Portfolio Construction and Optimization Employing Orenda's ESG dataset

by ORENDA'S QUANT RESEARCH TEAM

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Orenda's Overall ESG & Social Positioning within the S&P 500

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Abstract

In this paper, we demonstrate that Orenda's ESG (Environmental, Social and Governance) dataset can be employed quantitatively for security selection and portfolio optimization. By holding these assets in an equally weighted, quarterly rebalanced investment strategy, we outperformed the underlying benchmark. We further validated Orenda's unique dataset by optimizing the portfolio in an ESG mean variance approach, which led to improved empirical alpha, Sharpe ratio and portfolio absolute performance. To investigate our hypothesis, we solely employed Orenda's ESG scores as a way to select securities within the S&P 500 from the period of December 2015 to March 2020.

Keywords: social positioning, esg, s&p, s&p 500, factor investing, alternative data, stakeholders, social engagement

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Background

Companies that thrive during dynamic times adhere to fundamental values that strengthen relationships with many stakeholders. These values have always been interconnected and are continuously under pressure. As issues emerge, as they always do, these values are tested, and the invariable nature of a company always surfaces.

During the current Global Pandemic, we have seen many great companies giving back to the communities where they do business and ensuring their employees and customers remain safe during difficult times and expecting nothing in return. We've also witnessed the opposite, and the swift reaction bad behavior incites when digitally empowered stakeholders are triggered. Although intricate and nuanced in modern times, the problems we face as a society are not the key determinants of our character, it's how likeminded, compatible and committed we are when it comes to eradicating these problems. This is where Orenda focuses its technology, uncovering the degree society feels a company's daily and accumulative actions support the collective and wide-spread goals contained within ESG (Environmental, Social and Governance) ideals.

social positioning *(noun)*
The alignment of a company's values in comparison to the values of its stakeholders and others with interest or influence in its daily activities.

A company's social positioning score is used to compare against the social positioning score of its peers.

The scale Orenda uses to determine alignment between a company and its stakeholders is numerical, making it perfect for financial modeling. We use a 1-5 scale, with one being extremely negative. We extract text and organize it within our ESG framework, and negative phrases such as "the CEO is a liar," erodes the company's score in real time.

The framework Orenda utilizes to calculate a company's social positioning score is shaped by eight fundamental values, such as the level of trust a consumer has that a company will do the right thing. We also include an overall value that encapsulates a company's wide-ranging Environmental and Social activities, as well as its commitment to good Governance (ESG). We

ensure the technology remains timeless and adaptable to new and emerging topics of debate and discussion by using these scientifically proven relationship metrics as an effective standard and measurement for analysis. These fixed values provide a true representation of a company's real-time alignment and a method of alerting when a company has fallen out of alignment.

Our methodology is purposely unique and effective when it comes to other ESG data providers. We have proven that relying on company authored ESG reports provides a narrow and sluggish interpretation of the impact a company makes on people the planet and global prosperity. Due to its nature, company reports may also contain biases or omit concerns. That is why our approach is to connect directly to streaming social media content to rapidly source the issues of the day and to calculate how aligned companies are with the people and the world around them.

It all matters. And we prove it.

1. Introduction

This paper intends to validate two valuable applications of Orenda's dataset as an alternative ESG (Environmental, Social and Governance) dataset for capital markets. We first demonstrate, from a quantitative approach, how to select securities from the S&P 500. We roll these securities into an equally weighted portfolio, and subsequently contrast the absolute, relative and risk adjusted performance against an equally weighted ETF replicating the S&P 500 index. As a last step, we provide empirical evidence that Orenda's equity selection provides alpha after controlling for traditional factors. We then proceed to confirm the value-added of Orenda's powerful dataset as a portfolio optimization tool. Upon securing efficient asset weights, we contrast Orenda's optimized portfolio results against the previously equally weighted portfolio and the benchmark.

Environmental, Social and Governance, or as popularly referred to by its acronym ESG, are a set of standards or ideals of how companies behave with respect to the environment, how they engage and conduct socially, and how corporations manage governance matters, including but not limited to executive pay, shareholder rights, and internal controls. ESG has been around since the early 60s, when investors excluded tobacco related companies or those associated with dictatorships, from their portfolios. Since then, asset managers have seen material inflow of funds into ESG, even during crisis periods. For example, "in the first quarter of 2020, many markets felt the first shocks of the COVID-19 pandemic on the global economy. However, inflows into

Environmental, Social, and Governance (ESG) funds were resistant to the prevailing trend, and the sector saw robust levels of investment" (Lipper, 2020).

Although ESG could potentially represent a source of alpha, market participants have faced challenges in defining a reliable, timely, dynamic and homogeneous source of ESG data for security selection. Several datasets comprise companies' self-reported ESG metrics, which carry significant biases and potentially skew quantitative or qualitative scores and ratings. This level of complexity is aggravated by the lack of transparency when it comes to determining these metrics, which prevent asset managers from integrating ESG in an efficient and systematic way.

Orenda addresses these issues by consistently reporting from the perspective of the communities where these corporations are conducting business. The technology collects online content pertaining to each publicly traded company, subsidiaries and executives and delivers a real time ESG score that can effortlessly be incorporated into multifactor models, ranking signals, or simple screening processes for security selections. Additionally, Orenda's timeless ESG scoring methodology allows asset managers to optimize portfolios, combining remarkable value for market participants.

As markets continue to transition and ESG becomes mainstream, companies that are trusted by stakeholders are set to win market share from generations that are socially conscious and demand the same from government. According to Mckinsey & Company, "a strong ESG proposition helps companies tap new markets and expand into existing ones. When governing authorities trust corporate actors, they are more likely to award them the access, approvals, and licenses that afford fresh opportunities for growth. For example, in a recent, massive public–private infrastructure project in Long Beach, California, the for-profit companies selected to participate were screened based on their prior performance in sustainability" (Mckinsey & Company, "Five ways that ESG creates value", 2019).

As previously noted by Mckinsey and Company, trust is a defining factor for a strong ESG proposition and it is one of several metrics that comprise an efficient social indicator, and one of several that accelerate favorable ESG scores. Although trust by itself is paramount, once a company has achieved it, it must be nurtured and maintained. Additional values underpin trust, and a company's accumulative actions support the collective and wide-spread goals contained within ESG ideals.

