AI for ESG Integration: Training Machines to Predict Sustainable Alpha

RAM AI Systematic Equity

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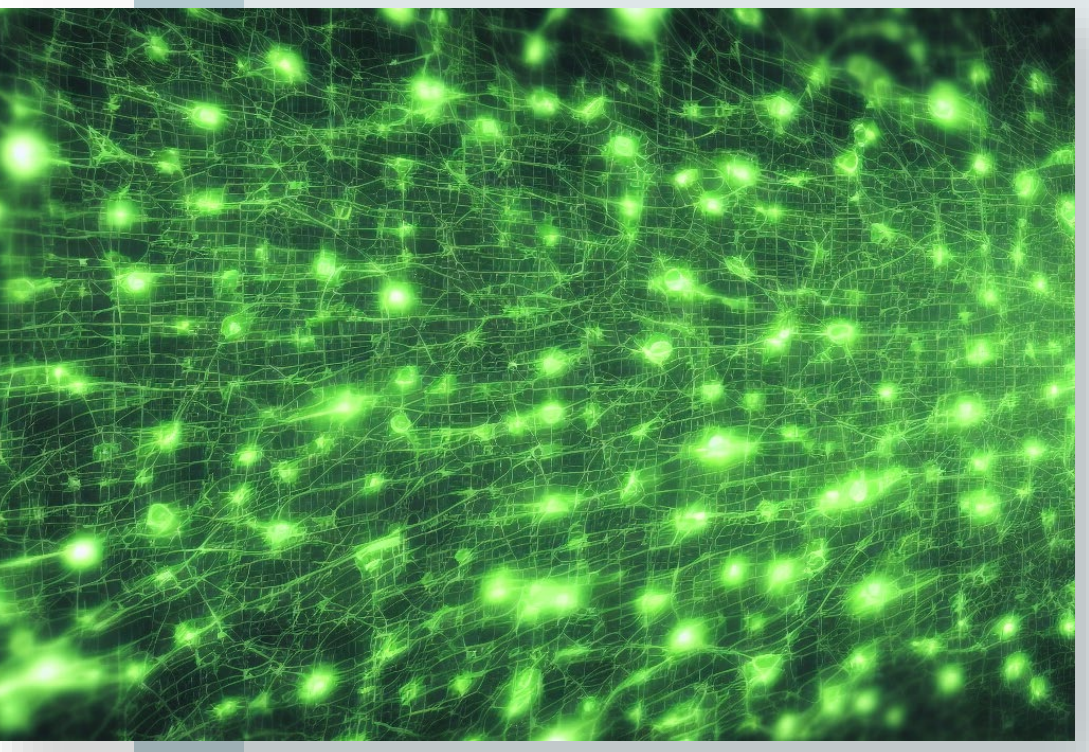
ACTIVE INVESTMENTS

Introduction

Over recent years, data measuring firms' sustainability characteristics has proliferated. Quantitative researchers took this opportunity to propose a wide range of ESG-based investment factors that measure clear sustainability characteristics while carrying value-added information from traditional sources.[1,2]

An important challenge that investment managers encounter is the combination of ESG and traditional factors such as value, growth and momentum. We believe that this integration is crucial for an optimal stock selection and portfolio construction process. RAM-AI's systematic equity team has developed a deep learning framework that models the interaction among different input features. In this paper, we will evaluate the efficacy of this framework when tuned to combine ESG and traditional factors for a stock return prediction task.



Source: AI generated with the Stable Diffusion Model on https://beta.dreamstudio.ai/dream

Methodology

To analyse the impact of integrating ESG metrics as input features for machine learning-based alpha prediction, we generate monthly rebalanced long-short portfolios, going long the top decile alpha prediction and short the bottom decile. For this, two approaches are considered:

- → Stock prediction without ESG integration (*alpha signal*), trained with approximately 450 features derived from traditional data sources, including financial statements, market data, sentiment and positioning.
- → Stock prediction with ESG integration (*sustainable alpha signal*), trained with approximately 500 features, including the 450 used for stock prediction without ESG integration and 50 built from ESG data sources, spread across the categories presented in figure 1.

