect to answer this question with much statistical significance, nor can one say much about long term performance. Nevertheless, as more portfolio managers (PMs) consider adding ESG to their portfolio construction process, data on recent performance and how it compares with the past is likely to be of value.

A second question for PMs is to what extent are ESG scores different from the factors found in commercial fundamental factor risk models, such as value, size, industries and countries? The answer to this question informs portfolio managers on how incorporating ESG into their portfolio construction process may interact with their existing goals and mandates. To the extent that ESG scores overlap with traditional factors, then ESG can be interpreted as beta ("smart beta" to the marketers); to the extent these scores do not overlap with traditional factors, then ESG can be interpreted as residual, idiosyncratic or company specific ("alpha" to the quants).

On the one hand, some of the key drivers of ESG are industries or industry-based. Companies that produce and sell tobacco, alcohol, and weapons, along with gambling businesses, are normally assigned low S scores. Utilities typically have a higher weight on E than banking or pharmaceutical companies. These traditional risk model factors (industries) are an inherent part of the definition of ESG, so overlap is inevitable.

On the other hand, some ESG drivers are company specific. For example, the number of women in a company's corporate structure and corporate pay and tax transparency are both components of the G score that can be altered by a company at its discretion. Hence, these are company-specific ESG decisions. Of course, if several competing companies increase the number of women on their boards at the same time, those independent decisions may be less company specific than anticipated.

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[1] PwC's 2016 ESG Pulse: Investors, corporates, and ESG: bridging the gap, available at https://www.pwc.com/us/en/services/governance-insights-center/library/esg-environmental-social-governance-reporting.html.

[2] See, for example, https://www.forbes.com/sites/christopherskroupa/2017/07/21/on-the-esg-horizon-achieving-a-global-standard/#6923a5901104; http://knowledge.wharton.upenn.edu/article/how-two-federal-rulings-are-removing-the-roadblocks-from-impact-investing/; https://www.msci.com/documents/1296102/0/PRI_MSCI_Global-Guide-to-Responsible-Investment-Regulation.pdf/ac76bbbd-1e0a-416e-9e83-9416910a4a4b;

Mathematically, the overlap can be estimated by regressing ESG scores against traditional risk model factors. The R-squared (percent variance explained) of each regression varies from 15% to 75% depending on the universe and methodology, indicating that there is substantial but not full overlap.

Herein, we will refer to three different ESG scores:

- **Raw ESG** = the original ESG scores;

- **Factor ESG** = the part of the original ESG score that overlaps with a set of risk model factors (mathematically, the original ESG score that spans the vector space defined by the risk model factors); and,

- **Residual ESG** = the part of the original ESG score that does not overlap with a set of risk model factors (the original ESG score that lies in the null space defined by the risk model factors).

The existing ESG literature is largely biased in favor of the Residual ESG. In some cases, this bias is explicit. For example, "ESG cannot be regarded as a traditional factor."[3] In other cases, the bias is implied. MSCI provides industry-adjusted ESG scores. In some studies, these industry-adjusted ESG scores are further neutralized with respect to size [4]. RobecoSAM's Smart ESG scores "isolate the ESG factor by removing the biases" (e.g., size and quality) [5]. These selective neutralizations change a raw ESG score that may overlap with other well-known factors, into a Residual (or partially residual) ESG score.

Diversification likely drives some of the bias toward Residual ESG. Residual ESG returns are more likely to be uncorrelated with market returns, and therefore can diversify a portfolio (e.g., reduce portfolio risk). Factor ESG is expected to be a less effective diversifier since both Factor ESG and the market are driven by the same factors and will often have positively correlated returns.

Nevertheless, the wide range of selective neutralizations employed by prior researchers make it difficult to distinguish the performance of Factor ESG from Residual ESG.

In this study, we evaluate the investment performance of ESG, highlighting recent ESG performance and the differences between Raw ESG, Factor ESG, and Residual ESG. Our analysis

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[3] ESG: The sustainability factor. C. S. Moredo, 2018. https://www.ipe.com/reports/special-reports/factor-investing/esg-the-sustainability-factor/10023927.article.

[4] Assessing Risk Through Environmental, Social and Governance Exposures, J. Dunn, S. Fitzgibbons, and L. Pomorski, 2017. https://www.aqr.com/Insights/Research/White-Papers/Assessing-Risk-through-Environmental-Social-and-Governance-Exposures;   Foundations of ESG Investing: Part 1: How ESG Affects Equity Valuation, Risk and Performance, G. Gise, L-E Lee, D. Melas, Z. Nagy, and L. Nishikawa, 2017. https://www.msci.com/www/research-paper/foundations-of-esg-investing/0795306949.

[5] RobecoSAM Smart ESG: heavy on ESG, light on Bias, R. Feldman, 2017, http://www.robecosam.com/images/Smart_ESG_Heavy_on_ESG_light_on_bias.pdf.

indicates that, in general, increasing exposure to Residual ESG or, to a lesser extent, Raw ESG, rarely underperforms the market, and often outperforms the market, especially over the last few years.

There are only two markets and time periods in the present study in which Factor ESG has outperformed: Japan since 2015 and Europe since 2016. Unlike Raw and Residual ESG, which tend to lead to portfolios with a small cap bias, tilting on Factor ESG is nominally size neutral. Performance attribution of the Factor ESG results does not show any particular factors or styles predominately driving performance.

