

Aggregate Confusion: The Divergence of ESG Ratings

Florian Berg, Julian F. Koelbel, Roberto Rigobon

FEEN Webinar Series,
October 7th, 2020

Outline

1 Problem

2 Methodology

- Measurement, Scope, and Weights
- Implementation

3 Empirical

- Data
- Discrepancy
- Taxonomy
- Estimation
- Decomposition
- Rater Effect

4 Summary

Outline

1 Problem

2 Methodology

- Measurement, Scope, and Weights
- Implementation

3 Empirical

- Data
- Discrepancy
- Taxonomy
- Estimation
- Decomposition
- Rater Effect

4 Summary

Influence of ESG Ratings

ESG¹ Rating Agencies are becoming influential institutions

- Investors with USD 80 trillions "integrate" ESG information
- Big players are buying ESG rating agencies
- Regulatory endorsement of ESG ratings possible

¹ESG = Environmental, Social, Governance. A.k.a. Sustainability Ratings or Corporate Social Responsibility (CSR) Ratings

Correlations

	Asset4	RobecoSAM	Sustainalytics	Vigeo-Eiris	MSCI	KLD
Asset4	100%	62%	67%	69%	38%	42%
RobecoSAM	62%	100%	67%	70%	38%	44%
Sustainalytics	67%	67%	100%	71%	46%	53%
Vigeo-Eiris	69%	70%	71%	100%	42%	49%
MSCI	38%	38%	46%	42%	100%	53%
KLD	42%	44%	53%	49%	53%	100%

- Investors: Which companies are "good"? Pricing implications?
- Companies: What is expected of us?
- Academics: How to work with ESG ratings empirically?

Essential Elements of ESG Ratings

- Scope: which attributes are included?
- Measurement: how are these attributes measured?
- Weights: how are indicators aggregated into one score?

Why Sustainability Ratings diverge?

- Three sources of divergence.
 - *Scope divergence:*
Ratings agencies rely on a different set of attributes.
 - *Weights divergence:*
Rating agencies take different views on the relative importance of attributes.
 - *Measurement divergence:*
Rating agencies measure the same attribute using different indicators.
- Results on Divergence
 - Measurement explains 53% of the variation
 - Scope 44% and Weights 3%
- Factors behind the measurement disagreement?
 - Rater Effect accounts for one fifth of the variation

