Academic Research Monitor

ESG Quant Investing

Equities

Global

Quantitative

The quant side of Environmental, Social and Governance (ESG) investing

Over recent years, there has been a significant increase in the interest in ESG investing. So, do companies with high ESG scores outperform? Conversely, does it pay off to exclude stocks with low ESG scores? We track the latest academic advances on this topic and provide insights on these questions. Additionally, we ask Julie Hudson, the Head of the UBS Global Sustainability team, to share her views; see pages 11-12.

Six myths about ESG investing – all busted – and the "materiality" of ESG issues

Do corporate efforts to incorporate ESG issues in their decision-making process lead to financial outperformance? Do they increase shareholder value or just constitute a way to manage risk and reduce costs? These and a few more questions constitute the myths of ESG investing that the first paper that we review identifies and subsequently refutes. The most important of all, we believe, highlights the importance of identifying the "material" ESG issues (vs. "immaterial") that are critically tied to the operations of each industry; as an example, managing its environmental impact is much more critical (i.e. "material") for a company specialising in fossil fuels than for a financial institution.

Stock selection or exclusion based on ESG scores (levels and recent changes)

Two other papers that we review investigate the advantages, in terms of overall performance, and disadvantages, in terms of diversification reduction, from selecting or excluding stocks based on ESG scores. Screening out stocks with the worst ESG scores, or overweighting stocks with the best ESG scores is shown to lead to outperformance (even though statistical strength is not always strong). Additionally, overweighting the stocks with the largest ESG score improvement can improve the performance further.

Adding two new ESG-related equity factors to a factor model

In order to distinguish socially responsible (SR) from conventional mutual funds, the last paper that we review introduces two new ESG-related factors: top versus bottom ESG scoring firms; stocks accepted in SR funds versus stocks that are avoided based solely on the industry that they operate in. The SR funds have higher exposure to both factors and outperform the conventional funds, but the return differential is not statistically strong. This is because they benefit from overweighting high ESG scoring firms, but are partly penalised from excluding certain industries from their investment universe.

Nick Baltas, PhD
Analyst
nick.baltas@ubs.com
+44-20-7568 3072

David Jessop
Analyst
david.jessop@ubs.com
+44-20-7567 9882

Claire Jones, CFA
Analyst
claire-c.jones@ubs.com
+44-20-7568 1873

Josie Gerken, PhD
Analyst
josephine.gerken@ubs.com
+44-20-7568 3560

Desi Ivanova
Associate Analyst
desi-r.ivanova@ubs.com
+44-20-7568 1754

Julie Hudson, CFA
Analyst
julie.hudson@ubs.com
+44-20-7568 4632

Paul Winter
Analyst
paul-j.winter@ubs.com
+61-2-9324 2080

Josh Holcroft
Analyst
josh.holcroft@ubs.com
+852-2971 7705

Shanle Wu, PhD
Analyst
shanle.wu@ubs.com
+852-2971 7513

Oliver Antrobus, CFA
Analyst
oliver.antrobus@ubs.com
+61-3-9242 6467

Pieter Stoltz
Analyst
pieter.stoltz@ubs.com
+61-2-9324 3779

Introduction

The interest in ESG investing has recently intensified

Over the last few years, there has been a significant increase in the interest in environmental, social and governance (ESG) investing.[1] The data quality on ESG factors has become progressively better and the coverage significantly broader than in the recent past. As a quantitative research team we have seen a significant increase in the number of questions that we receive from our client base regarding the value-add of ESG data and regarding the various ways that this type of data could be used while constructing systematic equity strategies.

The broad shift towards ESG investing is primarily driven by two key reasons; financial and non-financial (for an interesting discussion see Amenc, Christiansen, Goltz and Gautam, 2016).

Is there an ESG return premium?

On the financial aspect of ESG, there is an open question as to whether investing in stocks with high ESG scores leads to outperformance. To put it differently, is there an ESG premium? If there is one, does it constitute compensation for bearing exposure to some type of systematic risk?

The ethical impact of investing

The non-financial aspect of ESG is directly related to the ethical impact of investing. One can argue that investing in responsible corporates should put price pressure to the less responsible corporates, hence incentivising them to reform. In the longer term, these dynamics can lead towards more socially responsible, ethical and environmentally friendly corporate business models, with the respective benefits for society, the economy and the environment.

Without undermining the importance of both aspects of ESG, our focus – being a quantitative research team – is to provide insights on the financial one. In this issue of the ARM we review four recently published papers that focus on the broad topic of incorporating ESG data into equity factor investing (see Figure 1). Additionally, we ask Julie Hudson, the Head of the UBS Global Sustainability team, to share her views; see pages 11-12 of the report.

Figure 1: Papers on ESG

"ESG Integration in Investment Management: Myths and Realities" *Sakis Kotsantonis, Chris Pinney and George Serafeim*	*Journal of Applied Corporate Finance, Vol. 28, No. 2, 2016*
"ESG for All? The Impact of ESG Screening on Return, Risk, and Diversification" *Tim Verheyden, Robert Eccles and Andreas Feiner*	*Journal of Applied Corporate Finance, Vol. 28, No. 2, 2016*
"Can ESG add alpha? An analysis of ESG Tilt and Momentum strategies" *Zoltan Nagy, Altaf Kassam and Linda-Eling Lee*	*Journal of Investing, Vol. 25, No. 2, 2016*
"Classifying and measuring the performance of Socially Responsible Mutual Funds" *Meir Statman and Denys Glushkov*	*Journal of Portfolio Management, Vol. 45, No. 2, 2016*

Source: UBS.

[1] Even though ESG investing can be considered synonymous to Socially Responsible Investing (SRI), it is – in fact – a much wider term that encompasses the actual consideration of ESG factors in the investment process and stock selection, as opposed to SRI that has been traditionally associated with negative screening.

"ESG Integration in Investment Management: Myths and Realities"

by Sakis Kotsantonis, Chris Pinney and George Serafeim

There are several misconceptions around the value-add of ESG criteria in investment decisions. With their recent paper, Sakis Kotsantonis, Chris Pinney and George Serafeim highlight six myths about ESG investing and subsequently refute them. This paper is not a core research paper, but instead it is more of an essay that discusses various features of ESG. We subsequently state the six myths and briefly review the arguments of the authors in their efforts to refute them.

Myth #1: The net financial effect of corporate efforts to address environmental and social issues is the reduction of corporate returns on operating capital and, along with them, long-run shareholder value; and so, although ESG makes investors feel good, it effectively asks them to accept lower returns on investment.

Integrating ESG issues in corporate financial decision-making can be costly…

There is no doubt that addressing social or environmental issues can be very costly for a company. The critical question is whether such a shareholder investment can turn out to be of competitive advantage for the company and therefore become recognised by investors. The authors outline a number of examples of corporate social and environmental policies that have been actually shown to increase corporate cash flows or shareholder value.

