Breaking Away: New Data and Models to Improve Investment in Corporate Sustainability

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Abstract

Despite the various weaknesses of self-disclosed highly curated corporate Environmental, Social and Governance (ESG) data, more investment professionals are experimenting with these data. Being resourceful and contrarian is core to effective securities analysis and successful investment. However, non-financial ESG data provides a limited view of corporate sustainability and requires additional analysis to become an essential ingredient to investment decisions. From the perspective of investors, objective, evidence-based metrics that capture fundamental drivers and risks can improve investment decision-making and build a competitive edge. Specifically, we suggest that the mosaic of information used by investors can be substantially expanded by drawing from environmental and public health scientists to construct entirely new models that link corporate activity with impacts on society and the environment. The approach explained here does not rely solely on corporate ESG disclosure to bring unique insight, rigor and depth to securities analysis. It fully embraces the intention behind the "Mosaic Theory" by adopting a multi-disciplinary unconventional approach to investment analysis.

Introduction

Investors are looking for unbiased, complete, unique databases to help them form an opinion about a company, its management, and its prospects – its "intrinsic value". It was already apparent to Benjamin Graham and David Dodd (1934) that you could not build a complete picture of a company's intrinsic value by focusing solely on book value sourced from financial reports. Intangible assets (e.g. patents, R&D, brand value, and more recently ESG factors) are important qualitative factors for investors to consider. Qualitative factors, according to Graham and Dodd, are "exceedingly difficult to deal with intelligently" and hard to subject to "mathematical controls." They require deeper analysis and multidisciplinary approaches, while offering an opportunity for investment teams to build a differentiated view relative to the competition. Being resourceful and contrarian is core to effective securities analysis and successful investment.

According to the Mosaic Theory, the investor should gather many seemingly disparate bits of data to form a unique and compelling view of the company's business model and its prospects, including countercurrents and revenue boosting trends. Success in investing depends on a rich mosaic of data, which includes not only standard financial metrics, but also non-financial ESG metrics, such as those recommended by the Global Reporting Initiative and the Sustainability Accounting Standards Board (GRI, 2017; SASB, 2017). ESG factors are incorporated primarily as a risk-mitigating strategy and can reduce the volatility of portfolio returns (UBS, 2017). The underlying mechanisms can be explained by empirical research showing that companies with good governance, productive "happy" employees and lower environmental fines and penalties can boost financial performance (Bloom & Van Reenen, 2007; Deutsche Bank Group, 2012; Dhaliwal et al., 2012; Friede et al., 2015; Koehler & Hespenheide, 2013; Mercer, 2011). ESG data is being embraced as an enhancement to investment decisions, because it helps round out the mosaic of data and/or to attract a rapidly growing pool of socially conscious investors (Morgan Stanley, 2017; GSIA, 2017).

The challenge and opportunity is the lack of standardized ESG data, a topic of extensive scholarship. Third-party sustainability raters have opportunistically stepped in to help investors compensate for the lack of consistent and comprehensive data disclosed by companies. However, they do not necessarily correct for reporting biases, can introduce their own bias, and are not always transparent (CITI Research, 2018; Bouton et al, 2013). The ratings do not necessarily predict environmental or financial performance (Chatterji et al., 2009; Delmas & Blass, 2010). Consequently, an intrinsic value investor relying primarily on ESG ratings cannot readily determine whether any of the mechanisms mentioned above are in play and plausibly supportive of a forward-looking investment thesis for a company. For this reason many investors are creating their own ESG databases and scoring methodologies, which when combined with financial data and other qualitative data can yield unique insights.

Despite its flaws, ESG data is rapidly becoming another tool for the quant(itative) passive investor to construct a rules-based investment strategy. By the end of 2017 there were 270 sustainable index mutual funds and exchange-traded funds (ETFs) worldwide, amounting to approximately $102 billion in assets under management (AUM). While the majority of sustainability funds ("socially conscious") are actively managed, the fraction of passive strategies increased from 6% five years ago to 12%, out of a total of $970 billion in AUM, according to Morningstar (2018).