Outline

1 Problem

2 Methodology

- Measurement, Scope, and Weights
- Implementation

3 Empirical

- Data
- Discrepancy
- Taxonomy
- Estimation
- Decomposition
- Rater Effect

4 Summary

A_n

⋮

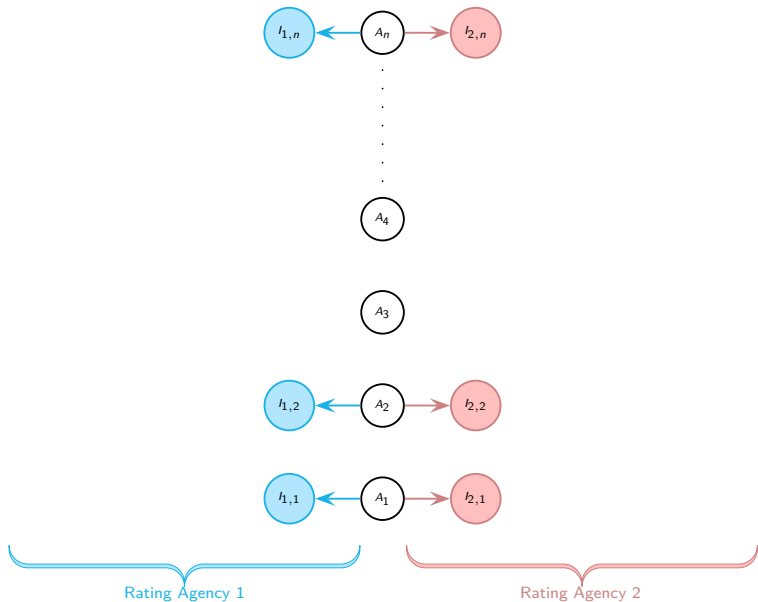
A_4

A_3

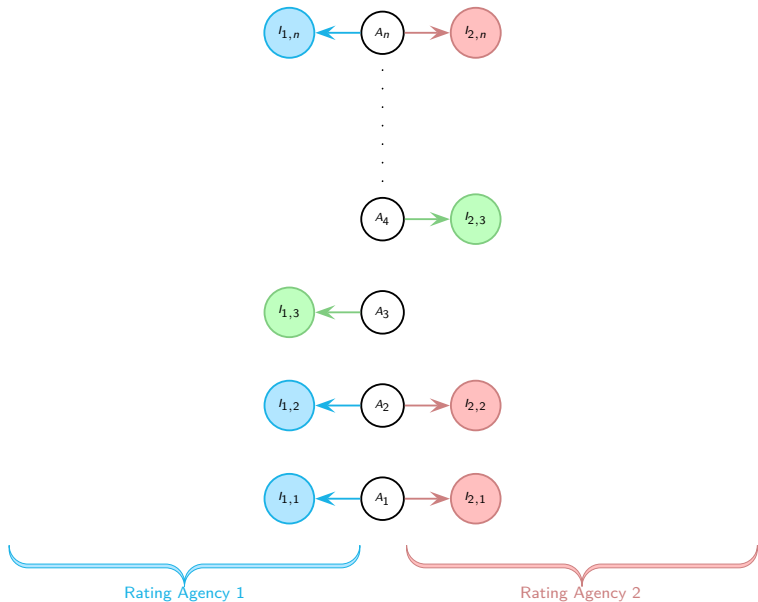
A_2

A_1

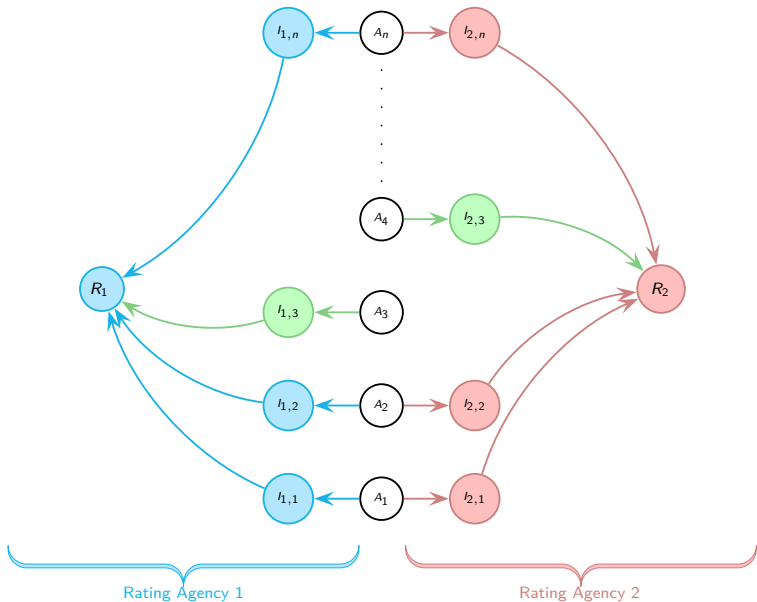
Measurement Disagreement



Scope Disagreement



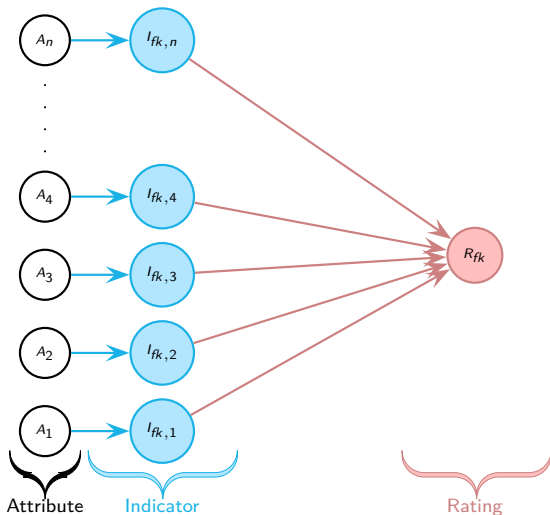
Weights Disagreement



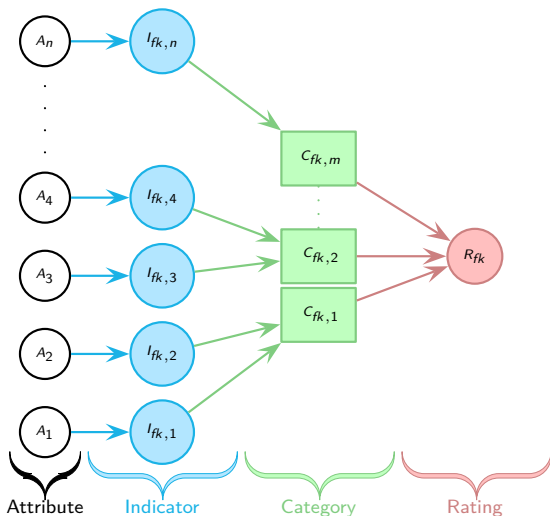
Comparing raw data

- Practically Impossible to find two rating agencies that measure the exact same attribute for the same firm (Only a dozen pairs).
- We need to match “raw data” otherwise *Scope* discrepancies would explain all the divergence. We created a Taxonomy for comparison purposes.

Decomposition of Discrepancies: Without Categories



Decomposition of Discrepancies: With Categories



Outline

1 Problem

2 Methodology

- Measurement, Scope, and Weights
- Implementation

3 Empirical

- Data
- Discrepancy