In our study, we employ a risk-aware portfolio construction approach (e.g., the ESG tilt was maximized subject to a tracking error constraint). A significant portion, if not the majority, of existing ESG indices are constructed using a simple sorting approach: the stocks in a given universe are ranked by their ESG score, and, typically, the worst ranking stocks are eliminated while the remaining stocks are cap-weighted (to avoid a small cap bias).   While this approach is simple to implement and explain, it suffers from the defect that the active tilt on ESG is typically small. In many (most?) cases, the active tilts on other risk model factors such as value and growth are just as large as the active tilt on ESG.   That is, such portfolios inherently incur a fairly large set of unintended bets on other risk factors, making it difficult to assess whether or not the ESG tilt is performing. You can backtest such a portfolio and find out if it outperforms, but you will be hard pressed to attribute any outperformance to ESG instead of value, growth, or just dumb luck.

2. ESG Data, Coverage and Factor Overlap

We use the ESG data provided by OWL Analytics. OWL Analytics offers global coverage of equities on a monthly basis beginning on March 31, 2009. We use these scores through March 29, 2018 (nine years). OWL uses a consensus approach for ESG scoring that aggregates data from hundreds of sources, including numerous ESG providers. Hence the OWL scores are derived, in large part, from the ESG scores and metrics of other ESG providers.

The rationale behind OWL's consensus approach is to reduce the subjectivity of ESG scores. For example, some ESG providers base their scores on a handful of different metrics, while others use as many metrics as possible. An aggregated ESG score from both kinds of vendors is likely less dependent on the particular choice of metrics used.

Our study reports results for five equity universes defined by Axioma's investable Model Portfolio universes. Table 1 shows the five universes selected: United States, Japan, Developed Markets ex US, Emerging Markets, and Developed Europe. **Table 1** also reports the average number of names in each universe from 3/31/2009 to 3/29/2018.

Table 1. The five equity universes used. The equities in Axioma's Model Portfolios are used for each universe.

Universe Name	Description	Ave Names Held
US-LMS	United States -- Large + Mid + Small Cap	2517.6
JP-LMS	Japan -- Large + Mid + Small Cap	1204.6
DMxUS-LM	Developed Markets ex-United States -- Large + Mid Cap	1263.2
EM-LMS	Emerging Markets -- Large + Mid + Small Cap	2404.4
EUDM-LMS	Developed Europe -- Large + Mid + Small Cap	1424.8

The five universes were chosen to give results relevant across the globe, using reasonably large universe sizes (between 1,000 and 3,000 names).

Figure 1 illustrates three descriptive statistics for the five universes over time: (1) the number of names in each universe; (2) the percent of names covered by OWL's ESG scores; and (3) the percent of the universe market weight covered by the ESG scores.

Figure 1. Descriptive statistics for the five universes over time: top, the number of names in each universe; middle, the fraction of names covered by OWL's ESG scores; and bottom, the fraction of the universe market weight covered by the ESG scores. The colors corresponding to each universe are listed at right.
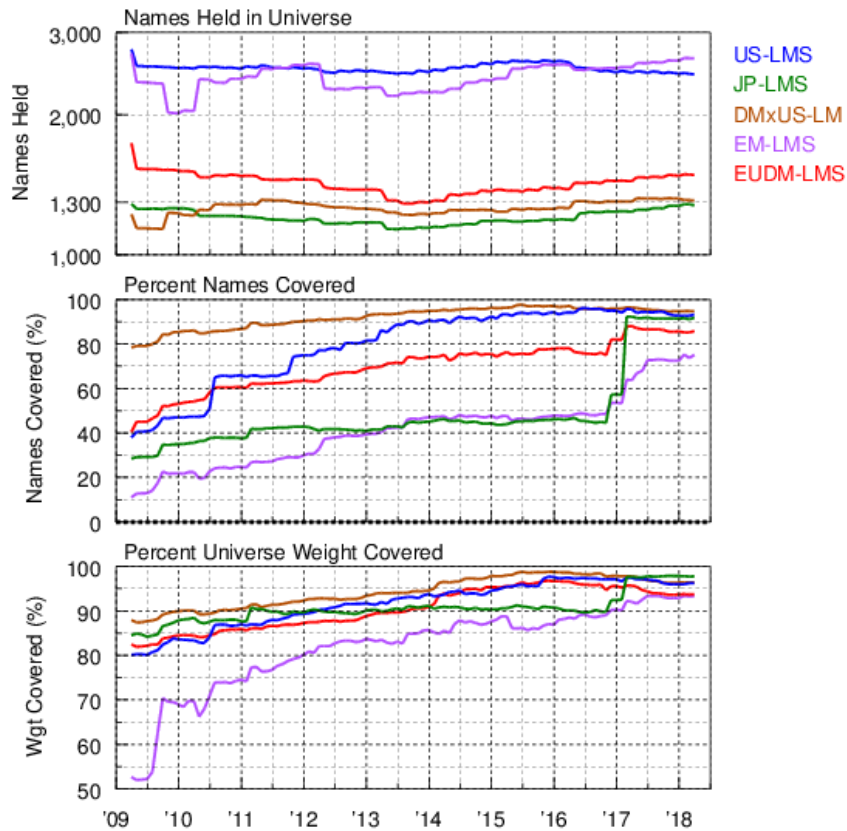
The number of names in each of the five universes has remained relatively constant over time. The fraction of names covered and the weight covered by OWL's ESG scores has steadily increased over time. At the start of the data in 2009, Emerging Markets (EM-LMS) had the lowest initial fraction of names covered (11%) and cap-weight covered (53%). By March 29, 2018, those numbers improved substantially, with the fraction of names covered rising to 75% and a corresponding 93% cap-weight covered. The numbers are higher for the other four universes. Since 2017, the fraction of universe weight covered has been over 90% for all five universes.