This raises the bar for sustainable investors, particularly for active stock pickers. Once data becomes a commodity the analyst and portfolio manager must look elsewhere. Furthermore, ESG data with its focus on downside risk does not enable unique insights into a company's business model – how it makes money and its future prospects. ESG data informs on risk management and process optimization. It does not help investors understand how much de-risking is good enough or *how sustainable* a company is in terms of its financial prospects and the benefits it provides to human health and the environment. This requires additional analysis which we argue should be firmly grounded in sustainability science.

Science-based metrics

Reference points matter to performance evaluation, comparative analysis, and ranking of companies. For example, sustainable investors have started referring to the 2˚ Celsius scenario when evaluating a company's carbon footprint and forward-looking commitments. The Task Force on Climate-Related Financial Disclosures (TCFD) recommended that companies conduct climate change scenario analysis as part of their climate risk disclosure, including the 2˚ Celsius warming scenario (TCFD, 2017). However, as we have noted elsewhere (Vorosmarty et al., 2018), focusing on carbon emissions omits significant additional human health and environmental impacts, such as air pollution and premature mortality, which have thus far been key drivers of regulatory action, most recently in China (Wang et al., 2018).

We propose a more comprehensive definition of corporate sustainability based on actionable science-based metrics that are tied to the UN Sustainable Development Goals (UN SDGs). These metrics link corporate activity with the most recent peer-reviewed findings in public health and environmental science in four critical domains: climate change/air pollution, health, access to clean water, and food security. We focus on the climate change/air pollution category here, which is becoming standard corporate disclosure practice around the world due initially to the annual Carbon Disclosure Project (CDP) survey and more recently the efforts of the TCFD.

Methodology

We used company case studies to develop detailed prototype models to link technologies that reduce greenhouse gas (GHG) emissions and air pollution with positive impacts on human health and the environment, shown in Figure 1.

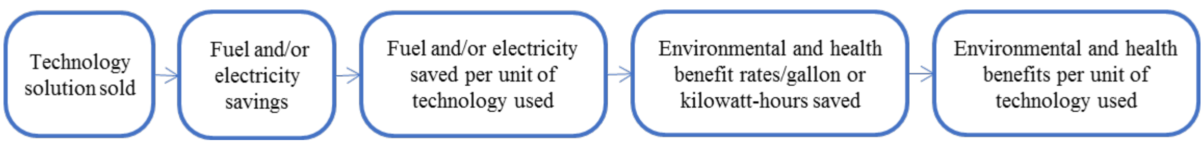

Figure 1: Climate change/air pollution impact measurement model

We sourced global sales data and technical specifications for relevant technologies from company websites, financial reports or specialized consumer reports and journals. Baselines were established for each technology to assess additivity relative to best practice or Business-As-Usual (BAU) technology, yielding both functional and temporal baselines. The selection of consistent baselines is important to avoid double counting when estimating additivity.

- *Functional baseline:* Current most common technological configuration that provides a certain level of service for a given function. Any new technology is compared to this functional baseline. For example, various modes of passenger ground transportation (including electric vehicles) in the United States of America are compared to the gasoline internal combustion engine as the functional baseline representing 63.15% of all highway passenger miles in the USA in 2016 (U.S. DOT, 2017).

- *Temporal baseline:* Performance is compared to a baseline for the technology set at a specific year or time frame. For example, fuel economy for jet airliners has increased by 12% in 2014 compared to 2000 (Kharina and Rutherford, 2015).

We used aggregate installed capacity for renewable energy generation technologies by each company to estimate averted emissions relative to the prevalent fuel mix per region or country. Given data available in corporate reports, financial news, energy reports, and/or revenue reports it was not always possible to assess annual energy generation in Kilowatt hours per company with the preferred level of geographic specificity to determine emissions averted.We estimated environmental benefits (e.g. reduced GHG and air emissions) by assessing the differences in emissions between using a unit of renewable energy and a unit of fossil energy relative to a baseline system/technology. We compiled data from a range of public sources, including worldwide government agencies (e.g. the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the U.S. Energy Information Administration) and life cycle assessment databases, such as EcoInvent 2.2. We treated GHG emissions, measured in tons of CO2 equivalent, as a global pollutant with each additional metric ton emitted contributing equally to global warming.

