Measuring the sustainability of complex portfolios

François Chevallier-Gravezat
Welton Investment Partners

Abstract

We propose a quantitative approach to measure the sustainability of complex investments portfolios. Despite the increased interest in financial products aligned with ESG values, almost all of the tools available to investors remain geared towards narrow and simple investment vehicles such as long-only stock portfolios. In this paper we present a methodology capable of accommodating complex portfolio concepts such as multi-asset investments and dynamic positioning.

1 Introduction

Over the past few years, sustainable investments have become increasingly popular. This popularity is leading the sustainable finance space to expand in multiple directions including data sources, asset classes and investment vehicles.

With respect to data, ESG data can nowadays be sourced and/or calculated from an increasingly large pool of providers (MSCI©, Sustainalytics©, Arabesque©, etc) and alternative data sets [1]. On the asset front, the past few years have seen attempts to develop ESG frameworks for asset classes other than Equities [2,3] and the popularity of sustainable-themed vehicles among hedge fund managers has increased significantly [4].

However, this rapid expansion has also created a number of issues for investors and product managers alike. While it is widely accepted that ESG scoring of investments should be done

[1] http://datatopics.worldbank.org/esg/methodology.html

[2] Inderst, G. and Stewart, F., Incorporating Environmental, Social and Governance (ESG) Factors into Fixed Income Investment. World Bank Group publication, April 2018

[3] Chevallier-Gravezat, F., ESG Scoring of Financial Derivatives. Welton Investment Partners, June 2020

[4] UNPRI, Technical Guide: ESG Incorporation in hedge fund. UNPRI, May 2020

using multiple data sources to increase the robustness of the measurement[5], there is currently no approved method as to how this should be done. The lack of standards is problematic given that scores generated by different ESG frameworks are likely to exhibit very different statistical properties (i.e., mean, variance and kurtosis). Another complication arises when considering ESG scores for financial assets other than equities which are difficult to source. Finally, there is little information on how ESG frameworks should be applied to a portfolio that does not use a long-only construction.

In this paper, we attempt to solve the above issues by developing a quantitative framework that is capable of unifying multiple ESG data sources and is agnostic to the portfolio construction methodology used. We start by presenting a method to normalize ESG scores (Section 2) so that data generated by independent frameworks can be compared and combined. In Section 3, we explain how ESG scores can be applied to active portfolios in order to measure their overall sustainability. Finally, in Section 4 we present a practical example by applying the methodology to the Welton Advantage portfolio which is an actively managed, multi-asset portfolio trading Equities, Futures and Options.

2 Normalizing ESG frameworks

Sustainability scores can be obtained from a variety of sources that range from international organizations to specialized data providers. They can also be the product of bespoke calculations using alternative data as is the case for the Welton Derivatives ESG Scores™. Given this diversity of sources, it is reasonable to expect that the statistical properties of various data sets obtained from different sources might be dissimilar even if a majority of frameworks appear to use scores that range from 0 to 100 (100 being the best score).

The above issue illustrates the need for a normalization method that would allow one to compare ESG scores issued by different frameworks. To this effect, we propose a normalized variable that we label "Excess Sustainability" (noted ES) and which is defined as follows: let us consider a sustainable framework producing ESG scores for N financial instruments noted S_i for $i = 1..N$. The excess sustainability of instrument i, ES_i, can be calculated using: as:

$$ES_i = erf\left(\frac{S_i - \overline{S}}{\sqrt{2}\sigma_S}\right) \tag{1}$$

Where erf represents the error function, $\overline{S}$ is the mean ESG scores across all instruments and σ_S is the standard deviation of the scores. As can be seen from Equation 1, the calcula-

[5]Pal A., Sekar S., Rising to the ESG challenge. CRISIL, June 2020

tion essentially consists in applying the error function to the z-score of the ESG scores. This transformation is quite standard and is commonly used to map a normal distribution defined on $[-\infty, +\infty]$ to a uniform distribution with a domain of definition bounded by $[-1, 1]$. Given the above, it is important to point out that the transformation will work best when the input ESG scores are close to being normally distributed. The ES metric defined by Equation 1 possesses a number of useful characteristics:

- Bounded: the ESG scores are mapped to the finite interval $[-1, 1]$ (1 represents the maximum score).
- Proportional: the ES_i is proportional to S_i.
- The ES metric is symmetric around 0 which will prove useful when considering short positions.

The Excess Sustainability metric also has a normalization impact as it transforms an absolute scale (i.e. scores between 0 and 100) to a relative one (dependent on the statistical properties of the sample) and should therefore be able to correct for most bias or scaling issues intrinsic to a given ESG framework.