ESG	E	S	G
Scores & Ratings	Biodiversity	Diversity & Inclusion	Management Structure
Sentiment	Emissions	Human Rights	Non-Financial Transparency
Trends	Energy	Supply Chain	Financial Transparency
	Waste		
	Water		

Figure 1: Source: RAM AI

The training process relies on weekly data starting from 2011 for an All Cap European universe. In total, approximately 4 million observations are used. The analysis covers the period from July 2017 to July 2022 and is derived from out-of-sample simulations.

The machine learning framework is illustrated in figure 2.

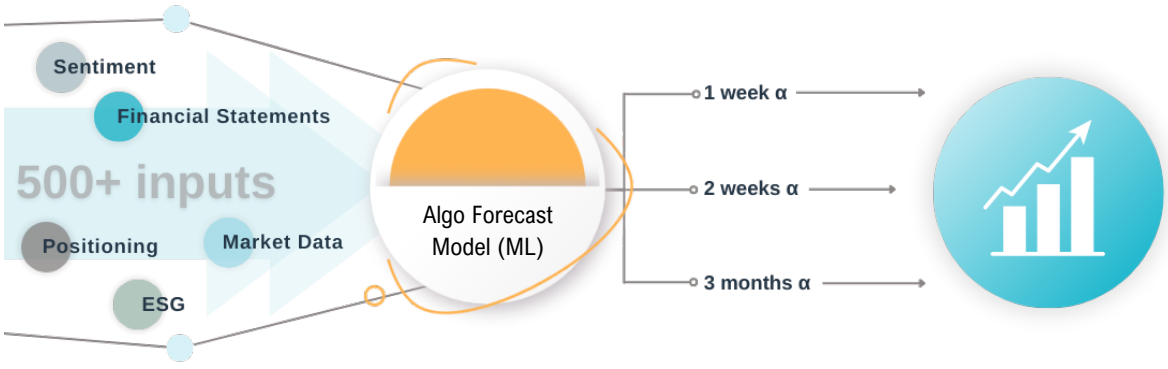


Figure 2: Source: RAM AI

Alpha vs Sustainable Alpha – The Impact on Return Profile

The purpose of the analysis is to illustrate alpha signal characteristics and not to present an actual strategy. Therefore, we do not consider any implementation constraint regarding liquidity, market impact, transaction cost, financing cost and borrowing availability. Figure 3 shows performance charateristics.

Decile Spread Statistics	Alpha With ESG Integration	Alpha No ESG Integration
Return	25.2%	25.2%
Volatility	10.0	10.5
Max Drawdown	-13.0%	-15.5%

Figure 3: Source: Factset, RAM AI, simulation from July 2017 to July 2022. Past performance is not a reliable indicator of future returns.

The decile spread return of the predicted alpha with ESG integration is in line with the predicted alpha without ESG integration. However, it displays lower volatility and lower drawdown characteristics. Figure 4 shows the cumulative log return over the simulation period.

