

ANOVA with binary variables - The F-test and some Alternatives

Appendix B 5 Tables and Graphs of the Type I Error Rates of all considered methods for fixed n_{ij} (5,10,...,50) in between subject designs

All tables refer to $\alpha=0.05$ and $\alpha=0.01$, graphs to $\alpha=0.05$. Reported are the proportions of rejections of the corresponding null hypothesis.

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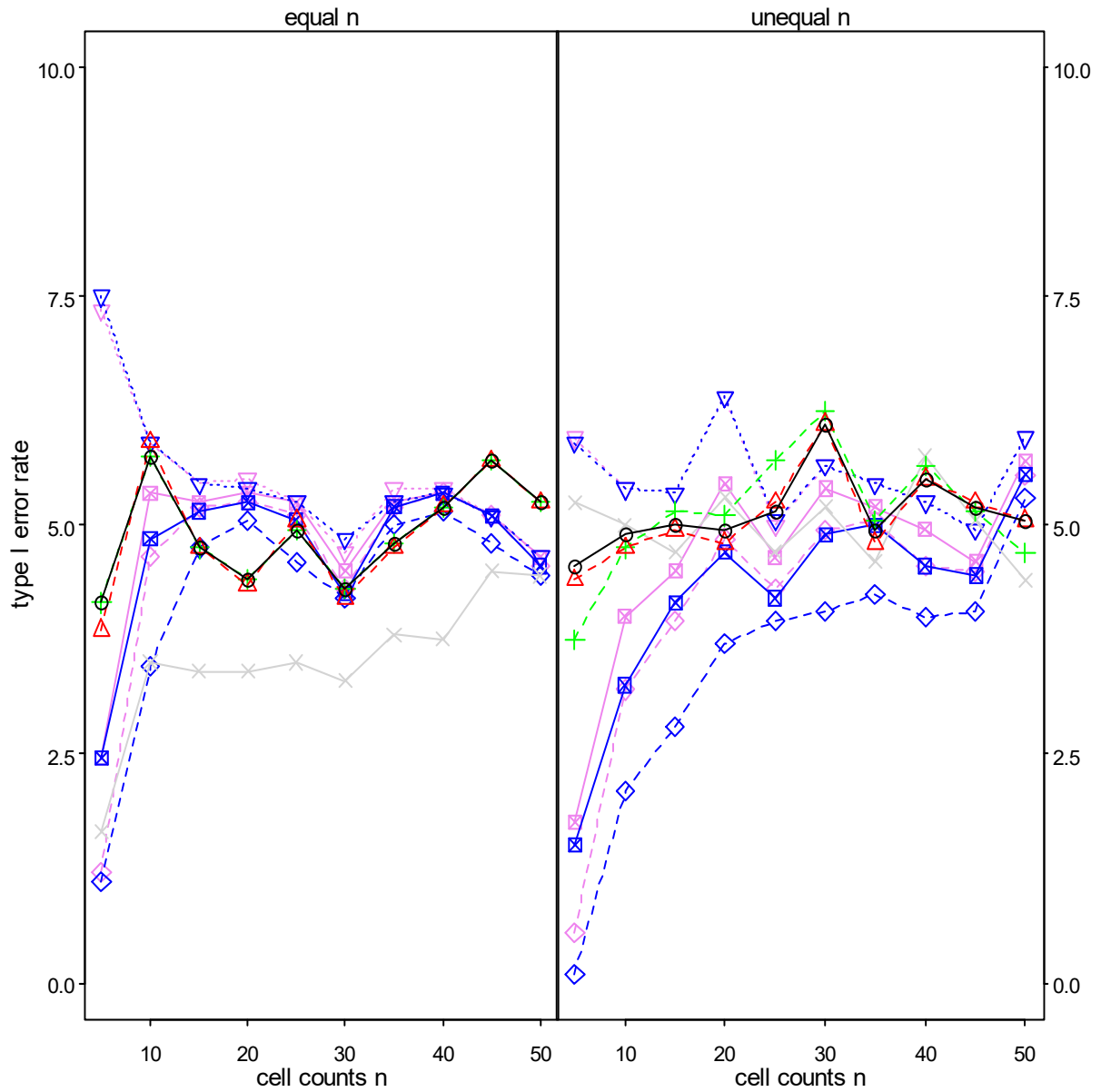
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5. 1. Main effect A - null model

5. 1. 1 $p = 0.5$

		equal cell counts (levels = 2*4)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	4.15	5.75	4.75	4.40	4.95	4.3	4.80	5.20	5.7	5.25
	Puri & Sen	3.85	5.90	4.75	4.35	5.05	4.2	4.75	5.20	5.7	5.25
	ATS	4.15	5.75	4.75	4.40	4.95	4.3	4.80	5.20	5.7	5.25
	logistic Wald	1.10	3.45	4.75	5.05	4.60	4.20	5.00	5.15	4.8	4.45
	logistic LR	7.50	5.90	5.45	5.40	5.25	4.85	5.25	5.35	5.1	4.65
	logistic W-LR	2.45	4.85	5.15	5.25	5.05	4.25	5.20	5.35	5.1	4.55
	probit Wald	1.20	4.65	5.20	5.25	5.10	4.30	5.20	5.35	5.1	4.55
	probit LR	7.35	5.90	5.45	5.50	5.25	4.70	5.40	5.40	5.1	4.65
	probit W-LR	2.45	5.35	5.25	5.35	5.25	4.50	5.25	5.35	5.1	4.65
chi-squared	1.65	3.50	3.40	3.40	3.50	3.3	3.80	3.75	4.5	4.45	
0.01	parametric	1.10	1.20	1.05	1.05	1.00	1.30	0.90	0.85	1.10	1.00
	Puri & Sen	0.60	1.00	0.90	0.95	0.80	1.30	0.90	0.60	1.10	1.00
	ATS	0.80	1.15	1.05	1.05	1.00	1.30	0.90	0.85	1.10	1.00
	logistic Wald	0.10	0.55	0.80	0.70	0.85	0.80	0.85	0.95	1.1	1.00
	logistic LR	1.55	1.40	1.25	1.00	1.20	1.20	1.10	1.15	1.1	1.15
	logistic W-LR	0.40	0.95	0.90	0.85	0.90	0.80	1.10	1.05	1.1	1.05
	probit Wald	0.10	0.95	0.95	0.85	1.00	0.85	1.10	1.05	1.1	1.05
	probit LR	1.55	1.40	1.25	1.00	1.20	1.20	1.10	1.15	1.1	1.15
	probit W-LR	0.45	1.10	1.10	0.90	1.00	1.10	1.10	1.05	1.1	1.10
chi-squared	0.25	0.40	0.70	0.60	0.50	1.05	0.75	0.55	0.75	0.80	
		unequal cell counts (levels = 4*5)									
0.05	parametric	4.55	4.90	5.00	4.95	5.15	6.10	4.95	5.50	5.20	5.05
	Puri & Sen	4.40	4.75	4.95	4.80	5.25	6.10	4.80	5.50	5.25	5.05
	ATS	3.75	4.75	5.15	5.10	5.70	6.25	5.05	5.65	5.15	4.70
	logistic Wald	0.10	2.10	2.80	3.70	3.95	4.05	4.25	4.00	4.05	5.30
	logistic LR	5.90	5.40	5.35	6.40	5.05	5.65	5.45	5.25	4.95	5.95
	logistic W-LR	1.50	3.25	4.15	4.70	4.20	4.90	5.00	4.55	4.45	5.55
	probit Wald	0.55	3.20	3.95	4.85	4.30	4.95	5.05	4.55	4.50	5.55
	probit LR	5.95	5.40	5.35	6.40	5.00	5.65	5.45	5.25	4.95	5.95
	probit W-LR	1.75	4.00	4.50	5.45	4.65	5.40	5.20	4.95	4.60	5.70
chi-squared	5.25	5.00	4.70	5.30	4.70	5.20	4.60	5.75	5.05	4.40	
0.01	parametric	0.60	1.00	1.10	1.10	1.15	1.20	1.15	1.20	0.90	0.90
	Puri & Sen	0.40	0.80	0.95	1.00	1.10	1.15	1.15	1.10	0.85	0.90
	ATS	0.60	1.00	1.05	1.30	1.10	1.25	1.20	1.55	0.90	0.95
	logistic Wald	0.05	0.25	0.30	0.45	0.75	0.65	0.80	0.90	0.6	1.05
	logistic LR	1.05	1.30	1.15	1.25	0.95	1.25	1.25	1.05	0.8	1.25
	logistic W-LR	0.05	0.70	0.70	0.90	0.80	1.00	1.00	1.00	0.8	1.15
	probit Wald	0.05	0.60	0.70	0.95	0.80	1.05	1.00	1.00	0.8	1.15
	probit LR	1.15	1.20	1.15	1.25	0.95	1.25	1.25	1.05	0.8	1.25
	probit W-LR	0.05	0.80	0.90	1.00	0.85	1.20	1.15	1.00	0.8	1.20
chi-squared	0.90	1.05	0.95	0.90	1.25	0.90	1.15	1.25	1.05	0.85	

Graphic for $\alpha=0.05$:



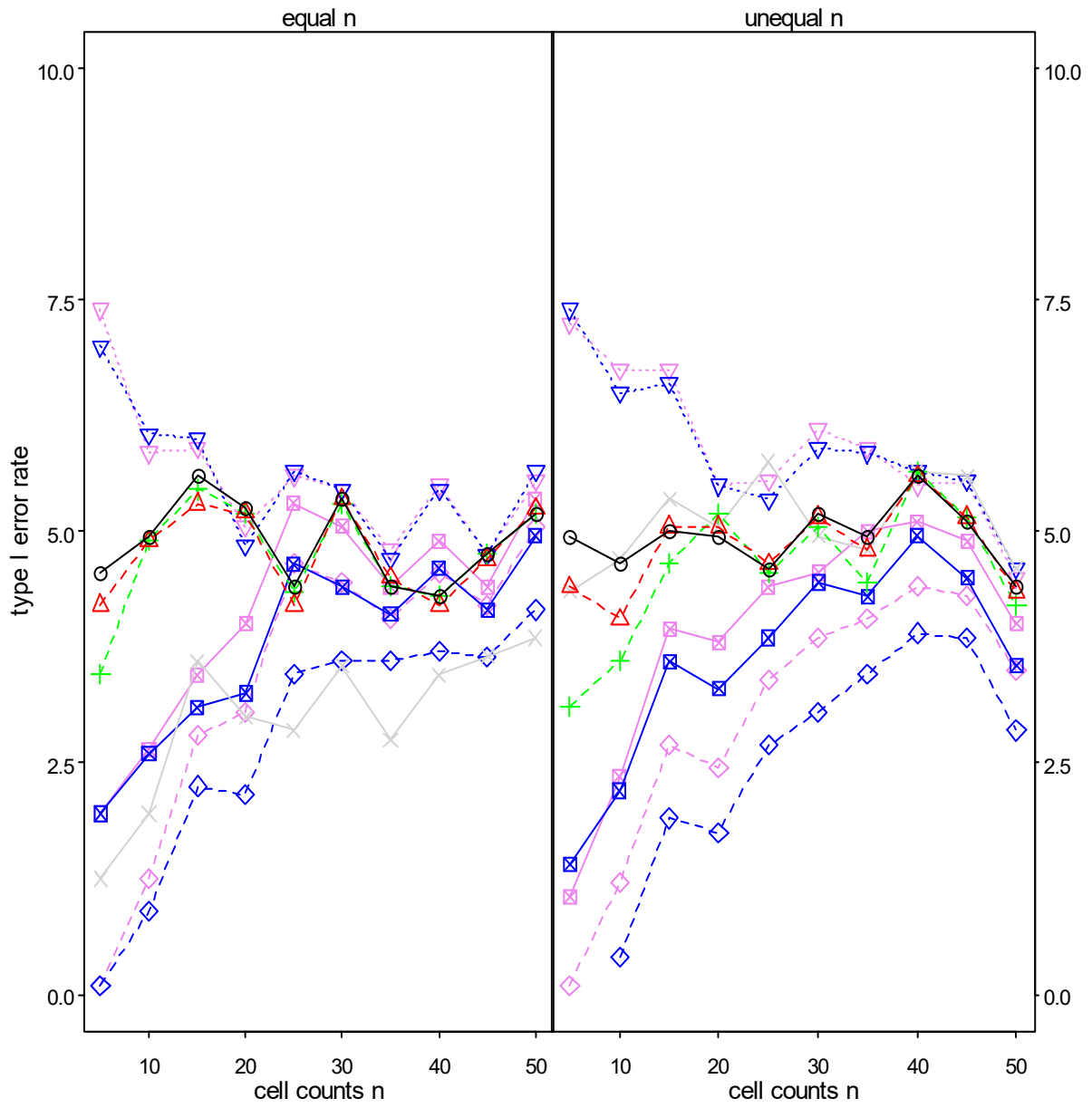
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|--------------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Puri & Sen | ...▽... | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- | probit/Wald |
| | | ...▽... | probit/LR |
| | | —■— | probit/Wald+LR |

5.1.2 p = 0.8

		equal cell counts (levels = 2*4)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	4.55	4.95	5.60	5.25	4.40	5.35	4.40	4.30	4.75	5.20
	Puri & Sen	4.20	4.90	5.30	5.20	4.20	5.35	4.50	4.20	4.70	5.25
	ATS	3.45	4.90	5.45	5.20	4.35	5.30	4.40	4.30	4.75	5.20
	logistic Wald	0.10	0.90	2.25	2.15	3.45	3.60	3.60	3.70	3.65	4.15
	logistic LR	7.00	6.05	6.00	4.85	5.65	5.45	4.70	5.45	4.75	5.65
	logistic W-LR	1.95	2.60	3.10	3.25	4.65	4.40	4.10	4.60	4.15	4.95
	probit Wald	0.10	1.25	2.80	3.05	4.65	4.45	4.05	4.55	4.20	5.05
	probit LR	7.40	5.85	5.90	5.05	5.60	5.45	4.80	5.50	4.75	5.55
	probit W-LR	1.95	2.65	3.45	4.00	5.30	5.05	4.40	4.90	4.40	5.35
	chi-squared	1.25	1.95	3.60	3.00	2.85	3.55	2.75	3.45	3.65	3.85
0.01	parametric	0.55	0.70	1.50	1.20	1.05	1.15	0.40	1.10	0.9	1.25
	Puri & Sen	0.45	0.55	1.55	1.20	0.95	1.05	0.45	1.10	0.9	1.20
	ATS	0.25	0.70	1.50	1.20	1.05	1.15	0.40	1.10	0.9	1.25
	logistic Wald	0.05	0.05	0.20	0.20	0.60	0.65	0.55	0.50	0.55	0.85
	logistic LR	1.85	1.45	0.90	0.80	1.35	1.20	1.15	0.80	0.90	1.15
	logistic W-LR	0.20	0.40	0.45	0.25	0.75	0.85	0.85	0.60	0.80	0.95
	probit Wald	0.05	0.10	0.50	0.25	0.75	0.85	0.85	0.65	0.75	0.90
	probit LR	2.05	1.35	0.95	0.70	1.30	1.20	1.20	0.85	0.90	1.15
	probit W-LR	0.20	0.40	0.50	0.30	0.85	1.15	1.00	0.75	0.85	1.05
	chi-squared	0.05	0.20	0.65	0.95	0.60	0.60	0.25	0.70	0.6	1.05
		unequal cell counts (levels = 4*5)									
0.05	parametric	4.95	4.65	5.00	4.95	4.60	5.20	4.95	5.60	5.10	4.40
	Puri & Sen	4.40	4.05	5.05	5.05	4.65	5.15	4.80	5.60	5.15	4.35
	ATS	3.10	3.60	4.65	5.20	4.55	5.05	4.45	5.65	5.15	4.20
	logistic Wald	0.05	0.40	1.90	1.75	2.70	3.05	3.45	3.90	3.85	2.85
	logistic LR	7.40	6.50	6.60	5.50	5.35	5.90	5.85	5.65	5.55	4.60
	logistic W-LR	1.40	2.20	3.60	3.30	3.85	4.45	4.30	4.95	4.50	3.55
	probit Wald	0.10	1.20	2.70	2.45	3.40	3.85	4.05	4.40	4.30	3.50
	probit LR	7.25	6.75	6.75	5.50	5.55	6.10	5.90	5.50	5.55	4.50
	probit W-LR	1.05	2.35	3.95	3.80	4.40	4.55	5.00	5.10	4.90	4.00
	chi-squared	4.35	4.70	5.35	5.05	5.75	4.95	4.80	5.65	5.60	4.60
0.01	parametric	0.95	0.80	1.00	1.30	1.10	0.90	0.75	0.80	0.70	0.65
	Puri & Sen	0.80	0.70	0.90	1.30	0.95	0.90	0.75	0.80	0.70	0.65
	ATS	0.90	0.65	0.65	0.80	1.30	0.80	0.60	0.85	0.75	0.65
	logistic Wald	0.05	0.05	0.10	0.15	0.50	0.55	0.65	0.55	0.50	0.35
	logistic LR	1.75	1.40	1.75	1.25	1.00	1.25	1.15	1.10	0.95	0.80
	logistic W-LR	0.05	0.35	0.60	0.45	0.65	0.80	0.85	0.85	0.65	0.50
	probit Wald	0.05	0.05	0.30	0.40	0.60	0.70	0.80	0.75	0.60	0.45
	probit LR	1.85	1.60	2.00	1.20	1.05	1.25	1.20	1.15	0.95	0.80
	probit W-LR	0.05	0.40	0.70	0.50	0.65	0.95	1.00	1.00	0.80	0.65
	chi-squared	0.80	0.65	1.00	1.25	1.15	0.90	0.95	1.55	0.75	0.80

Graphic for $\alpha=0.05$:



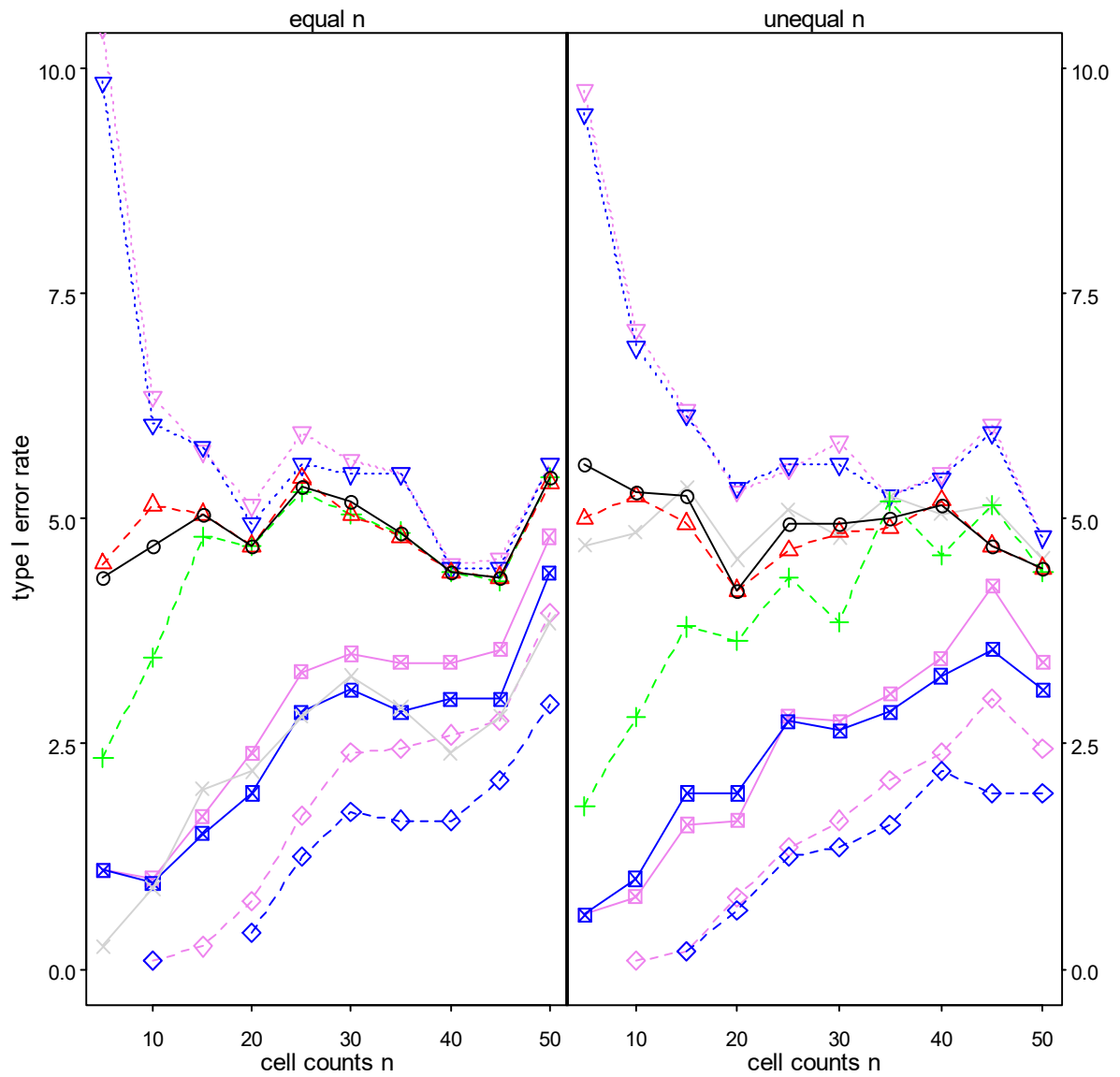
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|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Puri & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- - - | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5.1.3 p = 0.9

α	method	equal cell counts (levels = 2*4)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	4.35	4.70	5.05	4.7	5.35	5.20	4.85	4.40	4.35	5.45
	Puri & Sen	4.50	5.15	5.05	4.7	5.45	5.05	4.80	4.40	4.35	5.40
	ATS	2.35	3.45	4.80	4.7	5.30	5.05	4.85	4.40	4.30	5.45
	logistic Wald	0.05	0.10	0.05	0.40	1.25	1.75	1.65	1.65	2.10	2.95
	logistic LR	9.85	6.05	5.80	4.95	5.60	5.50	5.50	4.45	4.45	5.60
	logistic W-LR	1.10	0.95	1.50	1.95	2.85	3.10	2.85	3.00	3.00	4.40
	probit Wald	0.05	0.10	0.25	0.75	1.70	2.40	2.45	2.60	2.75	3.95
	probit LR	10.45	6.35	5.75	5.15	5.95	5.65	5.50	4.50	4.55	5.60
	probit W-LR	1.10	1.00	1.70	2.40	3.30	3.50	3.40	3.40	3.55	4.80
	chi-squared	0.25	0.90	2.00	2.2	2.80	3.25	2.90	2.40	2.80	3.85
0.01	parametric	0.2	0.55	0.90	1.05	1.15	1.05	0.95	0.75	0.75	1.05
	Puri & Sen	0.2	0.40	0.90	0.95	1.05	1.10	0.95	0.75	0.75	1.10
	ATS	0.1	0.45	0.90	0.90	1.10	1.05	0.95	0.75	0.75	1.05
	logistic Wald	0.05	0.05	0.05	0.05	0.10	99.95	0.10	0.15	0.15	0.25
	logistic LR	1.45	1.50	1.25	1.15	1.45	1.25	1.00	1.00	0.80	1.15
	logistic W-LR	0.05	0.10	0.10	0.10	0.40	0.40	0.50	0.30	0.50	0.75
	probit Wald	0.05	0.05	0.05	0.05	0.15	0.25	0.25	0.25	0.45	0.55
	probit LR	1.50	1.45	1.30	1.15	1.45	1.25	1.15	1.00	0.85	1.20
	probit W-LR	0.05	0.15	0.15	0.10	0.55	0.45	0.55	0.65	0.65	0.90
	chi-squared	0.05	0.20	0.10	0.20	0.65	0.55	0.65	0.40	0.35	0.75
		unequal cell counts (levels = 4*5)									
0.05	parametric	5.6	5.30	5.25	4.20	4.95	4.95	5.00	5.15	4.70	4.45
	Puri & Sen	5.0	5.25	4.95	4.20	4.65	4.85	4.90	5.20	4.70	4.45
	ATS	1.8	2.80	3.80	3.65	4.35	3.85	5.20	4.60	5.15	4.40
	logistic Wald	0.05	0.05	0.20	0.65	1.25	1.35	1.60	2.20	1.95	1.95
	logistic LR	9.50	6.90	6.15	5.35	5.60	5.60	5.25	5.45	5.95	4.80
	logistic W-LR	0.60	1.00	1.95	1.95	2.75	2.65	2.85	3.25	3.55	3.10
	probit Wald	0.05	0.10	0.20	0.80	1.35	1.65	2.10	2.40	3.00	2.45
	probit LR	9.75	7.10	6.20	5.30	5.55	5.85	5.25	5.50	6.05	4.80
	probit W-LR	0.60	0.80	1.60	1.65	2.80	2.75	3.05	3.45	4.25	3.40
	chi-squared	4.7	4.85	5.35	4.55	5.10	4.80	5.25	5.05	5.15	4.55
0.01	parametric	1.45	1.40	1.2	0.90	1.30	0.70	1.60	0.80	0.90	0.80
	Puri & Sen	1.15	1.10	1.1	0.80	1.25	0.65	1.50	0.80	0.95	0.80
	ATS	0.30	0.40	0.5	0.40	0.75	0.50	0.85	0.65	0.85	0.65
	logistic Wald	0.05	0.05	0.05	0.05	0.10	0.20	0.20	0.10	0.25	0.15
	logistic LR	2.25	1.95	1.65	1.25	1.50	0.95	1.35	0.85	1.15	0.95
	logistic W-LR	0.05	0.15	0.05	0.20	0.25	0.40	0.60	0.25	0.35	0.30
	probit Wald	0.05	0.05	0.05	0.05	0.15	0.35	0.35	0.15	0.30	0.25
	probit LR	2.30	1.75	1.60	1.35	1.55	0.95	1.35	0.90	1.05	1.00
	probit W-LR	0.05	0.15	0.05	0.15	0.40	0.35	0.55	0.30	0.35	0.50
	chi-squared	0.95	1.05	1.1	0.85	1.30	0.75	0.90	0.80	1.00	0.70

Graphic for $\alpha=0.05$:



legend

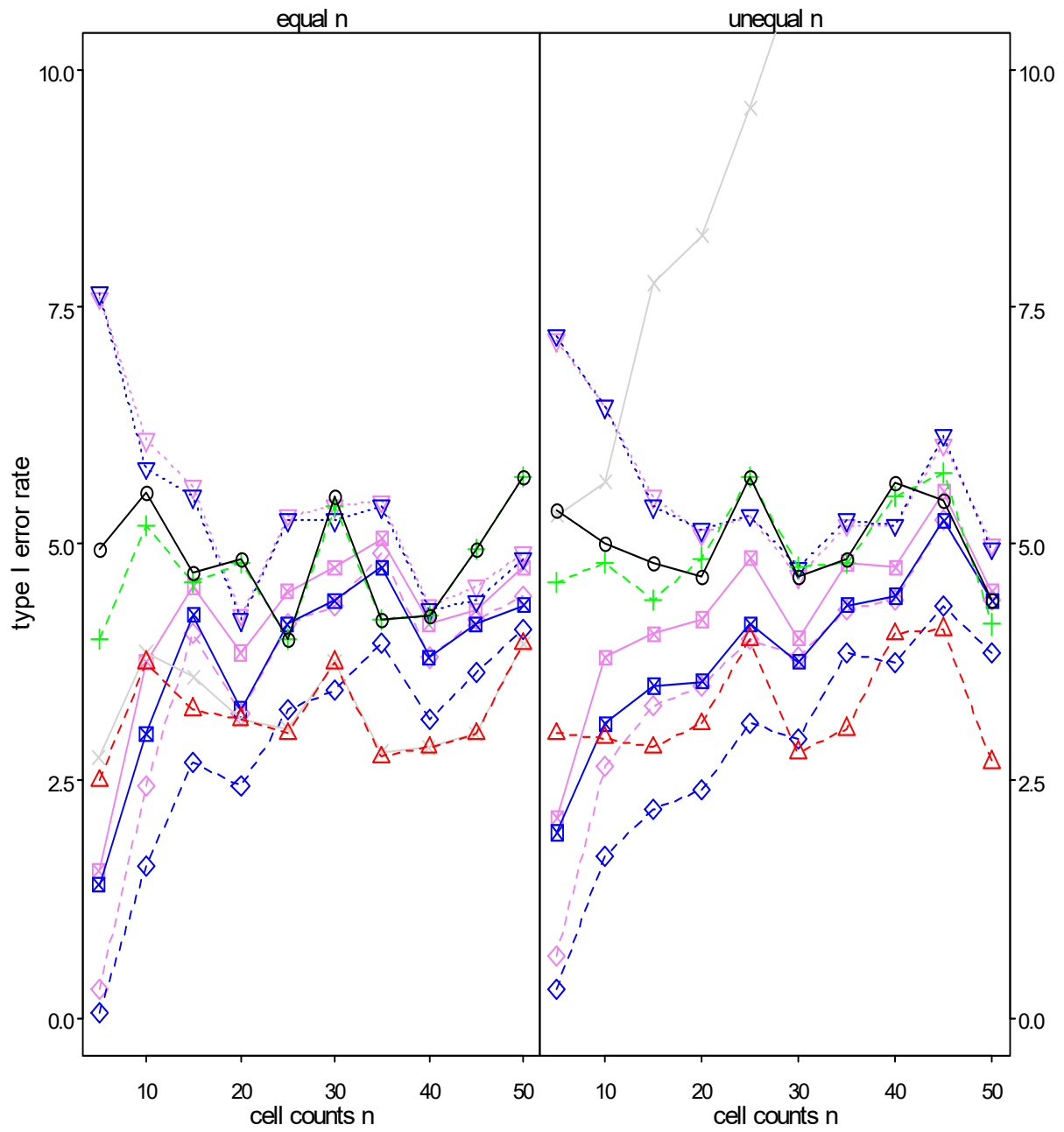
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|----------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- | Puri & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5. 2. Main effect B - A significant (effects $a_i = 0.6*s$) n_i and p_i independent

5. 2. 1 $p = 0.5$

		equal cell counts (levels = 2*4)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	4.95	5.55	4.70	4.85	4.00	5.50	4.20	4.25	4.95	5.70
	Puri & Sen	2.50	3.75	3.25	3.15	3.00	3.75	2.75	2.85	3.00	3.95
	ATS	4.00	5.20	4.60	4.80	4.00	5.40	4.20	4.25	4.95	5.70
	logistic Wald	0.05	1.60	2.70	2.45	3.25	3.45	3.95	3.15	3.65	4.10
	logistic LR	7.65	5.80	5.50	4.20	5.25	5.25	5.40	4.30	4.40	4.85
	logistic W-LR	1.40	3.00	4.25	3.25	4.15	4.40	4.75	3.80	4.15	4.35
	probit Wald	0.30	2.45	4.05	3.20	4.15	4.35	4.90	3.80	4.20	4.45
	probit LR	7.60	6.10	5.60	4.25	5.30	5.40	5.45	4.35	4.55	4.90
	probit W-LR	1.55	3.75	4.55	3.85	4.50	4.75	5.05	4.15	4.30	4.75
chi-squared	2.75	3.85	3.60	3.15	3.05	3.75	2.80	2.85	3.00	3.95	
0.01	parametric	1.35	1.70	1.00	0.85	0.90	0.60	0.75	0.75	0.85	1.45
	Puri & Sen	0.35	0.80	0.40	0.30	0.55	0.25	0.25	0.60	0.60	0.65
	ATS	0.80	1.40	1.00	0.80	0.90	0.50	0.75	0.75	0.85	1.45
	logistic Wald	0.05	0.10	0.35	0.55	0.75	0.50	0.80	0.65	0.40	0.85
	logistic LR	1.55	1.20	1.20	1.00	1.25	0.95	1.00	0.75	0.70	1.15
	logistic W-LR	0.05	0.50	0.55	0.95	1.05	0.70	0.95	0.65	0.50	1.05
	probit Wald	0.05	0.35	0.55	0.90	1.05	0.75	1.00	0.65	0.55	1.05
	probit LR	1.55	1.15	1.15	1.05	1.25	0.95	1.05	0.75	0.70	1.20
	probit W-LR	0.10	0.70	0.75	0.95	1.15	0.90	1.00	0.65	0.55	1.15
chi-squared	0.40	0.95	0.40	0.30	0.55	0.25	0.25	0.60	0.60	0.65	
		unequal cell counts (levels = 4*5)									
0.05	parametric	5.35	5.00	4.80	4.65	5.70	4.65	4.85	5.65	5.45	4.40
	Puri & Sen	3.00	2.95	2.85	3.10	4.00	2.80	3.05	4.05	4.10	2.70
	ATS	4.60	4.80	4.40	4.85	5.70	4.75	4.80	5.50	5.75	4.15
	logistic Wald	0.30	1.70	2.20	2.40	3.10	2.95	3.85	3.75	4.35	3.85
	logistic LR	7.20	6.45	5.40	5.15	5.30	4.75	5.25	5.20	6.15	4.95
	logistic W-LR	1.95	3.10	3.50	3.55	4.15	3.75	4.35	4.45	5.25	4.40
	probit Wald	0.65	2.65	3.30	3.50	4.00	3.80	4.30	4.40	5.25	4.40
	probit LR	7.15	6.45	5.50	5.10	5.30	4.65	5.20	5.20	6.05	5.00
	probit W-LR	2.10	3.80	4.05	4.20	4.85	4.00	4.80	4.75	5.55	4.50
chi-squared	5.30	5.65	7.75	8.25	9.60	11.15	14.00	14.20	17.25	18.35	
0.01	parametric	1.15	1.10	0.80	0.70	0.85	0.60	1.10	1.05	1.20	0.85
	Puri & Sen	0.55	0.65	0.55	0.25	0.30	0.45	0.65	0.65	0.70	0.45
	ATS	0.95	1.05	0.70	0.85	1.20	0.85	1.00	1.15	1.35	1.00
	logistic Wald	0.05	0.20	0.30	0.30	0.40	0.40	0.55	0.70	0.75	0.45
	logistic LR	2.05	1.30	0.75	0.95	1.15	0.75	0.80	1.20	1.15	0.60
	logistic W-LR	0.15	0.50	0.35	0.65	0.80	0.40	0.65	0.80	0.90	0.45
	probit Wald	0.05	0.40	0.35	0.65	0.80	0.40	0.65	0.80	0.85	0.45
	probit LR	2.00	1.35	0.75	0.95	1.15	0.75	0.85	1.15	1.15	0.60
	probit W-LR	0.20	0.55	0.50	0.75	0.85	0.55	0.65	1.00	1.00	0.55
chi-squared	1.00	1.55	1.50	1.90	2.25	3.30	3.85	3.80	5.00	5.45	

Graphic for $\alpha=0.05$:



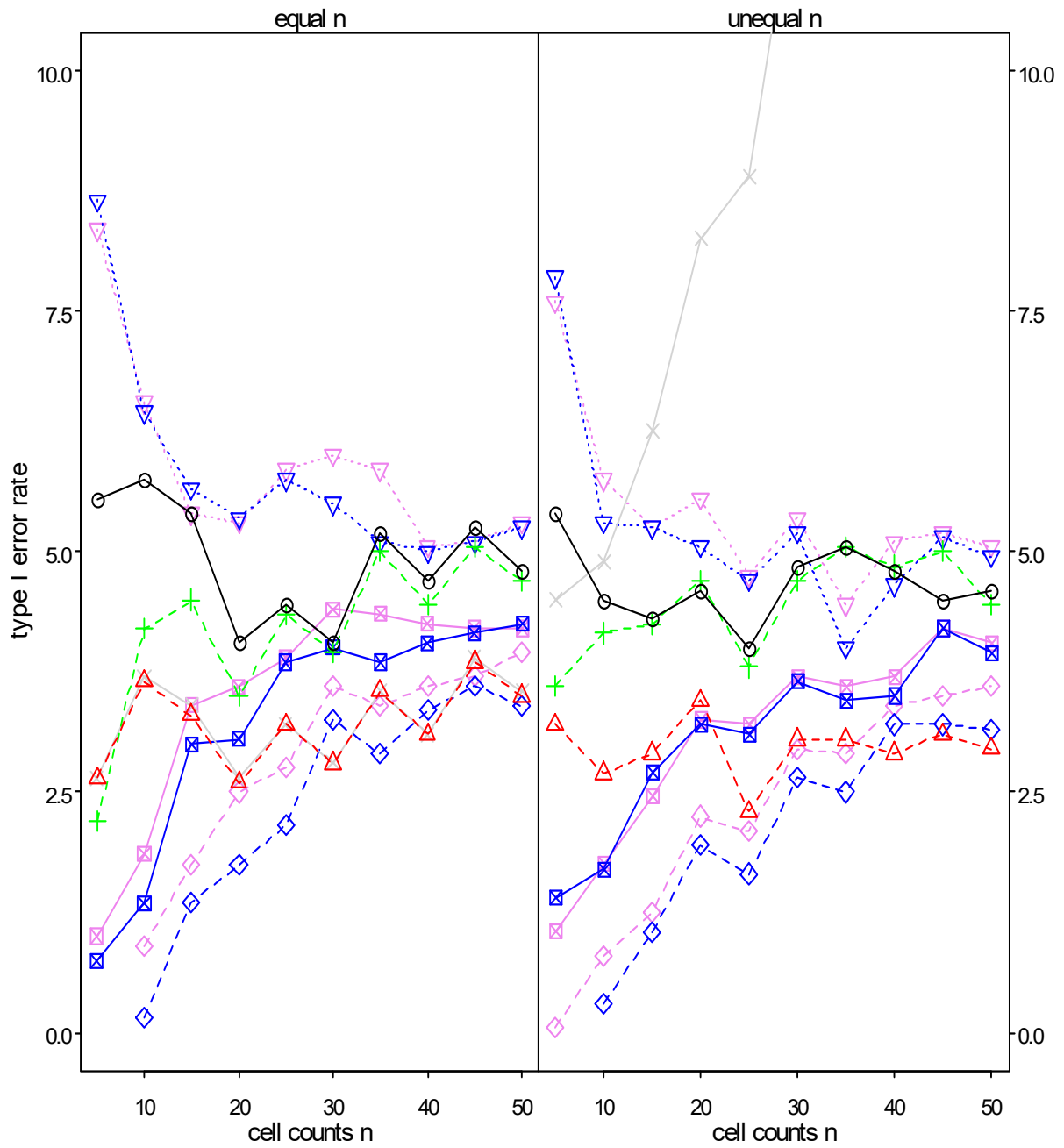
legend

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|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Furi & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —x— | chi-squared | - - -◇- - - | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5.2.2 $p = 0.8$

α	method	equal cell counts (levels = 2*4)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	5.55	5.75	5.40	4.05	4.45	4.05	5.20	4.70	5.25	4.80
	Puri & Sen	2.65	3.65	3.30	2.60	3.20	2.80	3.55	3.10	3.85	3.50
	ATS	2.20	4.20	4.50	3.50	4.35	3.95	5.00	4.45	5.05	4.70
	logistic Wald	0.05	0.15	1.35	1.75	2.15	3.25	2.90	3.35	3.60	3.40
	logistic LR	8.65	6.45	5.65	5.35	5.75	5.50	5.10	5.00	5.10	5.25
	logistic W-LR	0.75	1.35	3.00	3.05	3.85	4.00	3.85	4.05	4.15	4.25
	probit Wald	0.05	0.90	1.75	2.50	2.75	3.60	3.40	3.60	3.70	3.95
	probit LR	8.35	6.55	5.40	5.30	5.85	6.00	5.85	5.05	5.10	5.30
	probit W-LR	1.00	1.85	3.40	3.60	3.90	4.40	4.35	4.25	4.20	4.20
	chi-squared	2.65	3.70	3.40	2.65	3.20	2.80	3.55	3.10	3.90	3.55
0.01	parametric	1.15	1.50	1.20	1.00	1.30	0.85	0.90	0.55	1.55	1.15
	Puri & Sen	0.25	0.70	0.55	0.70	0.70	0.40	0.50	0.15	0.90	0.70
	ATS	0.10	0.65	0.75	0.90	1.15	0.70	0.70	0.40	1.40	0.90
	logistic Wald	0.05	0.05	0.20	0.35	0.20	0.35	0.3	0.35	0.45	0.30
	logistic LR	1.60	1.55	1.10	1.10	1.05	1.25	1.2	1.00	0.80	0.70
	logistic W-LR	0.05	0.05	0.25	0.65	0.30	0.30	0.6	0.60	0.70	0.50
	probit Wald	0.05	0.05	0.25	0.45	0.25	0.45	0.4	0.55	0.55	0.35
	probit LR	1.65	1.55	1.05	1.20	1.05	1.15	1.1	1.15	1.05	0.50
	probit W-LR	0.05	0.20	0.25	0.65	0.45	0.70	0.6	0.85	0.65	0.45
	chi-squared	0.25	0.75	0.60	0.75	0.75	0.45	0.50	0.15	0.90	0.70
		unequal cell counts (levels = 4*5)									
0.05	parametric	5.40	4.50	4.30	4.60	4.00	4.85	5.05	4.80	4.50	4.60
	Puri & Sen	3.20	2.70	2.90	3.45	2.30	3.05	3.05	2.90	3.10	2.95
	ATS	3.60	4.15	4.25	4.70	3.80	4.70	5.05	4.85	5.00	4.45
	logistic Wald	0.05	0.30	1.05	1.95	1.65	2.65	2.50	3.20	3.20	3.15
	logistic LR	7.85	5.30	5.25	5.05	4.70	5.20	4.00	4.65	5.15	4.95
	logistic W-LR	1.40	1.70	2.70	3.20	3.10	3.65	3.45	3.50	4.20	3.95
	probit Wald	0.05	0.80	1.25	2.25	2.10	2.95	2.90	3.40	3.50	3.60
	probit LR	7.60	5.75	5.25	5.55	4.75	5.35	4.45	5.10	5.20	5.05
	probit W-LR	1.05	1.75	2.45	3.25	3.20	3.70	3.60	3.70	4.20	4.05
	chi-squared	4.50	4.90	6.25	8.25	8.90	12.25	12.90	13.20	16.80	17.20
0.01	parametric	1.30	1.15	0.75	1.05	0.60	0.75	0.45	0.90	0.90	0.65
	Puri & Sen	0.50	0.40	0.35	0.65	0.25	0.30	0.20	0.50	0.40	0.40
	ATS	0.65	0.65	0.70	1.05	0.70	0.90	0.45	1.00	1.05	0.65
	logistic Wald	0.05	0.05	0.15	0.25	0.20	0.35	0.25	0.30	0.40	0.65
	logistic LR	2.15	1.15	1.25	1.15	1.00	0.95	0.65	0.70	0.75	0.90
	logistic W-LR	0.10	0.30	0.30	0.65	0.45	0.55	0.30	0.55	0.50	0.70
	probit Wald	0.05	0.05	0.15	0.35	0.30	0.55	0.30	0.25	0.50	0.65
	probit LR	2.20	1.25	1.25	1.30	1.05	0.95	0.80	0.70	0.80	0.85
	probit W-LR	0.05	0.30	0.30	0.60	0.45	0.60	0.40	0.45	0.55	0.70
	chi-squared	0.70	0.70	1.35	2.00	2.05	3.30	4.15	4.80	5.55	4.75

Graphic for $\alpha=0.05$:



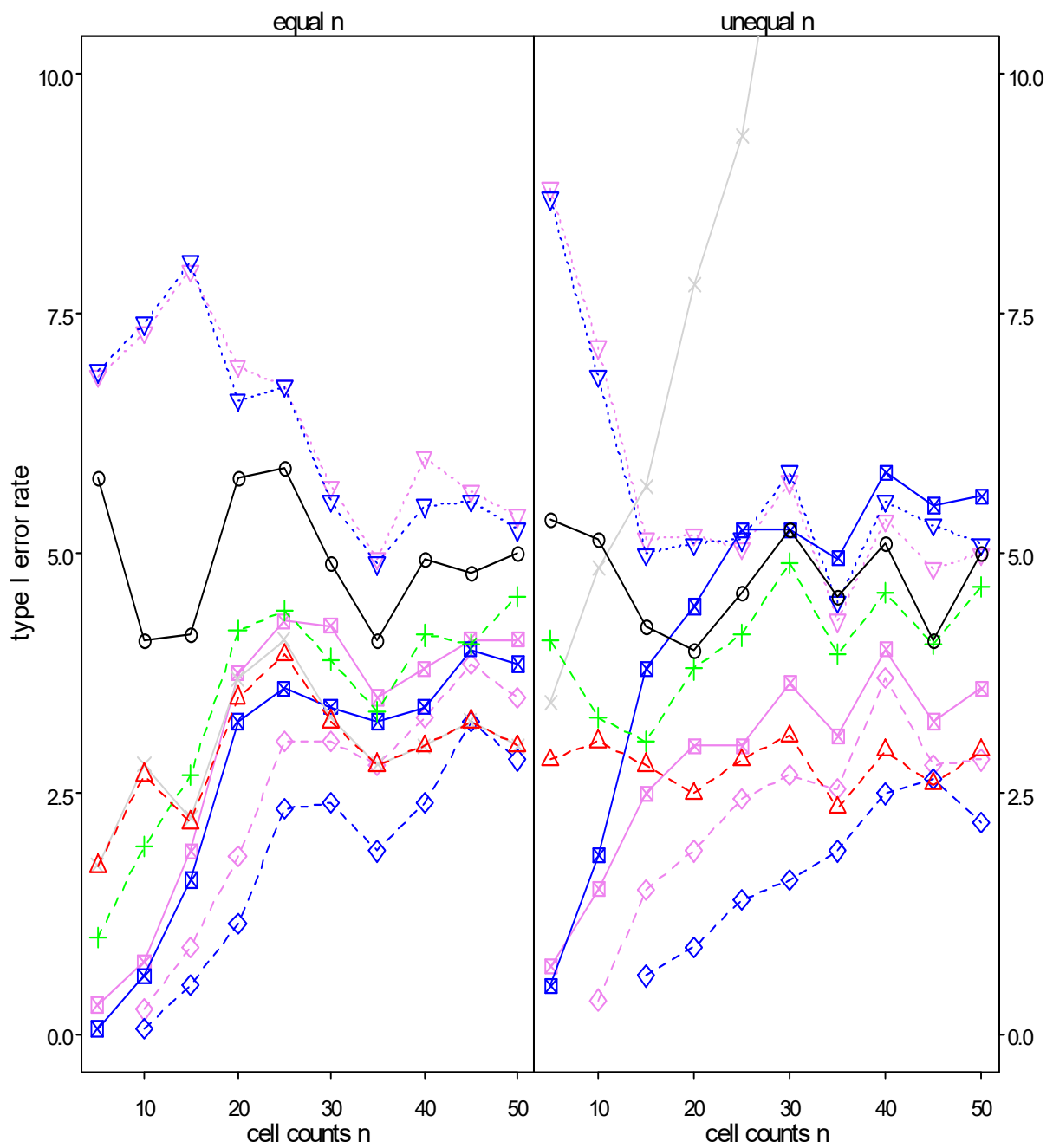
legend

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|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Puri & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —x— | chi-squared | - - -◇- - - | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5.2.3 $p = 0.9$