We estimated health benefits (premature deaths, hospitalizations, and sick days avoided) of reduced pollution based on differences in pollutant concentrations for fine particulate matter (PM2.5), sulfur dioxide (SO_2) and nitrogen oxides (NOx) between reliance on fossil fuel-based energy and use of renewable energy and/or biofuels. We derived estimated reductions in adverse human health impacts at a country level from a comprehensive global study of pollution-related premature mortality on a sectoral basis, including transportation, industry, and electricity generation (Lelieveld et al 2015).

Given that many publicly traded companies have global sales, a key challenge was to establish globally applicable models. We used case study results to estimate average global environmental and human health benefits per dollar of revenue for every technology – termed conversion factors. We evaluated outliers to determine whether the technology was appropriately grouped with like technologies by checking product specifications. Outliers that could not be explained by inappropriate technology identification were eliminated from the estimation and documented for future analysis. We used the resulting average global conversion factors to estimate benefits for all publicly traded companies with identifiable (disclosed) revenues to the analyzed technologies – revenue based estimates. Many companies can have revenues from several technologies, which can be captured by application of relevant conversion factors and then aggregated to assess total social and environmental impacts. In total we modeled 98 publicly traded companies with climate change/air pollution technology solutions. The results can be applied to any broad market index.

We conducted uncertainty and sensitivity analysis for each energy generation technology and the aggregate mean benefits for each company. We used a quality of information score card developed by Weidema & Wesnaes (1996) to identify and characterize uncertainty and create statistical distributions with variation in a Monte Carlo Analysis (Appendix 1).We used log-normal distributions as the standard statistical distribution to avoid negative numbers. The complete list of 35 technologies analyzed is shown in Appendix 2.

Results

While these social and environmental impact models do not rely on ESG data, they do rely on corporate disclosure. The main source of model uncertainty is limited disclosure related to a company's products and services, including geographic distribution of sales. Human health benefits range widely across the globe, from zero premature deaths per 1,000 GWH electricity generated in Norway to 350 premature deaths per 1000 GWH in Southeast Asia. Some companies, notably pure-play companies with a majority of sales in a single technology, tend to report efficiency gains to their customers, usually in the financial report or sustainability report. This reduced the uncertainty of our revenue-based estimates of CO_2e emissions averted. Analysis of 20 companies which disclose efficiency gains of their products shows a good match between the case study results and revenue-based estimates (Figure 2).

Company	Million Metric Tons of CO2eq averted (Case study-based Model)	Million Metric Tons of CO2eq Averted (Revenue-Based System)
Automotive components A	2.07	2.29
Automotive components B	6.81	4.65
Automotive components C	5.2	4.49
Automotive components D	0.88	1.01
Buildings A	0.9	0.65
Buildings B	1.2	0.87
Buildings C	0.52	0.47
Hydropower A	3.03	1.26
Hydropower B	2.1	1.93
Recycling A	6.35	7.04
Recycling B	2.46	3.74
Solar A	5.61	4.6
Solar B	6.23	5.59
Solar C	9.74	9.37
Rail freight transportation	90.61	91.56
Rail freight transportation	78.47	79.01
Rail freight transportation	62.17	62.89
Wind A	6.8	4.58
Wind B	3	2.98
Wind C	12.5	12.48

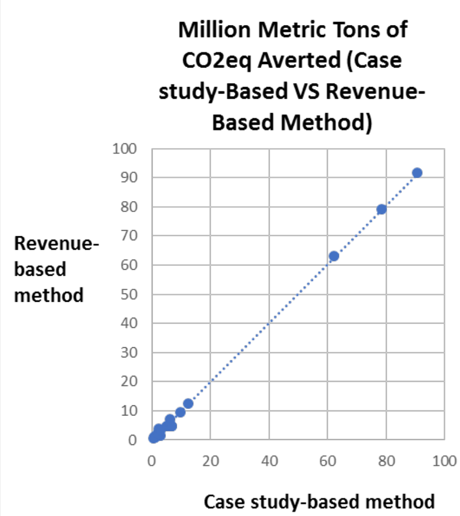

Figure 2. Comparative analysis of 20 companies selling clean energy and energy efficiency technologies with adequate disclosure of efficiency gains

Rail freight transportation companies reduce GHG emissions more than other energy efficiency and clean energy generation technologies. Trains are four times more efficient than trucks, the alternative baseline technology. They save on average 75% of the energy that would otherwise be used if cargo was transported by truck and are a much cheaper transport option (U.S. Department of Transportation, 2013; AAR, 2016). Therefore, GHG reduction per dollar spent on rail transportation is more effective than for truck transportation.