- Taxonomy
- Estimation
- Decomposition
- Rater Effect

4 Summary

Data

Rating Agency	Abbrv.	Owner	Indicators
KLD	KL	MSCI	78
Sustainalytics	SA	Morningstar	163
Vigeo Eiris	VI	Moody's	38
RobecoSAM	RS	S&P Global	80
Asset4	A4	Refinitiv	282
MSCI	MS	MSCI	68

- ESG and indicator level data
- Baseline year 2014 (robustness check 2017)
- 924 common firms between raters

Mean Absolute Deviation from the Median

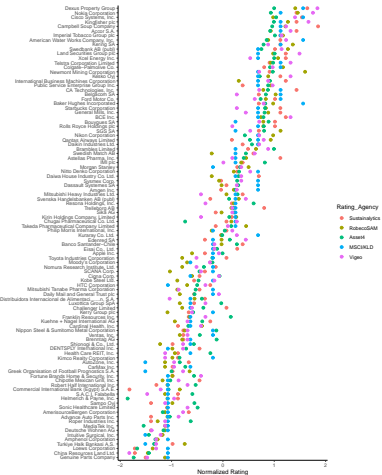
- Problem with Correlations
 - Correlations at rating agency level hides firm heterogeneity
Is the low correlation due to a small set of firms?
- Median Absolute Deviation

For each firm compute

$$MAD_f = \sum_k |R_{fk} - \text{median}(R_{f.})|$$

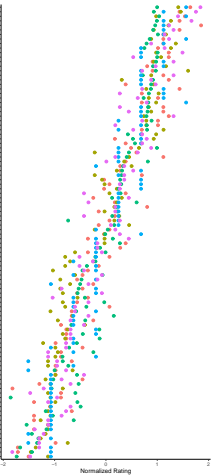
where R_{fk} is the score of firm f and rating agency k .
Group the top 100 and bottom 100 firms as measured by their mean median absolute deviations.

Comparison of firms' normalized scores.



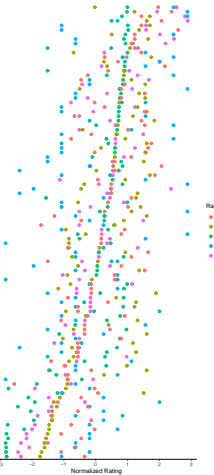
Comparison of firms' normalized scores.