Table 2 shows the R-Squared (Percent Variance Explained) values over time when the OWL ESG scores are regressed against the non-currency factors in Axioma's fundamental factor risk models [6]. These factors include the traditional Style, Industry, and Country factors found in commercial fundamental factor risk models. Two regression results are presented, one that equally weights each ESG score, and one that cap-weights each score.

Figure 2. Regression R-Squared values over time regressing the OWL ESG scores against the non-currency factors in Axioma's fundamental factor risk models. Top: equi-weighted ESG scores; bottom: cap-weighted ESG scores.
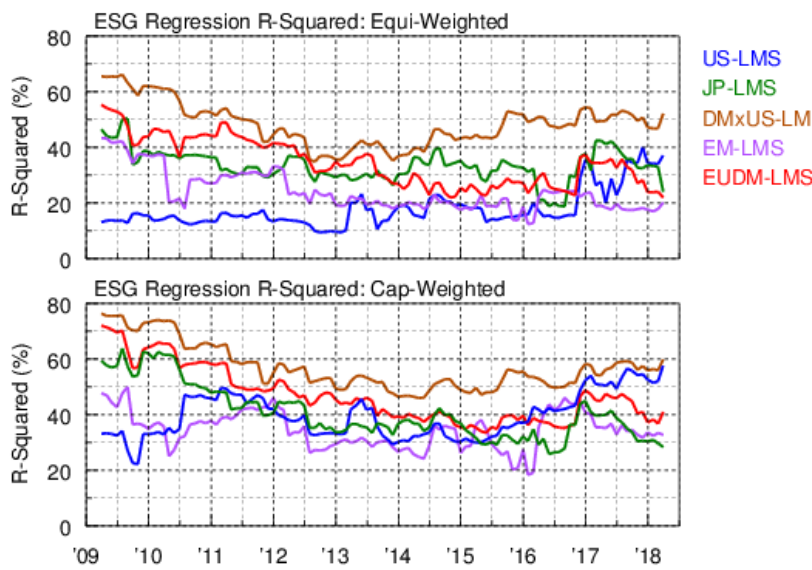
The R-Squared values range from a low of 13% (US equi-weight) to a high of over 70% (DMxUS-LM). The R-Squared values are somewhat higher prior to 2011 when coverage was less extensive. The R-Squared values since 2014 have been reasonably constant for all five universes, ranging from 20% to 50%.

The relatively high R-Squared values confirm that there is substantial overlap between ESG scores and traditional risk model factors.

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[6] The OWL ESG scores are numbers between 0 and 100. In order to make the regression well-posed, we convert these scores by taking the inverse cumulative normal of the raw score divided by 100.

3. ESG Performance: Aggregate Results

Given the limited coverage in the early years of the data, we construct an approach for measuring the active outperformance of the three different ESG scores that explicitly limits the impact of the missing ESG coverage. We use Axioma's portfolio construction software to construct a fully invested, long-only portfolio each month for each universe with the following characteristics:

- **Objective** - Maximize either Raw ESG, Factor ESG, or Residual ESG.

- **Uncovered Names** - Any assets in the universe without ESG scores are held at their benchmark weights. Hence their active returns are zero.

- **Asset Bounds** - The maximum active asset bet is 2.5% for all assets with valid ESG scores.

- **Tracking Error** - The maximum tracking error of the portfolio is 3% (annual volatility).

This portfolio construction approach could be made more realistic by applying constraints on the active risk model factor exposures of the optimized portfolio, but, initially, we keep the portfolio construction process as simple and unconstrained as possible. There are undoubtedly portfolio construction rules that would enhance the performance of our three ESG signals, but that is not our focus.

Table 2 shows summary backtest results from 3/31/2009 to 3/29/2018 for each of the three ESG scores. The results include the three active ESG exposures, the active size exposure, realized active return and risk, and Information Ratio (IR) for the backtests.

Table 2. Backtest results for each of the three ESG scores: Raw ESG (top), Factor ESG (middle), and Residual ESG (bottom).

Maximize Raw ESG	US-LMS	JP-LMS	DMxUS-LM	EM-LMS	EUDM-LMS
AveAct Raw ESG Exposure	38%	34%	33%	48%	31%
Ave Act Factor ESG Exposure	3%	3%	6%	4%	1%
Ave Act Residual ESG Exposure	34%	31%	27%	43%	29%
Ave Act Size Exposure	-23%	-17%	-14%	-34%	-31%
Real Act Ret (% Ann)	0.59%	-0.54%	1.91%	1.33%	1.48%
Real Act Risk (% Ann)	2.64%	3.18%	2.81%	3.33%	3.72%
Information Ratio	0.22	-0.17	0.68	0.40	0.40

Maximize Factor ESG	US-LMS	JP-LMS	DMxUS-LM	EM-LMS	EUDM-LMS
AveAct Raw ESG Exposure	11%	13%	16%	15%	10%
Ave Act Factor ESG Exposure	13%	19%	20%	15%	16%
Ave Act Residual ESG Exposure	-1%	-5%	-4%	0%	-5%
Ave Act Size Exposure	-6%	9%	11%	-14%	-2%
Real Act Ret (% Ann)	0.93%	0.02%	-0.18%	0.40%	-0.16%
Real Act Risk (% Ann)	3.46%	3.62%	3.03%	2.86%	3.78%
Information Ratio	0.27	0.01	-0.06	0.14	-0.04

