Portfolio diversification and environmental, social or governance criteria:
Must responsible investments really be poorly diversified?

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Abstract:

Andrew Rudd's *inescapable conclusion* that the integration of environment, social or governance (ESG) criteria in investment processes *must* worsen portfolio diversification appears to be academic wisdom since nearly thirty years, but is it right? We argue that it is wrong. We develop a simple theoretical model based on the three main drivers of portfolio diversification ((1) number of stocks, (2) correlation of stocks, (3) average specific risk of stocks) and recent robust evidence on the significantly negative relationship between a firm's ESG rating and its specific risk. Our theory argues that while the inclusion of ESG criteria into investment processes likely worsens portfolio diversification via the first and second driver, it similarly likely improves portfolio diversification through a reduction of the average stock's specific risk. This positive effect of ESG criteria probably leads best-in-class ESG screened funds to be better diversified than otherwise identical conventional funds. With our simple theory, we aim to open a debate on the question, if (and when) the inclusion of ESG criteria into investment portfolios really worsens their diversification. Our theory implies that mainstream active investment managers appear well advised to consider the inclusion of ESG criteria in their portfolio management process to optimise their risk management. Especially pension funds should at least contemplate about the use of ESG criteria, as an ignorance of ESG criteria could violate their fiduciary risk management duties.

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1 Introduction

We contribute to the responsible investment literature by theoretically challenging the widely held belief that integrating environmental, social or governance (ESG) screens in investment strategies *must* lead to a diversification penalty compared to otherwise identical conventional investment strategies. The theory of responsible investment, which defines itself by the integration of ESG criteria in investment processes, is strongly underdeveloped. Without any sophisticated theoretical or empirical investigation, authors have jumped since decades into the conclusion that ESG screens must have a generally negative effect on portfolio diversification, because they limit the available investment universe (e.g. Barnett and Salomon, 2006; Renneboog, ter Horst and Zhang, 2008; Rudd, 1981). Metaphorically, this line of reasoning argues that allocating eggs on the highest possible number of baskets and allocating the baskets on the highest possible number of people is always the safest way to walk eggs home from a grocery store.

We find this belief to be a too simplistic interpretation of Modern Portfolio Theory and challenge it with a simple model. In metaphoric terms, our simple theory finds that the safety of walking eggs home does not only depend on the number of baskets and the number of people carrying them, but it also depends on the quality of the baskets. Intuitively, most people would only allocate the eggs they transport over sufficient quality baskets, as using additional baskets with holes would be perceived as counter-productive. The same relationship holds in financial markets with the exception that investors tend to overlook the hole in the basket before the eggs have fallen and the value is lost. In other words, investors or their asset managers are diversifying their portfolios in irresponsible stock, which have a very low ESG rating due to their very high environmental, social or governance risks, and believe this behaviour to reduce their risk exposure despite it effectively does the opposite in many cases. This behaviour is especially tragic, if it is pursued by pension fund managers in the

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name of fiduciary duty, as it has negative effects on a pension fund's risk adjusted financial performance as well as on the pension fund's consideration of ESG criteria in my cases.

Technically, our theory stands on two robust pillars. First, it is based on recent, unchallenged empirical findings that stocks with a high ESG rating have ceteris paribus a lower total risk than otherwise identical stocks with the same systematic risk but a lower ESG rating (Bauer, Derwall and Hann, 2009; Boutin-Dufresne and Savaria, 2004; Lee and Faff, 2009). This empirical finding is theoretically intuitive, since companies with a considerable disregard for ESG criteria expose themselves to substantial risks of consumer boycotts, environmental disasters or other costly reputation scandals. Second, our theory is simply based on the mathematics of diversification. The diversification formula contains variance and covariance terms. While the variance terms are diversified into inconsequentiality with a rising number of stocks, the covariance terms are the predominant drivers of a portfolio's total risk after diversification. Each of these covariance terms includes the correlation between two assets' return and the standard deviation of those two assets' return. In summary portfolio diversification is hence driven by three components: (1) the number of selected assets, (2) the correlation between the selected assets, and (3) the standard deviation of the selected assets. ESG screens have a neutral or negative impact on portfolio diversification through the first and second effect, but a positive effect on portfolio diversification through the third effect due to the lower total risk and specific risk of stocks with a high ESG rating. Exploring these theoretical relationships, we challenge the widely held belief that integrating ESG screens in mainstream investment strategies must have a negative effect on portfolio diversification. Indeed, we find many cases, in which portfolio diversification can be improved through the use of ESG screens. Available empirical evidence supports our simple theory. Bello (2005: 43) compares U.S. responsible funds with size matched conventional funds and finds that "responsible .. funds do not differ significantly from conventional funds in … the degree of portfolio diversification". Similarly, Schröder (2007, Journal of Business Finance &

Accounting) observes responsible and conventional investment indices to have comparable standard deviations.