Devas Property Group
 Nanyang Commercial
 Citic Systems, Inc.
 Kinglonger plc
 Campbell Soup Company
 Imperial Tobacco Group S.A.
 American Water Works Company, Inc.
 Land Securities Group plc
 Kell Energy Inc.
 Taseco Corporation Limited
 Colgate-Palmolive Co.
 Newmont Mining Corporation
 International Business Machines Corporation
 Public Service Enterprise Group Inc.
 CA Technologies, Inc.
 Ford Motor Co.
 Baker Hughes International
 Standard Oil Corporation
 Genentech, Inc.
 JSC JSC
 RSC Inc.
 Rube Royce Holdings SA
 SOCS SA
 Nissan Corporation
 Odebrecht American Ltd
 Standard Life plc
 Swedish Lend Lease
 Swedish Match AB
 Amul Milk Processing, Inc.
 Morgan Stanley
 Nissin Densetsu Corporation
 Daihatsu Industry Co., Ltd.
 Sanyo Co., Ltd.
 Denso International
 Mitsubishi Heavy Industries, Ltd.
 Svenska Handelsbanken AB (publ)
 Heineken Holdings, Inc.
 Terex Inc.
 Koyo Holdings Corporation
 Chugai Pharmaceutical Co., Ltd.
 Takeda Pharmaceutical Company Limited
 Wharfedale Water Services, Inc.
 Kinross Co. Ltd.
 Edwards Inc.
 Banco Santander-Chile
 Enagsa S.A.
 Toyota Industries Corporation
 Massey Ferguson Ltd.
 Natures Research Institute, Ltd.
 JCB Plant Hire
 Kato Steel Co.
 ITC Corporation
 Mitsubishi Tanabe Pharma Corporation
 Delta Mail and General Paper plc
 Distribuidora Internacional de Alimentos
 Lantana Group SCA
 Chrysler Financial
 Berry Group plc
 Fagron International plc
 Cephalon Health, Inc.
 Nippon Steel & Sumitomo Metal Corporation
 Hantec, Inc.
 Shenyang, Inc.
 DENTSPLY International Co., Ltd.
 Health Care REIT, Inc.
 Kinco Realty Corporation
 Natuzzi, Inc.
 Greek Organization of Football Producers S.A.
 Fortune-Bright Water & Power, Inc.
 Cigarette Manufacturer S.A.
 Robert Half International plc
 Commercial International Real Estate Group S.A.C.I. (Canada)
 Harsco Corporation
 Sotac Health Services Co.
 Ameresco International Corporation
 Adiplex Auto Parts Inc.
 Ripco Industries Inc.
 Media Tenor Inc.
 Deutsche Wohnen AG
 Amphenol Corporation
 Tachyon-Vest Systems S.A.S.
 Lorent Corporation
 China Resources Land Ltd.
 Genzyme Paris Company



Rating_Agency
 ● Sunametrics
 ● RubicoSAM
 ● Asset4
 ● MSCIKLD
 ● Vigeo

L'Oreal SA
 STMicroelectronics NV
 BT Group plc
 Herbalife Ltd. & Co. (Korea)
 KFC
 Intel Corporation
 GlaxoSmithKline plc
 China
 Applied Materials, Inc.
 Baidu, Inc.
 Veeva Systems, Inc.
 Autodesk
 Northrup Grumman Corporation
 QYTOO GROUP INC.
 Verizon Communications Inc.
 Intel Corporation
 Canon
 Canadian National Railway Company
 Microsoft & Windows
 H&M
 LG Chemical, Ltd.
 Amkor Technology, Inc.
 H. & M. Hermann & Wenzel AG (publ)
 Royal DSM
 Nippon Telegraph and Telephone Corporation
 CSCEC S.A. de C.V.
 The Royal Bank of Scotland Group plc
 Power Assets Holdings Limited
 Leasing Corporation
 Advanced Micro Devices, Inc.
 American Electric Power, Inc.
 LG Electronics Inc.
 Hitech Chemical Co., Ltd.
 Oracle Corporation
 QMS Inc.
 Samsung Electronics Co., Ltd.
 Minerva Technologies AG
 Autodesk Research Co., Ltd.
 Fortinet Co., Ltd.
 Ruckus Networks, Inc.
 CTIC Financial Holdings Co., Ltd.
 Alkermis Ltd.
 John Deere
 Comcast Corporation
 Microsoft Corporation
 Fortinet Co., Ltd.
 Jasper Networks, Inc.
 VMware, Inc.
 Pfizer Inc.
 Sun Life of Canada
 FUJIFILM Holdings Corporation
 Lantini & Gatti Lombardi
 SCS Inc.
 Lan Research Corporation
 Hyundai Engineering & Construction Co., Ltd.
 Linx Real Estate Group
 Air Products and Chemicals, Inc.
 Google Inc.
 The Goodwin Thig & Phipps Corporation
 Delta Pacific Limited
 Dr. Reddy's Laboratories Ltd.
 Invesco Management Asia S.A.
 Aseprite Digital Corporation
 Sempra Energy Holdings Co., Ltd.
 Harsco Corporation
 STAG Corporation
 Golden Age Resources Ltd.
 Bogenstrom, S.P.A.
 Sunbeam Medical Group plc, Inc.
 Kiron Foods, Inc.
 Transcendental
 Grupo de Inversiones Sarmiento S.A.
 New Japan Wireless Company
 Praxair, Inc.
 Alkermis Ltd.
 Harsco Corporation
 PCCO Property and Casualty Co., Ltd.
 Kogen Corporation
 Tottoli S.p.A. Co., Ltd.
 Mitsui O.S. Lines Ltd.
 Pirelli Corporation
 Datsy Electric Railway Co., Ltd.
 Cheng Shin Rubber Industry Co., Ltd.
 TOTO Co. Ltd.