Maximize Residual ESG	US-LMS	JP-LMS	DMxUS-LM	EM-LMS	EUDM-LMS
AveAct Raw ESG Exposure	35%	27%	24%	45%	25%
Ave Act Factor ESG Exposure	-2%	-10%	-12%	0%	-10%
Ave Act Residual ESG Exposure	37%	38%	36%	45%	35%
Ave Act Size Exposure	-31%	-29%	-34%	-36%	-43%
Real Act Ret (% Ann)	0.28%	0.31%	3.79%	1.44%	2.29%
Real Act Risk (% Ann)	2.77%	3.23%	2.86%	3.35%	3.59%
Information Ratio	0.10	0.10	1.33	0.43	0.64

Across all 15 backtests, only three exhibit negative active returns, all of which are modest (-0.54%, -0.18%, and -0.16%). The positive active returns are notably stronger (a maximum of 3.79%). A few IRs are greater than 0.5 (DMxUS-LM and EUDM-LMS), but most of the IRs are modest in magnitude.

The results for Raw ESG and Residual ESG are qualitatively similar. Both have large ESG exposures, and several cases exhibit strong returns. However, in all the Raw ESG and Residual ESG cases, the portfolios exhibit a strong small-cap bias (negative size exposure). This strong tilt complicates the interpretation of these results because one cannot separate the performance of ESG from the performance of size [7].

The results for Factor ESG are more muted than the other two scores. The active ESG exposures are smaller, and none of the IRs exceed 0.3.

4. ESG Performance Revisited: Evolving Performance Over Time and the Size Effect

The initial results indicate that the three ESG scores may have some alpha associated with them, but they also raise two questions:

To what extent has performance evolved over time?

To what extent is the small-cap bias responsible for performance in Raw and Residual ESG?

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[7] Traditional performance attribution using a commercial factor risk model will not help differentiate performance because these risk models do not have ESG as a factor. Performance attribution for these portfolios shows that the size factor is the primary factor contributor.

To address the question of evolving ESG performance, **Figure 3** shows the trailing, 36-month, rolling, realized active return for the five universes over time, with different colors for Raw ESG (blue), Factor ESG (red), and Residual ESG (green).

Figure 3. Trailing, 36-month, rolling active returns for the five different universes. Blue = Raw ESG; Red = Factor ESG; Green = Residual ESG.
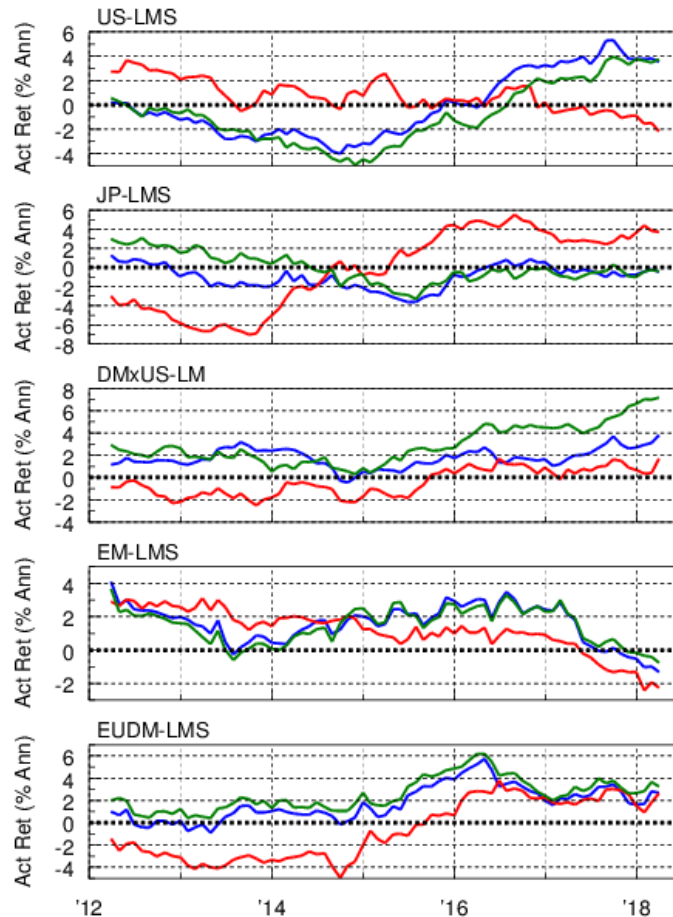
The most noticeable (and perhaps important) characteristic of the graphs shown in Fig. 3 is the speed at which ESG performance has changed over time. In the US, Raw and Residual ESG underperformed until 2016, and have since posted strong outperformance. Note that because the chart shows trailing 36-month active returns, any data point at a certain point in time on the chart includes the three years of performance data preceding that point in time. So, 2016 in Fig. 3 (and associated discussion) corresponds to performance since 2013. Similarly, 2015 corresponds to performance since 2012. As a specific example, the outperformance for Residual ESG for the US since 2016 demonstrates positive results not only for the last two years, but the last five years.

In Japan, Factor ESG underperformed until 2015, but has strongly outperformed since. Factor ESG exhibits a similar trend in Europe.

These observations highlight the danger of longer backtest results. The modest US Residual ESG and Japan Factor ESG active returns of 0.28% and 0.02% give no indication of the dramatic changes that have occurred.

The second most interesting characteristic shown in Fig. 3 is the rarity of Residual ESG underperformance. The only times when Residual ESG has notably underperformed are in the US prior to 2016 and in Japan in 2015 [8]. Otherwise, residual ESG has either outperformed or matched the market.