…but this could be an artefact of the perspective

However, the question of systematic superior stock performance as a result of such policies remains open. The authors argue that that the main reason why the myth persists is closely related to the lacklustre performance of SRI funds, and also to the fact that the ESG integration in their investment process is typically done via "exclusionary screening". That is, companies with the worst ESG scores are typically screened out of an investable universe before any investment decision is made; this ESG screening process is the main focus of the second paper that we reviewed for this ARM by Verheyden, Eccles and Feiner (2016); see page 6.

Material vs. immaterial ESG issues

The authors argue that such an ESG negative screening methodology cannot capture the value added by the various sustainability initiatives across companies and most importantly across industries. Using evidence from Khan, Serafeim and Yoon (2016), the authors argue in favour of a distinction between "material" and "immaterial" ESG issues, in line with the definitions of the Sustainability Accounting Standard Board (SASB). To give an example, it is of critical importance for a company specialising in fossil fuels to manage its environmental impact ("material" ESG issue), as opposed to – for instance – financial institutions ("immaterial" ESG issue). Conversely, marketing or advertising is significantly more important for the latter.

Investment in material ESG issues leads to profitability and superior risk-adjusted performance

Using data for 2,000 U.S. companies between 1993 and 2013, Khan *et al.* (2016) show that companies that make significant investments in material ESG issues (for their respective industry) experience high growth in profit margins and superior risk-adjusted stock returns. Conversely, companies that make significant investments in immaterial ESG issues show no sign of outperformance (and at times might also underperform).

Which ESG issues are material?

All in all, the authors of the current paper argue that it is crucial to identify the ESG issues that have a material impact for the long-run value of a firm or an industry as opposed to agnostically screening out companies based on a broad ESG score.

Myth #2: ESG is well on its way to being integrated into mainstream investment management and capital markets with over $60 trillion in assets now subscribed to the Principles for Responsible Investment established by the UN (UNPRI).

There is a thin line, the authors argue, between signing the United Nations Principles for Responsible Investment (UNPRI) and the actual ESG integration in the investment process. As the authors highlight, UNPRI signatories only commit to behaving in line with a set of principles on responsible investing, but this is not synonymous to actual ESG integration in their investment decisions.

Based on the annual report of the Global Sustainable Investment Alliance (GSIA), the total size of the global sustainable investment market is roughly $21.4 trillion (at the end of 2014), which falls short of the total AUM of UNPRI signatories ($60 trillion). The authors identify two reasons for this discrepancy. First, not all UNPRI signatories fully comply with the underlying principles or have not yet completed their ESG integration process. Second, UNPRI signatories have the freedom to choose how much of their AUM is subject to ESG integration.

All in all, the authors argue that "*we are still a long way from seeing ESG integrated into models that drive most mainstream investment decision-making*".

Myth #3: Companies have little if any ability to influence the kinds of investors who buy their company's shares. And because the main focus of the vast majority of investors is near-term reported earnings, with holding periods—and presumed time horizons—ranging from three months to a year, corporate managers are often forced by market pressures to sacrifice sustainability goals to meet quarterly earnings targets.

The investor base is largely fragmented and contains several groups of investors that differ greatly in terms of investment style, investment horizon and holding period. The authors use the following classification of US institutional investors[2]: (a) "transients": investors with short holding periods and high turnover, (b) "quasi-indexers": investors with broadly diversified portfolios, longer holding periods and low turnover, and (c) "dedicated holders": investors with concentrated portfolios and long holding periods.

ESG integration in corporate decision-making is more likely to create shareholder value in the longer run, which might cause adverse incentives for corporate managers that want to meet short-term objectives, like quarterly earnings targets, especially if the investor base is more tilted towards "transients".

Companies can actually attract longer-term investors

The critical question, following the above, is whether corporate managers have the ability to attract different types of investors using particular management policies. If this is the case, then managers that aim to incorporate ESG in their investment process would be willing to attract more "dedicated holders", as these are targeting longer-term performance at the expense of potential misses of short-term objectives. The authors highlight two recent academic papers by Knauer and Serafeim (2014) and Serafeim (2015), which show that companies that adopt more integrated reporting[3] do actually attract longer-term investors. They therefore have a clear opportunity to employ policies (e.g. ESG integration) that lead to long-term profitability and stock performance, hence refuting the myth in question.

---

[2] The classification has been developed by the Wharton accounting Professor Brian Bushee.
[3] Integrated reporting entails a periodic integrated report and related communications by an organisation on aspects of value creation; see Serafeim (2015).

***Myth #4**: It is nearly impossible to do good fundamental analysis taking into account ESG data because the data infrastructure is really lacking.*

This is possibly the most frequent concern relating to the use of ESG factors in the investment process. How good is the data? What is the coverage?

ESG data is getting progressively better

The authors do agree that the quality and coverage of ESG data is not yet comparable to financial data, however, they argue that there has been "*tremendous*" progress in the last few years on that front. This progress has been driven by a number of factors: (a) the investor interest in ESG data has intensified, (b) stock exchanges have started introducing listing requirements related to ESG reporting, (c) the number of ESG data providers has significantly increased and (d) regulators have been introducing directives on ESG disclosure.

The challenges ahead

All the above constitute evidence in favour of improved quality and coverage of ESG data. However, it must be stressed that there are still some challenges ahead for the end investor. One relates to the actual identification of the ESG factors that are "material" (see the discussion for Myth #1 above) for financial performance. Another one relates to the lack of a standardisation framework on the definition of ESG metrics. Several undergoing initiatives (like SASB) are expected to help in this regard.

***Myth #5**: ESG is only about managing risk and reducing costs.*

ESG integration can certainly lead to value creation

The authors argue that ESG integration is not *just* a way to improve efficiencies in order to reduce costs and manage risk, but it can certainly lead to value creation. To support this view, the authors briefly discuss a number of specific examples of firms that employed ESG integration in their decision-making process and have achieved long-term value; see the paper for the examples.

***Myth #6**: Consideration of ESG factors in investment portfolio construction is contrary to fiduciary duty.*

The authors quote a 2008 Employee Retirement Income Security Act (ERISA) bulletin by the U.S. Department of Labor that argues that fiduciaries should not make investment decisions that take into account "*any factor outside the economic interest of the plan*". The fact that ESG factors are generally considered as non-economic can raise concerns against their integration in investment decisions, as this could theoretically compromise the fiduciary duty to "*protect the financial interest of their beneficiaries*".