The following three categories comprise Orenda's Overall ESG score and are equally weighted for this research paper.

1. Environmental
2. Social
3. Governance

As these metrics increase for a corporation, so does its Overall ESG score. The same is true if and when these scores decrease.

The Overall score was subsequently employed in a forthcoming financial model for stock ranking and selection. We backtested its performance for the period of December 2015 through to June 2020, with the objective of testing our hypothesis that highly scored ESG stocks are superior investments and can lead to excess financial results, followed by employing the same dataset to secure optimal asset weights to further improve absolute, relative and risk adjusted results.

We organized the remaining of this paper as follows.

- **Section 2** further elaborates Orenda's background, social science and Overall ESG score.
- **Section 3** defines one of several ways to employ Orenda's ESG dataset in a quant-based approach and contemplates traditional factor performance.
- **Section 4** proposes the paper's hypothesis, describes the employed data and model design for simulation.
- **Section 5** delivers empirical results of the backtested simulations and proposes a portfolio optimization strategy based on Orenda's ESG datasets.
- **Section 6** presents the conclusions.

2. Orenda ESG Scores

2.1 Orenda Background

Orenda Software Solutions was incorporated in 2015, after its founder, Tanya Seajay, completed a 20-year communication experience and social science research journey that concluded in 2014 at McMaster University, located in Ontario, Canada. Throughout this time, Seajay invested several years of formal education and research efforts to develop a deep understanding of what

constitutes ESG excellence. She deepened her understanding while employed by the federal government of Canada and the province of Nova Scotia to lead communications for a highly contaminated and contentious cleanup project in her hometown. Her comprehensive research and hands on environmental work experience led to Orenda's first objective, to leverage existing social science research to create models that capture changing market perception of companies from an ESG perspective.

Orenda launched its first Social Positioning product as a retail solution for marketing managers and C-level executives. It subsequently transitioned into capital markets to address the need for timely and dynamic Environmental, Social and Governance (ESG) data.

2.2 Social Science

Orenda's social science models are based on 8-relationship metrics that were deemed necessary for a healthy relationship to establish and grow (Seajay, 2014). And although all eight metrics are paramount to efficiently assess how stakeholders perceive companies' social positioning, the existence of trust is crucial, as no relationship can exist without it. This builds on a significant body of research, including the six elements of a healthy relationship (one to six below), as defined by Childers Hon and Grunig (1999). Orenda's relationship metrics contain the following:

1. **Trust**: Measures the amount of integrity, dependability, and competence that the public has in a company and consumer-facing brands and considers whether people believe that an organization has the ability to follow-through and deliver on its promises.
2. **Satisfaction**: Determines the amount of favorability the public expresses about a company and its consumer-facing brands, and measures whether people's expectations with a product or service are positively reinforced by their experiences.
3. **Corporate Social Responsibility**: Measures the level of confidence that people have in a company, in relation to its actions to improve or uphold the social fairness and environmental awareness of society.
4. **Commitment**: Measures the level of dedication that the public has to a company or consumer-facing brand in order to receive their desired benefits, as opposed to filling these needs using other products or services.
5. **Influence**: Analyzes the capacity that a company can affect the opinions of the public, and measures how the public judges a company's leadership, transparency, and authority on

topics as an industry.

6. **Exchange of Benefits**: Measures the level of reciprocity the public expects from a company for choosing its products or services rather than from competing companies.
7. **Character**: The distinct qualities that the public, according to industry standards, judges the unique traits of a company in comparison to its competition.
8. **General**: Measures any remaining important social factors.

Orenda weighs Trust along with seven other relationship metrics to arrive at a company's Social Positioning score. This is achieved by analyzing millions of online conversations, for publicly traded and privately held companies, and processing as well as quantifying such content through Orenda's AI and proprietary dictionaries. Orenda's technology collects content and updates social positioning scores every 10 minutes, providing a total of 144-daily updates per company. The 10-minute interval allows Orenda to collect enough content to deliver a statistically meaningful score. The scoring methodology employs a range of 1 to 5, representing an extremely low to extremely high Social Positioning score, respectively. Additionally, Orenda collects the number of conversations each update is comprised of, representing the level of Social Engagement.

Table 1 provides a sample Social Positioning dataset for Starbucks (NYSE: SBUX).