This observation may be most helpful to PMs who are reluctantly under pressure to incorporate ESG into their portfolios. Incorporating Residual ESG (or, possibly, Raw ESG) into a portfolio is often benign, i.e., Residual ESG appears unlikely to notably subtract from performance.

Figure 4 addresses the small-cap bias embedded in the previous results. It shows the trailing, 36-month, rolling, realized active return for the five universes over time for Residual ESG without any size constraints (green; same results as shown in Fig. 3) and also after imposing minimum active size exposure of zero (brown).

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[8] EM Residual ESG performance has been steadily dropping for the last year and a half. This is the same period in which the number of names covered in EM-LMS increased from 50% to 70-80%. The new EM names may be responsible for the declining performance over this relatively short period. A large percentage of new names over that period are small cap names with a single source of ESG provider coverage, perhaps suggesting further study into the benefits of scores informed by multiple providers.

Figure 4. Trailing, 36-month, rolling active returns for the five different universes for Residual ESG. Green = no size constraint (same as Fig. 3); Brown: minimum size exposure of 0%.
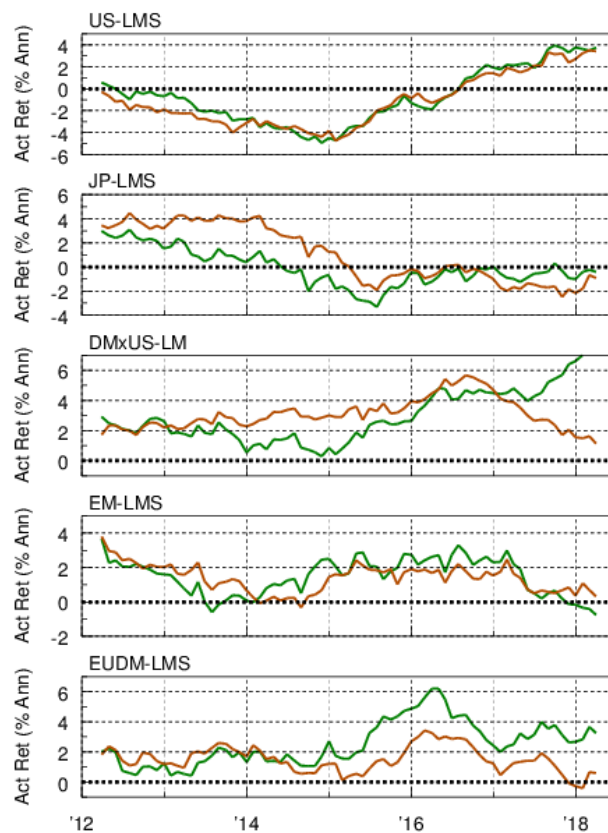
The results show that in some cases, the small-cap bias can be eliminated without substantially affecting Residual ESG performance (US-LMS, JP-LMS, EM-LMS). In other cases (DMxUS-LM since 2017, EUDM-LMS since 2015), Residual ESG performance is less once the small-cap bias is removed. Given these mixed results, it is difficult to draw any general conclusions about the influence of size. The impact of a small-cap bias must be analyzed in each individual case.

Nevertheless, with or without the size bias, the results in **Figure 4** still show that Residual ESG is benign towards performance (with the one exception being the US prior to 2017).

Figure 5 shows the results for the size-neutral, Residual ESG portfolios broken down by calendar year and compared with the relevant benchmark. In general, the total returns in each calendar year are quite similar, as would be expected given the low tracking error. In most cases, the small difference between return can be discerned, and, of course, matches the 3-year, rolling active returns shown in Fig. 4.

Figure 5. Calendar year total returns for the benchmark and the size-neutral, Residual ESG portfolios.   Brown: size neutral, Residual ESG portfolio; blue: benchmark.   2009 includes only 9 months and 2018 includes only 3 months.
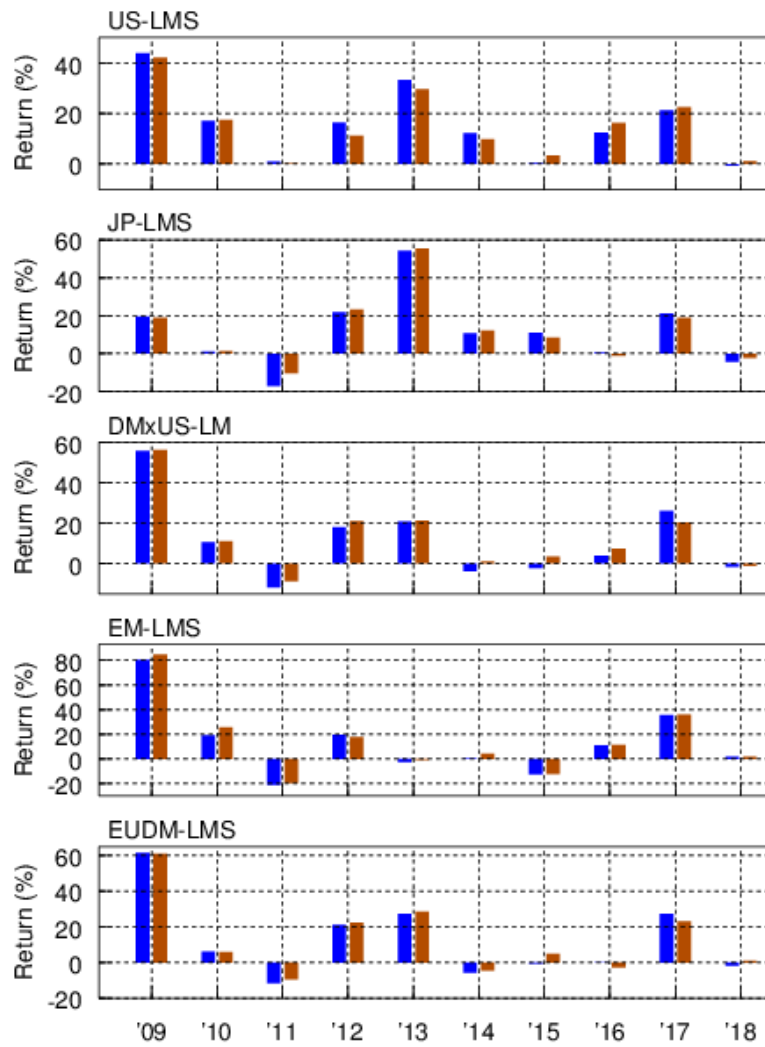
Finally, **Table 3** shows the performance of the size neutral, Residual ESG portfolio since January 2014 (4.3 years). With the exception of Japan, the active returns are positive, and the ESG tilts are strong (except for the exposure to Factor ESG).