Even though, strictly speaking, the above argument bears some validity, the authors argue that ESG factors should no longer be considered as being "non-economic". Conversely, the challenge (as already outlined in our discussion of Myth #1) is to identify the relevant ESG factors for each particular industry that investment managers invest in. The lack of industry standards in ESG reporting is certainly an obstacle towards this objective, and the authors highlight the importance of developing such standards, quoting a more recent bulletin (October 2015) of the U.S. Department of Labor that states that the 2008 bulletin had "*unduly discouraged fiduciaries from considering ETIs and ESG factors*".

"ESG for All? The Impact of ESG Screening on Return, Risk, and Diversification"

by Tim Verheyden, Robert Eccles and Andreas Feiner

The implications of a preliminary ESG screening on an equities universe

Tim Verheyden, Robert Eccles and Andreas Feiner explore whether a portfolio manager would be at a disadvantage in terms of performance, risk and diversification if he/she were to start from a universe that has been already screened based on ESG criteria.

Two broad equity universes

The paper presents an empirical analysis for two equity universes: (a) "Global All": large and mid-cap stocks across 23 developed and 23 emerging countries that jointly account roughly for 85% of the global equity universe; (b) "Global Developed Markets": the developed market subset of "Global All", which accounts roughly for 85% of the global developed equity universe.

The ESG screening is applied twice a year (in May and November) and is conducted on a sector-neutral basis. Any stocks without the necessary ESG information are excluded from the universe. The sample period is between January 2010 and December 2015, as prior to January 2010 the data coverage/availability is not great. The ESG data is from Sustainalytics.

The ESG screening process; excluding the bottom-ranked companies

The ESG-screened portfolios are constructed using the following criteria:

- A company is excluded from the universe at each rebalance date if it belongs at the bottom 10% or 25% of the stocks with the worst ESG score in its sector. The rule does not apply if a company has exhibited an improvement in its ESG score over the recent three to six months, as this indicates a significant effort to improve its ESG performance.
- A company is excluded from the universe at each rebalance date if it violates at least one of the 10 United Nations principles of responsible business (provisions for human rights, labour rights, environment, and anti-corruption).

The companies that are screened out increase as we move from developed to emerging markets, potentially driven by data availability. The Pacific Rim (Australia and New Zealand) has the smallest number of exclusions, followed by Europe and North America. As for sectors, the communications sector has the smallest number of exclusions, whereas energy and non-energy minerals have had the largest.

ESG-screened portfolios outperform their respective benchmarks

The empirical evidence shows that all ESG-screened portfolios have performed very similarly to their respective underlying benchmarks, if not slightly outperforming them. Excluding the bottom 10% (for both universes) or 25% of stocks (only for the "All" universe) based on ESG ranking is shown to have a small benefit in terms of increasing the average return and reducing the volatility, hence improving the risk-adjusted performance of the portfolio (most likely statistically insignificant though; the paper does not report the statistical strength of the results). These small benefits seem to be primarily driven by the fact that the stocks in the screened universe exhibit less downside risk compared to the entire population. Put differently, the findings of the paper show that – at the very least – there is no performance penalty from screening out low ESG-scoring firms of each industry.

Interestingly, the authors argue that the above benefits do not come with a significant impact in diversification (as measured by the diversification ratio of Choueifaty and Coignard, 2008). They argue that any reduction in the diversification ratio (which comes by construction due to the smaller number of stocks) is more than offset by the increase in the excess risk-adjusted returns.

"Can ESG add alpha? An analysis of ESG Tilt and Momentum strategies"

by Zoltan Nagy, Altaf Kassam and Linda-Eling Lee

In their recent paper, Zoltan Nagy, Altaf Kassam and Linda-Eling Lee investigate the alpha-generating potential of two ESG-related portfolios; "ESG tilt" and "ESG momentum". The former is a strategy which overweights stocks with higher ESG ratings, the latter strategy overweights stocks whose ESG score has improved. The objective of both is to improve the overall ESG score relative to a benchmark.

The analysis is motivated by the conviction that a relationship between ESG scores and future stock returns exists. It is therefore supposed that those stocks which rank favourably according to an ESG score system are better prepared to weather "ESG-related risks" and able to benefit from "ESG-related opportunities".

ESG Tilt and ESG Momentum

The two ESG strategies proposed are both based on an investment universe consisting of stocks in the MSCI World Index. The sample period runs from February 2007 to March 2015 (for ESG momentum the sample period starts one year later) and rebalancing is carried out on a monthly basis. The Barra Global Equity risk model (GEM3S) is used for performance attribution. The following constraints are applied to both strategies:

- 2.5% bound on tracking error
- 8% turnover limit
- +/- 5% country tilt bounds relative to the benchmark
- 5% upper bound on weights
- 2% maximum deviation of weights from the respective benchmark weight.

Outperforming the benchmark and improving the overall ESG score

The construction of the two ESG-related strategies uses ESG scores (for ESG tilt) or change in ESG scores over the past 12 months (for ESG momentum) to overweight or underweight stocks. Both portfolios are shown to (a) outperform MSCI World during the aforementioned sample period and (b) achieve an overall improvement in their ESG score; 4 points for the ESG tilt portfolio (score of 9.8 versus 5.8 for the benchmark) and 1.7 points for the ESG momentum portfolio (score 7.4 versus 5.7).

Stocks with high ESG score are generally expensive and have low idiosyncratic volatility

Focusing on the ESG tilt portfolio, the authors find that, whilst approximately 90% of the portfolio's active risk is stock-specific, the largest proportion of active return is attributed to style factors. This is primarily driven by three factors: residual volatility, size and non-linear size (mid-cap), and earnings yield. More specifically, stocks with high ESG scores tend to be mid-cap and have low idiosyncratic volatility and low earnings yield (i.e. expensive).

The story is slightly different for ESG momentum. In this case, the largest contributor to both active risk and active return has been stock-specific. In addition, whilst exposure to styles has still been high (mainly coming from exposure to size and price momentum), a greater proportion of performance is due to industry and country bets compared to ESG tilt.

Total active return earned from ESG momentum is more than double that of ESG tilt

Regarding overall performance, the total active return for ESG momentum has been more than double that of ESG tilt. In other words, ESG score improvement is more strongly related to future performance than just the level of the ESG score.

Overall, this analysis demonstrates that it is possible to construct a portfolio based on ESG scores that can outperform the benchmark whilst not deviating excessively from the benchmark composition. We provide a simple empirical backtest below.