Our results have important implications. For instance, mainstream investment managers appear well advised to consider the inclusion of ESG criteria in their portfolio management process to optimise their risk management. Similarly, pension funds should at minimum contemplate about the use of ESG criteria, as an ignorance of ESG criteria can in many cases be financially detrimental to them. Finally, policy makers might want to strengthen their support of ESG criteria in financial markets, as these cannot only decrease the ESG risks but also the financial risk of portfolios.

The subsequent text is structured as follows. Section two describes the nearly 30 year long academic consent on the issues that responsible investment must experience a diversification penalty. The third section investigates the mathematics of diversification and highlights the three drivers of its risk reduction. Section four discusses recent empirical evidence that stocks with a high ESG rating have a lower specific risk and hence a lower total risk than otherwise identical stocks with lower ESG rating. The fifth section discusses the implications of this recent evidence for the three drivers of portfolio diversification and outlines scenarios, in which the integration of ESG criteria likely improves portfolio diversification. Section six concludes.

2 Responsible investment's diversification penalty: nearly 30 years of academic consent

About thirty years ago, Rudd (1981: 57) arrived at "[t]he inescapable conclusion .. that the imposition of .. [social responsibility] criteria increases investment risk. The increase in investment risk will not be accompanied by a commensurate increase in expected return because it arises solely from moving the portfolio away from its normal position. The increased risk is not the result of an active decision, but a damaging permanent bias." Rudd (1981: 59) was strongly convinced that "[i]n general the impact of social responsibility criteria decreases the level of diversification … in the portfolio." Rudd's reasoning implies that responsible investment portfolios, which include environmental, social or governance (ESG) factors in their asset selection, are inevitably experiencing a diversification penalty.

While researchers subsequently did not deny responsible investors an active decision like Rudd, they unanimously agree with Rudd on the conclusion that the integration of ESG criteria into an investment portfolio will worsen portfolio diversification (e.g. Barnett and Salomon, 2006; Bauer, Otten and Tourani Rad, 2006; Geczy, Stambaugh and Levin, 2005; Renneboog et al., 2008). However, researchers debate, how costly the loss of portfolio diversification as result of the integration of ESG criteria really is. Derwall (2007), for instance, considers the question unresolved, if responsible funds can reach Statman's (2004) transaction cost optimal diversification level of over 300 stocks without incurring a meaningful cost. Following this line of reasoning, the two studies which empirically estimate the diversification penalty of responsible investments but cannot find any meaningful disadvantage explain their results with the inconsequential nature of the restrictions imposed by ESG criteria on portfolio diversification (Bello, 2005; Renneboog, ter Horst and Zhang, 2007).[1] To date, we are not aware of a single study which argues that ESG criteria might in some situations improve portfolios diversification.

3 Portfolio diversification: a process with three components

Portfolio diversification is a process determined by three components: (1) the number of selected assets, (2) the correlation between the selected assets, and (3) the standard deviation of the selected assets. To see this, consider the formula for the standard deviation of a portfolio of n stocks (σ_n) displayed in equation (1) following Markowitz' (1952) and Statman's (2004) notation,

$$\sigma_n = \sqrt{\sum_{j=1}^{n} \sum_{i=1}^{n} w_i w_j \operatorname{cov}(i, j)} \tag{1}$$

where w_i and w_j represents the weights of assets i and j, respectively, and cov(i,j) displays the covariance between the returns of asset i and j. Since any covariance between two assets' returns equals the product of the correlation between both assets' returns and both asset returns' standard deviations, we can rewrite equation (1) as shown in equation (2),

$$\sigma_n = \sqrt{\sum_{j=1}^{n} \sum_{i=1}^{n} w_i w_j \rho_{i,j} \sigma_i \sigma_j} \tag{2}$$

where σ_i and σ_j are the standard deviations of asset i's and j's returns, respectively, and $\rho_{i,j}$ is the correlation between asset i's and j's returns. To discriminate between covariances resulting from two separate assets' returns and variances, which Markowitz (1952) and Statman (2004) both display within a broad covariance term, we rewrite equation (2) as shown in equation (3),

$$\sigma_n = \sqrt{\sum_{j=1}^{n} w_j^2 \sigma_j^2 + \sum_{j=1}^{n} \sum_{i=1}^{n} w_i w_j \rho_{i,j} \sigma_i \sigma_j} \quad \forall \rho_{ij} \sigma_i \sigma_j \neq \rho_{i,j=i} \sigma_i \sigma_j \tag{3}$$

where the first and second summand represent the aggregated impact of variances and covariances on a portfolio's standard deviation, respectively. From this equation, one can see the three separate drivers of portfolio diversification.