Table 3. Performance of the size neutral, Residual ESG portfolios since 2014.

	US-LMS	JP-LMS	DMxUS-LM	EM-LMS	EUDM-LMS
Ave Act Raw ESG Exposure	29%	26%	21%	34%	21%
Ave Act Factor ESG Exposure	-1%	-7%	-7%	0%	-6%
Ave Act Residual ESG Exposure	29%	33%	28%	34%	27%
Ave Act Size Exposure	0%	0%	0%	0%	0%
Real Act Ret (% Ann)	1.75%	-0.62%	2.43%	1.29%	0.81%
Real Act Risk (% Ann)	2.72%	3.07%	2.90%	3.06%	2.93%
Information Ratio	0.64	-0.20	0.84	0.42	0.27

The Appendix gives summary performance attribution results for Raw, Factor, and Residual ESG from January 2014 to March 2018. In all cases the minimum size exposure is zero. The tables present average exposures and contributions to the Axioma style factors and to the 11 GICS sectors. To ease legibility, the results have been color coded so that the blue cells indicate exposure > 10% or contribution > 0.25%, while the red cells indicate exposure < -10% or contribution < -0.25%.

Overall, the style exposures are more likely to be large (colored) than the sector exposures, but there are more large contributors to the sectors than there are to style. There are many more blue contribution cells than red cells, which corroborates the observation that ESG tilts lead to positive returns more often than not.

As might be expected because of overlap, tilting on Factor ESG gives more large exposures and contributions than tilting on either Raw or Residual ESG. However, across all three attributions, once size underweighting has been eliminated, no single style factor or sector stands out.

5. Discussion and Conclusion

One of the key takeaways from the present study is to be wary of ESG studies that treat the historical data in a uniform manner. Such an approach ignores the evolving coverage and dramatically increased ESG marketing and regulations. The variable history and the fact illustrated here that ESG performance can change rapidly make it challenging to find statistically meaningful conclusions based on past performance.

That said, with the notable exception of the US prior to 2016, Residual ESG has rarely underperformed. To be sure, in several markets and time periods, Residual ESG performance has only matched the market. But the lack of periods of sustained underperformance (except, of course, the US prior to 2016) should be welcome news to skeptical PMs who may be under pressure to include ESG in their processes and portfolios. Addition of ESG may not always boost performance, but it also appears unlikely to be a significant drag on performance. And there have been periods of time across multiple regions in which ESG has improved performance.

As with previous ESG studies, our results indicate that Residual ESG may be the more attractive component of ESG. Interestingly, in our portfolios, the performance of Residual ESG was not notably different from Raw ESG. So, PMs who wish to avoid decomposing a vendor's ESG score into Factor and Residual components seem justified.

One of the unexpected results of this study was identifying regions and time periods in which Factor ESG has outperformed, namely Japan since 2015 and Europe since 2016. Note that the Factor ESG portfolios do not exhibit any systematic size underweights. In fact, the key drivers of performance for Factor ESG in the Europe and Japan have been varied. The only sector that has large positive contributions in both is Financials.

Finally, we note that there is no standard, accepted methodology for combining separate E, S, and G scores into a composite ESG score. It is possible, indeed, likely, that ESG scores from different vendors will exhibit different performance characteristics.   Hence, there is yet one more reason to be cautious when forming expectations about ESG: it varies across both time and vendors.

Appendix. Summary Performance Attribution

Tables 4, 5 and 6 give summary performance attribution results for the average exposure and factor contribution for the Style Factors and Sectors from January 2014 to March 2018. The blue cells indicate exposure > 10% or contribution > 0.25% while the red cells indicate exposure < -10% or contribution < -0.25%.

Table 4. Summary performance attribution of the Raw ESG portfolios with no size underweight from January 2014 to March 2018. Blue cells indicate exposure > 10% or contribution > 0.25%; red cells indicate exposure < -10% or contribution < -0.25%.