A simple empirical exercise

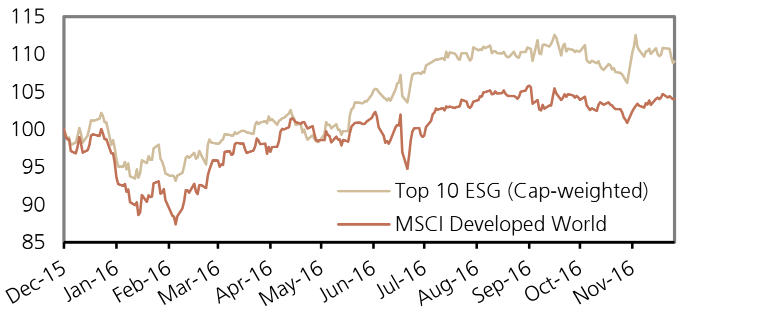
As an illustrative example, we have constructed a market-cap-weighted portfolio of the top 10 ESG stocks in the MSCI World Index as of end of November 2016 (see the latest factsheet for MSCI ESG World Index) and compared its historical performance to the underlying index.[4] It is obvious that there is forward-looking bias in this analysis, as the ranking information only becomes available at the end of the sample period. For this reason, the results that follow should only be considered as an illustrative example of the performance of high-ranked ESG stocks as opposed to an actual back-test. Figure 2 reports the top ESG ranked stocks at the end of November 2016 and Figures 3 and 4 present the performance of the portfolios over the last year.

Figure 2: Top MSCI World ESG Constituents

Security Name	Country	Industry
Microsoft Corp	US	MSCI Information Technology
Johnson & Johnson	US	MSCI Health Care
Alphabet Inc-cl A	US	MSCI Information Technology
Procter & Gamble Co/the	US	MSCI Consumer Staples
Verizon Communications Inc	US	MSCI Telecommunication Services
Coca-Cola Co/the	US	MSCI Consumer Staples
Intel Corp	US	MSCI Information Technology
Merck & Co. Inc.	US	MSCI Health Care
Roche Holding Ag-genusschein	CH	MSCI Health Care
Novartis Ag-reg	CH	MSCI Health Care

Source: MSCI. The table lists the 10 constituents in MSCI Developed World which ranked the highest according to an overall ESG score. The rankings are as of Nov 30th and are listed in the index factsheet online (https://www.msci.com/documents/10199/db88cb95-3bf3-424c-b776-bfdcca67d460).

Figure 3: Top 10 ESG Stocks vs. MSCI Developed World



Source: UBS Quantitative Research. The plot presents the performance of a value-weighted portfolio consisting of the top 10 ESG-ranked stocks in MSCI Developed World as of November 2016. Cumulative returns, over the same period, for MSCI Developed World index are also shown.

Figure 4: Performance Statistics

	TOP 10 VW	MSCI Dev. World
Return (%)	9.57	4.22
Volatility (%)	12.44	13.05
Skewness	0.24	-0.79
Max Drawdown (%)	8.87	13.03
Sharpe Ratio	0.77	0.32

Source: UBS Quantitative Research. The table presents performance statistics for the value-weighted (VW) top 10 ESG-ranked stocks in MSCI Developed World and the MSCI Developed World Index. Sample period: Dec. 2015 – Nov. 2016.

Acknowledging the forward-looking bias aspect of the analysis, it is obvious that the high-ESG stocks have significantly outperformed the benchmark index, achieving higher return, lower volatility, positive skewness and lower maximum drawdown. This illustrative result motivates further exploration in stock selection centred around ESG scores. We leave this for future research.

[4] This analysis has been conducted following written permission by MSCI. For further information, please see MSCI ESG Research: https://www.msci.com/research/esg-research

"Classifying and measuring the performance of socially responsible mutual funds"

by Meir Statman and Denys Glushkov

Constructing two new social responsibility factors

The absence of clear criteria to distinguish socially responsible (SR) from conventional mutual funds makes it difficult to *classify* funds as SR and *measure* the effect of social responsibility on the investment performance. In their recent paper, Meir Statman and Denys Glushkov address these issues and develop a model that could help resolving them. In particular, the authors extend the Carhart (1997) four-factor model (market, small-large, value-growth and momentum) by adding two social responsibility factors:

TMB captures the relative performance of stocks with strong vs weak ESG features

- **Top Minus Bottom** (TMB), which ranks companies according to their strengths and concerns on five ESG-related criteria: employee relations, community relations, environmental protection, diversity and products. The long (short) side of the TMB factor is a value-weighted portfolio consisting of companies that belong to the top (bottom) third of companies in at least two of the five criteria and not in the bottom (top) third of any criterion.

AMS imposes industry restrictions

- **Accepted Minus Shunned** (AMS), which is the difference between the returns of stocks commonly accepted in SR funds and those that are typically avoided. Shunned companies are those with operations in the tobacco, alcohol, gambling, military, firearms and nuclear industries. The long (short) side of the AMS factor is a value-weighted portfolio of accepted (shunned) stocks.

The data used to construct the two SR factors is obtained from the MSCI ESG database and consists of 4,904 US equities for the period between 1991 and 2011. A further screen is applied to filter out companies that have zero strengths or concerns on three or more of the social responsibility criteria, which produces a sample consisting of 17,180 company-year observations. The year-end scores are matched with monthly stock returns for the subsequent 12-months (thus resulting in 96,316 company-month observations).

Factor performance over the entire sample period

Over the entire sample period, the TMB factor has had an annualised return of 2.82%, while that of the AMS factor has been at -1.72%, implying that on average, the top social responsibility stocks outperform the bottom, but the accepted stocks underperform the shunned. The authors report a negligible negative correlation between the two factors at -0.04 meaning that the two factors capture different aspects of SRI.

Classifying SR mutual funds using two methodologies

The paper continues with a discussion of two methods for classifying mutual funds as socially responsible – the *betas method* and the *contents method*, and explores the correspondence between them.

The *betas* method:
A six-factor model is used to rank mutual funds as SR on a relative basis

The betas method ranks funds according to the TMB and AMS factor loadings (beta). A fund would rank high on the social responsibility scale if it, for instance, has a high TMB and/or AMS beta. High TMB beta would imply that the fund's managers explicitly or implicitly favour stocks with high scores on the five social responsibility categories, while a high AMS beta would be associated with the exclusion of shunned companies.

The *contents* method:
What does the fund invest in?

The contents method requires a social responsibility score to be assigned to each security that a fund holds. It is less biased, but computationally more intensive or even infeasible if holdings data is not available.

Based on Spearman correlations, the authors find a significant positive association between the two methods of fund classification. Although not perfect, this correspondence gives some confidence that the six-factor model might be a useful tool for classifying funds, especially if holdings data is unavailable or a large number of funds are to be ranked. In addition, the factor approach might be able to identify "hidden" SR funds or point at those whose investment strategy is inconsistent with their prospectus statements.

Classification by the contents method corresponds well to the betas method

To quantify the value-add attributable to socially responsible investing from that due to other sources (such as managerial skills), the authors compare the output from the four- and the six-factor model for the conventional S&P 500 index and two SR ones (KLD 400 and Calvert Social Index). The analysis reveals that the performance of SR stocks exceed that of conventional, however, the difference does not appear to be statistically significant, which is consistent with the findings in earlier studies.