Next, we illustrate the excess sustainability transformation by applying it to a set of Equities ESG scores provided by Arabesque©. The sample considered is the ensemble of ESG scores for a sample of US Equities (≈1000 names) taken at an arbitrary date (2018-05-01). The impact of the transformation is shown in Figure 1.

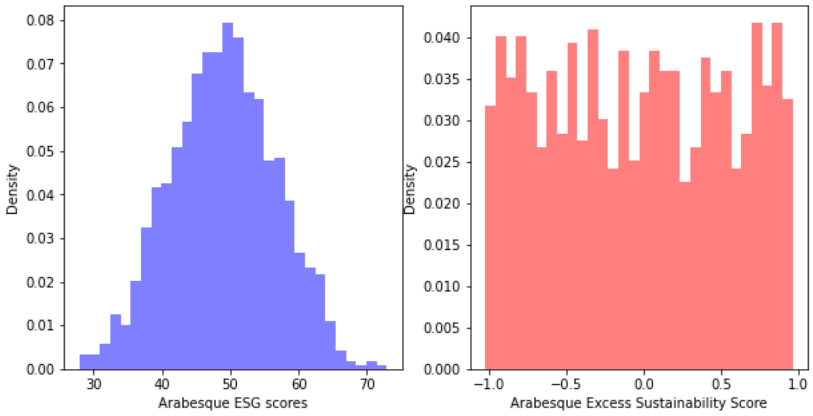

Figure 1: Illustration of Excess Sustainability normalization: The left plot displays the original ESG scores (Arabesque©) distribution for ≈1000 US securities on 2018-05-01 while the plot on the right shows the distribution of the corresponding Excess Sustainability values.

The standardization properties of the transformation presented in Equation 1 can be further visualized by considering ESG scores generated by another framework. To this effect, we consider a set of Welton Derivatives ESG Scores™. In this instance, the sample considered is a set of 41 Futures markets scores covering most common sectors (Commodities, Fixed Income, Equities and FX) and calculated for the year 2018. The calculation of the Excess Sustainability scores for these instruments is presented in Figure 2.

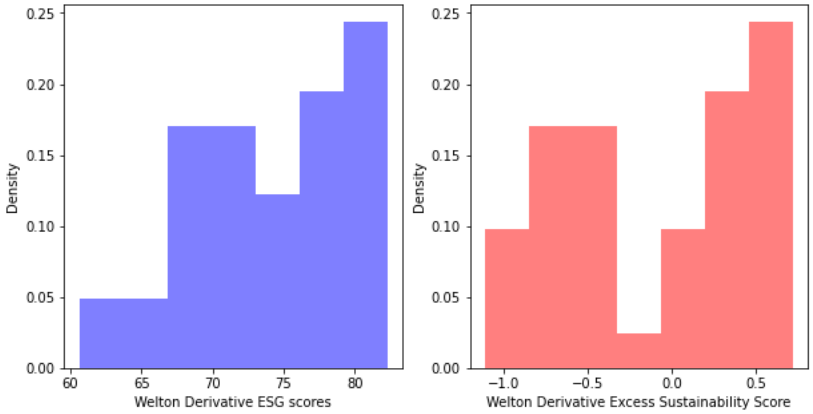

Figure 2: Excess Sustainability metric for 2018 Welton Derivative ESG Scores™calculated on 41 Futures markets.

As can be seen from Figure 2.2, the initial distribution of ESG scores for the derivative markets does not resemble the one observed for equities presented in Figure 2.1. Part of the differences come from the drastic dissimilar sample sizes (41 for Futures, 1000 for Equities) but it is also clearly visible that the mean of the distributions are not equal. These deviations are to be expected given that the methodologies used to derive the Equities and Derivatives scores are significantly different. However, despite these statistical differences, the Excess Sustainability transformation successfully normalizes them as illustrated in Table 1.

Table 1: Normalization effect of Excess Sustainability metric..

	ESG Scores		**Excess Sustainability**	
Arabesque (Equities)	$\mu = 49.75$	$\sigma = 7.66$	$\mu = 0.00$	$\sigma = 0.58$
Welton (Futures)	$\mu = 75.57$	$\sigma = 5.73$	$\mu = 0.02$	$\sigma = 0.60$

The *ES* metric can be used to normalize ESG frameworks and therefore to facilitate comparisons, but the methodology can also be used to combine multiple frameworks targeting the same asset class (e.g. MSCI and Arabesque Equities ESG scores).

In the next section, we show how one can use the ES metric to measure the sustainability of dynamic portfolios.