1. Number of selected assets: As shown inter alia by Statman (2004), a portfolio standard deviation decreases degressively with its number of stocks. This effect comes from the

fact that the aggregated impact of variances (first summand in equation 3) becomes inconsequentially small once a portfolio is invested in a sufficient number of stocks.

2. Correlation between selected assets: The less the assets in a portfolio correlated with each other, the smaller is the correlation factor in equation 3's second summand and the smaller is consequentially the standard deviation of the portfolio.

3. Standard deviation of selected assets: This driver of portfolio diversification seems to be often overlooked. But the size of the standard deviation of each selected assets affects the portfolio's standard deviation in the same way than the size of each correlation in a covariance term. Since each covariance term covers two standard deviations but only one correlation, the average standard deviation of the selected assets has a substantial impact on the portfolio's standard deviation. For instance, in a single covariance term, a reduction of the correlation by 10% has the same effect on a portfolio's standard deviation than reducing the average standard deviation by 5.13%. However, it is important to distinguish between two types of drivers of the average standard deviation of a portfolio's assets. While the proportion of average standard deviation resulting from an asset's systematic risk is compensated by financial markets, the other proportion of average standard deviation resulting from specific risk is uncompensated. Hence, if investors can reduce this latter specific risk based proportion by adopting different stock selection strategies, they can increase their return per unit of risk ceteris paribus. Since stocks with high ESG criteria have been found to experience significantly under-proportional specific risk, the use ESG criteria might be beneficial for portfolio diversification in some situations.

4 Environmental, social, and government (ESG) criteria and risk

Three papers have recently investigated the relationship between a stock's ESG criteria and its specific risk (Bauer et al., 2009; Boutin-Dufresne and Savaria, 2004; Lee and Faff, 2009). Boutin-Dufresne and Savaria (2004) annually rank 300 Canadian firms on their ESG performance from 1995 to 1999. They find that firms in the bottom quartile experience, on average, an about 40% higher specific risk than firms in the top quartile. Motivated by these results and claims that SG criteria would reduce a firm's specific risk (e.g. by avoidance of scandals or boycotts), Lee and Faff (2009) analyse the specific risk of global Dow Jones Sustainability Index (DJSI) members from 1998 to 2002. Their statistically highly significant finding is that DJSI members' specific risk is, on average, 18% lower than the equivalent of a country, industry and size matched sample of non-responsible Dow Jones Global Index members.[2] Bauer et al. (2009) investigate 976 U.S. firms from 1995 to 2006. Based on this large sample and a comprehensive set of control variables, they find the quality of a firm's employee relations to be significantly negatively related to its specific risk.[3] They expected this result, as they concur with previous literature that good employee relations reduce firm specific risk related to employees (e.g. Turnley and Feldman, 1999; Zingales, 2000).

This empirical finding of a significant negative relationship between a firm's ESG rating and its specific risk is strong for two reasons. First, all studies investigating this relationship between ESG rating and firm specific risk to date found a statistically significant negative relationship. No study came to any other conclusion. Second, this empirical finding is consistent with various theories, which state that firms displaying a high responsibility towards ESG factors are less exposed to ESG related risks (e.g. Fombrun, Gardberg and Barnett, 2000; Godfrey, 2005). Indeed, Godfrey et al. (2009) recently found that corporate ESG actions directed towards the society allow firms to build up an insurance like goodwill,

which protects them from overly negative market reactions in incidents of public legal or regulatory actions against them. Hence, we have full confidence in the empirical findings that a stock's ESG rating is negatively related to its specific risk. This implies that highly ESG rated stocks have a lower total risk than otherwise identical stocks with low ESG rating (but the same systematic risk).

