Yale

An ESG Performance Metric Based on Text Analysis

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Introduction

Sustainability and social responsibility are becoming increasingly important concerns for investors. While the industry has no consensus on how to define sustainable and socially-responsible investments, they generally fall under three categories: environmental, social, and governance (ESG). Important environmental concerns include greenhouse gas emissions, carbon footprint, and pollution. Social concerns include health and safety, workers' rights, and, for software companies, data security. Governance concerns include CEO pay and corruption.

This project consists of a natural language processing approach to measuring ESG performance using annual corporate 10K reports filed with the SEC. It compares 10Ks to standards for reporting on sustainable business practices. It calculates positive and negative ESG scores for each (10K, reporting standard) pair.

Materials and Methods

The Global Reporting Initiative publishes a set of reporting standards that describe how organizations should report their impact in areas related to sustainable investing, such as the economy, the environment, and society. The SEC makes annual 10K filings available online in text format through the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system. I used these 10K reports and the 2018 GRI Reporting Standards as input to the ESG scoring system.

The program uses a TF-IDF vectorizer model to extract feature vectors for calculating document similarity. It splits the 10K into sentences, extracts feature vectors, and calculates the similarity between the sentences and the GRI reporting standards. It then performs sentiment analysis on the similar sentences to determine how frequently the 10K speaks positively and negatively about the topics covered in each reporting standard.

<table>
<tr><th>Company name</th><th>TESLA MOTORS INC</th><th>FIRSTENERGY CORP</th><th>TEXTRON INC</th></tr>
<tr><th>Description</th><th>Renewable Energy</th><th>Production of coal or coal-based energy</th><th>Production of cluster munitions</th></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>GRI 102: GENERAL DISCLOSURES</td><td>3.222 | 0.222</td><td>2.889 | 0.222</td><td>2.786 | 0.143</td></tr>
<tr><td>GRI 407: FREEDOM OF ASSOCIATION</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 417: MARKETING AND LABELING</td><td>0.0 | 2.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 103: MANAGEMENT APPROACH</td><td>1.5 | 0.0</td><td>0.5 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 302: ENERGY</td><td>0.6 | 0.067</td><td>1.021 | 0.24</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 409: FORCED OR COMPULSORY LABOR</td><td>0.0 | 0.0</td><td>1.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 301: MATERIALS</td><td>1.5 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 204: PROCUREMENT PRACTICES</td><td>0.0 | 0.5</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 419: SOCIOECONOMIC COMPLIANCE</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 412: HUMAN RIGHTS ASSESSMENT</td><td>0.0 | 1.0</td><td>0.75 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 201: ECONOMIC PERFORMANCE</td><td>3.286 | 0.0</td><td>3.071 | 0.0</td><td>3.0 | 0.0</td></tr>
<tr><td>GRI 401: EMPLOYMENT</td><td>1.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI STANDARDS GLOSSARY</td><td>0.5 | 0.0</td><td>0.342 | 0.132</td><td>0.194 | 0.0</td></tr>
<tr><td>GRI 203: INDIRECT ECONOMIC IMPACTS</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 406: NON¬≠- DISCRIMINATION</td><td>0.0 | 0.0</td><td>1.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 206: ANTI - COMPETITIVE BEHAVIOR</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 403: OCCUPATIONAL HEALTH</td><td>0.0 | 0.5</td><td>1.143 | 0.286</td><td>1.0 | 2.0</td></tr>
<tr><td>GRI 404: TRAINING AND EDUCATION</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 306: EFFLUENTS AND WASTE</td><td>0.0 | 0.0</td><td>0.0 | 1.8</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 418: CUSTOMER PRIVACY</td><td>3.0 | 1.5</td><td>1.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 415: PUBLIC POLICY</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 205: ANTI - CORRUPTION</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 101: FOUNDATION</td><td>2.714 | 0.571</td><td>2.769 | 0.615</td><td>2.5 | 0.5</td></tr>
<tr><td>GRI 411: RIGHTS OF INDIGENOUS PEOPLES</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 307: ENVIRONMENTAL COMPLIANCE</td><td>0.0 | 0.0</td><td>3.0 | 0.0</td><td>1.0 | 0.5</td></tr>
<tr><td>GRI 305: EMISSIONS</td><td>0.4 | 0.2</td><td>0.703 | 0.311</td><td>0.0 | 1.0</td></tr>
<tr><td>GRI 408: CHILD LABOR</td><td>0.0 | 0.0</td><td>1.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 308: SUPPLIER ENVIRONMENTAL</td><td>0.0 | 0.0</td><td>0.75 | 0.5</td><td>1.25 | 0.75</td></tr>
<tr><td>GRI 402: LABOR/MANAGEMENT</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 405: DIVERSITY AND EQUAL</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 304: BIODIVERSITY</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 413: LOCAL COMMUNITIES</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 202: MARKET PRESENCE</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 410: SECURITY PRACTICES</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 416: CUSTOMER HEALTH AND SAFETY</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 414: SUPPLIER SOCIAL ASSESSMENT</td><td>1.0 | 0.0</td><td>0.0 | 0.0</td><td>0.0 | 0.0</td></tr>
<tr><td>GRI 303: WATER AND EFFLUENTS</td><td>0.0 | 0.0</td><td>0.303 | 0.424</td><td>0.0 | 0.0</td></tr>
</table>

