

Supplementary information

EVALUATION OF GROUP DECISION MAKING BASED ON GROUP PREFERENCES UNDER A MULTI-CRITERIA ENVIRONMENT

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1. Urban commercial bank data

Table 1. B-A level pair-wise comparison matrix of expert 1

B-A	B1	B2	B3	B4	W	CR
B1	1	3	2	3	0.455	0.004 < 0.1
B2	1/3	1	1/2	1	0.141	
B3	1/2	2	1	2	0.263	
B4	1/3	1	1/2	1	0.141	

Table 2. C-B1 level pair-wise comparison matrix of expert 1

C-B1	C1	C2	W	CR
C1	1	2	0.667	0 < 0.1
C2	1/2	1	0.333	

Table 3. C-B2 level pair-wise comparison matrix of expert 1

C-B2	C3	C4	W	CR
C3	1	2	0.667	0 < 0.1
C4	1/2	1	0.333	

Table 4. C-B3 level pair-wise comparison matrix of expert 1

C-B3	C5	C6	W	CR
C5	1	1/3	0.250	0 < 0.1
C6	3	1	0.750	

Table 5. C-B4 level pair-wise comparison matrix of expert 1

C-B4	C7	C8	W	CR
C7	1	3	0.750	0 < 0.1
C8	1/3	1	0.250	

Table 6. Weights by AHP of expert 1

	B1	B2	B3	B4	weight
	0.455	0.141	0.263	0.141	
C1	0.667				0.303
C2	0.333				0.152
C3		0.667			0.094
C4		0.333			0.047
C5			0.250		0.066
C6			0.750		0.197
C7				0.750	0.106
C8				0.250	0.035

Table 7. Alternative level of expert 1

	C1	C2	C3	C4	C5	C6	C7	C8
BOHZ	8	7	9	8	7	6	8	7
BOJS	7	8	6	8	9	8	7	6
BOWZ	8	7	6	9	5	7	8	6
BOSH	8	9	7	8	7	8	6	7
QLB	8	7	9	8	7	7	8	8
WHCCB	7	8	6	7	8	9	5	6
FZCCB	8	7	6	7	8	9	7	7
JXCCB	7	8	8	7	6	7	6	5
HZCCB	7	8	9	7	6	8	9	8
BOTZ	8	7	8	6	7	8	7	9
BONC	8	7	6	7	8	9	7	8
HSB	8	7	8	6	7	8	7	8

Table 8. B-A level pair-wise comparison matrix of expert 2

B-A	B1	B2	B3	B4	W	CR
B1	1	2	1/2	1	0.227	0.004 < 0.1
B2	1/2	1	1/3	1/2	0.122	
B3	2	3	1	2	0.424	
B4	1	2	1/2	1	0.227	

Table 9. C-B1 level pair-wise comparison matrix of expert 2

C-B1	C1	C2	W	CR
C1	1	1	0.5	0 < 0.1
C2	1	1	0.5	

Table 10. C-B2 level pair-wise comparison matrix of expert 2

C-B2	C3	C4	W	CR
C3	1	3	0.750	0 < 0.1
C4	1/3	1	0.250	

Table 11. C-B3 level pair-wise comparison matrix of expert 2

C-B3	C5	C6	W	CR
C5	1	1/2	0.333	0 < 0.1
C6	2	1	0.667	

Table 12. C-B4 level pair-wise comparison matrix of expert 2

C-B4	C7	C8	W	CR
C7	1	4	0.800	0 < 0.1
C8	1/4	1	0.200	

Table 13. Weights by AHP of expert 2

	B1	B2	B3	B4	weight
	0.227	0.122	0.424	0.227	
C1	0.5				0.113
C2	0.5				0.113
C3		0.750			0.092
C4		0.250			0.031
C5			0.333		0.141
C6			0.667		0.283
C7				0.800	0.182
C8				0.200	0.045

Table 14. Alternative level of expert 2

	C1	C2	C3	C4	C5	C6	C7	C8
BOHZ	7	8	6	9	8	7	6	7
BOJS	8	7	6	5	6	7	8	8
BOWZ	8	7	6	8	6	5	7	8
BOSH	8	7	9	8	6	7	7	6
QLB	8	7	6	7	9	8	7	6
WHCCB	8	7	8	6	7	6	7	8
FZCCB	7	8	6	7	8	9	8	7
JXCCB	8	6	5	7	7	6	6	8
HZCCB	8	7	6	8	6	6	8	7
BOTZ	7	8	8	7	6	8	8	7
BONC	8	9	7	6	8	7	6	7
HSB	7	8	9	6	7	8	7	8