3 Portfolio sustainability score

As mentioned in the Section 1, we are interested here in complex portfolios which we characterize as follows:

- Multiple asset classes: the portfolio trades a broad spectrum of financial instruments (Equities, Futures, Options, etc..)
- Active management: instrument positions change frequently
- Shorting: the portfolio can hold short positions

Up to this point, we have only addressed the multi-asset aspect of the portfolio (through the ES measure) and we now turn our attention to the dynamic positioning.

If the portfolio positions in a given instrument are liable to change, it appears logical that the sustainability measure of that position should also change and reflect the relative weight of exposures across the different holdings. This is because it is reasonable to expect that the more allocations are given to sustainable markets, the higher the sustainability measure of the portfolio should be.

Furthermore, as explained in a recent UNPRI publication[6], a short position is a valid way to express a sustainability view on a market, and shorting an instrument with a poor ESG score should be as rewarding as holding a long position in one with a high ESG score (from a sustainability standpoint).

Let us now consider the portfolio π, trading multiple markets M_i for $i = 1, ..N$. If we note E_i the net exposure (in \$) of the position in market i and ES_i represents the corresponding Excess Sustainability, then we define the normalized sustainability score $\overline{S}_\pi$ as follows:

$$\overline{S}_\pi = \frac{\sum_i E_i \times SL_i}{GNE_\pi} \tag{2}$$

The numerator of Equation 2 is essentially the "sustainable exposure" of the portfolio (net exposure weighted by Excess Sustainability) while the denominator is its gross notional exposure

[6]UNPRI, Technical Guide: ESG Incorporation in hedge fund. UNPRI, May 2020

(GNE).

From the numerator of Equation 2, we can also see that a short position (negative net exposure) in an instrument with a below-average ESG score ($ES < 0$) will result in a positive leverage measure. This highlights the advantage of the symmetry introduced by the ES metric.

However, Equation 2 also highlights that the $\overline{S}$ metric possesses the same domain of definition as ES ([-1, 1]) which is not very conventional for a score measure. This can however be easily remediated through a simple transformation (Equation 3) to obtain the Welton Normalized ESG Score™ which is defined over the interval [0,100].

$$\overline{S}_{\pi} = \frac{100}{2}\left(\frac{\sum_i E_i \times SL_i}{GNE_{\pi}} + 1\right) \tag{3}$$

The metric $\overline{S}$ as defined above allows us to calculate a dynamic sustainability score for a given portfolio. In this section, we have used ESG scores as input scores for the derivation but it is important to note that it is possible to use the same methodology to normalize sub-components such as E, S or G scores independently. In the next section, we illustrate how the normalized score can be used to quantify the sustainability of the newly launched Welton Advantage portfolio which is an actively managed ESG portfolio trading equities, futures, forwards and options.

4 Application

In this section, we calculate the Welton Normalized ESG Score™ for the Welton Advantage-US portfolio (Advantage-C). This program was recently launched (2020-06-16) and aims to deliver Equity-like returns with added downside protection and ESG awareness.

The portfolio trades over 600 independent markets across cash Equities, Futures, Forwards and Options instruments. Instrument exposures are adjusted daily and the program can take short positions in Futures and Forwards.

From an ESG standpoint, the program monitors the ESG scores of all the traded instruments through a combination of third-party data for Equities (Arabesque©) and Welton Derivative ESG Scores™ for Derivatives. Given the different nature of the underlying instruments, the ESG-compliance of the portfolio is managed differently depending on whether Equities or Derivatives are considered: for cash Equities, the ESG scores are used to actively select a tradeable universe while for derivatives, the scores are only used to inform allocations.

We apply the calculation shown in Equation 3 to the Advantage-C realized positions to calculate the normalized score since inception of the program. The result of this calculation is presented in Figure 3.