Source of Return	Contributions				
	US LMS	JP LMS	DMxUS LM	EM LMS	EUDM LMS
Portfolio	11.8%	9.1%	5.8%	8.6%	4.9%
Benchmark	10.5%	8.9%	4.8%	7.7%	4.1%
Active	1.2%	0.2%	1.0%	0.9%	0.8%
Specific Return	-1.8%	-0.9%	-0.1%	-0.5%	-1.1%
Factor Return	3.1%	1.1%	1.2%	1.4%	1.8%

Style Factors	Average Exposures					Factor Contributions				
	US LMS	JP LMS	DMxUS LM	EM LMS	EUDM LMS	US LMS	JP LMS	DMxUS LM	EM LMS	EUDM LMS
Dividend Yield	15%	22%	11%	13%	-11%	-0.1%	0.5%	0.1%	0.2%	0.0%
Earnings Yield	1%	-3%	0%	0%	0%	0.0%	-0.1%	0.0%	0.0%	0.0%
Exch Rate Sens	-4%	5%	-1%	-5%	-9%	0.0%	0.1%	0.0%	0.0%	-0.1%
Growth	-12%	-3%	0%	-6%	8%	0.1%	0.0%	0.0%	0.1%	0.0%
Leverage	4%	-24%	-2%	-3%	-9%	0.0%	0.2%	0.0%	0.0%	0.0%
Liquidity	-12%	-9%	-8%	-10%	-10%	0.0%	0.1%	0.1%	0.0%	0.0%
Market Sensitivity	-5%	-8%	-4%	-7%	-18%	0.1%	0.1%	-0.1%	0.1%	0.2%
Med-Term Momen	-2%	0%	-3%	0%	0%	-0.3%	-0.1%	-0.3%	0.0%	0.0%
Profitability	8%	5%	19%	11%	25%	0.3%	0.1%	0.4%	0.3%	0.5%
Size	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%
Value	-13%	-3%	-16%	-10%	-17%	0.0%	0.0%	-0.1%	0.1%	-0.1%
Volatility	-2%	-5%	-14%	-6%	-1%	0.0%	0.0%	0.5%	0.1%	0.0%

Sectors	Average Exposures					Factor Contributions				
	US LMS	JP LMS	DMxUS LM	EM LMS	EU LMS	US LMS	JP LMS	DMxUS LM	EM LMS	EU LMS
Consumer Discretionary	-8%	-1%	-6%	-3%	-4%	0.0%	0.1%	0.1%	0.0%	0.3%
Consumer Staples	7%	1%	5%	-1%	9%	0.3%	0.6%	0.1%	0.0%	0.2%
Energy	-4%	-1%	-3%	-3%	-3%	0.5%	0.0%	0.3%	0.2%	0.3%
Financials	-9%	-2%	-5%	4%	-10%	0.4%	0.0%	0.0%	0.1%	0.1%
Health Care	3%	2%	2%	-1%	5%	0.6%	0.1%	0.3%	0.0%	0.5%
Industrials	2%	-2%	1%	1%	2%	0.4%	0.0%	-0.2%	0.1%	-0.1%
Information Technology	11%	6%	-1%	5%	2%	0.8%	-0.1%	0.0%	0.3%	0.0%
Materials	2%	-3%	1%	-1%	0%	-0.1%	0.0%	0.2%	0.0%	0.1%
Real Estate	-1%	-2%	4%	0%	2%	0.0%	-0.3%	-0.3%	-0.1%	-0.3%
Telecomm Services	-2%	4%	0%	2%	-1%	0.0%	-0.1%	0.0%	-0.2%	0.1%
Utilities	-1%	-2%	1%	-2%	-1%	-0.1%	0.1%	0.1%	0.0%	0.1%

Table 5. Summary performance attribution of the Factor ESG portfolios with no size underweight from January 2014 to March 2018.

	Contributions				
Source of Return	US LMS	JP LMS	DMxUS LM	EM LMS	EUDM LMS
Portfolio	9.4%	12.4%	5.9%	7.1%	4.7%
Benchmark	10.5%	8.9%	4.8%	7.7%	4.1%
Active	-1.1%	3.6%	1.1%	-0.6%	0.6%
Specific Return	-2.8%	2.2%	0.6%	-2.0%	0.3%
Factor Return	1.7%	1.4%	0.6%	1.4%	0.2%

	Average Exposures					Factor Contributions				
Style Factors	US LMS	JP LMS	DMxUS LM	EM LMS	EUDM LMS	US LMS	JP LMS	DMxUS LM	EM LMS	EUDM LMS
Dividend Yield	13%	14%	32%	4%	21%	-0.2%	0.4%	0.2%	0.1%	0.1%
Earnings Yield	3%	4%	-10%	-15%	0%	0.2%	-0.1%	0.0%	-0.1%	0.0%
Exch Rate Sens	-1%	1%	-12%	-3%	-5%	0.0%	0.0%	-0.1%	0.0%	0.0%
Growth	-5%	1%	-21%	-10%	-17%	0.0%	-0.1%	0.1%	0.1%	0.1%
Leverage	-5%	-7%	-3%	5%	-2%	0.0%	0.0%	0.0%	0.0%	0.0%
Liquidity	-13%	0%	-4%	-6%	-4%	-0.1%	-0.1%	0.0%	0.0%	0.0%
Market Sensitivity	0%	2%	7%	-4%	-1%	-0.2%	0.0%	-0.1%	0.1%	0.2%
Med-Term Momen	-5%	1%	-3%	0%	-3%	-0.2%	0.2%	-0.3%	0.0%	-0.1%
Profitability	5%	1%	7%	7%	-8%	0.1%	0.0%	0.2%	0.1%	-0.1%
Size	9%	8%	11%	1%	3%	0.2%	-0.4%	-0.1%	0.0%	0.0%
Value	-11%	2%	-15%	-19%	-2%	0.0%	0.0%	-0.2%	-0.2%	0.0%
Volatility	-4%	-8%	-17%	-8%	-5%	0.0%	0.0%	0.6%	0.1%	0.1%