Rating_Agency
 ● Sunametrics
 ● RubicoSAM
 ● Asset4
 ● MSCIKLD
 ● Vigeo

Mean Median Absolute Deviations

- Very large heterogeneity at the firm level
- For the strong agreement set (100 smallest MAD's) correlation of measures across rating agencies is 90%
- For the low agreement set (100 smallest MAD's) correlation of measures across rating agencies is 32%

Comparing Rankings

- Financial Institutions care more about ranking than scores.
i.e. Scores might be uncorrelated, but rankings might be tightly related.
- Common firms among the top and bottom 20 percent (164 firms)

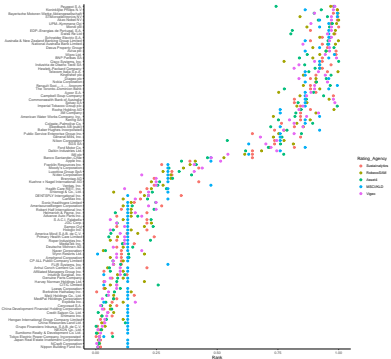
Common among Top quantile

Akzo Nobel NV
 Australia & New Zealand Banking Group Limited
 Aviva plc
 BMW AG
 BNP Paribas SA
 Campbell Soup Company
 Commonwealth Bank of Australia
 Dexus Property Group
 Diageo plc
 EDP-Energias de Portugal, S.A.
 Hewlett-Packard Company
 Imperial Tobacco Group plc
 Industria de Diseño Textil SA
 Kingfisher plc
 Koninklijke Philips N.V.
 Mondi plc
 National Australia Bank Limited
 Nokia Corporation
 Renault SA
 Schneider Electric S.A.
 Solvay SA
 STMicroelectronics NV
 Swiss Re Ltd
 Telecom Italia S.p.A.
 UPM-Kymmene Oyj
 Wipro Ltd.

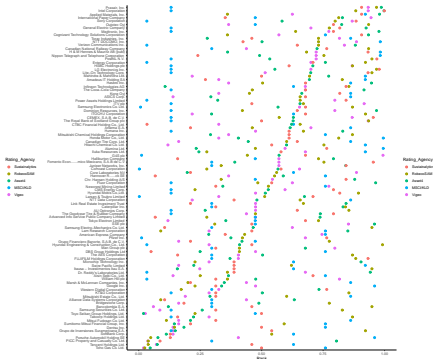
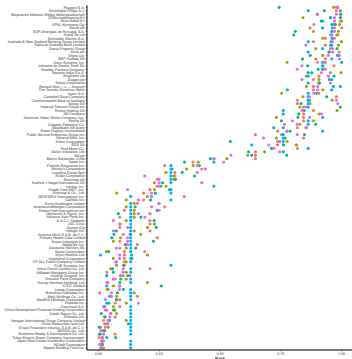
Common among Bottom quantile

Advance Auto Parts Inc.
 Affiliated Managers Group Inc.
 America Movil S.A.B. de C.V.
 Amphenol Corporation
 Berkshire Hathaway Inc.
 Cencosud S.A.
 China Development Financial Holding Corporation
 China Resources Land Ltd.
 CP ALL Public Company Limited
 Credit Saison Co. Ltd.
 Deutsche Wohnen AG
 Expedia Inc.
 Genuine Parts Company
 Grupo Financiero Inbursa, S.A.B. de C.V.
 Hengan International Group Company Limited
 Intuitive Surgical, Inc.
 Japan Real Estate Investment Corporation
 Loews Corporation
 MediaTek Inc.
 MedPal Holdings Corporation
 Meiji Holdings Co., Ltd.
 Naver Corporation
 NCSoft Corporation
 NEXON Co. Ltd.
 Nippon Building Fund Inc.
 Shimano Inc.
 Sumitomo Realty & Development Co. Ltd.
 Tokyo Electric Power Company, Incorporated

Comparison of firms' ranks.