α	method	equal cell counts (levels = 2*4)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	5.80	4.10	4.15	5.80	5.90	4.90	4.10	4.95	4.80	5.00
	Puri & Sen	1.75	2.70	2.20	3.50	3.95	3.25	2.80	3.00	3.25	3.00
	ATS	1.00	1.95	2.70	4.20	4.40	3.90	3.35	4.15	4.05	4.55
	logistic Wald	0.05	0.05	0.50	1.15	2.35	2.40	1.90	2.4	3.25	2.85
	logistic LR	6.90	7.40	8.05	6.60	6.75	5.55	4.90	5.5	5.55	5.25
	logistic W-LR	0.05	0.60	1.60	3.25	3.60	3.40	3.25	3.4	4.00	3.85
	probit Wald	0.05	0.25	0.90	1.85	3.05	3.05	2.80	3.3	3.85	3.50
	probit LR	6.85	7.30	7.95	6.95	6.75	5.70	4.95	6.0	5.65	5.40
	probit W-LR	0.30	0.75	1.90	3.75	4.30	4.25	3.50	3.8	4.10	4.10
	chi-squared	1.75	2.80	2.25	3.70	4.10	3.30	2.80	3.00	3.25	3.00
0.01	parametric	1.45	0.90	0.85	1.35	1.15	0.85	0.45	1.05	0.95	0.80
	Puri & Sen	0.10	0.45	0.35	0.40	0.50	0.45	0.15	0.50	0.55	0.40
	ATS	0.05	0.15	0.20	0.30	0.55	0.55	0.15	0.65	0.70	0.60
	logistic Wald	0.05	0.05	0.05	0.05	0.20	0.05	0.05	0.10	0.35	0.20
	logistic LR	0.50	1.60	1.55	1.95	1.15	1.25	0.75	1.20	1.25	0.80
	logistic W-LR	0.05	0.05	0.05	0.10	0.50	0.35	0.15	0.55	0.70	0.45
	probit Wald	0.05	0.05	0.05	0.05	0.55	0.30	0.15	0.40	0.50	0.45
	probit LR	0.55	1.60	1.50	2.00	1.20	1.25	0.75	1.30	1.20	0.75
	probit W-LR	0.05	0.05	0.05	0.20	0.60	0.40	0.25	0.70	0.95	0.55
	chi-squared	0.10	0.45	0.35	0.50	0.50	0.45	0.15	0.50	0.55	0.40
		unequal cell counts (levels = 4*5)									
0.05	parametric	5.35	5.15	4.25	4.00	4.60	5.25	4.55	5.10	4.10	5.00
	Puri & Sen	2.85	3.05	2.80	2.50	2.85	3.10	2.35	2.95	2.60	2.95
	ATS	4.10	3.30	3.05	3.80	4.15	4.90	3.95	4.60	4.05	4.65
	logistic Wald	0.05	0.05	0.60	0.90	1.40	1.60	1.90	2.50	2.65	2.20
	logistic LR	8.70	6.85	5.00	5.10	5.15	5.85	4.50	5.55	5.30	5.10
	logistic W-LR	0.50	1.85	3.80	4.45	5.25	5.25	4.95	5.85	5.50	5.60
	probit Wald	0.05	0.35	1.50	1.90	2.45	2.70	2.55	3.70	2.80	2.85
	probit LR	8.80	7.15	5.15	5.20	5.05	5.75	4.30	5.35	4.85	5.00
	probit W-LR	0.70	1.50	2.50	3.00	3.00	3.65	3.10	4.00	3.25	3.60
	chi-squared	3.45	4.85	5.70	7.80	9.35	12.50	13.10	15.15	16.80	18.90
0.01	parametric	1.70	1.40	1.40	0.95	0.80	0.90	0.85	1.10	0.80	1.15
	Puri & Sen	0.60	0.25	0.80	0.35	0.30	0.55	0.50	0.70	0.60	0.55
	ATS	0.80	0.40	0.65	0.55	0.40	0.50	0.55	0.95	0.80	0.75
	logistic Wald	0.05	0.05	0.05	0.10	0.20	0.20	0.05	0.30	0.25	0.35
	logistic LR	1.75	1.65	1.55	1.40	1.05	1.10	0.80	1.40	0.85	0.90
	logistic W-LR	0.05	0.10	0.60	0.75	0.80	1.05	0.90	1.45	0.90	0.95
	probit Wald	0.05	0.05	0.15	0.20	0.50	0.30	0.40	0.80	0.45	0.45
	probit LR	1.75	1.80	1.50	1.30	0.90	1.05	0.80	1.35	0.85	1.05
	probit W-LR	0.05	0.05	0.45	0.40	0.55	0.55	0.45	1.10	0.65	0.65
	chi-squared	0.65	0.90	1.10	1.95	2.40	3.20	3.15	4.10	4.90	5.15

Graphic for $\alpha=0.05$:



legend

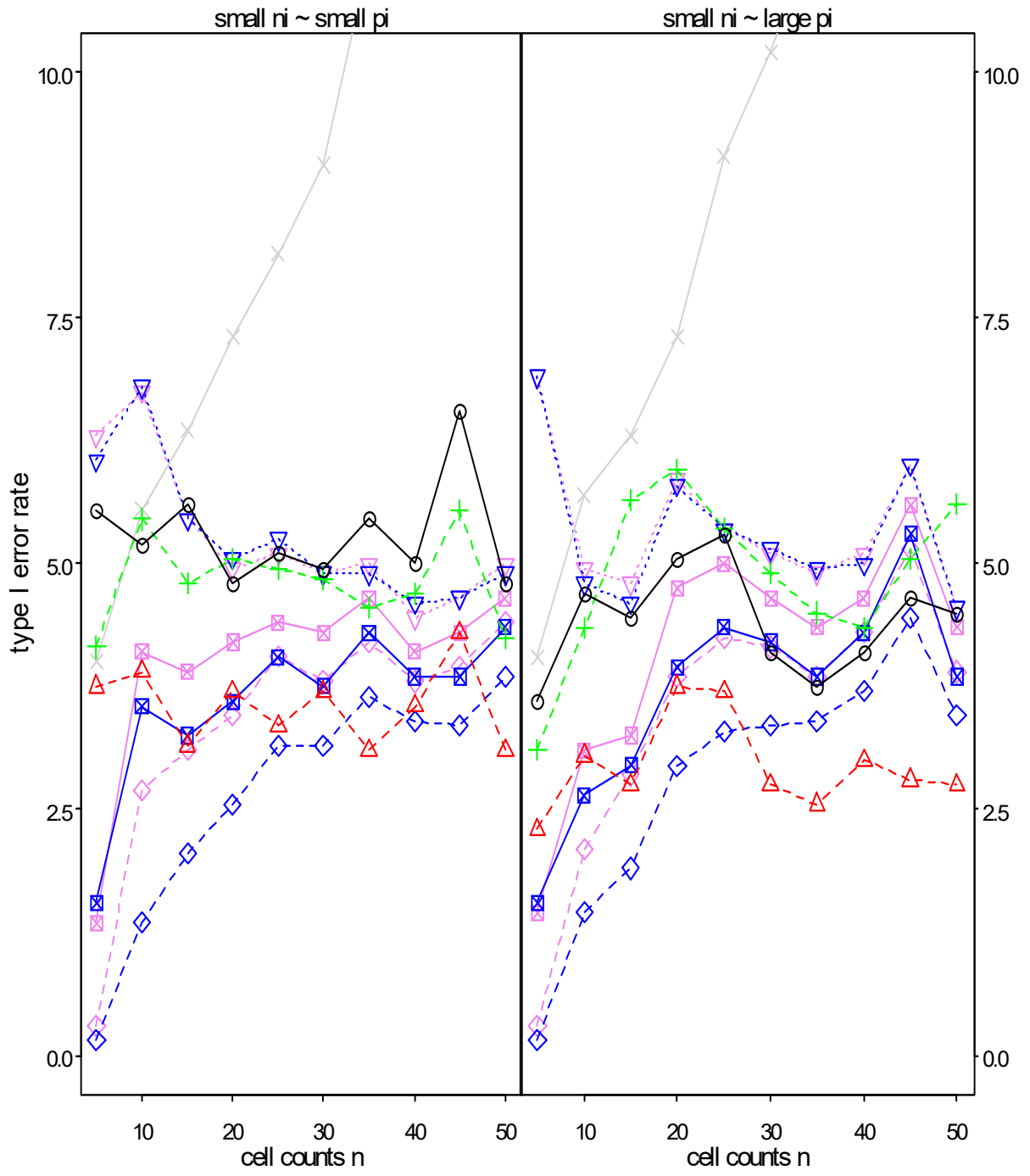
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|---------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| ---△--- | Furi & Sen | ⋯▽⋯ | logistic/LR |
| ---+--- | ATS | —■— | logistic/Wald+LR |
| —x— | chi-squared | ---◇--- | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5.3. Main effect B - A significant (effects $a_i = 0.6*s$) small $n_i \sim$ small p_i and small $n_i \sim$ large p_i