	Average Exposures					Factor Contributions				
Sectors	US LMS	JP LMS	DMxUS LM	EM LMS	EU LMS	US LMS	JP LMS	DMxUS LM	EM LMS	EU LMS
Consumer Discretionary	-11%	2%	-8%	-6%	-9%	0.4%	0.3%	0.3%	0.0%	0.1%
Consumer Staples	6%	-3%	9%	0%	6%	-0.2%	-0.3%	0.4%	-0.2%	0.0%
Energy	-3%	1%	2%	-1%	0%	0.5%	0.3%	-0.2%	0.3%	-0.1%
Financials	-12%	-7%	-15%	-4%	-14%	0.0%	0.9%	0.3%	0.7%	0.3%
Health Care	1%	-3%	0%	-2%	-10%	0.2%	-0.4%	-0.2%	0.0%	-0.4%
Industrials	1%	2%	-2%	3%	8%	0.9%	0.3%	0.0%	0.4%	-0.1%
Information Technology	10%	15%	5%	5%	4%	0.5%	-0.1%	-0.1%	0.0%	-0.2%
Materials	9%	-4%	6%	2%	4%	-0.6%	-0.1%	0.0%	0.2%	0.4%
Real Estate	-2%	-2%	-3%	-3%	-1%	0.0%	0.3%	0.0%	-0.1%	-0.1%
Telecomm Services	-1%	0%	2%	2%	-4%	0.1%	0.1%	-0.1%	-0.2%	0.2%
Utilities	4%	-2%	4%	4%	16%	0.1%	0.1%	0.1%	0.0%	0.3%

Table 6. Summary performance attribution of the Residual ESG portfolios with no size underweight from January 2014 to March 2018.

Source of Return	Contributions				
	US LMS	JP LMS	DMxUS LM	EM LMS	EUDM LMS
Portfolio	12.3%	8.3%	7.3%	9.0%	4.9%
Benchmark	10.5%	8.9%	4.8%	7.7%	4.1%
Active	1.7%	-0.6%	2.5%	1.3%	0.8%
Specific Return	-0.8%	-1.5%	1.8%	0.4%	-0.9%
Factor Return	2.5%	0.9%	0.7%	0.9%	1.7%

Style Factors	Average Exposures					Factor Contributions				
	US LMS	JP LMS	DMxUS LM	EM LMS	EUDM LMS	US LMS	JP LMS	DMxUS LM	EM LMS	EUDM LMS
Dividend Yield	5%	7%	-11%	10%	-11%	0.0%	0.1%	-0.1%	0.1%	-0.1%
Earnings Yield	3%	-9%	1%	7%	0%	0.0%	0.0%	0.1%	0.1%	0.0%
Exch Rate Sens	4%	2%	7%	-3%	0%	0.0%	0.1%	0.0%	0.0%	0.0%
Growth	-6%	-6%	9%	-3%	12%	0.1%	0.0%	-0.1%	0.0%	-0.1%
Leverage	3%	-13%	-18%	-2%	-10%	0.1%	0.2%	0.0%	0.0%	0.1%
Liquidity	-14%	-6%	-11%	-7%	-7%	0.1%	0.1%	0.0%	0.1%	0.0%
Market Sensitivity	0%	-9%	-20%	-6%	-17%	0.2%	0.1%	0.4%	0.1%	0.3%
Med-Term Momen	1%	0%	-2%	0%	2%	-0.1%	-0.2%	-0.2%	-0.1%	0.2%
Profitability	3%	7%	12%	3%	13%	0.1%	0.2%	0.2%	0.1%	0.3%
Size	0%	0%	0%	0%	0%	0.0%	0.0%	0.0%	0.0%	0.0%
Value	2%	-6%	-8%	2%	-5%	-0.2%	-0.2%	-0.1%	0.1%	-0.1%
Volatility	-3%	-1%	-7%	-5%	0%	0.2%	-0.1%	0.3%	0.1%	0.0%

Sectors	Average Exposures					Factor Contributions				
	US LMS	JP LMS	DMxUS LM	EM LMS	EU LMS	US LMS	JP LMS	DMxUS LM	EM LMS	EU LMS
Consumer Discretionary	-3%	-1%	5%	-2%	2%	-0.3%	0.3%	-0.4%	0.0%	0.0%
Consumer Staples	1%	5%	-2%	-2%	0%	0.2%	0.8%	-0.1%	0.0%	-0.2%
Energy	-4%	-1%	-3%	-2%	-2%	0.6%	0.0%	0.4%	0.1%	0.2%
Financials	1%	0%	2%	5%	1%	0.6%	-0.2%	0.0%	-0.1%	0.1%
Health Care	2%	3%	2%	-1%	10%	0.5%	0.2%	0.2%	0.0%	0.6%
Industrials	0%	-5%	0%	1%	-7%	0.0%	0.1%	-0.1%	0.0%	0.0%
Information Technology	6%	-6%	-2%	2%	1%	0.7%	-0.5%	0.0%	0.3%	0.2%
Materials	-2%	0%	-6%	-1%	-5%	0.1%	0.1%	0.0%	-0.1%	-0.1%
Real Estate	1%	1%	5%	1%	1%	-0.1%	-0.2%	-0.2%	0.0%	-0.1%
Telecomm Services	1%	3%	1%	0%	2%	-0.2%	-0.1%	0.0%	0.0%	-0.1%
Utilities	-3%	0%	-1%	-2%	-3%	0.0%	0.2%	0.0%	0.0%	0.0%