Measuring SR-related performance

To determine what causes this difference in performance, the authors examine how the TMB and AMS factors individually affect the performance of mutual funds. Using a sample of nearly 6,000 active US mutual funds they calculate the alpha associated with each fund using the four-factor model and estimate its TMB and AMS betas based on the six-factor model. The funds are then cross-tabulated according to "high", "medium" or "low" values of their TMB and AMS betas into nine groups (three groups by TMB and three by AMS). The average annualised alpha within the nine groups is calculated and used as a measure of performance of each category. The conclusions from this analysis are the following:

A more in-depth analysis: accounting for the TMB and AMS effects separately

- For any given level of AMS ("high", "medium" or "low"), increasing TMB always improves performance. The incremental changes in average alpha by moving TMB from "low" to "high" are reported as statistically significant.
- For any level of TMB, increasing AMS seems to have a negative effect on performance; however, the decrease is not significant.

These findings indicate that the lack of statistically significant differences between the performance of SR and conventional funds could be due to the investors' preferences for high TMB and high AMS exposure. In other words, mutual funds improve their performance by holding companies with strong ESG scores while imposing further industry restrictions detracts from it, resulting in a small net positive but insignificant effect.

Preference for high TMB and high AMS stocks is a likely the reason for lack of significance in the outperformance of SR funds

Commentary by the UBS Head of the Global Sustainability Team, Julie Hudson

ESG Investing and ESG Integration – Two Sides of the Same Coin

Ten years on, two important changes…

This Quant team publication on an important question – whether ESG investing pays off – happens to have arrived ten years on from a Research Foundation of CFA Institute Monograph (2006), *The Social Responsibility of the Investment Profession*,[5] authored by Julie Hudson. It suggests that two important changes are underway: there seems to be more and better evidence on the subject of ESG and investment returns; and corporate disclosures needed to support such investment approaches appear to have improved.

Change number one: ESG and investment returns: stronger evidence.

On the first point, the evidence reviewed in Chapter Five of the monograph in 2006, on the performance of ESG and SRI portfolios, was ambiguous. Sometimes, SRI portfolios outperformed, and sometimes they did not. On average, designing portfolios with a positive ESG or SRI bias (achieved through a range of different methodologies) appeared to make no difference. However, ten years on, the articles under review by our Quant team in this paper identify investment strategies that lead to outperformance, even if the statistical significance sometimes varies.

Change number two: ESG, a potentially rich data source for investment research?

On the second point – research costs and disclosures – the 2006 monograph also observed that if the costs associated with ESG research continued to be relatively high, and if the company disclosures supporting such work did not evolve, SRI and ESG would continue to be unreflected in valuations. We think it is likely that improved disclosure has helped to make it easier to produce insightful research on the subject of ESG investment. To the point, other work by the UBS Quant team earlier this year confirms that ESG data has become more readily available due to changes in reporting. Josh Holcroft recently published on supply chains.[6] He commented: "*Supply chains and network effects are of increasing importance in the global economy. The recent investor focus on quality and ESG (environmental, social and governance) has brought unprecedented transparency to the supply chain and revealed a rich new data source for financial analysis.*"

These results may be reflecting a cultural shift, in our view.

However we believe the results described by UBS's quants team in this paper are potentially reflecting more than operational facts of life such as data and disclosure. Josh Holcroft, above, refers to parallel developments: a structural shift in the economy (the greater importance of network effects and supply chains) as well as increased disclosure. In our view, cultural shifts driven by (among other things) the shock of the credit crunch, demographics and new technologies are shifting a number of environmental and social issues so that they are no longer an overlay, but at the core. To give an example of a similar insight from another team, the Technology Services ESG Industry Postcard,[7] on the subject of the sharing economy, observes: "*The rising sharing economy puts environmental and sustainability debates front and centre.*"

[5] J. Hudson CFA (2006). The Social Responsibility of the Investment Profession (Research Foundation of CFA Institute).
[6] Josh Holcroft (2016). How Can Supply Chains Improve Earnings Visibility?, 4th July, 2016.
[7] UBS's ESG Industry Postcards originated in the ESG Analyser (2010-2015) and our internal ESG Analyst Survey. They reflect our view that sound industry knowledge is needed to understand which ESG issues might be material.

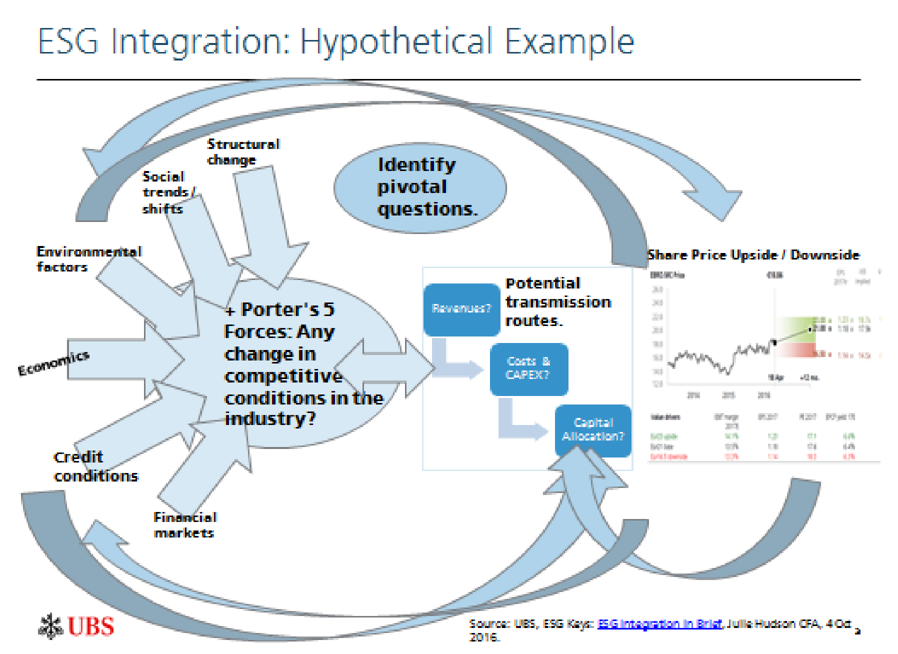
In a third important change over the past decade, we cannot help noticing many more instances of ESG-relevant content in so-called "mainstream" research. Such research notes were written because the investment issues they address go beyond being "material" in an accounting sense. They are better described as structural, or embedded, in sector business models. Examples include:

Change number three.