FIGI ID	TICKER	COMMITMENT	SOCIAL RESPONSIBILITY	INFLUENCE	EXCHANGE OF BENEFITS	GENERAL	CHARACTER	SATISFACTION	TRUST	OVERALL	GENERATED TIME	COUNTRY
BBG000CTQD87	SBUX	3.0541	3.3162	3.0408	3.0122	2.997	3.2861	3.2143	3.0726	3.1242	2015-03-31T10:30:00.000Z	US
BBG000CTQD87	SBUX	3.0544	3.3157	3.0401	3.0133	2.9964	3.2838	3.214	3.0733	3.1239	2015-03-31T10:40:00.000Z	US
BBG000CTQD87	SBUX	3.0556	3.3161	3.0396	3.0137	2.9977	3.2869	3.2153	3.0746	3.1249	2015-03-31T10:50:00.000Z	US
BBG000CTQD87	SBUX	3.0577	3.319	3.0398	3.0149	2.9993	3.2851	3.2156	3.0752	3.1258	2015-03-31T11:00:00.000Z	US
BBG000CTQD87	SBUX	3.0569	3.3213	3.0416	3.0144	2.9995	3.2926	3.2163	3.0747	3.1272	2015-03-31T11:10:00.000Z	US
BBG000CTQD87	SBUX	3.0568	3.3191	3.0416	3.0151	2.9984	3.291	3.2163	3.0717	3.1262	2015-03-31T11:20:00.000Z	US
BBG000CTQD87	SBUX	3.0581	3.3204	3.0401	3.0158	2.9999	3.2903	3.2181	3.0722	3.1269	2015-03-31T11:30:00.000Z	US
BBG000CTQD87	SBUX	3.0585	3.3212	3.0406	3.0176	3.0003	3.2934	3.2175	3.0701	3.1274	2015-03-31T11:40:00.000Z	US
BBG000CTQD87	SBUX	3.0599	3.3189	3.0395	3.019	2.9993	3.2958	3.2151	3.0703	3.1272	2015-03-31T11:50:00.000Z	US
BBG000CTQD87	SBUX	3.0618	3.3207	3.039	3.0192	3.0017	3.2963	3.2161	3.0711	3.1282	2015-03-31T12:00:00.000Z	US
BBG000CTQD87	SBUX	3.0619	3.322	3.0381	3.0195	3.0019	3.2895	3.2166	3.0696	3.1274	2015-03-31T12:10:00.000Z	US
BBG000CTQD87	SBUX	3.0613	3.3212	3.0398	3.0199	3.002	3.2886	3.2155	3.0693	3.1272	2015-03-31T12:20:00.000Z	US
BBG000CTQD87	SBUX	3.0626	3.3205	3.041	3.0192	3.0019	3.2903	3.2131	3.0698	3.1273	2015-03-31T12:30:00.000Z	US
BBG000CTQD87	SBUX	3.0637	3.3192	3.0418	3.02	2.9989	3.2814	3.2138	3.0627	3.1252	2015-03-31T12:40:00.000Z	US
BBG000CTQD87	SBUX	3.0665	3.3225	3.0432	3.0223	2.9988	3.2776	3.2136	3.0636	3.126	2015-03-31T12:50:00.000Z	US
BBG000CTQD87	SBUX	3.0682	3.3196	3.0436	3.0217	2.997	3.2812	3.2136	3.0643	3.1261	2015-03-31T13:00:00.000Z	US
BBG000CTQD87	SBUX	3.0672	3.3184	3.0434	3.0229	2.995	3.2874	3.2134	3.0645	3.1265	2015-03-31T13:10:00.000Z	US
BBG000CTQD87	SBUX	3.0644	3.3176	3.0413	3.0216	2.9971	3.2859	3.2115	3.0617	3.1251	2015-03-31T13:20:00.000Z	US
BBG000CTQD87	SBUX	3.0641	3.3181	3.0392	3.0223	2.9982	3.2821	3.2108	3.0629	3.1247	2015-03-31T13:30:00.000Z	US
BBG000CTQD87	SBUX	3.0673	3.3207	3.045	3.0286	2.997	3.2851	3.2142	3.0671	3.1281	2015-03-31T13:40:00.000Z	US
BBG000CTQD87	SBUX	3.0645	3.322	3.0431	3.029	2.9982	3.2884	3.2149	3.0651	3.1281	2015-03-31T13:50:00.000Z	US
BBG000CTQD87	SBUX	3.0597	3.3218	3.0438	3.0268	3.0019	3.2949	3.2126	3.0652	3.1283	2015-03-31T14:00:00.000Z	US

Table 1

Building on Orenda's social science models, an additional framework was developed with its own taxonomy and is concurrently applied to ESG conversations. For example, when the public expresses its opinion about a company's executive compensation, Orenda's technology categorizes this content under governance. Contingent upon the vocabulary employed, this opinion

affects the company's real time ESG score positively or negatively, mimicking the process for Social Positioning.

Table 2 captures a sample ESG subject categorization below:

ENVIRONMENTAL	SOCIAL	GOVERNANCE
Climate Change	Human Rights	Shareholder Rights
Pollution	Employment Rights	Company Transparency
Clean Energy	Gender Equality	Inclusiveness
Recycling	Safe Work Conditions	Responsiveness
Waste Disposal	Anti-Corruption	Lawfulness

Table 2

3. Orenda ESG and Traditional Risk Factors

Orenda's ESG scores can naturally be incorporated into multifactor models. As we will cover in subsequent sections, these scores are employed to select securities that are, in the public's perception, ESG aligned. The opposite also holds true for poorly aligned companies, since this will signal investors to divest, short or refrain from holding such securities. This allows us to replicate a traditional risk factor exposure, but for this paper, we restrict it solely to ESG-aligned companies.

Orenda's ESG risk factor comes at a time when traditional factor models are openly being challenged by the market and academia. For example, Fama and French (1993), introduced an extension to the Capital Asset Pricing model by contemplating the Small minus Big (size premium) and High minus Low (value premium). Later, Fama and French (2015) built on their 3-factor model by adding a Conservative minus Aggressive (investment premium) and a Robust minus Weak (profitability premium). These models were globally accepted and employed but have come under scrutiny for lack of efficient results, especially within the last decade. David Blitz found that "over the most recent 2010-2019 decade, the return on each of the Fama-French factors fell well short of its long-term average. The size and value factors even experienced a negative decade, with the return of the value factor being particularly poor. It is not just the size and value factors

which have had a hard time, however. Over the past decade, the premium on the investment factor also failed to materialize, with a return close to zero. Only the profitability factor generated a positive return, but the magnitude of this premium is only about half its pre-2010 level" (David Blitz, 2020).

Although textbook finance emphasizes discounted cash flows (DCF) as the basis for security valuation, the majority of sell side security analyst reports do not present DCF computations. Much more common is for security analysts to use comparable based valuation ratios, respectively scaling price relative to earnings, book value of equity, EBITDA, the ratio of earnings to forecasted growth, and cash flow from operations. Given this reality, it should come as no surprise that individual investors rarely use DCF methodologies to assess the value of securities. While some individual investors make use of price-based ratios, the majority of investors rely on intuition, what psychologist Daniel Kahnemen calls "fast thinking" or "system 1 thinking."

The above is a plausible explanation why traditional factors can experience periods of long-lasting disappointing results. Asset managers with discretionary power must decide between patience or exposing their portfolios to different risk factors that would help them secure higher risk-adjusted results. In contrast, Orenda's ESG risk factor aims at capturing a systematic risk premium for companies that are perceived as socially aligned with stakeholders' values, providing an opportunity for superior risk adjusted returns.

4. Research

4.1 Hypothesis

This paper contemplates the hypothesis that constructing a paper portfolio based on Orenda's ESG scores provides superior risk adjusted results when compared to a predefined benchmark (Invesco S&P 500 Equal Weight ETF (NYSE:RSP)). We proceed by testing a second hypothesis that considers utilizing the same ESG dataset to optimize the equally weighted portfolio and improve absolute, relative and risk adjusted results. To validate the above, we test for positive statistically meaningful empirical alpha after controlling for traditional market, size, value, investment and profitability risk factors.