5.3.1 $p = 0.6$

		small $n_i \sim$ small p_i (levels = 4*5)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	5.55	5.20	5.60	4.80	5.10	4.95	5.45	5.00	6.55	4.80
	Puri & Sen	3.75	3.90	3.15	3.70	3.35	3.70	3.10	3.55	4.30	3.10
	ATS	4.15	5.45	4.80	5.05	4.95	4.85	4.55	4.70	5.55	4.25
	logistic Wald	0.15	1.35	2.05	2.55	3.15	3.15	3.65	3.40	3.35	3.85
	logistic LR	6.05	6.80	5.45	5.05	5.25	4.90	4.90	4.60	4.65	4.90
	logistic W-LR	1.55	3.55	3.25	3.60	4.05	3.75	4.30	3.85	3.85	4.35
	probit Wald	0.30	2.70	3.10	3.45	4.05	3.80	4.20	3.80	3.95	4.40
	probit LR	6.30	6.75	5.45	4.95	5.10	4.90	5.00	4.45	4.65	5.00
	probit W-LR	1.35	4.10	3.90	4.20	4.40	4.30	4.65	4.10	4.30	4.65
chi-squared	4.85	4.00	5.55	6.35	7.30	8.15	9.05	11.15	12.45	15.25	
0.01	parametric	1.35	1.85	1.25	1.25	1.10	1.30	1.20	1.15	1.50	1.00
	Puri & Sen	0.50	0.95	0.50	0.75	0.70	0.90	0.60	0.65	0.95	0.55
	ATS	0.80	1.55	1.15	1.20	1.10	1.45	0.95	1.05	1.40	0.95
	logistic Wald	0.05	0.15	0.40	0.25	0.60	0.70	0.65	0.60	0.40	0.75
	logistic LR	1.25	2.00	1.25	1.00	1.05	0.85	0.95	1.15	0.65	1.00
	logistic W-LR	0.05	0.50	0.90	0.55	0.90	0.75	0.75	0.75	0.60	0.75
	probit Wald	0.05	0.45	0.85	0.45	0.90	0.70	0.80	0.75	0.60	0.75
	probit LR	1.30	2.10	1.30	0.95	1.05	0.90	0.95	1.15	0.65	1.00
	probit W-LR	0.10	0.90	0.95	0.70	0.95	0.80	0.85	1.05	0.65	0.85
chi-squared	0.35	1.25	1.40	1.25	2.05	2.50	2.90	3.40	4.75	3.80	
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	3.60	4.70	4.45	5.05	5.30	4.10	3.75	4.10	4.65	4.50
	Puri & Sen	2.30	3.05	2.75	3.75	3.70	2.75	2.55	3.00	2.80	2.75
	ATS	3.10	4.35	5.65	5.95	5.35	4.90	4.50	4.35	5.05	5.60
	logistic Wald	0.15	1.45	1.90	2.95	3.30	3.35	3.40	3.70	4.45	3.45
	logistic LR	6.90	4.80	4.60	5.80	5.35	5.15	4.95	5.00	6.00	4.55
	logistic W-LR	1.55	2.65	2.95	3.95	4.35	4.20	3.85	4.30	5.30	3.85
	probit Wald	0.30	2.10	2.85	3.85	4.25	4.15	3.85	4.30	5.15	3.90
	probit LR	6.90	4.95	4.80	5.85	5.35	5.10	4.90	5.10	6.00	4.55
	probit W-LR	1.45	3.10	3.25	4.75	5.00	4.65	4.35	4.65	5.60	4.35
chi-squared	4.05	5.70	6.30	7.30	9.15	10.20	11.55	12.95	15.00	15.85	
0.01	parametric	0.60	0.80	1.20	1.3	0.90	0.60	0.80	0.70	0.90	0.70
	Puri & Sen	0.45	0.35	0.85	0.8	0.45	0.15	0.25	0.30	0.35	0.30
	ATS	0.55	1.00	1.25	1.6	1.30	0.85	1.05	0.80	0.85	0.75
	logistic Wald	0.15	1.45	1.90	2.95	3.30	3.35	3.40	3.70	4.45	3.45
	logistic LR	6.90	4.80	4.60	5.80	5.35	5.15	4.95	5.00	6.00	4.55
	logistic W-LR	1.55	2.65	2.95	3.95	4.35	4.20	3.85	4.30	5.30	3.85
	probit Wald	0.30	2.10	2.85	3.85	4.25	4.15	3.85	4.30	5.15	3.90
	probit LR	6.90	4.95	4.80	5.85	5.35	5.10	4.90	5.10	6.00	4.55
	probit W-LR	1.45	3.10	3.25	4.75	5.00	4.65	4.35	4.65	5.60	4.35
chi-squared	0.80	1.00	1.35	1.6	2.45	2.45	3.25	3.05	4.45	4.95	

Graphic for $\alpha=0.05$:



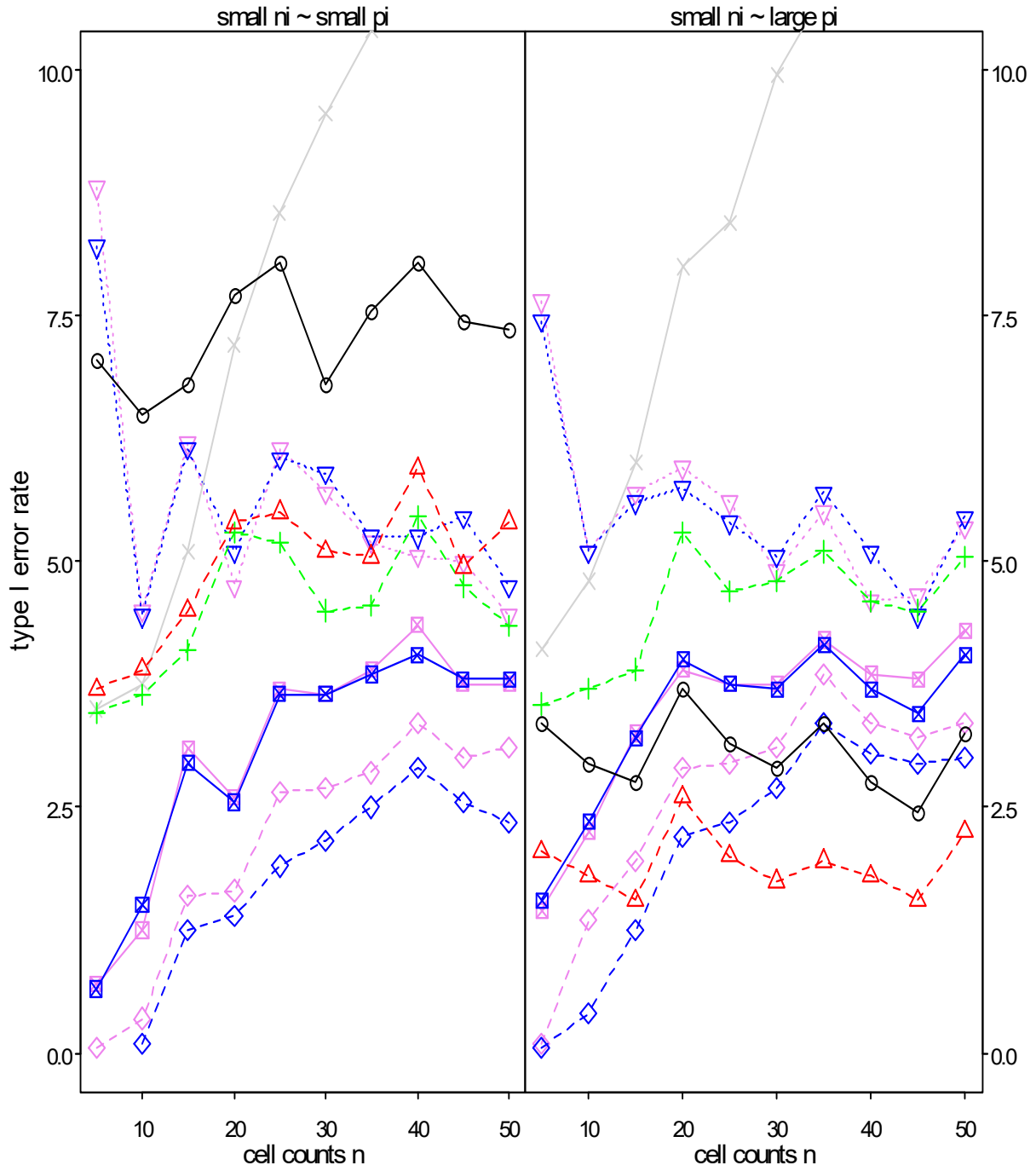
legend

- | | | | |
|---------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| ---△--- | Furi & Sen | ⋯▽⋯ | logistic/LR |
| ---+--- | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | ---◇--- | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5.3.2 $p = 0.8$