Table 15. B-A level pair-wise comparison matrix of expert 3

B-A	B1	B2	B3	B4	W	CR
B1	1	2	3	3	0.455	0.004 < 0.1
B2	1/2	1	2	2	0.263	
B3	1/3	1/2	1	1	0.141	
B4	1/3	1/2	1	1	0.141	

Table 16. C-B1 level pair-wise comparison matrix of expert 3

C-B1	C1	C2	W	CR
C1	1	1/2	0.333	0 < 0.1
C2	2	1	0.667	

Table 17. C-B2 level pair-wise comparison matrix of expert 3

C-B2	C3	C4	W	CR
C3	1	1/2	0.333	0 < 0.1
C4	2	1	0.667	

Table 18. C-B3 level pair-wise comparison matrix of expert 3

C-B3	C5	C6	W	CR
C5	1	2	0.667	0 < 0.1
C6	1/2	1	0.333	

Table 19. C-B4 level pair-wise comparison matrix of expert 3

C-B4	C7	C8	W	CR
C7	1	2	0.667	0 < 0.1
C8	1/2	1	0.333	

Table 20. Weights by AHP of expert 3

	B1	B2	B3	B4	weight
	0.455	0.263	0.141	0.141	
C1	0.333				0.152
C2	0.667				0.303
C3		0.333			0.088
C4		0.667			0.175
C5			0.667		0.094
C6			0.333		0.047
C7				0.667	0.094
C8				0.333	0.047

Table 21. Alternative level of expert 3

	C1	C2	C3	C4	C5	C6	C7	C8
BOHZ	8	8	7	6	7	8	8	7
BOJS	7	8	6	7	7	6	8	7
BOWZ	8	7	7	9	8	7	8	8
BOSH	8	9	7	8	7	8	6	8
QLB	7	8	7	6	8	7	9	7
WHCCB	7	6	8	5	7	6	5	6
FZCCB	8	7	6	5	7	8	8	8
JXCCB	7	8	6	7	6	8	8	7
HZCCB	7	8	6	7	8	7	7	6
BOTZ	8	7	8	9	7	8	7	8
BONC	8	7	6	7	7	6	7	8
HSB	7	7	8	8	6	7	8	7

2. Listed oil company data

Table 22. B-A level pair-wise comparison matrix of expert 1

B-A	B1	B2	B3	B4	B5	B6	W	CR
B1	1.00	2.00	4.00	2.00	3.00	4.00	0.319	0.008 < 0.1
B2	0.50	1.00	3.00	1.00	2.00	3.00	0.209	
B3	0.25	0.33	1.00	0.33	0.50	1.00	0.068	
B4	0.50	1.00	3.00	1.00	2.00	3.00	0.209	
B5	0.33	0.50	2.00	0.50	1.00	2.00	0.126	
B6	0.25	0.33	1.00	0.33	0.50	1.00	0.068	

Table 23. C-B1 level pair-wise comparison matrix of expert 1

C-B1	C1	C2	C3	C4	C5	W	CR
C1	1.00	3.00	2.00	4.00	4.00	0.394	0.010 < 0.1
C2	0.33	1.00	0.50	2.00	2.00	0.164	
C3	0.50	2.00	1.00	3.00	3.00	0.268	
C4	0.25	0.50	0.33	1.00	1.00	0.087	
C5	0.25	0.50	0.33	1.00	1.00	0.087	

Table 24. C-B2 level pair-wise comparison matrix of expert 1

C-B2	C6	C7	C8	C9	C10	W	CR
C6	1.00	3.00	2.00	4.00	5.00	0.388	0.020 < 0.1
C7	0.33	1.00	0.50	2.00	3.00	0.177	
C8	0.50	2.00	1.00	3.00	4.00	0.271	
C9	0.25	0.50	0.33	1.00	2.00	0.106	
C10	0.20	0.33	0.25	0.50	1.00	0.059	

Table 25. C-B3 level pair-wise comparison matrix of expert 1

C-B3	C11	C12	C13	C14	C15	C16	W	CR
C11	1.00	3.00	2.00	4.00	1.00	0.50	0.212	0.016 < 0.1
C12	0.33	1.00	0.50	2.00	0.33	0.25	0.081	
C13	0.50	2.00	1.00	3.00	0.50	0.33	0.135	
C14	0.25	0.50	0.33	1.00	0.25	0.20	0.047	
C15	1.00	3.00	2.00	4.00	1.00	0.50	0.212	
C16	2.00	4.00	3.00	5.00	2.00	1.00	0.313	

