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Leadership performance of financial firms on climate change action

Abstract

Global awareness of the urgent need to decarbonize the economy has been growing. Although legislative and regulatory actions have been lagging, some businesses have emerged as leaders in this process. In particular, financial institutions as information producers and resource allocators play an important role. In order to accelerate the global transition to a low-carbon economy, market participants need to develop the ability to identify and support firms that are leading on climate change action. Using CDP data on ten climate change action metrics for 2013, the authors apply the dichotomous Rasch model to rank the overall climate change action performance of U.S. financial firms across multiple dimensions of this effort. Simultaneously, the results identify the climate change action metrics for which success was most difficult to achieve. The authors show that investors, managers and regulators should consider ranking firms using this more comprehensive methodology rather than the CDP's Performance Band or the CDP's Disclosure Score alone when assessing firm leadership in this area. While this study focuses on financial firms, a similar analysis could be conducted for ranking firms in other industries as well. The authors' results are important for investors, managers and regulators charged with firm performance evaluation and resource allocation in the face of growing pressures to decarbonize the global economy.

Keywords: CDP data, performance ranking, climate change, financial firms.

JEL Classification: G20, M14.

Introduction

Global awareness of the urgent need to decarbonize the economy has been growing (SDSN, 2014), and numerous global and local organizations have emerged to address the challenge. While politicians and government regulators have been slow to respond, some businesses have steadily increased their efforts and expanded their roles in mitigating climate change caused by human activity¹. Corporate carbon reduction targets are currently not mandatory, but many large firms have begun to implement them nonetheless (Byrd et al., 2014)². Concerns center, however, on how slowly broad-based action is unfolding (Byrd et al., 2013). While the momentum for action on climate change was strengthened at the United Nations Climate Change Conference in Paris, France in December of 2015 (United Nations, 2015), the resulting international agreement remains non-binding. This leaves the financial market as one of a few major forces capable of decarbonizing the economy.

For purposes of capital allocation, investors need to know how to measure an organization's perfor-

mance in the area of climate change mitigation and decarbonization so that they can direct resources to the most deserving firms. Climate-related financial and non-financial information disclosure is a critical first step in this reporting and resource allocation process, and several organizations have taken the initiative to address this need (CDSB, 2012; SASB, 2013; CDP, 2015; TCFD, 2016). Beyond climate-related awareness and information disclosure, firms' climate-related policies and practices, as well as carbon emission reductions, matter to market participants. How is it possible to synthesize information about such a variety of efforts and, then, rank organizations by their overall performance on this important issue? Several studies address the need to engage with companies on climate change risks and ways to reduce holdings of high-carbon assets (IIGCC, 2015), but more research is needed on how firms' climate change action performance is to be assessed. This paper suggests a new, more comprehensive approach to ranking organizations' overall performance on climate change action by using data from the CDP.

We focus on financial institutions since they are one of the most important and influential sectors in the economy. These institutions occupy a central role in information production about creditworthy firms and organizations. Awareness of the need for climate change action in the financial sector is a prerequisite for the responsible allocation of funding across all sectors. In other words, the information production and monitoring by financial firms will support in meaningful and measurable ways all firms' success in formulating and meeting greenhouse gas reduction targets, as well as climate science and policy creation

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¹ Businesses invest in climate action. (2016, May 13). Retrieved from <http://climatenexus.org/learn/private-sector/businesses-invest-climate-action>.

² Science Based Targets, a joint collaboration between CDP (formerly, the Carbon Disclosure Project), the United Nations Global Compact, the World Resources Institute, and WWF, provides guidance to companies that aim to take a leadership role in setting ambitious carbon reduction targets in line with current climate science (<http://sciencebasedtargets.org>).

(IIGCC, 2014). In addition, by practicing corporate environmental responsibility and fostering it in other firms, financial institutions are enhancing their own operating performance, as the positive effects of these practices are not confined to the manufacturing sector (Jo et al., 2014). Not only will the entire economy be better off with an efficient allocation of funding consistent with environmental responsibility, but also stakeholders in financial institutions will benefit as well.