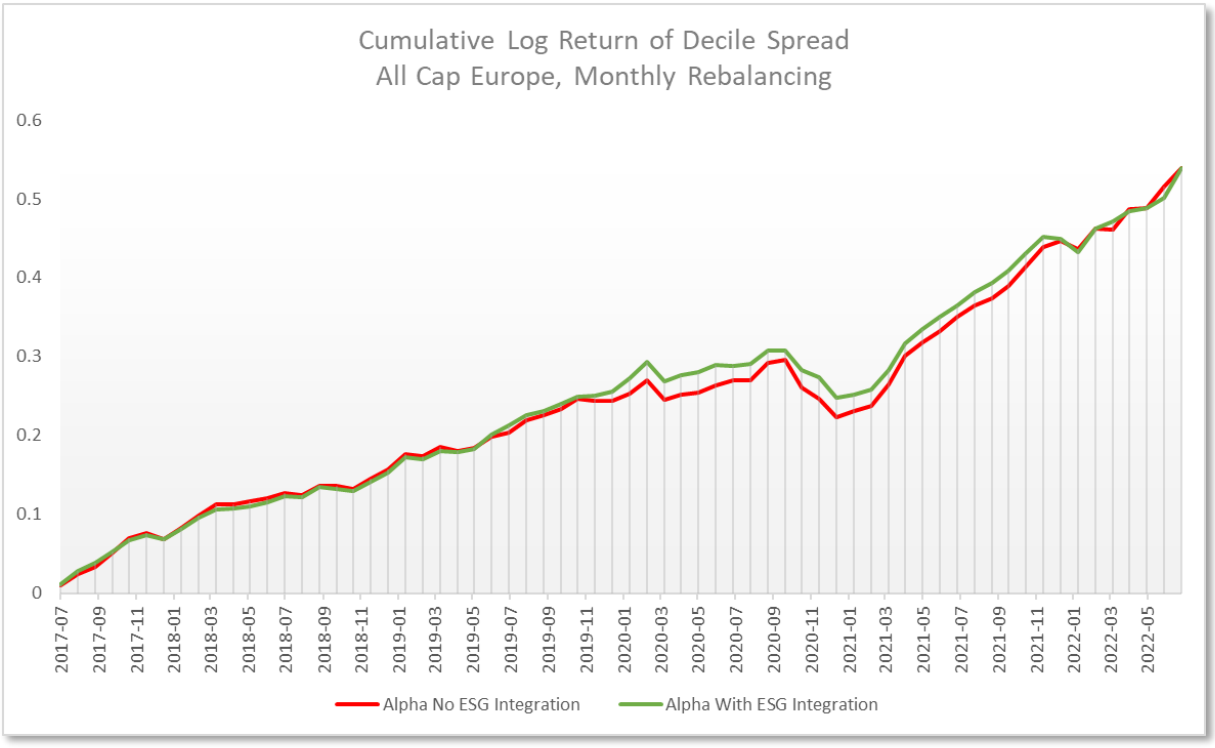


Figure 4: Source: Factset, RAM AI, simulation from July 2017 to July 2022. Past performance is not a reliable indicator of future returns.

Alpha vs. Sustainable Alpha – The Impact on ESG Profile

It is important to verify if the machine learning algorithm trained with ESG inputs has successfully identified sustainability patterns. This is confirmed by an improved ESG profile of the top decile selection and a worse ESG profile for the bottom decile. The figures below show the average levels of the ESG Score, ESG Trend, Carbon Intensity Scope 1 & 2 and Carbon Intensity Scope 3. The green arrows indicate the expected direction for sustainability improvement.