Figure 1. Positive and Negative ESG scores for 10Ks from 2017.

Disclosure 303-1

Interactions with water as a shared resource

Reporting requirements

Disclosure 303-1

The reporting organization shall report the following information:

a. A description of how the organization interacts with water, including how and where water is withdrawn, consumed, and discharged, and the water-related impacts caused or contributed to, or directly linked to the organization's activities, products or services by a business relationship (e.g., impacts caused by runoff).

b. A description of the approach used to identify water-related impacts, including the scope of assessments, their timeframe, and any tools or methodologies used.

c. A description of how water-related impacts are addressed, including how the organization works with stakeholders to steward water as a shared resource, and how it engages with suppliers or customers with significant water-related impacts.

d. An explanation of the process for setting any water-related goals and targets that are part of the organization's management approach, and how they relate to public policy and the local context of each area with water stress.

Reporting recommendations

1.2 The reporting organization should report the following additional information:

1.2.1 An overview of water use across the organization's value chain;

1.2.2 A list of specific catchments where the organization causes significant water-related impacts.

Figure 2. Text from the GRI reporting standard on water and effluents..

Results

Textron, the munitions manufacturer, scored twice as high on positive occupational health as on negative occupational health. In the case of Tesla, its positive energy score was nine times as large as its negative energy score. Similarly, Tesla's positive emissions score was twice as large as its negative counterpart. For both of these companies, the positive and negative ESG scores in relevant areas track the company's expected performance.

However, the energy and emissions scores for FirstEnergy Corp., the coal company, complicate the proposition that we can simply compare a company's positive and negative scores to each other to estimate its ESG performance. A comparison of positive scores to negative would indicate that FirstEnergy performs well in energy and emissions, the opposite of what I expected from a blacklisted coal company.

As an alternative, I calculated the ratio between FirstEnergy's scores and Tesla's. While FirstEnergy scores higher than Tesla for positive energy, it scores comparatively higher for negative energy. This is as expected.

Conclusion

The combination of TFIDF similarity and basic sentiment analysis produced a model for roughly capturing a firm's ESG performance. More work is needed to refine the design, specifically in synthesizing the data produced by the text-analysis model into a useful metric. Potential developments include using more sentiment categories than just "positive" and "negative", incorporating semantic analysis into the sentiment scorer, and compiling a set of baseline companies against which to compare scores in each category.

Acknowledgement

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