This paper assesses the overall performance of U.S. firms in the financial sector with respect to action on climate change. We use the Global 500 Climate Change 2014 Summary Data Set from the CDP (formerly Carbon Disclosure Project), which includes data reported by financial institutions for 2013. Performance rankings generated with a simple Rasch model identify the financial firms that succeed relative to their peers across a range of climate change action (CCA) metrics. In the absence of mandatory reporting and emissions reduction, these firms exhibit exceptional leadership, a remarkable ability to identify priorities and an above-average sense of corporate social responsibility. It is interesting to note that these are attributes of strong managerial talent, which has been linked to more investments in corporate social responsibility (Chatjuthamard et al., 2016).

Along with providing the firm performance rankings, the Rasch methodology simultaneously identifies which CCA metrics are the most difficult to achieve. The next section describes the Rasch model and its application. Section 2 discusses the CDP data, section 3 reports the Rasch results, and the final section concludes.

1. The Rasch model and application

Schellhorn and Sharma (2013) have previously used a range of financial metrics and a Rasch model to rank the multi-dimensional financial performance of firms in individual industries. In this paper, we take a similar approach to measure the CCA performance of firms in the financial sector. In the human sciences, a dichotomous Rasch model predicts the probability of a person's success on a test that consists of several items by simultaneously measuring person ability and item difficulty. The probability of a correct response increases with higher measures of person ability and with lower measures of item difficulty. Similarly, financial firms being evaluated on CCA are tested on a number of metrics covering various CCA performance dimensions. Managers' ability to move their firms into CCA leadership positions, then, corresponds to person ability, and the difficulty of earning a favorable reading on a particular CCA me-

tric corresponds to the difficulty of finding the correct answer to a test item. The dichotomous Rasch model developed by Georg Rasch in 1960³, the simplest in the family of Rasch models, defines the conditional probability P_{ni} of a correct answer with score $x = 1$ (as opposed to $x = 0$) by person n to a test item i as a function of the difference between the estimated ability of the person (B_n) and the estimated difficulty of the item (D_i):

$$P_{ni}(x_{ni} = 1 / B_n, D_i) = \frac{e^{(B_n - D_i)}}{1 + e^{(B_n - D_i)}}. \quad (1)$$

The calculation of probabilities involves an iterative procedure, which estimates person ability and item difficulty on a logit scale with the average logit set to equal zero⁴. The model implies that when person ability is exactly matched by item difficulty ($B_n - D_i = 0$), the person has a 50% chance of correctly answering the item. When item difficulty exceeds person ability, the probability of success is less than 50%, while it exceeds 50% when person ability is greater than item difficulty.

Any application of the Rasch model requires a certain relationship among the data. In this application, the probability of a given firm's success is a logistic function of the difference between the estimated ability of the firm to lead on CCA performance and the estimated CCA metric difficulty. The data for a set of CCA metrics for firms in the financial sector at a particular time either fit this model, or they do not. Measures of fit, specifically the infit t , the outfit t and the Rasch Metric Reliability Index, provide information about how well any given data set meets the requirements of the Rasch model. The following section explains the CCA metrics data that were provided by financial firms to CDP and are used in our analysis of the firms' leadership performance on CCA.

2. The use of CDP data

Currently, the disclosure of climate change risks and CCA metrics in the U.S. is not mandatory. Yet, on behalf of hundreds of institutional investors, CDP periodically requests that companies voluntarily disclose a comprehensive set of climate change policy and implementation data. An increasing number of firms have complied over the years likely because of positive valuation effects from both carbon disclosure and reduced carbon emissions as documented by Matsuura et al. (2014).

We use data from the Global 500 Climate Change Summary Data Set provided by the CDP in December 2014⁵ to rank U.S. financial firms by their CCA per-

³ See Rasch (1960).

