**Response to Referee’s Report #3  
‘Sustainable Factor Investing: Where Doing Well Meets Doing Good’**IREF\_2019\_983R1

# INTRODUCTION

First of all, we would like to once again thank the Editor, Professor Brian Lucey, and the Associate Editor, Professor Larisa Yarovaya, for forwarding the constructive feedback of the Referee and for providing us with the opportunity to further improve our paper. We are grateful to the Referee for their feedback and insightful comments. We have amended the manuscript taking all remarks carefully into consideration.

In Section 2, we re-iterate the comments of the referee (*in italics*) and explain the revisions made in the paper to address each of these comments.

# RESPONSE TO COMMENTS

**Comment 1:**

*Theory: Although it is popular, sustainable factor is not part of traditional finance theory. The author should provide logic to incorporate the sustainable factor into standard finance theory.*

We thank the referee for this suggestion.

Traditional finance focuses solely on financial return and risk. In contrast, sustainable finance considers factors beyond financial risk and returns. Like the referee, we have thought long and hard about the theoretical transition from traditional finance to sustainable finance. Throughout history, as the human civilization evolved, theories also evolved with it. Driven by both climate and societal change, the investment management industry is undergoing a paradigmatic shift as a result of the changing investor demand. As a greater proportion of funds redistributes to millennials and Gen Z, the generation driving substantial moves towards sustainability, such shift has significant implications for the pricing of assets.

Like most other studies in the ESG investing literature, our motivation is to examine the empirical link between firm’s non-financial (i.e., ESG) and financial performance (i.e., stock returns). Our particular interest is to understand how ESG scores *interact* with firm characteristics that are fundamental to the pricing of Australian stocks. There is no universal method to build ESG integrated portfolios. For instance, the optimization-based approach in Bender *et al.* (2017), portfolio sorts in Kaiser (2018) and more recently an ESG-efficient frontier in Pedersen, Fitzgibbons & Pomorski (2019), to name a few. Our work proposes and tests one of many ways to integrate ESG into the investment process, in a previously untested, developed stock market with unique features. Such knowledge would aid the design of better investment strategies and help accelerate the “mainstreaming of sustainable investing” globally (Grei, 2018). In fact, our work makes a timely contribution to the investment management industry as managers have started implementing such ideas (BlackRock, 2020).

Indeed, we found evidence that the outperformance of ESG integrated factors has become stronger in more recent time, suggesting that the market is starting to price in ESG systematically. Theoretically, good ESG practices can shelter firms from shocks to their underlying cash flows and provide improved investment and production opportunities, thereby creating value for shareholders (Cornell & Shapiro, 1987; Flammer, 2015). However, costs of firms’ investments in ESG could outweigh the benefits, thereby resulting in the destruction of shareholder value (Statman & Glushkov, 2009; Revelli & Viviani, 2015). Following this vein, the outperformance of ESG integrated factors suggests that viewing ESG and financial performances of a firm jointly better captures value than viewing ESG or financial performance in isolation, because financial performance helps prevent (or minimize) the allocation to potentially value-destroying, but high ESG-rated stocks.

We are grateful to the referee for this constructive suggestion, the above paragraph has been inserted on page 22 of the revised manuscript.

**Comment 2:**

*Sample: The authors state that "To limit the exposure to micro-capitalization stocks and form investable portfolios consistent with the demand of institutional investors, we exclude stocks with market capitalization that are below 75th percentile." I understand the rationale to exclude micro-capitalization stocks, but classifying 75% of stocks as micro-cap seems too much. The author need to cite literatures that have excluded such a high percentage of stocks as micro-cap, or provide better logic for doing so.*

We thank the referee for raising the point on size breakpoints.

The number of micro-cap stocks is a prominent feature of the Australian stock market. Although the Australian market ranks the 9th largest in the world by market-cap (Statista, 2020), its relative size to the US market (4% of the US) presents a challenge for institutional investors with large mandates. To address this, the S&P/ASX indices only include stocks which meet the liquidity requirement of institutional investors (S&P, 2020). As at March 2020, the widey-accepted market benchmark S&P/ASX200 (ticker: XJO) index accounts for approximately 80% of the Australian equity market. The S&P/ASX300 (ticker: XKO), the largest index maintained by the S&P, accounts for 84% of the total Australian market cap, only 4% more than the ASX200 (Market Index, 2020). For this reason, the literature often examines ASX200 or ASX300 constituents, because stocks outside of this universe are considered not investable from an institutional perspective (Limkriangkrai, Koh & Durand, 2017; Lim & Coggins, 2005; Doan, Lin & Zurbruegg, 2010; Galbreath, 2013).