Comparison of firms' ranks.



Taxonomy

- Bottom-up taxonomy, resulting in 64 distinct criteria
- Two rules:
 - Indicators can only be part of ONE category
 - At least TWO matching indicators from different raters to establish a new category
- Example for the category "Water"

Rater	Indicator	Category
Asset4	A4: 4.E.Emission Reduction/Discharge into Water System	Water
Asset4	A4: 4.E.Resource Reduction/Water Use	Water
Asset4	A4: 4.E.Resource Reduction/Water Recycling	Water
KLD	KL: 3.ENV.CON.Water Management	Water
KLD	KL: 3.ENV.STR.Water Stress	Water
RobecoSAM	RS: 3.E.Water Operations	Water
RobecoSAM	RS: 3.E.Water Related Risks	Water
Sustainalytics	SA: 3.E.1.2.7 Water Intensity-Raw Score	Water
Sustainalytics	SA: 3.E.1.3.4 Water Management Programmes-Raw Score	Water
Vigeo	VI: 4.E.ENV2.1 Water	Water
MSCI	MS: 5.Water Stress Mgmt	Water

Category Scores

	KL SA	KL VI	KL RS	KL A4	KL MS	SA VI	SA RS	SA A4	SA MS	VI RS	VI A4	VI MS	RS A4	RS MS	A4 MS	Average
Access to Basic Services	0.08			0.13	0.85			0.49	0.15						0.16	0.31
Access to Healthcare	0.66		0.57	0.49	0.85		0.67	0.56	0.74				0.44	0.71	0.7	0.64
Anti-Competitive Practices		-0.06		0.56	0.76						0	-0.05			0.56	0.30
Audit						0.57		0.66				0.62				0.62
Biodiversity		0.06	-0.08	0.06	0.66					0.61	0.41	0.47	0.47	0.01	0.2	0.29
Board						0.37		0.58			0.51					0.49
Board Diversity								0.8								0.80
Business Ethics	0.04		-0.11	0.4	0.6		0.33	0.03	0.01				-0.1	-0.15	0.38	0.14
Chairman Ceo Separation								0.59								0.59
Child Labor				0.49												0.49
Climate Risk Mgmt.			0.44	0.42	0.8								0.54	0.54	0.5	0.54
Clinical Trials								0.73								0.73
Collective Bargaining						0.59		-0.04			0					0.18
Community and Society	-0.15	0.25	0.2	0.11		-0.1	-0.19	-0.13		0.51	0.5		0.56			0.16
Customer Relationship	0.38	-0.08	-0.09	0		-0.04	-0.13	-0.05		0.49	0.47		0.41			0.14
Diversity	-0.06	-0.02		0.03		0.61		0.52			0.56					0.27
Employee Development	0.22	0.29	0.37	0.37	0.73	0.23	0.19	0.36	0.34	0.39	0.29	0.31	0.55	0.45	0.51	0.37
Environmental Policy						0.52	0.46	0.46		0.63	0.61		0.62			0.55
Environmental Reporting							0.52	0.25					0.36			0.38
GHG Emissions	0	-0.03		-0.06		0.28		0.31			0.5					0.17
GHG Policies							0.48	0.62					0.41			0.50
GMOs							0.38	0.43					0.25			0.35
Global Compact Member								0.92								0.92
Green Buildings	0.54		0.59	0.21	0.83		0.25	0.26	0.55				-0.02	0.66	0.28	0.42
Green Products	0.23	0.07	0.27	0.34	0.76	0.1	0.37	0.47	0.32	0.31	0.29	-0.05	0.53	0.44	0.53	0.33
Health and Safety	0.01	0.27	0.27	0.35	0.73	-0.1	-0.16	-0.16	-0.05	0.63	0.67	0.5	0.57	0.44	0.6	0.30
Human Rights	0	0.19		0.08		-0.01					0.42					0.10
Indigenous Rights	0.26			-0.11				-0.46								-0.10
Labor Practices	0.21	-0.04	-0.14	0.07	0.1	0.2	0.14	0.32	0.27	0.54	0.45	0.43	0.35	0.34	0.37	0.24
Lobbying						-0.28										-0.28
Product Safety	-0.05	0.06	0.16	0	0.63	-0.14		-0.03	0.07	0.46	0.21	0.11	0.38	-0.03	0.1	0.14
Responsible Marketing	-0.5	-0.06	-0.38	0.24		0.38	0.68	0		0.49	0.05		-0.1			0.08
Waste		0.34		0.23							0.33					0.30
Water	0.36	0.36	0.23	0.23	0.67	0.47	0.29	0.31	0.45	0.48	0.32	0.5	-0.02	0.24	0.44	0.36
Average	0.20	0.12	0.20	0.21	0.69	0.29	0.32	0.33	0.37	0.48	0.38	0.34	0.35	0.37	0.38	