⁴ See Appendix A in Bond and Fox (2007) for an in-depth discussion of the technical aspects of the Rasch model.

⁵ The Global 500 Climate Change 2014 Summary Data Set was downloaded free of charge from the CDP web site <https://www.cdp.net/en>

formance in 2013. We focus on U.S. firms only because firms' CCA performance is likely to vary across countries with different levels of sensitivity to the climate change issue and differences in the regulatory environment. Our overall CCA performance ranking considers performance along three dimensions: awareness and willingness to participate, carbon disclosure, and carbon performance. We apply ten metrics across the three dimensions. The first of these, the awareness and willingness to participate dimension, includes the two measures of whether a firm answered the CDP questionnaire (Response Status), and whether the firm gave permission to make the response publicly available (Permission Status). The carbon disclosure dimension is measured with three items: whether or not the firm disclosed its Scope 1 and Scope 2 emissions (Scope 1 and 2 Disclosure)⁶, its CDP Disclosure Score for 2013⁷, and the change in the Disclosure Score from 2012 to 2013 (Disclosure Score Improvement). Finally, carbon performance is measured by the remaining five variables: whether a firm reduced its Scope 1 emissions (Scope 1 Reduction), Scope 2 emissions (Scope 2 Reduction) or both (Scope 1 and 2 Reduction) from 2012 to 2013, the firm's CDP Performance Band for 2013⁸, and whether the firm showed improvement in the CDP Performance Band from 2012 to 2013 (Performance Band Improvement).

Application of the dichotomous Rasch model requires translation of the firms' readings on each of these ten metrics into dichotomous values (1, 0). The value of one represents a correct response (success), while a value of zero denotes an incorrect response (failure). For several of the variables, the assignment of dichotomous values is straightforward. Response Status, Permission Status, and Scope 1 and 2 Disclosure for each company equals one, if the firm responded to the CDP questionnaire, if the firm gave permission to make the response publicly available, and if the firm reported its Scope 1 and Scope 2 emissions, respectively.

Regarding the translation of the CDP Disclosure Score and the CDP Performance Band into dichotomous

values, there is some room for varying the difficulty of achieving success. Given that our study includes some metrics for which favorable readings are easy to achieve, such as Response Status and Permission Status, we chose to restrict the definition of success for both the CDP Disclosure Score and the CDP Performance Band to those of the highest performers, those with scores at 90 or above and bands of A or A-, respectively. Disclosure Score Improvement is equal to one if the firm's CDP Disclosure Score increased from 2012 to 2013. The emission reduction variables for Scope 1, Scope 2, and both Scope 1 and 2 emissions are equal to one if the firm reported these emissions for 2012 and the corresponding emissions declined from 2012 to 2013. The Performance Band Improvement is equal to one if the firm maintained its Performance Band at B or higher, or received a Performance Band in 2013 that was an improvement over 2012.

Several caveats are important to keep in mind. In the notes that accompany the Global 500 Climate Change Summary Data Set, the CDP emphasizes the need for detailed scrutiny of a company's choice of carbon accounting methodology. A uniform standard currently does not exist, but it is useful to ascertain whether a firm is accounting for its carbon emissions and, if it is, the direction of emission change. Another issue with the raw data submitted to the CDP is that it is self-reported, that is, the CDP scores are based only on the information it receives directly from the companies. No attempt is made to verify the information that is provided⁹. Nonetheless, this information is valuable to market participants as it sheds some light on the extent of a firm's commitment to CCA and environmental responsibility.

3. Results

The results of our analysis for 2013 reveal a difficulty hierarchy of CCA metrics for the financial firms in our sample along with a ranking of firms by their overall CCA performance (see Tables 1 through 3). The standardized fit statistics for the Rasch methodology, infit t and outfit t, for the difficulty hierarchy all lie between +2 and -2, indicating that the ten CCA metrics fit the requirements of the Rasch model for this sample¹⁰. In addition, the Rasch Metric Reliability Index is high at 0.86 (the range is 0 to 1), thus, indicating repeatability of the metric difficulty rankings for a similar sample of firms.