Table 26. C-B4 level pair-wise comparison matrix of expert 1

C-B4	C17	C18	C19	W	CR
C17	1.00	0.25	0.50	0.134	0.020 < 0.1
C18	4.00	1.00	3.00	0.611	
C19	2.00	0.33	1.00	0.255	

Table 27. C-B5 level pair-wise comparison matrix of expert 1

C-B5	C20	C21	C22	C23	W	CR
C20	1.00	2.00	5.00	3.00	0.438	0.027 < 0.1
C21	0.50	1.00	4.00	2.00	0.299	
C22	0.20	0.25	1.00	0.33	0.071	
C23	0.33	0.50	3.00	1.00	0.192	

Table 28. C-B6 level pair-wise comparison matrix of expert 1

C-B6	C24	C25	C26	W	CR
C24	1.00	3.00	5.00	0.605	0.048 < 0.1
C25	0.33	1.00	3.00	0.291	
C26	0.20	0.33	1.00	0.103	

Table 29. Weights by AHP of expert 1

	B1	B2	B3	B4	B5	B6	weight
	0.319	0.209	0.068	0.209	0.126	0.068	
C1	0.394						0.126
C2	0.164						0.052
C3	0.268						0.086
C4	0.087						0.028
C5	0.087						0.028
C6		0.388					0.081
C7		0.177					0.037
C8		0.271					0.057
C9		0.106					0.022
C10		0.059					0.012
C11			0.212				0.015
C12			0.081				0.006
C13			0.135				0.009
C14			0.047				0.003
C15			0.212				0.014
C16			0.313				0.021
C17				0.134			0.028
C18				0.611			0.128
C19				0.255			0.053
C20					0.438		0.055
C21					0.299		0.038
C22					0.071		0.009
C23					0.192		0.024
C24						0.605	0.041
C25						0.291	0.020
C26						0.103	0.007

Table 30. Alternative level of expert 1

	XOM	NCPC	BP	Shell	CP	Chevron	Total
C1	9	8	7	8	8	7	7
C2	8	8	6	9	7	8	5
C3	6	8	7	6	5	7	8
C4	7	7	8	7	9	6	7
C5	6	9	5	7	6	9	8
C6	8	7	8	5	7	8	7
C7	7	6	6	7	6	7	6

	XOM	NCPC	BP	Shell	CP	Chevron	Total
C8	6	8	9	8	5	7	7
C9	7	7	8	6	9	7	5
C10	8	8	6	7	5	9	5
C11	7	9	7	6	8	5	6
C12	7	8	9	8	6	7	7
C13	8	7	6	7	6	7	8
C14	9	8	6	8	7	5	7
C15	8	7	6	7	9	6	6
C16	8	7	6	7	6	5	7
C17	9	8	7	8	9	7	5
C18	8	7	8	9	6	9	7
C19	8	9	9	7	8	7	6
C20	9	8	6	8	7	6	9
C21	8	9	9	8	6	8	6
C22	8	7	9	6	7	8	8
C23	8	9	8	8	8	9	7
C24	8	7	9	7	7	9	6
C25	6	8	7	9	7	7	8
C26	7	8	7	6	5	6	7

Table 31. B-A level pair-wise comparison matrix of expert 2

B-A	B1	B2	B3	B4	B5	B6	W	CR
B1	1.00	0.50	1.00	2.00	0.33	0.50	0.112	0.007 < 0.1
B2	2.00	1.00	2.00	3.00	0.50	1.00	0.200	
B3	1.00	0.50	1.00	2.00	0.33	0.50	0.112	
B4	0.50	0.33	0.50	1.00	0.25	0.33	0.061	
B5	3.00	2.00	3.00	4.00	1.00	2.00	0.315	
B6	2.00	1.00	2.00	3.00	0.50	1.00	0.200	

Table 32. C-B1 level pair-wise comparison matrix of expert 2

C-B1	C1	C2	C3	C4	C5	W	CR
C1	1.00	2.00	3.00	3.00	4.00	0.385	0.009 < 0.1
C2	0.50	1.00	2.00	2.00	3.00	0.252	
C3	0.33	0.50	1.00	1.00	2.00	0.143	
C4	0.33	0.50	1.00	1.00	2.00	0.143	
C5	0.25	0.33	0.50	0.50	1.00	0.077	

Table 33. C-B2 level pair-wise comparison matrix of expert 2

C-B2	6	7	8	9	10	W	CR
6	1.00	2.00	4.00	2.00	3.00	0.356	0.009 < 0.1
7	0.50	1.00	3.00	1.00	2.00	0.222	
8	0.25	0.33	1.00	0.33	0.50	0.072	
9	0.50	1.00	3.00	1.00	2.00	0.222	
10	0.33	0.50	2.00	0.50	1.00	0.128	

