



Online-Appendix

Impact of Audit Assurance on the Quality of Sustainability Reporting

Alexander Grommes

Catholic University of Eichstätt-Ingolstadt

Junior Management Science 10(1) (2025) 201-235

Appendix A: Variable definitions

Dependent variables:		applied for:
<i>GPT_Rating</i>	A rating assigned by the LLM GPT 3.5, which assesses the quality of the reporting according to the criteria defined in Chapter 6.2.	H1
<i>File_Size</i>	The text file size of the report, whereby for integrated reports the proportion of the sustainability section in the overall report has been approximated using a correction factor.	H2
<i>Assurance_LVL</i>	Indicates the level of assurance, distinguishing between <i>no assurance</i> , <i>limited assurance</i> and <i>reasonable assurance</i> .	H3
Independent and Control variables:		applied for:
<i>Assurance_LVL</i>	Indicates the level of assurance, distinguishing between <i>no assurance</i> , <i>limited assurance</i> and <i>reasonable assurance</i> .	H1, H2, H3
<i>ESG_Score</i>	Bloomberg score for overall ESG rating on a scale between 0 and 10.	H1, H2, H3
<i>ENV_Score</i>	Bloomberg score for the environmental subset of <i>ESG_Score</i> on a scale of 0 to 10.	H1, H2, H3
<i>SOC_Score</i>	Bloomberg Score, which assesses the social subset <i>ESG_Score</i> score on a scale of 0 to 10.	H1, H2, H3
<i>GOV_Score</i>	Bloomberg Score, which assesses the governance subset of <i>ESG_Score</i> score on a scale of 0 to 10.	H1, H2, H3
<i>Market_CAP</i>	Market capitalization in US dollars on 31 December 2022 or at the end of the 2022 financial year.	H1, H2, H3
<i>Total_ASS</i>	Total assets in US dollars on 31 December 2022 or at the end of the 2022 financial year.	H1, H2, H3
<i>File_Size</i>	The text file size of the report, whereby for integrated reports the proportion of the sustainability section in the overall report has been approximated using a correction factor.	H1, H3

Independent and Control variables (continued):		applied for:
<i>File_Size_ABS</i>	Size of the reporting text file based on the relevant text sections extracted according to the procedure in Chapter 6.3.1.	H1, H3
<i>GPT_Rating</i>	A rating assigned by LLM GPT 3.5, which assesses the quality of the reporting according to the criteria defined in Chapter 6.2.	H2
<i>Neutrality_Score_ABS</i>	Figure (referring to the file of relevant abstracts of reports) which assesses the neutrality of the language by contrasting positively and negatively connotated words from the Loughran and McDonald's word list and putting them in a ratio with the total amount of words.	H1, H2, H3
<i>Fog_Index_ABS</i>	Figure (referring to the file of relevant abstracts of reports) of the Gunning Fog Index to determine readability.	H1, H2, H3
<i>Neutrality_Score</i>	Figure (referring to non-financial reports) which assesses the neutrality of the language by contrasting positively and negatively connotated words from the Loughran and McDonald's word list and putting them in a ratio with the total amount of words.	H1, H2, H3
<i>Fog_Index</i>	Figure (referring to non-financial reports) of the Gunning Fog Index to determine readability.	H1, H2, H3
<i>Neg_Words/ Pos_Words/ Total_Words</i>	Absolute number of negative/positive/total words of a report or abstract.	n/a
<i>Tone</i>	Figure which assesses the tone of the language by putting negative and positive words in a ratio (a positive tone indicates that there are more positive than negative words in the text).	n/a

Table 5: Variable definitions

Appendix B: Descriptive statistics

	DAX Companies	<i>% of total</i>	MDAX Companies	<i>% of total</i>
Total Companies	40		50	
ESG Reporting	40	<i>100</i>	49	<i>98</i>
Integrated Reporting	18	<i>45</i>	19	<i>38,8</i>
Audit Assurance:				
None	5	<i>12,5</i>	15	<i>30,6</i>
Limited	31	<i>77,5</i>	34	<i>69,4</i>
Reasonable (Limited/Reasonable)	4	<i>10</i>	0	<i>0</i>
Big Four Auditor	35	<i>100</i>	31	<i>91,2</i>

Table 6: Descriptive statistics of company sample

Appendix C: Summary statistics of primary variables

Panel A: Summary Statistics

Variables ²⁴	Obs	Mean	SD	P10	P25	Median	P75	P90
<i>ESG_Score</i>	86	4.32	1.12	2.87	3.60	4.41	5.19	5.62
<i>ENV_Score</i>	86	4.14	2.06	1.34	2.96	4.40	5.56	6.21
<i>SOC_Score</i>	86	3.48	1.67	1.53	2.33	3.19	4.67	5.74
<i>GOV_Score</i>	89	6.06	0.93	5.04	5.44	5.89	6.86	7.17
<i>Market_CAP</i> ²⁵	90	21,185	29,552	2,357	4,165	8,665	26,054	59,583
<i>Total_ASS</i> ²⁶	90	77,585	190,509	1,967	4,587	11,861	57,428	167,307
<i>GPT_Rating</i>	77	61.96	18.95	33.00	50.00	68.00	75.00	85.00
<i>File_Size</i> ²⁷	89	314.83	197.38	126.96	196.09	276.25	389.00	518.52
<i>File_Size_ABS</i> ²⁸	89	12.21	9.23	0.00	5.00	11.00	17.00	28.20

Table 7: Summary statistics of primary variables

²⁴ Scores and ratings range from 0 to 100.