5 Portfolio diversification and ESG criteria

Relating the recent evidence on ESG criteria's effect on a stock's specific and hence total risk (section 4) to the total risk driver of the diversification process (section 3) leads us to challenge Rudd's (1981: 57) "inescapable conclusion" that the integration of ESG criteria into investment processes necessarily worsen portfolio diversification. Specifically, we argue that if two portfolios are identically exposed to the diversification drivers 'number of selected assets' and 'correlation between selected assets', then the portfolio with the on average better ESG rating will have the lower total risk, the lower specific risk and hence the better diversification, ceteris paribus. For instance, these two portfolios could be two active equity investment funds, which allocated their assets over the same number of stocks, industries and countries, whereby one of these two funds would ignore ESG criteria, while the other fund would follow a best-in-class responsible investment strategy. Hence, adopting a best-in-class responsible investment strategy likely allows mutual funds, pension funds, or sovereign wealth funds to improve instead of worsen their portfolio diversification.

However, we do not argue that ESG criteria necessarily improve diversification. Instead, our simple theory argues as shown in Figure 1 that ESG criteria can worsen portfolio diversification through reducing the number of selected assets or increasing the correlation between selected assets but that ESG criteria can also improve portfolio diversification through a reduction in the specific risk of the selected assets. The question is, how relevant

these three effects of ESG criteria on portfolio diversification are in various contexts of ESG investment. In this sense, we aim to open a debate with this paper, if (and when) the integration ESG criteria into investment portfolios really worsen their diversification ceteris paribus as believed by Rudd (1981). This question on which even the strongest advocates of responsible investment appeared to have given up long time ago (e.g. Kurtz, 2000), has unlikely one general answer, since responsible investment approaches differ substantially in their diversification implications.

Negative exclusionary ESG screening strategies especially according to irresponsible products or services can fairly be expected to forgo a considerable opportunity to reduce a portfolio's inter asset correlations. Hence, such strategies would need to exclude assets with substantial additional specific risk to avoid a diversification penalty in comparison with otherwise identical funds with the same number of assets. In contrast, purely best-in-class or positive screened ESG investment funds unlikely have much higher inter asset correlations than otherwise identical funds. Hence, their lower average asset standard deviations would likely lead them to experience a net diversification bonus resulting from their integration of ESG criteria. Purely best-in-class or positive screened responsible funds appear consistently competitive to otherwise identical conventional funds even with a strongly rising number of assets in each portfolio. Only with respect to (near) tracker funds and indices, responsible investment is left with its natural disadvantage of a reduced investment universe. However, when a portfolio is already diversified over some thousand assets, the advantages of additional diversification become relatively marginal. Hence, we consider a hypothetical responsible investment index, which would invest in all but the worst stocks in an industry class, to have a fair chance of being competitive to the market benchmark in its Sharpe (1966) ratio.[4]

The available evidence appears to support our reasoning. Bello (2005: 43) compares U.S. responsible funds with size matched conventional funds over a 87 months period ending

in March 2001 and finds that "responsible .. funds do not differ significantly from conventional funds in … the degree of portfolio diversification". Similarly, Renneboog et al. (2007) do not observe responsible investment funds to have a significantly worse correlation than conventional funds. Furthermore, Schröder (2007) observes responsible and conventional investment indices to have comparable Sharpe ratios, which implies that ESG integration might not worsen diversification even at the index level.
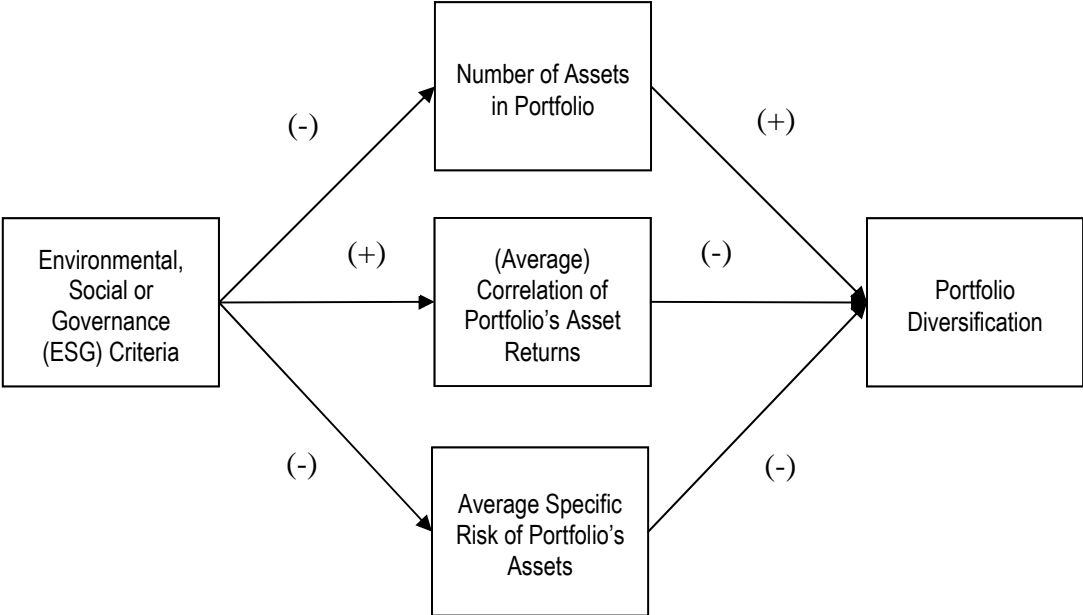