US/Results/Pages/academic-data.aspx on December 8, 2014. The CDP Manual for this data set is available at: <https://www.cdp.net/en-US/Results/Documents/2014/guidance-global-500-summary-data.pdf>.

⁶ Scope 1 emissions are defined as all direct greenhouse gas emissions reported by the firm including, for example, emissions associated with the firm's facilities and vehicles. Scope 2 emissions are all indirect greenhouse gas emissions reported by the firm including, for example, emissions associated with the consumption of purchased electricity, heat or steam.

⁷ The CDP Disclosure Score measures the comprehensiveness of the firm's response, the quality and transparency of its internal data management, and its understanding of climate change issues as evident in the detail provided.

⁸ The CDP Performance Band recognizes actions considered to advance climate change mitigation and adaptation.

⁹ See the detailed explanations provided, for example, in the CDP 2013 Scoring Methodology document available at: <https://www.cdp.net/Documents/Guidance/CDP-2013-Scoring-Methodology.pdf>.

¹⁰ The chi-square statistics used by the Rasch model are commonly known as infit and outfit statistics. The infit statistic is inlier-sensitive giving relatively more weight to unexpected outcomes close to a firm or CCA metric measure, while the outfit t statistic is not information-weighted and relatively more sensitive to outliers.

Of the ten metrics we analyzed, the CDP Performance Band was the one metric for which a favorable reading (A or A-) was most difficult to achieve with the highest metric difficulty measure of 2.91 logits. Next were the CDP Disclosure Score and Scope 1 and 2 Reduction at 1.62 logits each. These were followed by Scope 1 Reduction at 1.15 logits and Scope 2 Reduction at 0.44 logits. Not surprisingly, responding to the CDP questionnaire was the least difficult accomplishment with a metric difficulty measure of -3.51 logits.

The top two CCA performers for the sample of U.S. financial firms for 2013 are Morgan Stanley and Wells Fargo, each with a logit score of 4.65, followed by Citigroup, JPMorgan Chase and Simon Property Group each with a logit score of 3.21.

Both Rasch Real Firm Reliability and Cronbach-Alpha Reliability Indices are relatively high with readings of 0.79 and 0.87, respectively. The reliability indices indicate the replicability of firm rankings if the samples of firms were evaluated along another similar set of CCA metrics. The reliability indices are reported on a 0 to 1 scale with 1 being maximum reliability. Both the Rasch Real Firm Reliability Index and the Cronbach-Alpha Reliability Index are based on raw scores rather than logit measures and, therefore, provide relatively conservative estimates of replicability¹¹. Only MetLife, Inc. produced an infit t of 2.2, slightly outside the +2 to -2 band indicating an unusual data pattern not completely consistent with the requirements of the Rasch model, e.g., scoring successes on the more difficult CCA metrics while striking out on the easier ones.

Table 1. “CDP” and capitalization should be consistent Definition of Climate Change Action metrics “CDP” sample of 32 U.S. financial firms 2013