In light of these facts, it is important to point out that even after excluding stocks with market-cap below 75th percentile, our sample is considerably larger compared to the above-mentioned studies, with 295 (495) stocks remaining in the “Rated” (“All”) sample in 2016. Thus, following the suggestion of the referee, we have inserted the above-mentioned literature in the revised manuscript to avoid confusion for future readers.

**Comment 3:**

*Methodology of ESG integrated strategy: Only M3 can be considered as ESG integrated. M1 and M2 are just ESG rated. Since the author does not provide theories why ESG rated stocks should perform better (or worse) than others stocks, M1 and M2 are not important for this paper. It can be put on a footnote or appendix. Including the information causes a lot of extra columns in tables and lines in figures which diluted the major issue.*

We thank the referee for this comment.

As exclusionary ESG methods are often employed by investment managers, M1 and M2 offer baseline results which M3 is benchmarked against. Whilst ESG is not directly integrated with a factor strategy in M1 and M2, direct integration is investigated in M3.

Though we understand the referee’s concern, we have kept the M1 and M2 in the revised manuscript as instructed by the editor.

**Comment 4:**

*The author states that "Responsible investors seek companies with strong financial performance whilst integrating non-financial factors such as environmental (E), social (S) and governance (G) scores into the investment decision process". It seems suggesting other types of investing is not responsible. It is an opinion too strong.*

This comment is well-taken.

Indeed, utilizing the phrase “Responsible” may infer that other types of investing are not responsible. We have amended the text in the revised manuscript as “Investors are increasingly seeking companies with strong non-financial factors such as environmental (Env), social (Soc) and governance (Gov) scores…”.

**Comment 5:**

*Table 1, the explanation of ∆ is unclear. First I thought it was annualized, then figured out it is the total change. Some are in %, while others in X.*

We thank the referee for point out this confusion.

To address this, in the description of Table 1, thefollowing statement has been modified from:

“Δ represents the percentage change in stock counts and scores from 2007 for all industries with the exception of Utilities, which represents the percentage change from 2009.”

To:

“Δ represents the percentage change in stock counts (x) and scores (%) from 2007 for all industries with the exception of Utilities, which represents the percentage change from 2009.”

**Comment 6:**

*Empirically, studies have found stocks with lower risk outperform stocks with higher risk in the long-run". (page 9) If risk is measured correctly, stocks with lower risk should have lower return in the long-run in an efficient market, according to standard finance theory. Claiming lower risk outperform higher risk stocks in the long-run based on several study seems a stretch too far.*

We wish to thank the referee for this constructive feedback.

To improve the clarity and precision, the sentence, “Empirically, studies have found stocks with lower risk outperform stocks with higher risk in the long-run” is amended.

The sentence now reads as “Traditional finance theory suggests that riskier securities, on average, deliver higher return as compensation for holding that risk. Black, Jensen and Scholes (1972) first identified the anomaly that being long low beta securities and short high beta securities generated significant positive returns. The notion of low and/or minimum volatility has since expanded in the literature as this factor provides an investor a more defensive approach on the downside while capturing most of the upside”.

**Comment 7:**

*Equation 1 is a measure of volatility. The paper does not refer to the equation, and did not provide an explanation of variables. Even it is a simple equation, a basic note is still needed. Also the "Minimum volatility" strategy should be named as "low volatility" strategy. Minimum is a little misleading.*

This comment is well-taken.

We think there may have been some confusion when reading equation 1 as there is an explanation defining the variables in the previous version of the manuscript. However, we have improved the description and made direct reference to equation (1) in the revised manuscript.

As for the term “minimum volatility”, we followed BlackRock’s terminology (see <https://www.blackrock.com/us/individual/investment-ideas/what-is-factor-investing>). However, upon reflecting on the referee’s comment, we understand that “low volatility” may be better suited to the readership of the journal. Therefore, the term “minimum volatility” has been changed to “low volatility” throughout the revised manuscript.

**Comment 8:**

*According to equation 2, the momentum strategy is based on cumulative past returns (adding up monthly returns instead of compounding them), not holding period past returns. Cumulative return often overstates the true return for stocks with high volatility. Why not using the holding period return?*

This comment is well-taken.