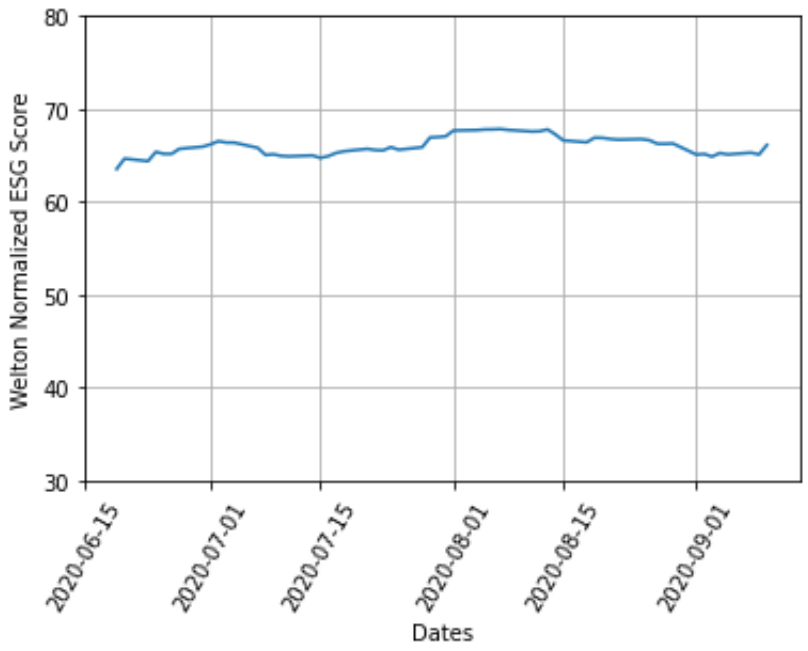

Figure 3: Normalized ESG score for Advantage-C portfolio (2020-06-16/2020-07-29).

As can be seen, the sustainability score of the portfolio oscillates around 65 which suggests a bias towards sustainability (neutral sustainability would yield a score around 50) which is expected given the ESG tilt of the Advantage-C program.

We can extend the above analysis further by calculating normalized scores at more granular levels. As an example, Figure 4 shows the comparison of the normalized ESG score for the Equities portion of the portfolio and compares it to the Derivatives component (Futures, Forward and Options). The results obtained are consistent with Figure 4.1 and suggest that both sub-portfolios similarly contribute to the sustainability of the portfolio.

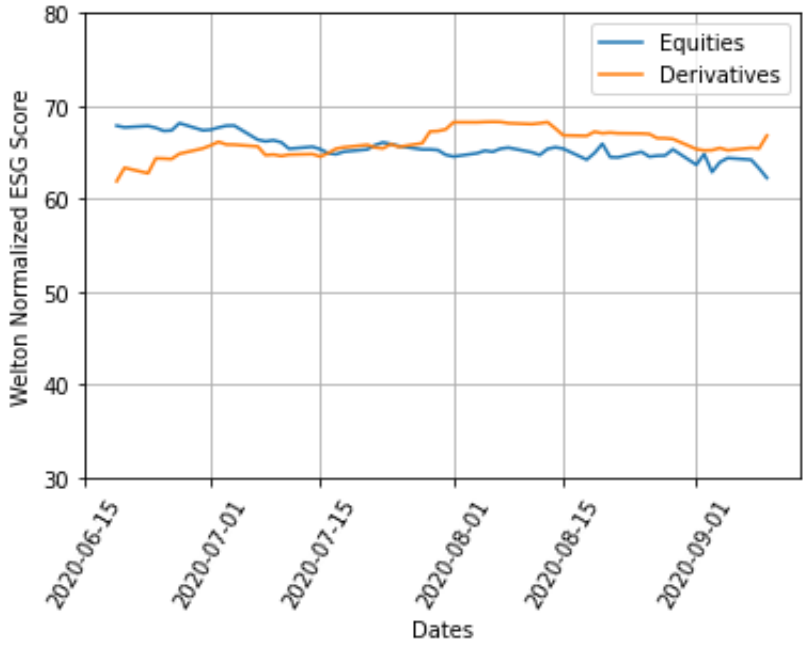

Figure 4: Normalized ESG score for Advantage-C derivatives and equities sub-portfolios (2020-06-16/2020-07-29).

5 Summary

In this paper, we have shown how it is possible to apply sustainability analysis to more complex investments beyond standard passive long-only Equities portfolios. This is made possible through the definition of two new metrics:

- The Excess Sustainability (ES) metric which is used to normalize ESG frameworks issued by different sources
- The Welton Normalized ESG Score™ metric which quantifies the overall sustainability of an investment by taking into account not only the holdings of the portfolio but also the magnitude and direction of individual positions.

The Welton Normalized ESG Score™ can be used to quantify the sustainability of a given portfolio at any point in time using a single metric and should therefore prove useful for the monitoring of ESG behavior across multiple investments.

THE TRADING PROGRAM DESCRIBED HEREIN IS SPECULATIVE, INVOLVES SUBSTANTIAL RISK AND IS NOT SUITABLE FOR ALL INVESTORS. NO REPRESENTATION IS BEING MADE THAT ANY INVESTOR WILL OR IS LIKELY TO ACHIEVE SIMILAR RESULTS. THIS DOCUMENT IS NOT A SOLICITATION FOR INVESTMENT. SUCH INVESTMENT IS ONLY OFFERED ON THE BASIS OF INFORMATION AND REPRESENTATIONS MADE IN THE APPROPRIATE OFFERING DOCUMENTATION.