Climate Change Action metric	Definition	Success (Rasch variable set = 1)
<i>Awareness and willingness to participate</i>		
Response status	2013 Company response to CDP questionnaire.	Company responds
Permission status	2013 Permission to make the company's response publicly available	Company allows availability to public
<i>Carbon disclosure</i>		
Scope 1 and 2 Disclosure	2013 Company disclosure of Scope 1 and Scope 2 emissions.	Company discloses both Scope 1 and 2 emissions
CDP Disclosure Score	Level of detail and comprehensiveness in disclosure for 2013.	Company achieves at least 90
Disclosure Score Improvement	Change in CDP Disclosure Score from 2012 to 2013.	Company improves CDP Disclosure Score in 2013
<i>Carbon performance</i>		
Scope 1 Reduction	Change in Scope 1 emissions from 2012 to 2013.	Company reduced Scope 1 emissions in 2013
Scope 2 Reduction	Change in Scope 2 emissions from 2012 to 2013.	Company reduced Scope 2 emissions in 2013
Scope 1 and 2 Reduction	Change in both Scope 1 and 2 emissions from 2012 to 2013.	Company reduced both Scope 1 and Scope 2 emissions in 2013
CDP Performance Band	Level of action taken on climate change in 2013 as evidenced by the company's CDP response for minimum disclosure scores of 50.	Company earned an A or A- (the two highest possible levels)
Performance Band Improvement	Change in CDP Performance Band from 2012 to 2013	Company maintained its CDP Performance Band at B or higher, or improved in 2013.

Table 2. “CDP” and capitalization should be consistent Difficulty Hierarchy of Climate Change Action metrics “CDP” sample of 32 U.S. financial firms 2013

Climate Change Action metric	Metric difficulty measure	Infit t	Oufit t
CDP Performance Band	2.91	1.2	0.7
CDP Disclosure Score	1.62	0.0	-0.1
Scope 1 and 2 Reduction	1.62	-0.3	-0.3
Scope 1 Reduction	1.15	0.8	0.3
Scope 2 Reduction	0.44	-1.4	-1.2
Performance Band Improvement	-0.36	1.7	0.6
Scope 1 and 2 Disclosure	-1.02	-1.4	-0.9
Permission status	-1.42	0.3	-0.1
Disclosure Score Improvement	-1.42	0.7	0.3

¹¹ See <http://www.winsteps.com/winman/index.htm?reliability.htm> and <http://www.rasch.org/rmt/rmt1131.htm> for a discussion of the various reliability indices.

Table 2 (cont.). “CDP” and capitalization should be consistent Difficulty Hierarchy of Climate Change Action metrics “CDP” sample of 32 U.S. financial firms 2013

ersion Change Action metric	Metric difficulty measure	Infit t	Oufit t
Response status	-3.51	-0.6	-0.1
Mean	0.00	0.1	-0.1
Rasch metric Reliability Index: 0.86			

Note: Mean metric difficulty measures for non-extreme metric readings are set to zero by the model by default. More positive (less negative) measures indicate greater difficulty. Infit t and outfit t statistics between +2 and -2 indicate that the sample data meet the requirements of the Rasch model. The reliability index is reported on a 0 to 1 scale with 1 being maximum reliability.

Table 3. “CDP” and capitalization should be consistent Climate Change Action Performance Ranking “CDP” sample of 32 U.S. financial firms 2013

Company name	Ticker	Firm performance measure	Infit t	Oufit t
Morgan Stanley	MS US	4.65	Max.	Max.
Wells Fargo & Company	WFC US	4.65	Max.	Max.
Citigroup Inc.	C US	3.21	-0.5	0.1
JPMorgan Chase & Co.	JPM US	3.21	-0.5	0.1
Simon Property Group	SPG US	3.21	-0.5	0.1
AFLAC Incorporated	AFL US	2.16	-0.7	0.2
Bank of America	BAC US	2.16	0.8	0.5
BNY Mellon	BK US	2.16	0.8	0.5
Capital One Financial	COF US	2.16	-0.7	0.2
Goldman Sachs Group Inc.	GS US	2.16	0.8	0.5
Prudential Financial, Inc.	PRU US	2.16	-0.7	0.2
Franklin Resources, Inc.	BEN US	1.39	0.4	0.4
HCP Inc.	HCP US	1.39	1.1	0.5
Marsh&McLennan Companies, Inc.	MMC US	1.39	-0.7	-0.1
U.S. Bancorp	USB US	1.39	0.4	0.4
Allstate Corporation	ALL US	0.71	-0.4	-0.2
American Express	AXP US	0.71	1.5	0.9
PNC Financial Services Group, Inc.	PNC US	0.71	-0.8	-0.4
The Chubb Corporation	CB US	0.71	1.5	0.9
State Street Corporation	STT US	0.05	-0.8	-0.6
Ventas Inc	VTR US	0.05	-1.8	-1.0
MetLife, Inc.	MET US	0.05	2.2	2.0
The Travelers Companies, Inc.	TRV US	-0.61	0.6	0.4
American International Group, Inc.	AIG US	-1.31	0.0	-0.1
BlackRock	BLK US	-1.31	0.0	-0.1
Charles Schwab Corporation	SCHW US	-1.31	0.0	-0.1
Discover Financial Services	DFS US	-3.32	1.0	0.8
Equity Residential	EQR US	-4.90	Min.	Min.
BB&T Corporation	BBT US	-4.90	Min.	Min.
Berkshire Hathaway	BRK/B US	-4.90	Min.	Min.
General Growth Properties	GGP US	-4.90	Min.	Min.
Public Storage	PSA US	-4.90	Min.	Min.
Mean		0.25	0.1	0.3
Rasch Real Firm Reliability Index	0.79			
Cronbach-Alpha Reliability Index	0.87			