Table 34. C-B3 level pair-wise comparison matrix of expert 2

C-B3	11	12	13	14	15	16	W	CR
11	1.00	2.00	3.00	3.00	0.50	1.00	0.209	0.008 < 0.1
12	0.50	1.00	2.00	2.00	0.33	0.50	0.126	
13	0.33	0.50	1.00	1.00	0.25	0.33	0.068	
14	0.33	0.50	1.00	1.00	0.25	0.33	0.068	
15	2.00	3.00	4.00	4.00	1.00	2.00	0.319	
16	1.00	2.00	3.00	3.00	0.50	1.00	0.209	

Table 35. C-B4 level pair-wise comparison matrix of expert 2

C-B4	17	18	19	W	CR
17	1.00	2.00	3.00	0.529	0.010
18	0.50	1.00	2.00	0.309	
19	0.33	0.50	1.00	0.162	

Table 36. C-B5 level pair-wise comparison matrix of expert 2

B5	20	21	22	23	W	CR
20	1.00	0.50	1.00	0.33	0.140	0.005
21	2.00	1.00	2.00	0.50	0.273	
22	1.00	0.50	1.00	0.33	0.140	
23	3.00	2.00	3.00	1.00	0.446	

Table 37. C-B6 level pair-wise comparison matrix of expert 2

B6	24	25	26	W	CR
24	1.00	1.00	3.00	0.429	0 < 0.1
25	1.00	1.00	3.00	0.429	
26	0.33	0.33	1.00	0.143	

Table 38. Weights by AHP of expert 2

	C1	C2	C3	C4	C5	C6	AHP weight
	0.112	0.2	0.112	0.061	0.315	0.2	
C1	0.385						0.043
C2	0.252						0.028
C3	0.143						0.016
C4	0.143						0.016
C5	0.077						0.009
C6		0.356					0.071
C7		0.222					0.044
C8		0.072					0.014
C9		0.222					0.044
C10		0.128					0.026
C11			0.209				0.023
C12			0.126				0.014
C13			0.068				0.008
C14			0.068				0.008
C15			0.319				0.036
C16			0.209				0.023
C17				0.529			0.032
C18				0.309			0.019
C19				0.162			0.010
C20					0.14		0.044
C21					0.273		0.086
C22					0.14		0.044
C23					0.446		0.141
C24						0.429	0.086
C25						0.429	0.086
C26						0.143	0.029

Table 39. Alternative level of expert 2

	XOM	NCPC	BP	Shell	CP	Chevron	Total
C1	8	8	7	7	6	9	7
C2	9	6	9	5	8	6	6
C3	7	8	6	9	7	8	6
C4	9	7	8	8	5	7	7
C5	8	9	7	9	6	8	6
C6	6	7	8	7	5	7	9
C7	6	8	6	7	6	8	8

	XOM	NCPC	BP	Shell	CP	Chevron	Total
C8	8	7	9	8	6	7	5
C9	9	8	6	5	7	8	7
C10	6	8	7	7	6	5	8
C11	5	7	6	8	6	5	9
C12	8	6	7	6	7	8	7
C13	9	8	7	5	6	7	6
C14	8	6	7	9	6	7	8
C15	8	8	9	7	6	8	7
C16	7	9	6	8	7	5	6
C17	7	8	9	6	7	8	5
C18	8	6	8	9	7	6	7
C19	8	6	7	9	8	6	9
C20	8	7	6	9	7	8	8
C21	6	8	9	7	6	5	7
C22	7	8	7	8	6	7	7
C23	6	8	9	7	6	5	6
C24	8	7	9	6	8	7	5
C25	9	9	8	8	6	7	7
C26	6	7	5	8	9	8	7

Table 40. B-A level pair-wise comparison matrix of expert 3

B-A	B1	B2	B3	B4	B5	B6	W	CR
B1	1.00	0.50	0.33	1.00	0.25	0.50	0.074	0.012 < 0.1
B2	3.00	1.00	0.50	2.00	0.33	1.00	0.162	
B3	3.00	2.00	1.00	3.00	0.50	2.00	0.238	
B4	1.00	0.50	0.33	1.00	0.25	0.50	0.074	
B5	3.00	3.00	2.00	4.00	1.00	2.00	0.310	
B6	2.00	1.00	0.50	2.00	0.33	1.00	0.141	