Figure 1:   A simple theory of the effect of ESG criteria on portfolio diversification

6 Conclusion

Nearly 30 years ago, Rudd's (1981: 57) comes to the "inescapable conclusion" that the integration of ESG criteria into investment processes necessarily worsens portfolio diversification. Since then, researchers have debated the economic relevance of this diversification penalty of ESG investments (e.g. Derwall, 2007), but nobody appears to have publicly questioned Rudd's conclusion.

We challenge Rudd's *inescapable conclusion* with a simple theory. Our theory connects the three drivers of portfolio diversification ((1) number of stocks, (2) correlation of stocks, (3) average specific risk of stocks) to recent robust evidence on the significantly negative relationship between a firm's ESG rating and its specific risk. We argue that while the inclusion of ESG criteria into investment processes likely worsens portfolio diversification via the first and second driver, it similarly likely improves portfolio diversification through a reduction of the average stock's specific risk. Our simple theory of negative and positive effects of ESG criteria on portfolio diversification is consistent with the available empirical evidence, which struggles to find a diversification penalty of ESG investment (Bello, 2005; Renneboog et al., 2007). With our theory, we aim to open a debate on the question, if (and when) the inclusion of ESG criteria into investment portfolios really worsens their diversification as believed by Rudd (1981). Starting this debate, we argue that negative ESG screening likely results in a diversification penalty for active mutual funds, while purely positive or especially best-in-class screening probably leads active funds to experience a diversification bonus.

Our results have implications for professionals and academics. Mainstream active investment managers appear well advised to consider the inclusion of ESG criteria in their portfolio management process to optimise their risk management. Especially a best-in-class strategy has a high potential of improving their portfolio diversification. Similarly, pension

funds should at least contemplate about the use of ESG criteria, as an ignorance of ESG criteria can in many cases violate their fiduciary risk management duties. Policy makers might want to strengthen their support of ESG criteria in financial markets, as these cannot only decrease the ESG risk but also the financial risk of investment portfolios. They could, for instance, require sovereign wealth funds or government pension funds to integrate ESG criteria or improve corporations' mandatory reporting on ESG issues. Academic researchers of ESG investment might want to challenge our simple theoretical model or join a debate on when ESG criteria really worsen portfolio diversification and when they actually improve portfolio diversification. The latter could be done by extending our theoretical model or by empirically researching the relationships between ESG ratings, firm specific risk and portfolio diversification in various contexts.

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Endnotes

[1] Two other studies investigate responsible investments diversification penalty (Galema, Plantinga and Scholtens, 2009; Schröder, 2007). However, as these studies do not sufficiently address total or idiosyncratic risk in their estimation methods, their results are not informative for our purpose.

[2] As the Dow Jones Sustainability Index was not launched before September 1999 (e.g. Schröder, 2007), Lee and Faff (2009: 218) use a "short period of back-dated data .. [but] find that these data do not influence the findings."

[3] While Lee and Faff discuss recent studies (e.g. Goyal and Santa-Clara, 2003; Malkiel and Xu, 2006) finding that investors appear to expect (some) reward for idiosyncratic risk, which hence matters to asset pricing, none of these three studies relates their results in anyway to diversification.

[4] Large indices covering (nearly) the total market cannot be compared with the market benchmark in terms of idiosyncratic risk, as no portfolio or index can outperform the index, which is defined as market benchmark. In contrast, the financial performance of large indices which aim to be chosen by diversification focused investors as asset to be mimicked is sensibly measured by the Sharpe (1966) ratio or a variant also considering higher moments of the return distribution such as the skewness adjusted Sharpe ratio (Koekebakker and Zakamouline, 2007).