4.2 Data & Benchmark Selection

We have secured ESG data, comprised of 2.1 billion datapoints, from Orenda Software Solutions for current and historical constituents of the S&P 500. Pricing data for current and historical constituents as well as for the benchmark were obtained from yahoo finance. Daily and monthly Fama and French factor data was downloaded from Fama-French library.[1] The sample period for ESG data covers from January 1st, 2015 to March 30th, 2020. The benchmark selection was based on the universe of stocks Orenda tracks and quantifies ESG data for and the equal weights employed in the first investment simulation strategy. We found that Invesco S&P 500 Equal Weight ETF (NYSE: RSP) provided all of the desirable features of a suitable benchmark - it is unambiguous, measurable, investable, appropriate, and it was specified prior to developing and testing the model.

4.3 Model Design

The model design aimed at introducing simple probability in Orenda's dataset. With this objective in mind, we delineated a model that allowed us to rebalance a paper portfolio quarterly. In our opinion, this provided the minimum amount of time that a security needs to materialize good or bad ESG actions into stock price performance. Portfolio creation took place on December 31st, 2015 (Q4, 2015). Thereafter, we rebalanced with what is calculated to be highly regarded ESG companies, as dictated by the model detailed below:

First step consisted of averaging monthly ESG (1) scores.

$$ESG\ Monthly\ Average = \frac{\sum(ESG)_{\text{month t}}}{\#\ of\ Days_{month\ \text{t}}} \quad (1)$$

We then computed the change in monthly ESG (2) for the trailing twelve months. If variation was negative, we simply assigned a -1 (negative one) for that month. If positive, 1 (positive 1) or 0 (zero) if the ESG score remained unchanged from previous month. For the purpose of this paper, we called this transformation Simple Delta.

$$\text{Simple Delta} = \ln\left(\frac{ESG\ Monthly\ Average_t}{ESG\ Monthly\ Average_{t-1}}\right) = \{1, 0, -1\} \quad (2)$$

[1] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

We proceeded to aggregate the results of (2) into semiannual periods (3). For example, if for the second half of calendar 2015, a particular security experienced consecutive monthly positive change in its ESG score, it would enjoy a score of six. Should the security experience consecutive monthly negative change in its ESG score, the semiannual score would amount to negative six.

$$\text{Semiannual ESG Score} = \sum(\text{Monthly } ESG\ Simple\ Delta)_{\ Semiannual\ t} = \{6\ldots\ldots -6\} \tag{3}$$

At every rebalancing point, we incorporated into the model the trailing two semimanual periods as quantified in (3). However, we assigned exponential weights giving the most recent semiannual period more importance into the score (4). We fixed the exponential weights at 41.42% & 58.58% for the first and second semiannual periods, respectively. For this paper, we reference (4) as a semiannual weighted ESG score.

$$Semiannual\ weighted\ ESG\ score = \sum((\text{Semiannual } ESG\ Score_{\ Semiannual\ t-1} * 41.42\%) + (Semiannual\ ESG_{\ Semiannual\ t} * 58.58\%)) \tag{4}$$

We proceeded to compute the weighted probability of each security experiencing an increase in its ESG score (5) based on the trailing two semiannual periods. For example, if in the last 6 months (the most recent semiannual period), the security's ESG increased consecutively for 6 months, then its standalone probability would be computed as 6 of 6 or 100%. If it didn't increase and only eroded, then it would be 0 of 6 or 0%. We then assigned the same fixed exponential weights, employed earlier, of 41.42% & 58.58% for the first and second semiannual periods, respectively.

$$\text{Weighted Probability of an Increase in ESG Score} = \sum((\text{Standalone Probability}_{\ Semiannual\ t-1} * 41.42\%) + (\text{Standalone Probability}_{\ Semiannual\ t} * 58.58\%)) \tag{5}$$

The final step consisted of computing the product of the Semiannual Weighted ESG (4) and the Weighted Probability of an Increase in ESG (5) to arrive at what we refer to as the ESG factor for security selection.

$$ESG\ Factor = (\text{Semiannual Weighted ESG} * \text{Weighted Probability}) \tag{6}$$

4.4 Selection Methodology

The selection methodology consisted of choosing companies corresponding to all sectors

represented in the S&P 500 while approaching the same sector breakdown as shown on figure 1. For this paper, we selected the top 10% of Orenda's ESG factor distribution, although we have obtained similar results with top 20% or 30%.