²⁵ in million \$

²⁶ in million \$

²⁷ in kilobyte

²⁸ in kilobyte

Panel B: Pairwise correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) <i>ESG_Score</i>	1								
(2) <i>ENV_Score</i>	0.7077	1							
(3) <i>SOC_Score</i>	0.6412	0.0906	1						
(4) <i>GOV_Score</i>	0.4133	0.2033	0.1019	1					
(5) <i>Market_CAP</i>	0.2764	0.3033	0.0576	0.1170	1				
(6) <i>Total_ASS</i>	0.1648	0.1743	0.0438	0.0648	0.3564	1			
(7) <i>GPT_Rating</i>	0.1104	-0.0326	0.1292	0.0572	0.1226	0.1491	1		
(8) <i>File_Size</i>	-0.0631	-0.0818	-0.0008	-0.0511	-0.0024	-0.0147	0.0045	1	
(9) <i>File_Size_ABS</i>	0.0337	0.0038	0.0438	-0.0493	0.0841	0.0397	0.0993	0.0035	1

Table 8: Pairwise correlations of primary variables

Summary statistics of secondary variables

Panel C: Summary statistics

Variables	Obs	Mean	SD	P10	P25	Median	P75	P90
<i>Neg_Words_ABS</i>	89	22.45	12.50	5.00	13.00	21.00	31.00	38.20
<i>Pos_Words_ABS</i>	89	8.65	6.38	0.00	4.00	8.00	12.00	17.00
<i>Total_Words_ABS</i>	89	1829	1314	110	829	1757	2534	3927
<i>Tone_ABS</i>	89	3.38	1.76	1.54	2.08	3.00	5.00	5.00
<i>Neutrality_Score_ABS</i>	89	0.0233	0.0120	0.0107	0.0141	0.0196	0.0280	0.0455
<i>Fog_Index_ABS</i> ²⁹	89	25.43	5.38	17.25	23.21	25.52	27.47	29.96
<i>Neg_Words</i>	89	283.99	117.91	128.60	181.00	293.00	375.00	441.20
<i>Pos_Words</i>	89	119.24	31.99	75.60	98.00	127.00	141.00	154.20
<i>Total_Words</i>	89	83069	55201	20571	32402	75592	123205	153953
<i>Tone</i>	89	2.30	0.52	1.61	1.85	2.29	2.70	3.03
<i>Neutrality_Score</i>	89	0.0066	0.0031	0.0035	0.0042	0.0056	0.0087	0.0106
<i>Fog_Index</i>	89	26.31	3.16	22.61	24.11	25.90	27.67	29.93

Table 9: Summary statistics of secondary variables

²⁹ The *Fog_Index_ABS* and *Fog_Index* values are excessively high. Their mean value implies that it would take 25 years of education to comprehend sustainability reports abstract files and 26 years of education to comprehend the sustainability reports as a whole (Li 2008: 225). On one hand, the Fog Index evaluates texts in a business context as disproportionately difficult to read due to the polysyllabic words (Loughran and McDonald 2014: 1644-1645). On the other hand, the value could potentially increase if the text was not accurately extracted during PDF conversion, resulting in words being written together and thus incorrectly classified as one excessively long word.

Panel D: Pairwise correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) <i>Neg_Words_ABS</i>	1											
(2) <i>Pos_Words_ABS</i>	0.7356	1										
(3) <i>Total_Words_ABS</i>	0.7714	0.6847	1									
(4) <i>Tone_ABS</i>	-0.1722	-0.6685	-0.3384	1								
(5) <i>Neutrality_Score_ABS</i>	-0.4519	-0.3566	-0.7348	0.2580	1							
(6) <i>Fog_Index_ABS</i>	0.5569	0.4075	0.6143	-0.1575	-0.6581	1						
(7) <i>Neg_Words</i>	0.2534	0.1155	0.2105	0.0230	-0.1003	0.1588	1					
(8) <i>Pos_Words</i>	0.1366	0.0917	0.0388	-0.0693	0.1172	0.0372	0.8868	1				
(9) <i>Total_Words</i>	0.2252	0.0686	0.2514	0.0692	-0.1919	0.2158	0.9403	0.7825	1			
(10) <i>Tone</i>	0.2887	0.1060	0.3328	0.1032	-0.2907	0.2379	0.8702	0.5587	0.8623	1		
(11) <i>Neutrality_Score</i>	-0.1438	-0.0596	-0.1760	0.0164	0.1212	-0.2079	-0.8561	-0.8124	-0.8590	-0.7317	1	
(12) <i>Fog_Index</i>	0.3653	0.2694	0.1962	0.0182	-0.1029	0.4023	0.1994	0.1858	0.1352	0.1409	-0.0446	1