- The August 2014 Q-Series, from the Global Utilities, Autos & Chemicals teams, which asked: "Will solar, batteries and electric cars re-shape the electricity system?", by Patrick Hummel and team.
- The work on the sharing economy from a number of teams – for example the Q-Series by Eric Sheridan asking "What is the Scope of the Sharing Economy?"
- Two Q-series on the topic of water risk, one lead-authored by UBS's ESG team, and one by Simon Powell, Head of Asian Utilities, asking "Is China consuming too much water to make electricity?"

In a recent note on ESG Integration, we used a diagram to describe a circular process by means of which ESG issues might be "priced in", alongside many other market drivers. If we are right about the abovementioned cultural shift, and this diagram is a fair representation of market ecosystems, we can expect ESG issues to become increasingly priced in.

Figure 5: Market Mechanics: How Are ESG Issues Priced In?



Source: UBS, ESG Keys: ESG Integration in Brief, Julie Hudson CFA, 4 Oct 2016.

References

Amec, A., Christiansen, E., Goltz, F. & Gautam, K. (2016). Scientific Beta Low Carbon Multi-Beta Multi-Strategy Indices. *ERI Scientific Beta Paper*.

Carhart, M. M. (1997). On persistence in mutual fund performance. *Journal of Finance, 52*(1), 57-82.

Khan, M., Serafeim, G., & Yoon, A. (2016). Corporate Sustainability: First evidence on Materiality. *The Accounting Review, 91*(6), 1697-1724.

Knauer, A., & Serafeim, G. (2014). Attracting Long - Term Investors Through Integrated Thinking and Reporting: A Clinical Study of a Biopharmaceutical Company. *Journal of Applied Corporate Finance, 26*(2), 57-64.

Kotsantonis, S., Pinney, C., & Serafeim, G. (2016). ESG Integration in Investment Management: Myths and Realities. *Journal of Applied Corporate Finance, 28*(2), 10-16.

Nagy, Z., Kassam, A. & Lee, Linda-Eling. (2016) Can ESG Add Alpha? An Analysis of ESG Tilt and Momentum Strategies, Journal of Investing, Vol. 25, No. 2, pp. 113-124.

Serafeim, G. (2015). Integrated Reporting and Investor Clientele. *Journal of Applied Corporate Finance, 27*(2), 34-51.

Statman, M., & Glushkov, D. (2016). Classifying and Measuring the Performance of Socially Responsible Mutual Funds. *Journal of Portfolio Management, 42*(2), 140-151.

Verheyden, T., Eccles, R. G., & Feiner, A. (2016). ESG for All? The Impact of ESG Screening on Return, Risk, and Diversification. *Journal of Applied Corporate Finance, 28*(2), 47-55.

UBS Equity Quantitative Research publications

Monographs, Keys and Q-Series		Academic Research Monitor	
Title	Date	Topic	Date
Systematic Strategies for Single-Stock Futures	Oct-16	Quality, Low-Risk and Momentum Investing	Nov-16
Irrational asset management	Oct-16	Combining Smart Beta Factors	Sep-16
China domestic market – alpha for quantitative investors	Oct-16	Portfolio Construction and Overfitting	Jul-16
Are you already timing styles successfully?	Sep-16	UBS Equity Markets Conference	May-16
Do low-volatility stocks have interest-rate risk?	Sep-16	European Quantitative Conference 2015 Highlights	Apr-16
What does splitting the financials sector change?	Aug-16	Does Oil matter for Equity Markets?	Mar-16
Harvesting Yield from Cross-Asset Carry	Aug-16	Low Risk Investing	Feb-16
When is the stock market likely to correct?	Aug-16	Value Investing	Dec-15
Is it easier to be a quant in small cap?	Aug-16	Analyst Forecasts and Measuring Distance	Nov-15
Follow the smart money	Jul-16	UBS Market Microstructure Conference	Oct-15
How can supply chains improve earnings visibility?	Jul-16	Equity Risk Premium Forecasting and Market Timing	Sep-15
Why does increasing volatility matter?	Feb-16	Behavioural Investing Patterns	Jul-15
What crowded positions are bubbling up in equity markets	Feb-16	Quality and Size Investing	May-15
What happened to Value, and when will it return?	Jan-16	European Quantitative Conference 2015 Highlights	Apr-15
Who benefits from automation?	Nov-15	Smart Beta, Factors and Style Investing	Feb-15
The Spectre of Equity-Bond allocation	Nov-15	Momentum-Investing	Jan-15
Dynamic Asset Allocation	Nov-15	Investment Strategies & Textual Analysis Signals	Dec-14
How will demographics shape investing for the next ten years?	Nov-15	Commodity Risk & Institutional Investing Habits	Nov-14
Surfing the macro wave	Sep-15	Index Membership, Investor (in)attention to News & Spurious Correlations	Sep-14
Why blame Risk-parity and CTAs?	Sep-15	Forecasting the Equity Risk Premium	Aug-14
Bonds are better: asset allocation in target dated funds	Sep-15	Implied Cost of Capital & Shorting Premium	Jun-14
Low-Risk Investing: perhaps not everywhere	Jul-15	Trend Following	Mar-14
Cost efficient trading with time varying alphas	Jul-15	Factor investing & Quality	Feb-14
The Madness of Crowds	Jul-15	Quality & Gross Profitability	Jan-14
Lessons from Behavioural Finance	Jul-15	Minimum variance: valuation, concentration and exchange rates	Dec-13
Understanding Size Investing	Jun-15	Liquidity & back test overfitting	Oct-13
Safe Dividends in Times of Financial Repression	Jun-15	News and its effect on asset prices	Sep-13

PAS User Guides

PAS Macros	Feb-16	Reports	Apr-14
Quick Reference Guide	Nov-15	Risk Parity	Feb-13
Risk Parity and Composite Assets	Jan-15	Advanced Analysis	Oct-12
Introduction to the UBS Portfolio Analysis System	Jan-15	Risk Models	Nov-11
Long-Short Analysis	Jan-15	UBS Hybrid Risk Model	Dec-10
Installation	May-14	Quick Portfolio Analysis	Jul-10

R Advice

R and Excel	Dec-16	Optimising in Rs	Aug-16
Rolling window calculations – which package to use	Oct-16	Speeding up R / Plotting correlation matrices	Jun-16
Getting started with random forests	Sep-16		

Team

UK – London

Nick Baltas	+44-20-7568 3072
Maylan Cheung	+44-20-7568 4477
Ian Francis	+44-20-7568 1872
Josie Gerken	+44-20-7568 3560
Simon Iley	+44-20-7568 6327
Desi Ivanova	+44-20-7568-1754
David Jessop	+44-20-7567 9882
Claire Jones	+44-20-7568 1873
Manoj Kothari	+44-20-7568 1997
Simon Stoye	+44-20-7568 1876
Christine Vargas	+44-20-7568 2409

Hong Kong

Cathy Fang (Shanghai)	+86-021-3866 8891
Josh Holcroft	+852-2971 7705
Shanle Wu	+852-2971 7513

Australia– Sydney

Oliver Antrobus	+61-3-9242 6467
Luke Brown	+61-2-9324 3620
Pieter Stoltz	+61-2-9324 3779
Paul Winter	+61-2-9324 2080
Jenevieve Zhang	+61-2-9324 2247

Valuation Method and Risk Statement

The articles in this document are based on third party research as disclosed in each piece; however, where this methodology has been applied to a dataset, full responsibility for its application and/or extrapolation is accepted by the analyst.