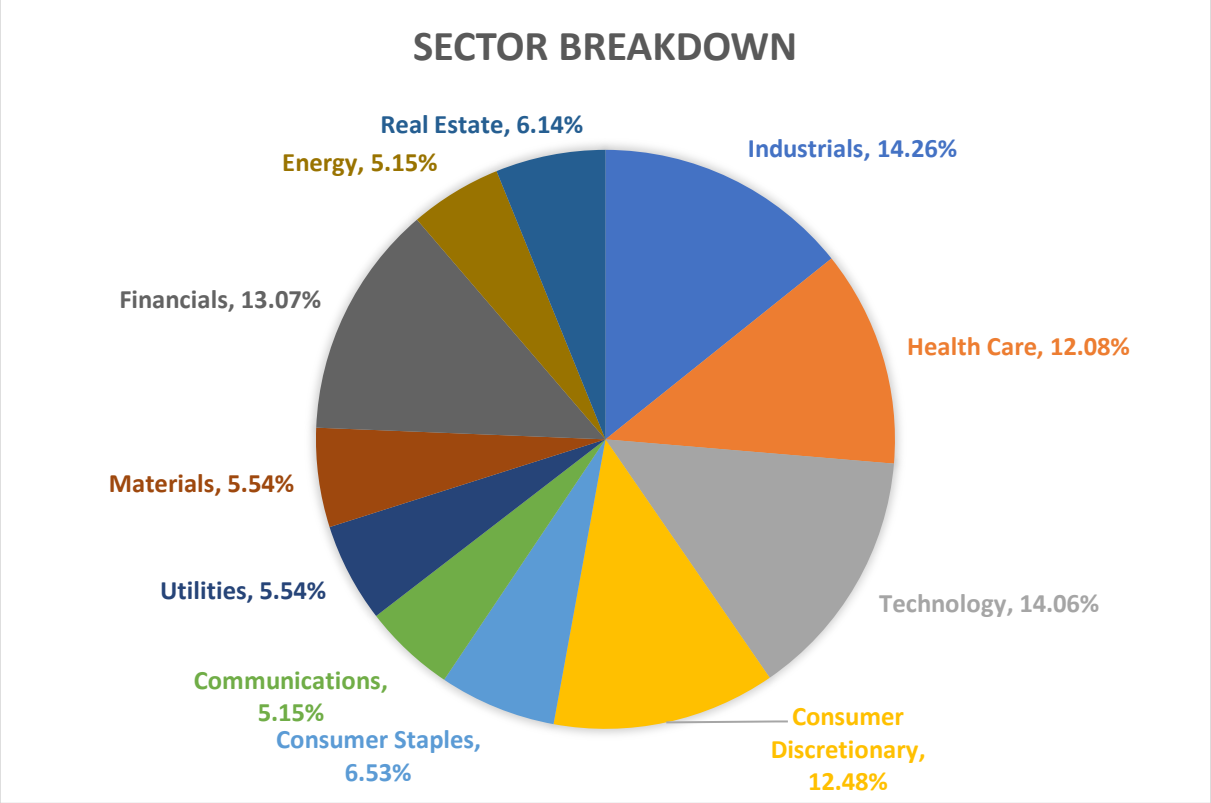

Figure 1

5. Empirical Evidence and Results

This section presents the empirical evidence, performance and risk adjusted results for Orenda's top 10% selection (portfolio A). For this portfolio, we assigned equal weights. We then proceeded to allocate weights based on a mean-variance approach utilizing Orenda's ESG historical dataset. Here, we proposed employing Sharpe's model, but replaced it with Orenda's dataset to position the portfolio in an ESG efficient frontier (portfolio B). We developed this concept in section 5.2.

To validate the existence of positive alpha in the proposed model, after controlling for traditional risk factors, we employed time-series regressions on Orenda's daily excess returns against Fama-French 3 and 5 factor model (7 & 8). Fama and French 3 factor model includes risk, size and value premiums while the 5 factor adds profitability and investment premiums.

$$R_{Orenda,t} - R_{f,t} = \alpha_{ff3} + \widehat{\beta\_mkt}(R_{mt} - R_{ft}) + \widehat{\beta_{smb}}(SMB_t) + \widehat{\beta_{hml}}(HML_t) + e_{it} \quad (7)$$

$$R_{Orenda,t} - R_{f,t} = \alpha_{ff3} + \widehat{\beta_{mkt}}(R_{mt} - R_{ft}) + \widehat{\beta_{smb}}(SMB_t) + \widehat{\beta_{hml}}(HML_t) + \widehat{\beta_{rmw}}(RMW_t) + \widehat{\beta_{cma}}(CMA_t)\, e_{it} \quad (8)$$

5.1 Portfolio A – Empirical Alpha

Table 3 captures the coefficient estimates of Fama and French 3 factor model against portfolio A daily excess return for the period of December 31st, 2015 to April 30th, 2020. As observed, Jensen's (daily) Alpha is positive and significant at a 95% confidence level (P-value of 0.0479). The presented empirical results also showed that Portfolio A returns are principally systematic as measured by the statistically meaningful market beta of 1.009 and, to a lesser extent, to value and size factors with relatively low coefficients of 0.155 and 0.2399. It is important to note that empirical alpha was achieved despite the severe impact COVID had on capital markets and such results were secured with 55 equally weighted stocks.

Residuals:				
Min	1Q	Median	3Q	Max
-0.0175436	-0.0014501	0.0000964	0.0015579	0.0209403
Coefficients:				
	Estimate	Std. Error	t value	Pr (>|t|)
(Intercept)	1.766e-04	8.915e-05	1.981	0.0479 *
Mkt_RF	1.01E+00	7.43E-03	135.795	<2e-16 ***
SMB	1.55E-01	1.54E-02	10.074	<2e-16 ***
HML	2.40E-01	1.35E-02	17.729	<2e-16 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				
Residual standard error: 0.002934 on 1085 degrees of freedom				
Multiple R-squared: 0.9513				
Adjusted R-squared: 0.9512				
F-statistic: 7067 on 3 and 1085 DF, p-value: < 2.2e-16				

Table 3

We repeated this empirical test against Fama and French 5 factor model. As shown in Table 4, Jensen's (daily) Alpha is positive and significant at a 90% confidence level (P-value of 0.057189). Although we have obtained similar results for market, size and value premiums, the investment factor (CMA) coefficient was not statistically related to Portfolio A, indicating that returns for ESG stocks did not behave as those of companies with aggressive investment strategies. A possible explanation is that socially aligned companies were more selective when deploying capital for investments since stakeholders' wellbeing, as opposed to solely shareholders' wealth maximization, was a factor in the investment decision-making process. Profitability factor (RMW) is statistically meaningful with a lower coefficient representing the least relation to Portfolio's A returns among the four meaningful factors.

Residuals:

Min	1Q	Median	3Q	Max
-0.0180411	-0.0014998	0.0000669	0.0015665	0.0205606

Coefficients:

	Estimate	Std. Error	t value	Pr (>|t|)
(Intercept)	1.69E-04	8.87E-05	1.904	0.057189
Mkt_RF	1.01E+00	7.77E-03	129.889	<2e-16 ***
SMB	1.63E-01	1.57E-02	10.377	<2e-16 ***
HML	2.38E-01	1.61E-02	14.845	<2e-16 ***
RMW	9.15E-02	2.44E-02	3.752	0.000184
CMA	-1.27E-02	3.01E-02	-0.423	0.672332

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.002918 on 1083 degrees of freedom

Multiple R-squared: 0.9519

Adjusted R-squared: 0.9517

F-statistic: 4291 on 5 and 1083 DF, p-value: < 2.2e-16

Table 4

5.2 Portfolio A – Relative, Risk Adjusted and Absolute Performance

Orenda's equally weighted portfolio produced a Sharpe ratio of 0.6414 vs 0.493 for the equally weighted benchmark RSP. In terms of absolute performance, a hypothetical $10,000 investment in Portfolio A, would have reached $16,915 vs $14,375 for the benchmark from December 31st, 2015 to June 30th, 2020. Table 5 summarizes our findings.