Table 10: Pairwise correlations of secondary variables

Appendix D: Regression results³⁰

Panel A: Regression Statistics for H1

Regression Statistics	
Multiple R	0.27981926
R Square	0.07829882
Adjusted R Square	0.03822485
Standard Error	18.4192096
Observations	73

	Degrees of freedom	Sum of squares	Mean square	F	Significance F
Regression	3	1988.63978	662.879927	1.953857515	0.12903439
Residual	69	23409.4424	339.267281		
Total	72	25398.0822			

	Coefficients	Standard Error	t-Stat.	P-value	Lower 95%	Upper 95%
<i>Intersect</i>	60.4278108	11.8359136	5.10546229	2.78898E-06	36.81580911	84.0398124
<i>Assurance_LVL</i>	-7.22069906	4.83843162	-1.49236357	0.140162246	-16.873106	2.43170791
<i>ESG_Score</i>	5.85783398	2.84172289	2.06136707	0.043038071	0.18875194	11.526916
<i>Market_CAP</i>	-2.43111131	1.57275428	-1.54576678	0.126735383	-5.56867025	0.70644763

Table 11: Regression statistics for H1

³⁰ The regression statistics for all further regression analyses can be found in the digital appendix.

Panel B: Regression Statistics for H2

Regression Statistics	
Multiple R	0.52645311
R Square	0.27715288
Adjusted R Square	0.25952246
Standard Error	151.663524
Observations	85

	Degrees of freedom	Sum of squares	Mean square	F	Significance F
Regression	2	723184.449	361592.225	15.720154	1.66305E-06
Residual	82	1886149.61	23001.8246		
Total	84	2609334.06			

	Coefficients	Standard Error	t-Stat.	P-value	Lower 95%	Upper 95%
<i>Intersect</i>	101.10828	66.4159555	1.52234924	0.131768816	-31.0142131	233.230772
<i>ESG_Score</i>	35.8267374	15.3980796	2.32670166	0.022449059	5.195051942	66.4584229
<i>Market_CAP</i>	2.4967E-09	5.9019E-10	4.23042534	6.03613E-05	1.32267E-09	3.6708E-09

Table 12: Regression statistics for H2

Panel C: Regression Statistics for H3

Regression Statistics	
Multiple R	0.37003982
R Square	0.13692947
Adjusted R Square	0.11587897
Standard Error	0.46283885
Observations	85

	Degrees of freedom	Sum of squares	Mean square	F	Significance F
Regression	2	2.78691741	1.39345871	6.504808111	0.00238725
Residual	82	17.5660238	0.2142198		
Total	84	20.3529412			

	Coefficients	Standard Error	t-Stat.	P-value	Lower 95%	Upper 95%
<i>Intersect</i>	1.34124453	0.20268476	6.61739222	3.50376E-09	0.938039986	1.74444908
<i>ESG_Score</i>	0.09046662	0.04699106	1.92518794	0.057672867	-0.00301357	0.1839468
<i>Market_CAP</i>	4.2821E-12	1.8011E-12	2.3775078	0.019757558	6.99167E-13	7.8651E-12

Table 13: Regression statistics for H3

Panel D: Influence of company's industry

Regression Statistics						
Multiple R	0.116656041					
R Square	0.013608632					
Adjusted R Square	0.000456747					
Standard Error	8.446013292					
Observations	77					

	Degrees of freedom	Sum of squares	Mean square	F	Significance F	
Regression	1	73.8125121	73.8125121	1.03472863	0.31232088	
Residual	75	5350.13554	71.3351405			
Total	76	5423.94805				

	Coefficients	Standard Error	t-Stat.	P-value	Lower 95%	Upper 95%
<i>Intersect</i>	10.894635	3.31071476	3.29071992	0.00152466	4.29935301	17.489917
<i>GPT_Rating</i>	0.05200442	0.05112426	1.01721612	0.31232088	-0.04984033	0.15384918

Table 14: Regression statistics for industry influence

Appendix E: GPT_Rating standard deviation

Percentile Placement of <i>File_Size_ABS</i>	P25	P75	P90
Company Name	Allianz	Deutsche Post	Freenet
1. GPT Run	70	75	70
2. GPT Run	65	75	70
3. GPT Run	50	65	70
4. GPT Run	75	75	72
5. GPT Run	85	72	55
6. GPT Run	90	70	60
7. GPT Run	85	70	65
8. GPT Run	70	65	50
9. GPT Run	75	70	72
10. GPT Run	65	85	75
Mean	73	72.2	65.9
Standard deviation (absolute)	11.83	5.83	8.27
Standard deviation (relative)	0.1621	0.0807	0.1254

Table 15: GPT_Rating standard deviation

Appendix F: Extraction procedure and code data

Appendix F is available as a digital appendix.