A comparative analysis between estimated GHG emissions averted based on case studies vs. revenue-based estimates for 10 companies that do not report product related efficiency gains shows a greater discrepancy (Figure 3).

Company	Million Metric Tons of CO2eq averted (Case study-based Model)	Million Metric Tons of CO2eq Averted (Revenue-Based System)
Automation A	18.7	5.9
Automation B	2.4	1.6
Automation C	60.71	47.38
Consumer products A	0.39	0.8
Consumer products B	0.2	0.43
Electronic components A	4.16	0.22
Electronic components B	0.2	0.8
Electronic components C	1.61	3.4
Telecommunications A	33	22.82
Telecommunications B	27	15.86

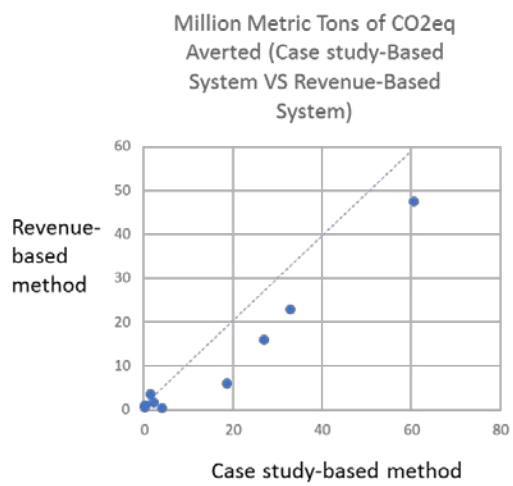

Figure 3. Comparative analysis of 10 companies related to electronics and technology with inadequate disclosure of efficiency gains

In this case, results from automation and telecommunication companies are potentially significant. Our revenue-based estimates are lower than the case study results, a good opportunity to improve the accuracy in the future. Additionally, companies in these sectors could significantly benefit from such research and include this information in their usual sustainability reporting. Anecdotally, our conversations with companies on this methodology are very positive and an inspiration for additional exchange around how to measure the benefits of their technologies.

As a general rule, most companies (even those that report product-related efficiency gains) do not report GHG emissions saved due to use of their products. They, guided by CDP and other reporting standards, focus exclusively on disclosure of operations and supply chain-related GHG emissions. In conclusion, of the 98 companies with identifiable revenues to climate change/air pollution related technologies we analyzed, only a few disclose information on product related GHG emissions. Additionally, none of the companies reported quantitative health benefits derived from air pollution reductions for clean energy generation or energy saved by using their products.

In the aggregate, the positive impact associated with these technologies in an actively managed portfolio can be significant. For a portfolio (with $2 billion in assets under management) that invests in 18 companies with identifiable 2017 global sales of these technologies reduces GHG emissions by an estimated 1,110 million metric tons. This is close to the 1,207 million metric tons of GHG emitted by all US coal-fired power plants in 2017 (US EIA, 2018). Air pollution avoided (175,740 tons PM2.5) reduces mortality equivalent to 38,100 lives. An analysis of the global mortality associated with the excess on-road diesel-related air pollution due to the recent diesel emissions scandal estimated 38,000 premature deaths in 2015 alone (Nature, 2015).

Discussion & implications for corporate sustainability reporting

The real value of a company depends on its utility. Investors use cash flow as a proxy for utility and to predict a company's intrinsic value, its market size, and longevity. However, rising expectations of asset owners that business and finance should serve a social purpose, and notably the opinions of millennials irrevocably signal that the utility function of a company should include a range of stakeholder preferences. ESG metrics, regardless of the imperfections of corporate voluntary disclosure, provide information on operational efficiency and risk management of interest to investors. The link to benefits for society and the environment is implied, but not measured.