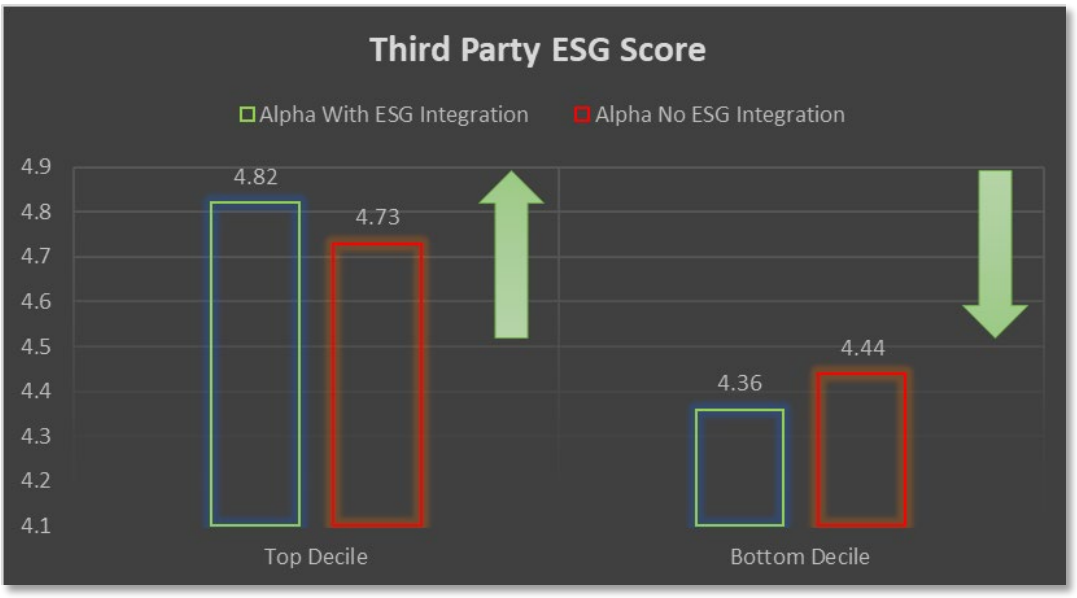


*Figure 5: Source: MSCI ESG Research, Factset, RAM AI, simulation from July 2017 to July 2022. The **ESG Score** takes into account Environmental, Social and Governance metrics for each company in the portfolio and compares companies by sector.*

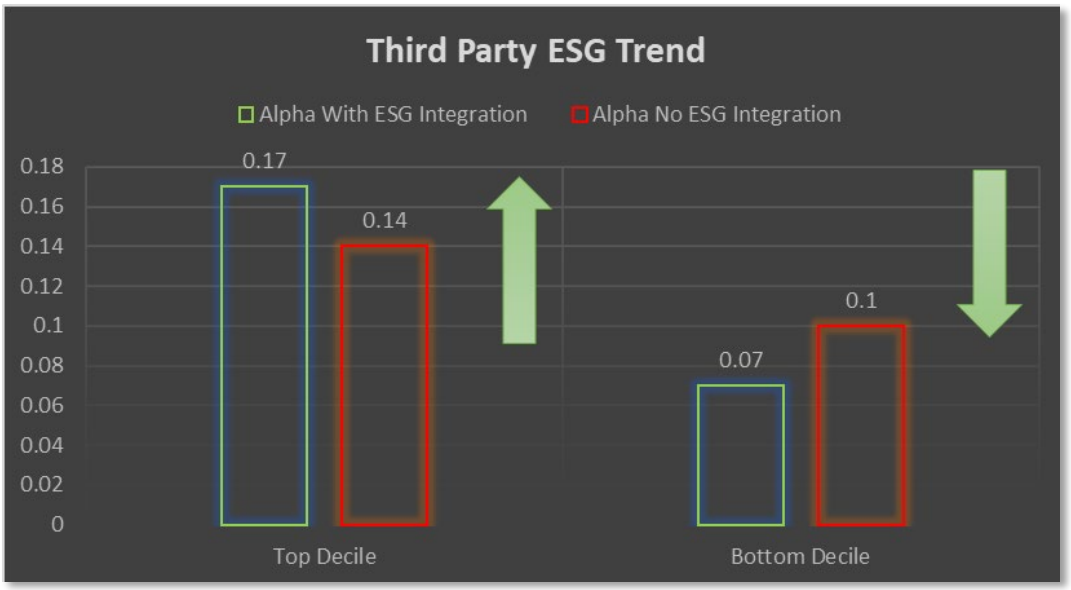


*Figure 6: Source: MSCI ESG Research, Factset, RAM AI, simulation from July 2017 to July 2022. The **ESG Trend** indicates the rating change from previous to current reports for each company.*