PERFORMANCE PERIOD DECEMBER 31st, 2015 TO JUNE 30th, 2020	ORENDA'S EQUALLY WEIGHTED ESG PORTFOLIO	EQUALLY WEIGHTED BENCHMARK (RSP)
SHARPE RATIO	0.6414	0.493
$10,000 ABSOLUTE PERFORMANCE	$16,915	$14,375
HOLDING PERIOD RETURN	69.15%	43.75%

Table 5

5.3 Portfolio Optimization Employing Orenda's Dataset

Our optimization strategy consisted of developing a counterpart to the Sharpe ratio by solely employing Orenda's historical dataset. Our hypothesis was that, after selecting securities based on Orenda's ESG factor, market participants would create an efficient market portfolio from the perspective of expected ESG and its corresponding variance, effectively replacing Harry Markowitz's portfolio-return mean-variance approach.

Harry Markowitz's work is the foundation of Modern Portfolio Theory. His work contemplated the construction of portfolios that maximize the expected single period return for a given level of risk. His paper, "Portfolio Selection", developed the concept of diversification by considering the relationship among assets, their expected returns and standard deviation. The latter, subject to nonlinear standard deviation and their covariances of returns (Markowitz, 1952).

Markowitz's thesis is grounded in the fact that, as securities are added to a portfolio, the corresponding number of covariances increases and becomes larger than the number of securities. Then, the portfolio's risk is heavily impacted by the covariance among securities instead of individual asset risk.

Markowitz model (Markowitz, 1952) has the following design for the portfolio's expected return and standard deviation (9).

$$maxE(rp) = max\sum_{i=1}^{n} w_i\mu_i$$

$$\min \sigma_p = \sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \sigma_i \sigma_j \rho_{ij}}$$

When $\rho_{ij} = 1$ for $i = j$, *or:* (9)

$$\min \sigma_p = min\sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \sigma_{ij}}$$

$$0 \leq w_i \leq 1, i = 1, \dots, n$$

$$\sum_{i=1}^{n} w_1 = 1$$

Where w_i is weight allocated to asset i; μ_i the expected return on asset i; σ_{ij} is the covariance between the return on assets i and j; $E(rp)$ is the expected return of the portfolio; σ_p is the risk of the portfolio.

Approaching Markowitz's work, our objective is to maximize the expected ESG for a given level of ESG risk. To achieve the above, we replace daily stock returns for daily change in securities' ESG (10), and securities' return variance for ESG variance (11).

$$Orenda\ ESG\ daily\ change = \frac{\text{ESG}_{\ t} - \text{ESG}_{t-1}}{\text{ESG}_{\ t-1}} \quad (10)$$

$$ESG\sigma_i^2 = Var(ESG_i) = \frac{\sum_{t=1}^{m}(ESG_t^i - \mu ESG_i)^2}{m-1} \quad (11)$$

Where m represents the number of periods, σ_i^2 security's i ESG variance and μESG_i security's i mean ESG. Security's i ESG standard deviation, ESGσ_i , would simply be the square root of its variance, $\sqrt{ESG\sigma_i^2}$.

Having established the above, we proceeded with defining security's i Orenda's Sharpe Ratio as follows;

$$Orenda's\ Sharpe\ Ratio\ for\ security\ i = \frac{\text{E}(\text{ESG Score}_i\ - 0)}{ESG\sigma_i} \quad (12)$$

Orenda's Sharpe ratio is essentially the expected change in security's i ESG score per unit of risk defined as the standard deviation for security's i ESG score. Since Orenda does not track ESG

scores for risk free securities, we have assigned 0 for its proxy.

Provided (12), Orenda's Sharpe Ratio for a portfolio (15) is simply computed as the expected ESG score for the portfolio (13) per unit of portfolio's ESG risk (14). The portfolio's ESG risk contemplates the ESG covariance among assets.

$$E\left(\mathrm{ESG}_p\right) = max\sum_{i=1}^{n} w_i \mu ESG_i \tag{13}$$

$$\mathrm{ESG}\,\sigma_p = min\sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j ESG\ \sigma_{ij}} \tag{14}$$

$$Portfolio - Orenda's\ Sharpe\ Ratio\ = \frac{\mathrm{E}(\mathrm{ESG}_p\ - 0)}{ESG\sigma_p} \tag{15}$$

Our portfolio optimization consisted of finding optimal weights to maximize Orenda's ESG Sharpe Ratio for securities in the ESG paper portfolio introduced earlier. For visualization purposes, Figure 2 captures Orenda's ESG efficient frontier portfolios for a sample quarterly stock selection exercise.