Ultimately profits are the best measure of a company's value to consumers and investors. Understanding the social purpose of a business model requires a different measurement framework altogether, as described here. A growing cadre of companies is driven by the desire to demonstrate their social purpose, but lack credible objective evidence-based metrics to do so. If clearly linked to revenue, cash flows, profits, and long term opportunity, the measurement of a company's social and environmental impact is an attempt to assess the long-term utility function of a company that directly influences its ability to attract capital and resources to continue its business. Should companies start disclosing information on their positive impacts, it would enable investors to assemble a rich mosaic of data that incorporates future growth options more aligned with sustainability, and specifically with the vision of sustainability defined by the UN SDGs.

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Appendix 1

Table 2. Pedigree Matrix used to assess the quality of data sources for renewable energy and energy efficiency companies derived from (Pedersen Weidema & Wesnaes 1996)

Level	**1**	**2**	**3**	**4**	**5**	Notes
Reliability	Verified data based on measurements	Verified data based on assumptions OR non-verified data based on measurements	Non-verified data partly based on qualified estimates	Qualified estimate (i.e. by industrial expert) Data derived from theoretical information (stoichiometry, enthalpy, etc.)	Non-qualified estimate	Verified means: published in public environmental reports of companies, official statistics, etc. Unverified means: personal information by letter, fax or e-mail
Completeness	Representative data from all sites relevant for the market considered over an adequate period to even out normal fluctuations	Representative data from > 50 % of the sites relevant for the market considered over an adequate period to even out normal fluctuations	Representative data from only some sites (<<50 %) relevant for the market considered OR > 50 % of site but for shorter periods	Representative data from only one site relevant for the market considered OR some sites but from shorter periods	Representativeness unknown or data from a small number of sites AND from shorter periods	Length of adequate periods depends on process/ technology
Temporal Correlation	Less than 3 years of difference to our reference year	Less than 6 years of difference to our reference year	Less than 10 years of difference to our reference year	Less than 15 years of difference to our reference	Age of data unknown or more than 15 years of difference	Score for processes with investment cycles of less than 10 years; for other cases, scoring

				year	to our reference year	adjustments can be made accordingly
Geographical Correlation	Data from area under study	Average data from larger area in which the area under study is included	Data from smaller area than area under study, or from environmentally similar areas		Data from unknown OR distinctly different area (Europe instead than South America, etc.)	Similarity expressed in terms of environmental legislation. Suggestion for grouping: - North America, Australia; - European Union, Japan, South Africa; -South America, North and Central Africa and Middle East; Russia, China, Far East Asia
Technological Correlation	Data from Enterprises, processes and materials under study (i.e. identical technology)		Data on related processes or materials but same technology, OR Data from processes and materials under study but from different	Data on related processes of materials but different technology, OR data on laboratory scale processes and the same technolog	Data on related processes or materials but on laboratory scale of different technology	Examples of different technology: - steam turbine instead of motor propulsion in ships - Emission factor B(a)P for diesel train based on lorry motor data - Data for tiles instead of

			technology	y		bricks production - Data of refinery infrastructure for chemical plants infrastructure
Sample Size	>100, continuous measurement, balance of purchased products	>20	>10, aggregated figure in environmental report	≥ 3	Unknown	Sample size behind a figure reported in the information source

Appendix 2.
List of technologies related to clean energy, energy efficiency

Appliances
Architectural doors and windows
Architectural glass
Automotive components
Automotive plastics
Automotive powertrains
Bicycles
Biodiesel fuel
Bus passenger transportation
Catalytic converter
Electricity metering- Advanced (“smart meters”)
Ethanol fuel
Fuel saved by advanced electricity metering
Household insulation
Heating, Ventilation and Air Conditioning (HVAC)- Energy Management in Buildings
Hybrid batteries
Hydropower generation
Industrial automation
Industrial gases (enabler of heating, ventilation and air conditioning systems)
Inventory management systems- electronic
Lighting systems
Municipal Solid Waste (MSW) to energy
Radio Frequency Identification Systems (RFIDs) tracking systems
Rail freight
Rail passenger transportation
Rail transportation infrastructure
Recycled oil and paint
Recycling of municipal solid waste
Remanufacturing
Smart grid energy management systems
Solar power generation (photovoltaic with silicon-based panels)
Teleconferencing technologies
Tile carpets
Train components manufacturing
Wind power generation

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