Aggregation Rules

	Sustainalytics	RobecoSAM	Asset4	Vigeo-Eiris	MSCI	KLD
Access to Basic Services	0.019	-	0	-	0.138***	0.065***
Access to Healthcare	0.051***	0.004	0	-	0.079***	0.051***
Animal Welfare	0.05***	-	0	-	-	-
Anti-Competitive Practices	-	-	0.05***	0.023***	0	0.131***
Audit	0	-	0.026*	0.084***	-	-
Biodiversity	0	0	0	0.028***	0.366***	0.076***
Board	0.072***	-	0.196***	0.113***	0	-
Board Diversity	0.043***	-	0	-	-	0
Business Ethics	0.097***	0.046***	0.008	-	0	0.148***
Chairman Ceo Separation	0.039***	-	0.016	-	-	-
Child Labor	-	-	0.008	0	-	0.046***
Climate Risk Mgmt.	-	0.137***	0.064***	-	0.069**	0.234***
Clinical Trials	0	-	0	-	-	-
Collective Bargaining	0.051***	-	0.011*	0.072***	-	-
Community and Society	0.079***	0.086***	0.03*	0.001	-	0.14***
Corporate Governance	-	0.048***	-	-	0.198***	-
Corruption	0.049***	-	0.022*	0.072***	0.388***	0.124***
Customer Relationship	0.127***	0.097***	0.086***	0.027***	-	0.104***
Diversity	0.108***	-	0.066***	0.159***	-	0.04***
ESG incentives	0.006	0	-	-	-	-
Electromagnetic Fields	0.021**	0	-	-	-	-
Employee Development	0.018*	0.221***	0.116***	0.067***	0.406***	0.149***
Employee Turnover	0.024*	-	0	-	-	-
Energy	0.032**	0.016***	0.029**	0.103***	0.194***	0.046***
Environmental Fines	0	-	0	-	-	0
Environmental Mgmt. System	0.199***	-	0.009	-	-	0.205***
Environmental Policy	0.091***	0.098***	0.012	0.187***	-	-
Environmental Reporting	0.043**	0.039***	0.007	-	-	-
Financial Inclusion	0	-	-	-	0.089***	0.061***
Forests	0.008	0.016*	-	-	-	-
GHG Emissions	0.048***	-	0.002	0.033***	-	0.021**
...
Waste	0	0.005	0.035***	0.009	-	0.186***
Water	0.03**	0.016***	0.028**	0	0.035	0.175***
Unclassified Indicators	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.90	0.98	0.92	0.96	0.79	0.99
Firms	924	924	924	924	924	924

Results of Estimation: Including Robustness

R^2 from each specification

	OLS (signs)	Random Forest	Neural Network	SASB (Categorization)
Asset4	0.92	0.98	0.96	0.92
MSCI/KLD	0.99	0.93	0.98	0.98
RobecoSAM	0.98	0.99	0.99	0.98
Sustainalytics	0.90	0.95	0.93	0.90
Vigeo-Eiris	0.96	0.98	0.98	0.96