Table 41. C-B1 level pair-wise comparison matrix of expert 3

C-B1	C1	C2	C3	C4	C5	W	CR
C1	1.00	0.50	0.50	1.00	2.00	0.163	0.004
C2	2.00	1.00	1.00	2.00	3.00	0.293	
C3	2.00	1.00	1.00	2.00	3.00	0.293	
C4	1.00	0.50	0.50	1.00	2.00	0.163	
C5	0.50	0.33	0.33	0.50	1.00	0.087	

Table 42. C-B2 level pair-wise comparison matrix of expert 3

C-B2	C6	C7	C8	C9	C10	W	CR
C6	1.00	1.00	0.50	1.00	0.50	0.143	0 < 0.1
C7	1.00	1.00	0.50	1.00	0.50	0.143	
C8	2.00	2.00	1.00	2.00	1.00	0.286	
C9	1.00	1.00	0.50	1.00	0.50	0.143	
C10	2.00	2.00	1.00	2.00	1.00	0.286	

Table 43. C-B3 level pair-wise comparison matrix of expert 3

C-B3	C11	C12	C13	C14	C15	C16	W	CR
C11	1.00	3.00	2.00	3.00	2.00	0.50	0.233	0.008 < 0.1
C12	0.33	1.00	0.50	1.00	0.50	0.25	0.073	
C13	0.50	2.00	1.00	2.00	1.00	0.33	0.139	
C14	0.33	1.00	0.50	1.00	0.50	0.25	0.073	
C15	0.50	2.00	1.00	2.00	1.00	0.33	0.139	
C16	2.00	4.00	3.00	4.00	3.00	1.00	0.345	

Table 44. C-B4 level pair-wise comparison matrix of expert 3

C-B4	C17	C18	C19	W	CR
C17	1.00	2.00	1.00	0.400	0 < 0.1
C18	0.50	1.00	0.50	0.200	
C19	1.00	2.00	1.00	0.400	

Table 45. C-B5 level pair-wise comparison matrix of expert 3

C-B5	C20	C21	C22	C23	W	CR
C20	1.00	1.00	3.00	2.00	0.347	0.005 < 0.1
C21	1.00	1.00	3.00	2.00	0.347	
C22	0.33	0.33	1.00	0.50	0.107	
C23	0.50	0.50	2.00	1.00	0.198	

Table 46. C-B6 level pair-wise comparison matrix of expert 3

C-B6	C24	C25	C26	W	CR
C24	1.00	0.50	0.50	0.200	0 < 0.1
C25	2.00	1.00	1.00	0.400	
C26	2.00	1.00	1.00	0.400	

Table 47. Weights by AHP of expert 3

	C1	C2	C3	C4	C5	C6	weight
	0.074	0.162	0.238	0.074	0.31	0.141	
C1	0.163						0.012
C2	0.293						0.022
C3	0.293						0.022
C4	0.163						0.012
C5	0.087						0.006
C6		0.143					0.023
C7		0.143					0.023
C8		0.286					0.046
C9		0.143					0.023
C10		0.286					0.046
C11			0.233				0.056
C12			0.073				0.017
C13			0.139				0.033
C14			0.073				0.018
C15			0.139				0.033
C16			0.345				0.082
C17				0.4			0.030
C18				0.2			0.015
C19				0.4			0.030
C20					0.347		0.108
C21					0.347		0.108
C22					0.107		0.033
C23					0.198		0.061
C24						0.2	0.028
C25						0.4	0.057
C26						0.4	0.056

Table 48. Alternative level of expert 3

	XOM	NCPC	BP	Shell	CP	Chevron	Total
C1	7	7	7	8	9	5	6
C2	6	9	8	6	7	8	7
C3	9	8	6	7	6	7	8
C4	7	8	9	6	8	7	7
C5	8	9	6	8	5	6	8
C6	9	7	6	5	8	9	6
C7	7	7	9	8	7	6	9
C8	7	9	6	6	8	9	7
C9	8	6	5	9	7	6	6
C10	8	9	7	7	8	8	8
C11	9	7	8	6	5	7	5
C12	8	8	6	8	7	6	7
C13	6	9	8	7	6	5	9
C14	9	7	6	7	9	8	8
C15	8	6	9	7	8	6	7
C16	9	8	5	6	8	7	9
C17	8	7	6	7	9	6	8
C18	8	8	9	7	6	8	7
C19	7	8	6	5	9	6	6
C20	8	6	9	7	6	8	5
C21	7	9	5	8	7	6	7
C22	7	9	8	8	6	7	6
C23	9	7	6	9	5	8	8
C24	5	9	7	8	6	5	7
C25	8	7	9	6	7	8	6
C26	7	9	7	8	7	6	8