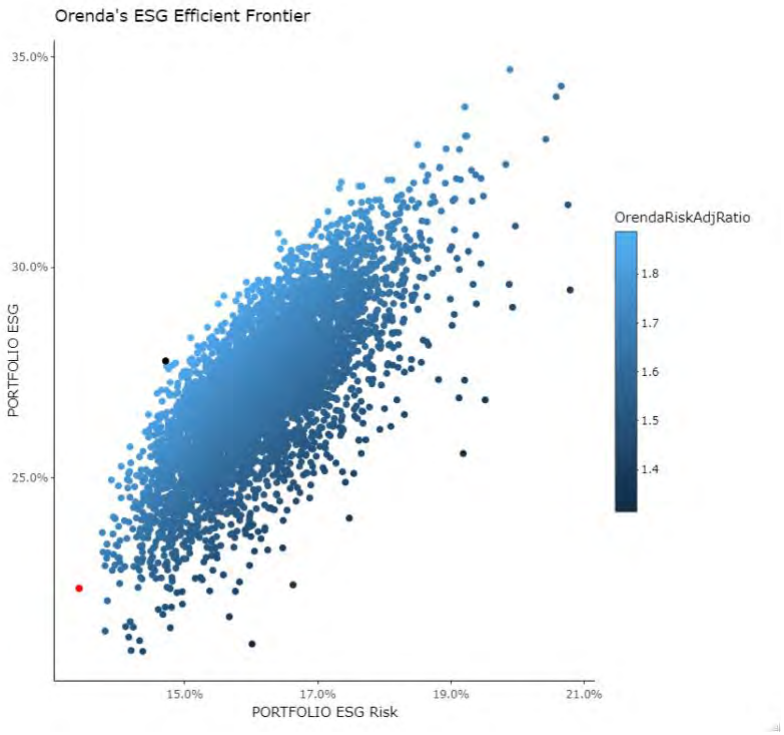

Figure 2

The tangency portfolio represented by the black datapoint carries the optimal weights that would maximize the Portfolio's ESG Sharpe Ratio. The minimum variance portfolio characterized by the red datapoint produced the weights that minimizes the portfolio's ESG risk. This optimization strategy was applied to portfolio A at every quarterly rebalancing period. For this paper, we name this newly created strategy portfolio B in order to test for empirical alpha and contrast its performance against the equally weighted portfolio A, and our predefined benchmark as covered in section 5.4.

5.4 Portfolio B – Empirical Alpha

Table 6 captures the coefficient estimates of Fama and French 3 factor model against Portfolio B daily excess return for the period of December 31st, 2015 to April 30th, 2020. Jensen's (daily) Alpha is positive and significant at a 95% confidence level (P-value of 0.0437). The presented empirical results also show that Portfolio B returns are largely systematic as measured by the statistically meaningful market beta of 0.972 and, to a lesser extent, to value and size factors with relatively low coefficients of 0.139 and 0.196. Once again, it's important to note that empirical alpha was achieved despite the severe impact COVID had on capital markets.

Residuals:

Min	1Q	Median	3Q	Max
-0.0201837	-0.0014149	-0.0002874	0.0013836	0.0282282

Coefficients:

	Estimate	Std. Error	t value	Pr (>|t|)
(Intercept)	0.0002874	0.0001423	2.019	0.0437 *
Mkt_RF	0.9728285	0.0115307	84.368	<2e-16 ***
SMB	0.1399263	0.0224	6.247	6.01E-10 ***
HML	0.1964944	0.019932	9.858	<2e-16 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0. 004687 on 1085 degrees of freedom

Multiple R-squared: 0. 8803

Adjusted R-squared: 0.88

F-statistic: 2659on 3 and 1085 DF, p-value: < 2.2e-16

Table 6

We repeated this empirical test by controlling for Fama and French 5 factors; market risk, size

(SMB), value (HML), profitability (RMW) and investment (CMA). As shown in Table 7, Jensen's (daily) Alpha is positive and significant at a 95% confidence level (P-value of 0.0412). Although we have obtained similar results for market, size and value premiums, the investment (CMA) and profitability (RMW) factor coefficients are not statistically related to Portfolio B, indicating that returns for ESG stocks do not behave as those of companies with aggressive investment strategies. As proposed before, a possible explanation is that socially aligned companies are more selective at times of deploying capital for investments since stakeholders' wellbeing, as opposed to solely shareholders' wealth maximization, is a factor in the investment decision-making process. At the risk of generalization, a possible explanation for an unrelated Profitability factor (RMW) is that firms that prioritize profits, as opposed to stakeholders' wellbeing, are regarded as low ESG entities since "the purpose of a company is not just to produce profits, it is to produce solutions to problems of people and planet and in the process to produce profits," (Robert G. Eccles and Svetlana Klimenko, 2019). Companies should participate with others to bring balance to people, the planet and prosperity.

Residuals:

Min	1Q	Median	3Q	Max
-0.0202131	-0.0013958	-0.0002913	0.0013886	0.0282526

Coefficients:

	Estimate	Std. Error	t value	Pr (>|t|)
(Intercept)	0.0002913	0.0001425	2.044	0.0412
Mkt_RF	0.9711613	0.011807	82.253	<2e-16 ***
SMB	0.1392888	0.0227301	6.128	1.24E-09***
HML	0.2025763	0.0216333	9.364	<2e-16 ***
RMW	0.0225601	0.0343916	0.656	0.512
CMA	-0.0345845	0.0396447	-0.872	0.3832

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.004689 on 1083 degrees of freedom

Multiple R-squared: 0.8804

Adjusted R-squared: 0.8799

F-statistic: 1595 on 5 and 1083 DF, p-value: < 2.2e-16

Table 7

5.5 Portfolio B – Relative, Risk Adjusted and Absolute Performance

Table 8 summarizes all performance metrics for Portfolios A & B and our predefined benchmark. Orenda's optimized portfolio (B) outperformed the benchmark and Orenda's equally weighted ESG portfolio in all 3 metrics. The Sharpe ratio for portfolio B is 0.6902 vs 0.6414 and 0.493 for portfolio A and the benchmark, respectively. On absolute terms, a hypothetical $10,000 would have produced $17,792 for portfolio B while portfolio A and the benchmark $16,915 and $14,375, correspondingly as captured in Figure 3 below . In addition, portfolio B Jensen's (daily) alpha of 0.0002913 was significantly higher than portfolio A's .000169, supporting our hypothesis that Orenda's ESG dataset can be an efficient source for security selection and portfolio optimization.

PERFORMANCE PERIOD DECEMBER 31st, 2015 TO JUNE 30th, 2020	ORENDA'S OPTIMIZED ESG PORTFOLIO	ORENDA'S EQUALLY WEIGHTED ESG PORTFOLIO	EQUALLY WEIGHTED BENCHMARK (RSP)
SHARPE RATIO	0.6902	0.6414	0.493
$10,000 ABSOLUTE PERFORMANCE	$17,792	$16,915	$14,375
HOLDING PERIOD RETURN	77.92%	69.15%	43.75%