Arithmetic Decomposition: Decomposition

The arithmetic decomposition is an exact decomposition:

$$\begin{aligned}
 \Delta_{a,b} &= \Delta_{meas} + \Delta_{weights} + \Delta_{scope} \\
 &= \left(C_{ajcom} - C_{bjcom} \right) \times \hat{w}^* + \hat{R}_{a,com} - \hat{R}_{b,com} - \left(C_{ajcom} - C_{bjcom} \right) \times \hat{w}^* + \hat{R}_{a,ex} - \hat{R}_{b,ex} \\
 &= \hat{R}_{a,com} + \hat{R}_{a,ex} - \hat{R}_{b,com} - \hat{R}_{b,ex} \\
 &= \hat{R}_a - \hat{R}_b
 \end{aligned}$$

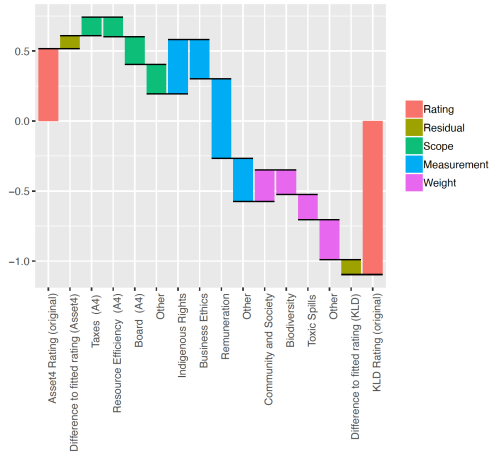
Arithmetic Decomposition: Results

Mean Absolute Deviations (over 924 firms)

	Scope	Measurement	Weights	Fitted	True
KLD	0.43	0.60	0.37	0.76	0.80
Sustainalytics	0.41	0.53	0.31	0.63	0.69
Vigeo	0.44	0.51	0.25	0.66	0.70
RobecoSAM	0.40	0.54	0.26	0.69	0.73
Asset4	0.39	0.53	0.33	0.66	0.75
MSCI	0.84	0.55	0.52	0.78	0.84
Average	0.48	0.54	0.34	0.69	0.75

- Measurement is the most important source of divergence
- MSCI has a pronounced scope divergence

Barrick Gold Corp.: Asset4 vs. KLD

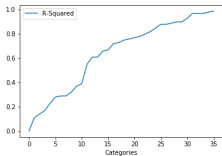


Rater Effect: Fixed Effect Results

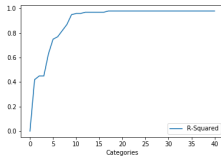
Dummies	R^2
Firm	0.22
Firm + Firm-Rater	0.38
Firm + Firm-Category	0.47
Firm + Firm-Category + Firm-Rater	0.62

Rater effect adds between **14** and **16** percent!

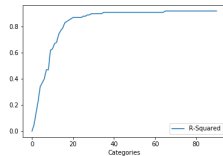
Rater Effect: LASSO



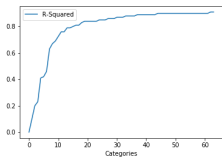
(a) KLD



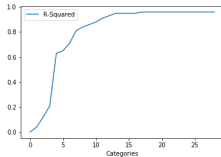
(b) RobecoSAM



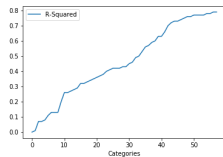
(c) Asset4



(d) Sustainalytics



(e) Vigeo-Eiris



(f) MSCI

Robustness Checks

- Alternative taxonomy based on 26 SASB criteria
- Statistical decomposition
- Repeat analysis for 2017 data
- Repeat analysis in rankings instead of normalized data

Outline

1 Problem

2 Methodology

- Measurement, Scope, and Weights
- Implementation

3 Empirical

- Data
- Discrepancy
- Taxonomy
- Estimation
- Decomposition
- Rater Effect

4 Summary

Key Findings

- Measurement is the most important source of ESG rating divergence
- Measurement is in part driven by a rater effect

Implications

● Academics

- Use average rating to represent the market's consensus view
- Use of a single rating must be carefully justified
- Use more specific categories to test specific hypotheses

● Companies

- Our methodology can help to figure out why scores diverge

● Rating Agencies

- Differences between raters are not merely conceptual differences but also differences in measurement
- Rater effect has implications for the organizational structure of rating agencies

● Investors

- Either buy one rating that fits your purpose and trust the process
- Or buy raw data from different providers and construct your own