Note: More positive (less negative) performance measures indicate better performance. Infit t and outfit t statistics between +2 and -2 indicate that the sample data meet the requirements of the Rasch model. The reliability indices are reported on a 0 to 1 scale with 1 being maximum reliability. Both the Rasch Real Reliability Index and the Cronbach-Alpha Reliability Index are based on raw scores rather than logit measures. Big absolute differences between the indices likely result from differences in the treatment of extreme scores.

Table 4. Climate Change Action (CCA) Performance Ranking Versus Ranking by CDP Performance Band & CDP Disclosure Score 2013

Sorted by CDP Performance Band and then by CDP Disclosure Score	CCA Performance Rank	Company name	CDP Performance Band	CDP Disclosure Score
1		BNY Mellon	A	100
2		Bank of America	A	98
3		Goldman Sachs Group Inc.	A	98
4	2	Wells Fargo & Company	A	96
5	1	Morgan Stanley	A	96
6		HCP Inc.	A-	97
7		MetLife, Inc.	A-	92
8		Marsh & McLennan Companies, Inc.	B	98
9	5	Simon Property Group	B	98
10		Allstate Corporation	B	96
11	3	Citigroup Inc.	B	95
12	4	JPMorgan Chase & Co.	B	91

In Table 4, we present the top twelve financial firms in the 2013 CDP sample sorted first by the CDP Performance Band and then by the CDP Disclosure Score, two of the most restrictive stand-alone CCA metrics used in this study. Five companies earned a CDP Performance Band of A, including Morgan Stanley and Wells Fargo (the top two, according to the results of the Rasch analysis), but three of those companies (BNY Mellon, Bank of America and Goldman Sachs Group Inc.) had higher CDP Disclosure Scores than Morgan Stanley and Wells Fargo. If investors naively used just those two CDP metrics, they might incorrectly judge Morgan Stanley and Wells Fargo, ranked fifth and fourth by those metrics, as not being the top leaders for CCA when, in fact, they appear to be according to the Rasch analysis.

In other words, the CCA performance rankings provided by the Rasch method simultaneously consider ten CCA metrics across three different CCA performance dimensions and are, therefore, more comprehensive and better at identifying corporate CCA leaders than any one metric alone. Investors, as well as other stakeholders, attempting to ascertain which financial firms are most committed to CCA and environmental responsibility will likely find that the Rasch analysis gives them a more complete picture. Better performance measurement is likely to improve capital allocation and financial security valuation.

Conclusion

Using a simple Rasch model, we present composite rankings of climate change action performance for U.S. financial firms that reported to the CDP in 2013, and an estimated difficulty hierarchy of the ten climate change action metrics that inform the analysis. Our results suggest that Morgan Stanley and Wells Fargo emerged as the strongest performers across this particular range of metrics assessing climate change action for that year. Our results synthesize information about a range of variables that are available to institutional investors who value climate change action and environmental responsibility with important implications for security valuation and resource allocation.