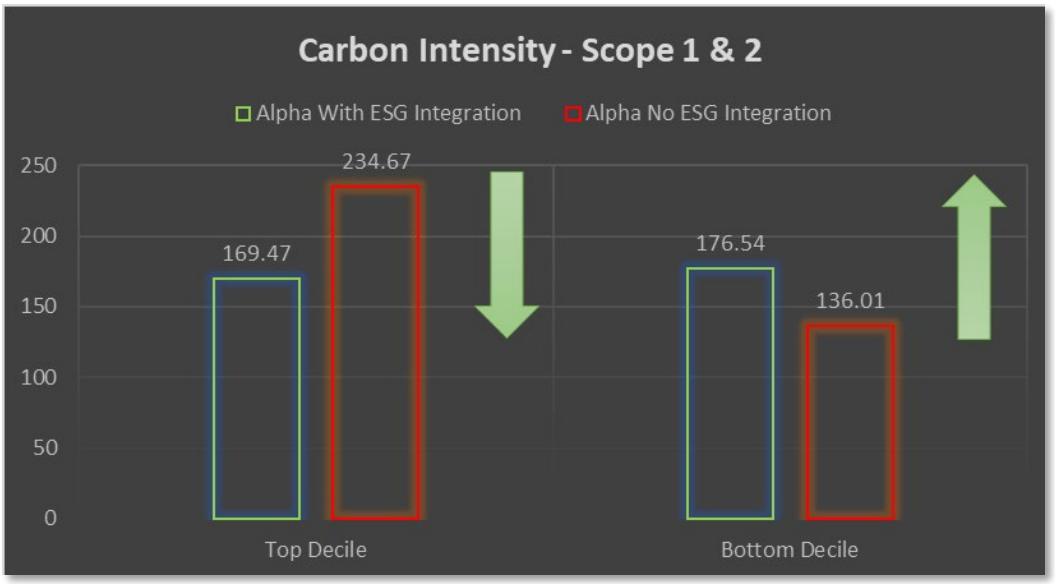


*Figure 7: Source: MSCI ESG Research, CPD, Factset, RAM AI, simulation from July 2017 to July 2022. The **Carbon Intensity** is obtained by dividing the greenhouse gas (GHG) emissions (in tons) by the total sales of the company (in Mn USD). **Scope 1** emissions are direct emissions from sources owned/controlled by the company. **Scope 2** emissions are indirect emissions that result from the energy purchased by a company, but other entities own the source.*