Table 8

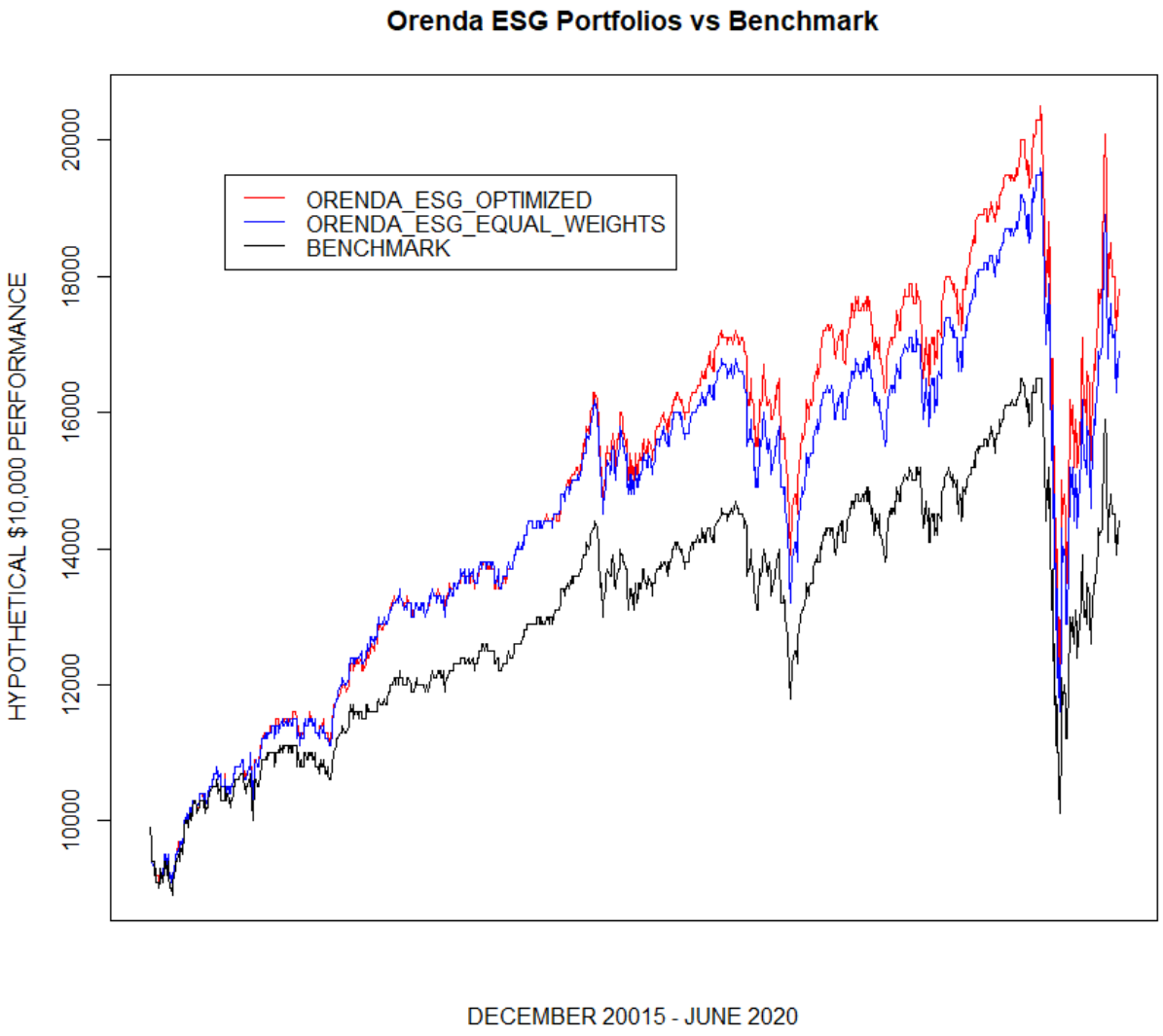

Figure 3

6. Conclusion

Environmental, Social and Governance (ESG) ideals are tied to global capital markets and stakeholders seek investment opportunities that prioritize people, planet and prosperity. The old corporate approach of solely seeking shareholder wealth maximization has been redefined to stakeholder's utility maximization

Companies that follow good ESG practices are considered virtuous investments and having the ability to segregate those that enjoy a robust ESG rating from companies that are considered unethical can lead to profitable investment strategies. Loosely speaking, investors choose stocks

according to how they feel about the stocks they choose to purchase, hold, sell, or ignore. For some, investors feeling good about a stock entails a concordance between the investor's personal values and characteristics of the stock or company that correspond to those values. In this respect, financial portfolios bring both financial benefits and psychological benefits. An important challenge is to find a systematic way to quantify investors' values and the way they evaluate securities through the lens of those values. However, employing ESG data for asset selection is challenging to say the least. Market participants are faced with unconsolidated, biased and outdated ESG datasets that may not be accurate or modeled systematically.

Orenda addressed this problem directly by generating high frequency ESG data from the perspective of the communities where these corporations are conducting business. As people issue opinions or statements on how corporations are behaving socially, with regards to the planet, and their governance practice, Orenda quantifies this content in real time by employing a simple scoring methodology. This allows asset managers to introduce our datasets systematically for ESG security selection, portfolio construction and alpha generation.

To test this hypothesis, we have employed Orenda's datasets as an efficient tool to select securities that are regarded as high quality ESG companies. We conducted this exercise by creating 2 paper portfolios from the S&P 500 universe of stocks. We approached the sector weights comprised in the index while only selecting the top 10% distribution of Orenda's ESG factor. Portfolio A was equally weighted. Portfolio B employed a portfolio optimization strategy based on maximizing the portfolio's ESG Sharpe ratio utilizing Orenda's dataset. The returns were subsequently compared between the two portfolios and the predefined benchmark on absolute, relative and risk adjusted basis, and after controlling for Fama and French 3 and 5 factor models.

Our primary empirical findings demonstrate that the portfolios of stocks selected based on high ESG factor distribution do provide alpha after controlling for Fama and French 3 and 5 factor models, which include market, size, value, profitability and investment premiums. After conducting the previously introduced ESG portfolio optimization, portfolio B's empirical alpha was also significant after controlling for all 3 and 5 factors and it was materially larger than portfolio A.

Both ESG portfolios outperformed the benchmark on risk adjusted and absolute basis, as captured by the Sharpe ratio and hypothetical $10,000 growth. Further validating our hypothesis

that Orenda ESG dataset can be used for portfolio optimization, portfolio B outperformed portfolio A on risk adjusted, absolute basis and its empirical alpha was significantly larger.

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