

Proportional Odds & Partial Proportional Odds/ Parallel Lines & Non-Parallel Lines

Richard Williams, University of Notre Dame, <https://academicweb.nd.edu/~rwilliam/>

Last revised March 27, 2019

Model 0: Perfect Proportional Odds/ Parallel Lines							
gender		attitude					
		SD	D	A	SA		Total
-----+							
Male		250	250	250	250		1,000
Female		100	150	250	500		1,000
-----+							
Total		350	400	500	750		2,000

	1 versus 2, 3, 4	1 & 2 versus 3 & 4	1, 2, 3 versus 4
Odds _M	750/250 = 3	500/500 = 1	250/750 = 1/3
Odds _F	900/100 = 9	750/250 = 3	500/500 = 1
OR (Odds _F / Odds _M)	9/3 = 3	3/1 = 3	1/ (1/3) = 3
Gologit2 Betas	1.098612	1.098612	1.098612
Gologit2 χ^2 (3 d.f.)	176.63 (p = 0.0000)		
Ologit χ^2 (1 d.f.)	176.63 (p = 0.0000)		
Ologit Beta (OR)	1.098612 (3.00)		
Brant Test (2 d.f.)	0.0 (p = 1.000)		
Comment	If proportional odds holds, then the odds ratios should be the same for each of the ordered dichotomizations of the dependent variable. Proportional Odds works perfectly in this model, as the odds ratios are all 3. Also, the Betas are all the same, as they should be.		

Model 1: Partial Proportional Odds I					
gender	SD	attitude			Total
		D	A	SA	
Male	250	250	250	250	1,000
Female	100	300	300	300	1,000
Total	350	550	550	550	2,000

	1 versus 2, 3, 4	1 & 2 versus 3 & 4	1, 2, 3 versus 4
Odds _M	750/250 = 3	500/500 = 1	250/750 = 1/3
Odds _F	900/100 = 9	600/400 = 1.5	300/700 = 3/7
OR (Odds _F / Odds _M)	9/3 = 3	1.5/1 = 1.5	(3/7)/(1/3) = 1.28
Gologit2 Betas	1.098612	.4054651	.2513144

Gologit2 χ^2 (3 d.f.)	80.07 (p = 0.0000)
Ologit χ^2 (1 d.f.)	36.44 (p = 0.0000)
Ologit Beta (OR)	.4869136 (1.627286)
Brant Test (2 d.f.)	40.29 (p = 0.000)
Comment	Gender has its greatest effect at the lowest levels of attitudes, i.e. women are much less likely to strongly disagree than men are, but other differences are smaller. The effect of gender is consistently positive, i.e. the differences involve magnitude, not sign.

Model 2: Partial Proportional Odds II					
gender	SD	attitude			Total
		D	A	SA	
Male	250	250	250	250	1,000
Female	100	400	250	250	1,000
Total	350	650	500	500	2,000

	1 versus 2, 3, 4	1 & 2 versus 3 & 4	1, 2 3 versus 4
Odds _M	750/250 = 3	500/500 = 1	250/750 = 1/3
Odds _F	900/100 = 9	500/500 = 1	250/750 = 1/3
OR (Odds _F / Odds _M)	9/3 = 3	1/1 = 1	(1/3)/(1/3) = 1
Gologit2 Betas	1.098612	0	0
Gologit2 χ^2 (3 d.f.)	101.34 (p = 0.0000)		
Ologit χ^2 (1 d.f.)	9.13 (p = 0.0025)		
Ologit Beta (OR)	.243576 (1.275803)		
Brant Test (2 d.f.)	83.05 (p = 0.000)		
Comment	Gender has its greatest – and only – effect at the lowest levels of attitudes, i.e. women are much less likely to strongly disagree than men are. But, this occurs entirely because they are much more likely to disagree rather than strongly disagree. Other than that, there is no gender effect; men and women are equally likely to agree and to strongly agree. The ologit estimate underestimates the effect of gender on the lower levels of attitudes and overestimates its effect at the higher levels.		

Model 3: Partial Proportional Odds III					
gender	SD	attitude			Total
		D	A	SA	
Male	250	250	250	250	1,000
Female	100	400	400	100	1,000
Total	350	650	650	350	2,000
		1 versus 2, 3, 4		1 & 2 versus 3 & 4	
Odds _M		750/250 = 3		500/500 = 1	
Odds _F		900/100 = 9		500/500 = 1	
OR (Odds _F / Odds _M)		9/3 = 3		1/1 = 1	
Gologit2 Betas		1.098612		0	
Gologit2 χ^2 (3 d.f.)		202.69 (p = 0.0000)			
Ologit χ^2 (1 d.f.)		0.00 (p = 1.0000)			
Ologit Beta (OR)		0 (1.00))			
Brant Test (2 d.f.)		179.71 (p = 0.000)			