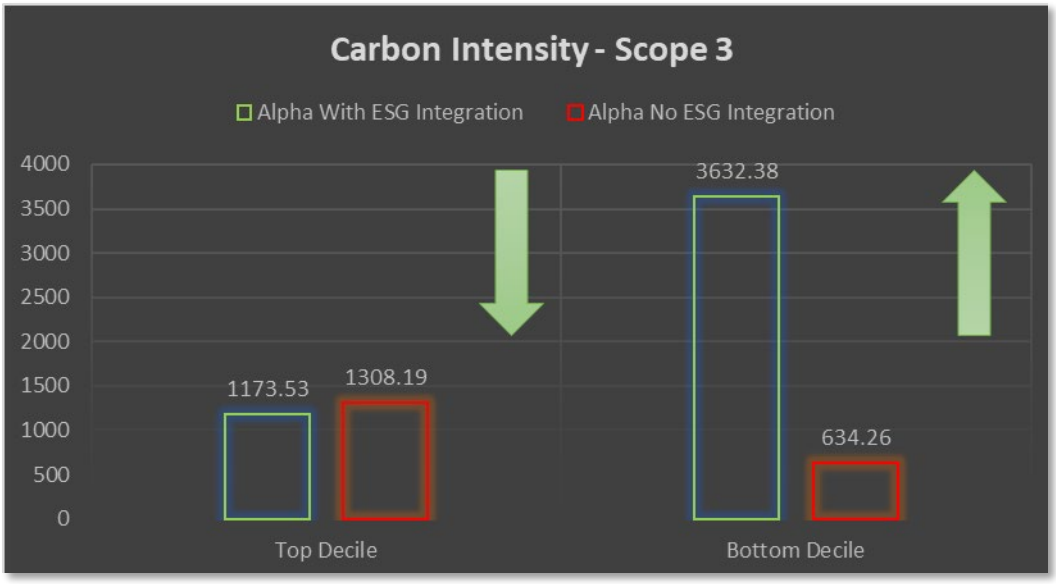
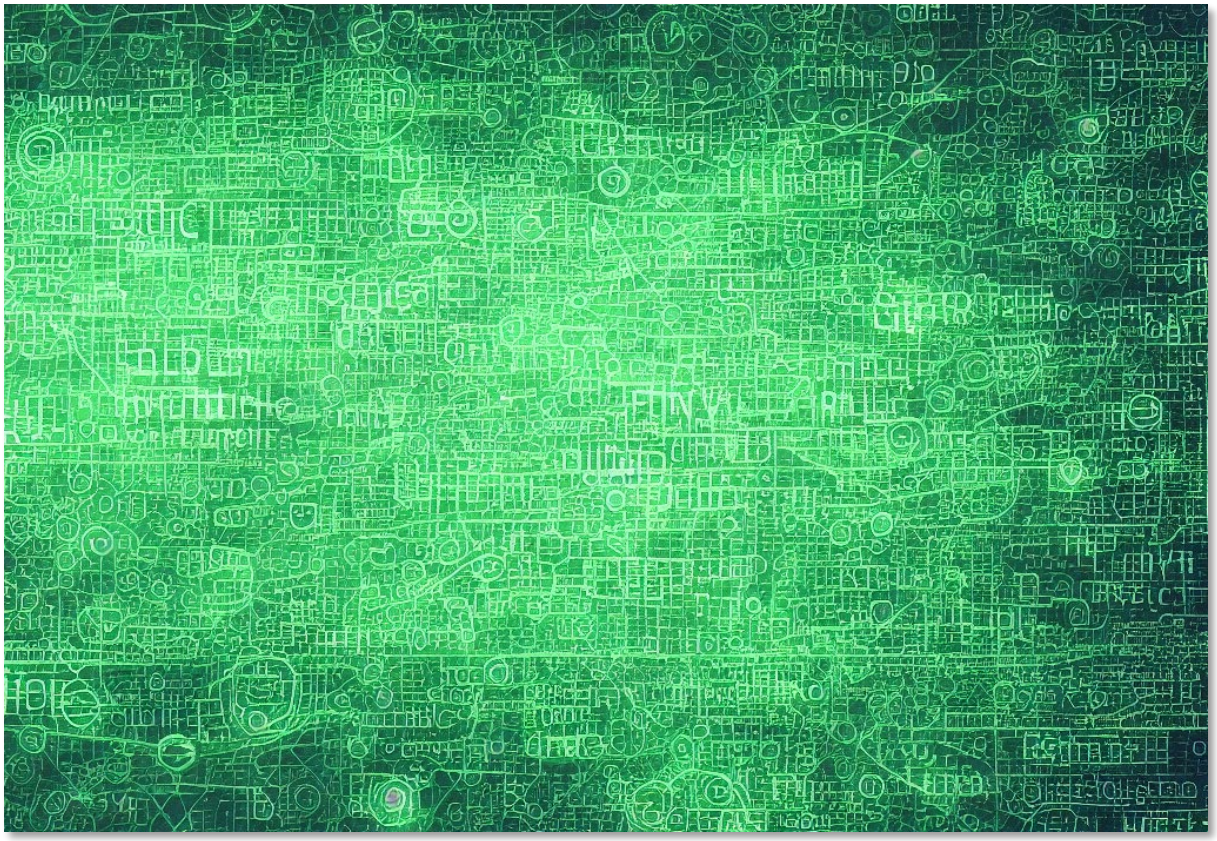


*Figure 8: Source: MSCI ESG Research, CPD, Factset, RAM AI, simulation from July 2017 to July 2022. **Scope 3** emissions are all indirect emissions (not included in Scope 2) that the company cannot control (often a large portion of a company's carbon footprint).*

Conclusion

The increased availability of non-financial data enables quantitative researchers to develop new ranges of predictive alpha inputs. The challenge lies in the optimal integration of those ESG factors with traditional investment metrics. The deep learning infrastructure developed at RAM AI is able to predict sustainable alpha by efficiently modeling factor interactions. Compared to a traditional alpha signal (that does not integrate any ESG element), we observe an improved long-short risk/return profile (unchanged return and lower volatility) with enhanced sustainability charateristics.



Source: AI generated with the Stable Diffusion Model on https://beta.dreamstudio.ai/dream

References

1. Jamet, Nicolas. “A leading approach to ESG Integration,” 2019.
2. Guo, Tian, et al. “ESG2Risk: A deep learning framework from ESG news to stock volatility prediction.” arXiv preprint arXiv:2005.02527.2020.

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