Our quantitative models rely on reported financial statement information, consensus earnings forecasts and stock prices. Errors in these numbers are sometimes impossible to prevent (as when an item is misstated by a company). Also, the models employ historical data to estimate the efficacy of stock selection strategies and the relationships among strategies, which may change in the future. Additionally, unusual company-specific events could overwhelm the systematic influence of the strategies used to rank and score stocks.

Required Disclosures

This report has been prepared by UBS Limited, an affiliate of UBS AG. UBS AG, its subsidiaries, branches and affiliates are referred to herein as UBS.

For information on the ways in which UBS manages conflicts and maintains independence of its research product; historical performance information; and certain additional disclosures concerning UBS research recommendations, please visit www.ubs.com/disclosures. The figures contained in performance charts refer to the past; past performance is not a reliable indicator of future results. Additional information will be made available upon request. UBS Securities Co. Limited is licensed to conduct securities investment consultancy businesses by the China Securities Regulatory Commission. UBS acts or may act as principal in the debt securities (or in related derivatives) that may be the subject of this report. This recommendation was finalized on: 14 December 2016 03:27 AM GMT.

Analyst Certification: Each research analyst primarily responsible for the content of this research report, in whole or in part, certifies that with respect to each security or issuer that the analyst covered in this report: (1) all of the views expressed accurately reflect his or her personal views about those securities or issuers and were prepared in an independent manner, including with respect to UBS, and (2) no part of his or her compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed by that research analyst in the research report.

UBS Investment Research: Global Equity Rating Definitions

12-Month Rating	Definition	Coverage[1]	IB Services[2]
Buy	FSR is > 6% above the MRA.	45%	28%
Neutral	FSR is between -6% and 6% of the MRA.	39%	25%
Sell	FSR is > 6% below the MRA.	15%	17%
Short-Term Rating	**Definition**	**Coverage[3]**	**IB Services[4]**
Buy	Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%
Sell	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%

Source: UBS. Rating allocations are as of 30 September 2016.
1:Percentage of companies under coverage globally within the 12-month rating category.
2:Percentage of companies within the 12-month rating category for which investment banking (IB) services were provided within the past 12 months.
3:Percentage of companies under coverage globally within the Short-Term rating category.
4:Percentage of companies within the Short-Term rating category for which investment banking (IB) services were provided within the past 12 months.

KEY DEFINITIONS: Forecast Stock Return (FSR) is defined as expected percentage price appreciation plus gross dividend yield over the next 12 months. **Market Return Assumption (MRA)** is defined as the one-year local market interest rate plus 5% (a proxy for, and not a forecast of, the equity risk premium). **Under Review (UR)** Stocks may be flagged as UR by the analyst, indicating that the stock's price target and/or rating are subject to possible change in the near term, usually in response to an event that may affect the investment case or valuation. **Short-Term Ratings** reflect the expected near-term (up to three months) performance of the stock and do not reflect any change in the fundamental view or investment case. **Equity Price Targets** have an investment horizon of 12 months.

EXCEPTIONS AND SPECIAL CASES: UK and European Investment Fund ratings and definitions are: Buy: Positive on factors such as structure, management, performance record, discount; **Neutral:** Neutral on factors such as structure, management, performance record, discount; **Sell:** Negative on factors such as structure, management, performance record, discount. **Core Banding Exceptions (CBE):** Exceptions to the standard +/-6% bands may be granted by the Investment Review Committee (IRC). Factors considered by the IRC include the stock's volatility and the credit spread of the respective company's debt. As a result, stocks deemed to be very high or low risk may be subject to higher or lower bands as they relate to the rating. When such exceptions apply, they will be identified in the Company Disclosures table in the relevant research piece.

Research analysts contributing to this report who are employed by any non-US affiliate of UBS Securities LLC are not registered/qualified as research analysts with FINRA. Such analysts may not be associated persons of UBS Securities LLC and therefore are not subject to the FINRA restrictions on communications with a subject company, public appearances, and trading securities held by a research analyst account. The name of each affiliate and analyst employed by that affiliate contributing to this report, if any, follows.

UBS Limited: Nick Baltas, PhD; David Jessop; Claire Jones, CFA; Josie Gerken, PhD; Desi Ivanova; Julie Hudson, CFA. **UBS Securities Australia Ltd:** Paul Winter; Oliver Antrobus, CFA; Pieter Stoltz. **UBS AG Hong Kong Branch:** Josh Holcroft; Shanle Wu, PhD.

Unless otherwise indicated, please refer to the Valuation and Risk sections within the body of this report. For a complete set of disclosure statements associated with the companies discussed in this report, including information on valuation and risk, please contact UBS Securities LLC, 1285 Avenue of Americas, New York, NY 10019, USA, Attention: Investment Research.

Global Disclaimer

This document has been prepared by UBS Limited, an affiliate of UBS AG. UBS AG, its subsidiaries, branches and affiliates are referred to herein as UBS.

Global Research is provided to our clients through UBS Neo and, in certain instances, UBS.com (each a "System"). It may also be made available through third party vendors and distributed by UBS and/or third parties via e-mail or alternative electronic means. The level and types of services provided by Global Research to a client may vary depending upon various factors such as a client's individual preferences as to the frequency and manner of receiving communications, a client's risk profile and investment focus and perspective (e.g., market wide, sector specific, long-term, short-term, etc.), the size and scope of the overall client relationship with UBS and legal and regulatory constraints.

All Global Research is available on UBS Neo. Please contact your UBS sales representative if you wish to discuss your access to UBS Neo.

When you receive Global Research through a System, your access and/or use of such Global Research is subject to this Global Research Disclaimer and to the terms of use governing the applicable System.

When you receive Global Research via a third party vendor, e-mail or other electronic means, your use shall be subject to this Global Research Disclaimer and to UBS's Terms of Use/Disclaimer (http://www.ubs.com/global/en/legalinfo2/disclaimer.html). By accessing and/or using Global Research in this manner, you are indicating that you have read and agree to be bound by our Terms of Use/Disclaimer. In addition, you consent to UBS processing your personal data and using cookies in accordance with our Privacy Statement (http://www.ubs.com/global/en/legalinfo2/privacy.html) and cookie notice (http://www.ubs.com/global/en/homepage/cookies/cookie-management.html).