To clarify, we have employed cumulative returns which are computed over the holding period to measure momentum. The previous equation would have been appropriate if our returns were in logarithmic forms. Frankly speaking, we copied the equation from another project (which employs log returns) and neglected to update the equation. To avoid confusion, equation 2 has been modified to accurately reflect the momentum signal employed in the study. We are very grateful to the referee for point out this inconsistency.

Also worth clarifying is that in section 2.1 of the manuscript “*We obtain price-relatives, market-capitalization, Global Industry Classification Standard (GICS) sectors, dividends, trading volume and risk-free rate on Australian stocks from the Share Price & Price Relatives (SPPR) database*”. Price-relatives take into account all distributions received by stockholders and assumes reinvestment of any distributions.

**Comment 9:**

*M2: not having equal number of stocks in long vs. short portfolio does not necessarily lead to unbalanced portfolio, as long as the total investment of long vs. short is the same. For example, long position can have 2 stocks with $1 million total investment while short position can have negative $1 million position with 3 stocks.*

We thank the referee for raising this fair point.

We agree with the referee that one can manage the long vs. short exposure in a long-short portfolio. However, even if the dollar exposures are actively managed to be the same between long and short legs, our intension is to stress the fact that long-short M2 portfolios would no longer be market-neutral, because the “unbalanced” positions (i.e., net-long or net-short) would likely result in time-varying exposures to the market.

To improve the precision of our communication, we have amended the statement on page 11 to reflect the above discussions.

**Comment 10:**

*The short sampling period (only 10 years) is a weakness. Factor based portfolio performance tend to vary from time to time. If possible, I would like to see a much longer sample period. The author can also use a different period as an out-of-sample test. This is a suggestion because I understand it might be very time consuming to address this.*

We thank the referee for this constructive feedback.

Our sample period is dictated by the availability of Bloomberg ESG ratings data which begins at the start of our sample period. This is common for alternative ESG data providers such as Asset4 and Regan, whereas OWL and other ESG data sources start even later from 2009. At the time when your comments reached us, the maximum out-of-sample period we could potentially include was from 2017 to 2018, because the SPPR data are only updated once a year with a one-year lag. We would have loved to include this in the paper, but unfortunately, we are unable to perform this analysis due to limitations on database subscription as a result of the COVID-19. To resolve this issue, we also reached out to colleagues at neighbouring universities, however, they too share the same challenges. To our best knowledge, the additional 24 data points (2017-2018) do not incorporate significant business cycle variations in Australia. We hope this partially addresses the referee’s concern and we would like to sincerely thank the referee for his/her understanding.

**Comment 11:**

*Add Fama-Macbeth regression to include ESG score as an additional factor to explain cross-sectional stock returns.*

We thank the referee for this comment.

Following the referee’s suggestion, we employ Fama-MacBeth regression to investigate whether “integrated ESG” has cross-sectional pricing power beyond benchmark asset pricing factors. In the spirit of Fama-MacBeth (1973) two-stage approach, we first measure the time-varying risk exposures of each stock by OLS estimation of *N* time-series regression in a 36-month rolling window. Only benchmark risk factors (i.e., MKT, SMB, HML, UMD) are included in the first stage. At stage two, we obtain the prices of risk through monthly cross-sectional OLS regressions, while controlling for firm-level characteristics, ESG scores and “ESG x fundamental” interaction terms. Table 1 (below) reports the results.

Consistent with previous studies, we do not observe significance on MKT, SMB, HML and UMD factors under the baseline model (1). Model (2) introduces firm-level ESG characteristics as an additional variable to explain cross-sectional stock returns. After controlling for known risk factors, ESG scores report an insignificant lambda. After controlling for market cap and book-to-market under Model (3), ESG scores becomes statistically significant. This is in line with our main results that excluding ESG leads to inferior performance. Meanwhile, improvements in adjusted R2 are negligible from Models (1) to (3).

Building on Model (3), we introduce interaction effects between ESG and size (Model (4a)), momentum (Model (4b)) and quality (Model (4c)), respectively, while controlling for fundamentals with relevant to each factor. The results from Table 1 show that interaction terms for size (4a) and quality (4c) remain statistically significant, suggesting that integrating ESG with size and quality fundamentals positively predicts cross-sectional stock returns beyond well-established risk factors and firm-level fundamentals. Overall, Table 1 confirms the pricing power of ESG integrated factors in the cross-section of Australian stocks.