As the need to contain rising global average temperatures becomes increasingly urgent, it is critically important that all firms act to mitigate climate change. Taking a leadership role in the absence of mandatory climate change disclosure and performance is remarkable and potentially signals superior managerial ability. Future research may develop increasingly informative Rasch climate change action performance rankings not just for financial firms, but for businesses in other industries as well. Synthesizing information about climate change action metrics from more than one data source to produce the Rasch performance rankings may offer additional insights. Future research might also explore a possible link between leadership in the area of climate change action, investments in other areas of corporate social and environmental responsibility, and long-term financial performance.

References

1. Bond, T. & Fox, C. (2007). *Applying the Rasch model: Fundamental measurement in the human sciences*. Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.
2. Byrd, J., Bettenhausen, K. & Cooperman, E.S. (2013). Context-based sustainability and corporate CO₂ reduction targets: Are companies moving fast enough? *International Review of Accounting, Banking and Finance*, 5, pp. 84-100.

3. Byrd, J., Cooperman, E.S. & Bettenhausen, K. (2014). Determinants of corporate carbon reduction targets, *Interdisciplinary Environmental Review*, 15, pp. 271-289.
4. CDP. (2015). Global climate change report. Retrieved from <https://www.cdp.net/CDPResults/CDP-global-climate-change-report-2015.pdf>.
5. CDSB. (2012). Climate change reporting framework: Advancing and aligning disclosure of climate change-related information in mainstream reports. Retrieved from <http://www.cdsb.net/what-we-do/reporting-frameworks/climate-change>.
6. Chatjuthamard, P., Jiraporn, P., Tong, S. & Singh, M. (2016). Managerial talent and corporate social responsibility (CSR): How do talented managers view corporate social responsibility? *International Review of Finance*, 16 (2), pp. 265-276.
7. IIGCC. (2014). Financial institutions taking action on climate change. Retrieved from <http://www.iigcc.org/publications/publication/financial-institutions-taking-action-on-climate-change>.
8. IIGCC. (2015). Climate change investment solutions: A guide for asset owners. Retrieved from <http://www.iigcc.org/publications/publication/climate-change-investment-solutions-a-guide-for-asset-owners>.
9. Jo, H., Kim, H. & Park, K. (2014). *Corporate environmental responsibility and firm performance*. KAIST College of Business Working Paper Series No. 2014-007. Retrieved from <http://ssrn.com/abstract=2470872>.
10. Matsumura, E.M. Prakash, R. & Vera-Munoz, S.C. (2014). Firm-value effects of carbon emissions and carbon disclosures, *The Accounting Review*, 89, pp. 695-724.
11. Rasch, G. (1960). *Probabilistic models for some intelligence and attainment tests*. Copenhagen, Denmark: Danmarks Paedagogiske Institut.
12. SASB. (2013). Conceptual framework. Retrieved from <http://www.sasb.org/wp-content/uploads/2013/10/SASB-Conceptual-Framework-Final-Formatted-10-22-13.pdf>.
13. Schellhorn, C. & Sharma, R. (2013). Using the Rasch model to rank firms by managerial ability. *Managerial Finance*, 39, pp. 306-319.
14. SDSN. (2014). Pathways to deep decarbonization. Retrieved from http://unsdsn.org/wp-content/uploads/2014/09/DDPP_Digit.pdf.
15. TCFD. (2016). Phase I Report of the Taskforce on Climate-Related Financial Disclosure. Retrieved from <https://www.fsb-tcf.org/phase1report/>.
16. United Nations. (2015). Historic Paris agreement on climate change. Retrieved from <http://newsroom.unfccc.int/unfccc-newsroom/finale-cop21/>.