If you receive Global Research, whether through a System or by any other means, you agree that you shall not copy, revise, amend, create a derivative work, transfer to any third party, or in any way commercially exploit any UBS research provided via Global Research or otherwise, and that you shall not extract data from any research or estimates provided to you via Global Research or otherwise, without the prior written consent of UBS.

This document is for distribution only as may be permitted by law. It is not directed to, or intended for distribution to or use by, any person or entity who is a citizen or resident of or located in any locality, state, country or other jurisdiction where such distribution, publication, availability or use would be contrary to law or regulation or would subject UBS to any registration or licensing requirement within such jurisdiction. It is published solely for information purposes; it is not an advertisement nor is it a solicitation or an offer to buy or sell any financial instruments or to participate in any particular trading strategy. No representation or warranty, either expressed or implied, is provided in relation to the accuracy, completeness or reliability of the information contained in this document ("the Information"), except with respect to Information concerning UBS. The Information is not intended to be a complete statement or summary of the securities, markets or developments referred to in the document. UBS does not undertake to update or keep current the Information. Any opinions expressed in this document may change without notice and may differ or be contrary to opinions expressed by other business areas or groups of UBS. Any statements contained in this report attributed to a third party represent UBS's interpretation of the data, information and/or opinions provided by that third party either publicly or through a subscription service, and such use and interpretation have not been reviewed by the third party.

Nothing in this document constitutes a representation that any investment strategy or recommendation is suitable or appropriate to an investor's individual circumstances or otherwise constitutes a personal recommendation. Investments involve risks, and investors should exercise prudence and their own judgement in making their investment decisions. The financial instruments described in the document may not be eligible for sale in all jurisdictions or to certain categories of investors. Options, derivative products and futures are not suitable for all investors, and trading in these instruments is considered risky. Mortgage and asset-backed securities may involve a high degree of risk and may be highly volatile in response to fluctuations in interest rates or other market conditions. Foreign currency rates of exchange may adversely affect the value, price or income of any security or related instrument referred to in the document. For investment advice, trade execution or other enquiries, clients should contact their local sales representative.

The value of any investment or income may go down as well as up, and investors may not get back the full (or any) amount invested. Past performance is not necessarily a guide to future performance. Neither UBS nor any of its directors, employees or agents accepts any liability for any loss (including investment loss) or damage arising out of the use of all or any of the Information.

Any prices stated in this document are for information purposes only and do not represent valuations for individual securities or other financial instruments. There is no representation that any transaction can or could have been effected at those prices, and any prices do not necessarily reflect UBS's internal books and records or theoretical model-based valuations and may be based on certain assumptions. Different assumptions by UBS or any other source may yield substantially different results.

This document and the Information are produced by UBS as part of its research function and are provided to you solely for general background information. UBS has no regard to the specific investment objectives, financial situation or particular needs of any specific recipient. In no circumstances may this document or any of the Information be used for any of the following purposes:

(i) valuation or accounting purposes;

(ii) to determine the amounts due or payable, the price or the value of any financial instrument or financial contract; or

(iii) to measure the performance of any financial instrument.

By receiving this document and the Information you will be deemed to represent and warrant to UBS that you will not use this document or any of the Information for any of the above purposes or otherwise rely upon this document or any of the Information.

UBS has policies and procedures, which include, without limitation, independence policies and permanent information barriers, that are intended, and upon which UBS relies, to manage potential conflicts of interest and control the flow of information within divisions of UBS and among its subsidiaries, branches and affiliates. For further information on the ways in which UBS manages conflicts and maintains independence of its research products, historical performance information and certain additional disclosures concerning UBS research recommendations, please visit www.ubs.com/disclosures.

Research will initiate, update and cease coverage solely at the discretion of UBS Investment Bank Research Management, which will also have sole discretion on the timing and frequency of any published research product. The analysis contained in this document is based on numerous assumptions. All material information in relation to published research reports, such as valuation methodology, risk statements, underlying assumptions (including sensitivity analysis of those assumptions), ratings history etc. as required by the Market Abuse Regulation, can be found on NEO. Different assumptions could result in materially different results.

The analyst(s) responsible for the preparation of this document may interact with trading desk personnel, sales personnel and other parties for the purpose of gathering, applying and interpreting market information. UBS relies on information barriers to control the flow of information contained in one or more areas within UBS into other areas, units, groups or affiliates of UBS. The compensation of the analyst who prepared this document is determined exclusively by research management and senior management (not including investment banking). Analyst compensation is not based on investment banking revenues; however, compensation may relate to the revenues of UBS Investment Bank as a whole, of which investment banking, sales and trading are a part, and UBS's subsidiaries, branches and affiliates as a whole.

For financial instruments admitted to trading on an EU regulated market: UBS AG, its affiliates or subsidiaries (excluding UBS Securities LLC) acts as a market maker or liquidity provider (in accordance with the interpretation of these terms in the UK) in the financial instruments of the issuer save that where the activity of liquidity provider is carried out in accordance with the definition given to it by the laws and regulations of any other EU jurisdictions, such information is separately disclosed in this document. For financial instruments admitted to trading on a non-EU regulated market: UBS may act as a market maker save that where this activity is carried out in the US in accordance with the definition given to it by the relevant laws and regulations, such activity will be specifically disclosed in this document. UBS may have issued a warrant the value of which is based on one or more of the financial instruments referred to in the document. UBS and its affiliates and employees may have long or short positions, trade as principal and buy and sell in instruments or derivatives identified herein; such transactions or positions may be inconsistent with the opinions expressed in this document.

United Kingdom and the rest of Europe: Except as otherwise specified herein, this material is distributed by UBS Limited to persons who are eligible counterparties or professional clients. UBS Limited is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. **France:** Prepared by UBS Limited and distributed by UBS Limited and UBS Securities France S.A. UBS Securities France S.A. is regulated by the ACPR (Autorité de Contrôle Prudentiel et de Résolution) and the Autorité des Marchés Financiers (AMF). Where an analyst of UBS Securities France S.A. has contributed to this document, the document is also deemed to have been prepared by UBS Securities France S.A. **Germany:** Prepared by UBS Limited and distributed by UBS Limited and UBS Europe SE. UBS Europe SE is regulated by the Bundesanstalt fur Finanzdienstleistungsaufsicht (BaFin). **Spain:** Prepared by UBS Limited and distributed by UBS Limited and UBS Securities España SV, SA. UBS Securities España SV, SA is regulated by the Comisión Nacional del Mercado de Valores (CNMV). **Turkey:** Distributed

UBS