We have thought long and hard about whether these results should be included in the revised manuscript. Although these findings are supportive of our main findings in the paper, we feel that formal asset pricing tests are beyond the scope of the current paper. We are encouraged by these results and would like to investigate the full asset pricing implications of ESG integration in a follow-up paper. We thank the referee for her/his suggestion, a new footnote 17 has been inserted on page 16 to summarise the above results.

**Table 1 Fama-Macbeth Regression**

This table reports the results of Fama-MacBeth (1973) regressions of 36-month excess returns of individual firms on realized-risk characteristics. The sample period covers March 2006 through December 2016. A 36-month rolling window is employed on ESG rated firms within the ‘All’ sample for the Australian market. MKT is the CAPM beta, SMB and HML are formed through size and book-to-market bivariate sorts, UMD is the momentum factor, size is the log of the market capitalization characteristic, bm is the book-to-market characteristic, mom is the previous 12 months returns characteristic, roe is the quality characteristic, ESG is the Bloomberg ESG characteristic, whilst ESG x Rett-1, t-12, ESG x ln(cap), and ESG x ROE are interaction terms between ESG and the momentum, size and quality factor characteristics, respectively. The average price (λ), adjusted R2, change in R2 from baseline model (∆R2) and Newey-West corrected *t*-statistics in parentheses are reported. Six models are shown below: (1) baseline model including equities risk factors of MKT, SMB, HML and UMD; (2) baseline model augmented to include ESG as an explanatory variable; (3) model 2 augmented to include firm characteristics of market cap (log) and bm; (4a) model 3 augmented to include ESG and market cap interaction effect; (4b) model 3 augmented to include ESG and momentum interaction effect; and (4c) model 3 augmented to include, ROE and ESG and roe interaction effect.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4a) | | (4b) | | | | (4c) |
|  |  |  |  |  | |  | |  | | |
| λMKT | 0.006 | 0.002 | 0.001 | 0.003 | | 0.003 | | 0.003 | | |
|  | (1.14) | (0.31) | (0.34) | (0.57) | | (0.64) | | (0.58) | | |
| λSMB | -0.003 | 0.007 | -0.004 | -0.002 | | -0.002 | | -0.000 | | |
|  | (-1.26) | (0.62) | (-1.16) | (-0.51) | | (-0.58) | | (-0.16) | | |
| λHML | 0.000 | -0.013 | -0.001 | -0.001 | | 0.001 | | 0.000 | | |
|  | (0.27) | (-0.90) | (-0.38) | (-0.41) | | (0.41) | | (0.04) | | |
| λUMD | -0.011 | -0.005 | -0.004 | -0.006 | | -0.003 | | -0.009 | | |
|  | (-1.21) | (-0.49) | (-0.55) | (-0.73) | | (-0.36) | | (-1.14) | | |
| λln(cap) |  |  | 0.004\*\*\* | 0.002 | | 0.004\*\*\* | | 0.003\*\* | | |
|  |  |  | (2.76) | (1.14) | | (2.82) | | (2.61) | | |
| λbm |  |  | -0.001 | 0.001 | | 0.006 | | 0.004 | | |
|  |  |  | (-0.25) | (0.45) | | (1.62) | | (1.15) | | |
| λRett-1, t-12 |  |  |  |  | | 0.004 | |  | | |
|  |  |  |  |  | | (0.32) | |  | | |
| λROE |  |  |  |  | |  | | 0.000 | | |
|  |  |  |  |  | |  | | (-1.47) | | |
| λESG |  | -0.000 | -0.000\*\*\* | | -0.004\* | | -0.000\*\* | | -0.001\*\* | | |
|  |  | (-1.32) | (-5.16) | (-1.90) | | (-2.4) | | (-2.61) | | |
| λESG x Rett-1, t-12 |  |  |  |  | | -0.014 | |  | | |
|  |  |  |  |  | | (-0.41) | |  | | |
| λESG x ln(cap) |  |  |  | 0.000\* | |  | |  | | |
|  |  |  |  | (1.68) | |  | |  | | |
| λESG x ROE |  |  |  |  | |  | | 0.002\*\* | | |
|  |  |  |  |  | |  | | (2.40) | | |
| Adj. R2 | 0.250 | 0.268 | 0.290 | 0.306 | | 0.349 | | 0.330 | | |
| ∆R2 |  | 0.02 | 0.04 | 0.06 | | 0.10 | | 0.08 | | |

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