α	method	small $n_i \sim$ small p_i (levels = 4*5)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	7.05	6.50	6.8	7.70	8.05	6.80	7.55	8.05	7.45	7.35
	Puri & Sen	3.70	3.90	4.5	5.40	5.50	5.10	5.05	5.95	4.95	5.40
	ATS	3.45	3.65	4.1	5.30	5.20	4.50	4.55	5.45	4.75	4.35
	logistic Wald	0.05	0.10	1.25	1.40	1.90	2.15	2.50	2.90	2.55	2.35
	logistic LR	8.20	4.45	6.15	5.10	6.05	5.90	5.25	5.25	5.45	4.75
	logistic W-LR	0.65	1.50	2.95	2.55	3.65	3.65	3.85	4.05	3.80	3.80
	probit Wald	0.05	0.35	1.60	1.65	2.65	2.70	2.85	3.35	3.00	3.10
	probit LR	8.80	4.50	6.20	4.75	6.15	5.70	5.20	5.05	5.00	4.45
	probit W-LR	0.70	1.25	3.10	2.60	3.70	3.65	3.90	4.35	3.75	3.75
	chi-squared	3.50	3.75	5.1	7.20	8.55	9.55	10.40	13.55	13.70	15.20
0.01	parametric	1.6	1.70	1.60	2.40	2.35	1.95	1.95	2.10	2.20	1.70
	Puri & Sen	0.6	0.65	0.80	1.55	1.25	0.95	1.10	1.15	1.25	1.00
	ATS	0.7	0.60	0.70	1.25	1.20	1.15	1.00	1.15	1.00	1.05
	logistic Wald	0.05	0.05	0.05	0.15	0.35	0.25	0.35	0.35	0.45	0.50
	logistic LR	1.35	1.10	1.20	0.80	1.40	1.25	1.10	1.30	0.70	1.15
	logistic W-LR	0.05	0.20	0.45	0.35	0.50	0.40	0.50	0.50	0.50	0.75
	probit Wald	0.05	0.05	0.15	0.15	0.35	0.40	0.40	0.50	0.50	0.55
	probit LR	1.50	1.05	1.35	0.90	1.30	1.20	1.10	1.30	0.60	1.10
	probit W-LR	0.05	0.20	0.45	0.35	0.65	0.55	0.55	0.55	0.60	0.90
	chi-squared	1.6	1.70	1.60	2.40	2.35	1.95	1.95	2.10	2.20	1.70
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	3.35	2.95	2.75	3.70	3.15	2.90	3.35	2.75	2.45	3.25
	Puri & Sen	2.05	1.80	1.55	2.60	2.00	1.75	1.95	1.80	1.55	2.25
	ATS	3.55	3.70	3.90	5.30	4.70	4.80	5.10	4.60	4.50	5.05
	logistic Wald	0.05	0.40	1.25	2.20	2.35	2.70	3.35	3.05	2.95	3.00
	logistic LR	7.45	5.10	5.60	5.75	5.40	5.05	5.70	5.10	4.45	5.45
	logistic W-LR	1.55	2.35	3.20	4.00	3.75	3.70	4.15	3.70	3.45	4.05
	probit Wald	0.10	1.35	1.95	2.90	2.95	3.10	3.85	3.35	3.20	3.35
	probit LR	7.65	5.10	5.70	5.95	5.60	4.90	5.50	4.60	4.65	5.35
	probit W-LR	1.45	2.25	3.25	3.90	3.75	3.75	4.20	3.85	3.80	4.30
	chi-squared	4.10	4.80	6.00	8.00	8.45	9.95	10.80	12.45	13.25	15.20
0.01	parametric	0.70	0.45	0.25	0.55	0.45	0.25	0.40	0.25	0.30	0.65
	Puri & Sen	0.35	0.20	0.15	0.10	0.30	0.15	0.25	0.15	0.10	0.15
	ATS	0.80	0.70	0.80	0.75	0.75	0.80	1.00	0.55	0.45	1.35
	logistic Wald	0.05	0.05	0.05	0.25	0.25	0.35	0.55	0.30	0.30	0.45
	logistic LR	1.70	1.25	0.85	1.90	1.10	0.95	1.25	0.80	0.75	1.20
	logistic W-LR	0.05	0.20	0.35	0.85	0.45	0.50	0.75	0.35	0.40	0.85
	probit Wald	0.05	0.05	0.15	0.45	0.35	0.40	0.60	0.30	0.25	0.55
	probit LR	1.85	1.30	0.85	1.80	1.05	1.00	1.15	0.80	0.75	1.25
	probit W-LR	0.10	0.20	0.35	0.75	0.70	0.55	0.75	0.35	0.40	0.85
	chi-squared	0.95	0.85	1.55	1.95	2.45	2.55	3.00	3.50	3.95	4.85

Graphic for $\alpha=0.05$:



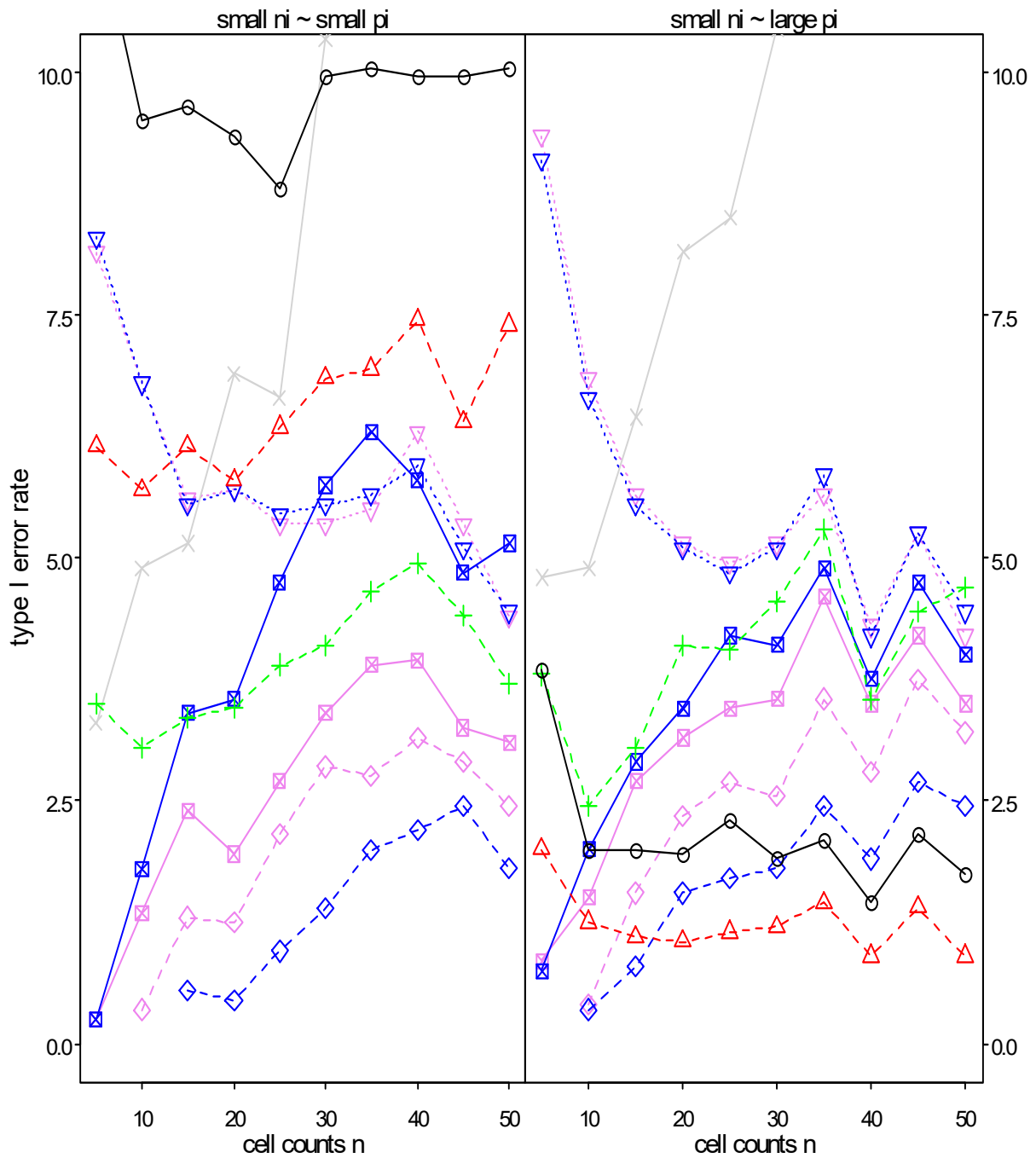
legend

- | | | | |
|---------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| ---△--- | Furi & Sen | ...▽... | logistic/LR |
| ---+--- | ATS | —■— | logistic/Wald+LR |
| —x— | chi-squared | ---◇--- | probit/Wald |
| | | ...▽... | probit/LR |
| | | —■— | probit/Wald+LR |

5.3.3 $p = 0.9$

α	method	small $n_i \sim$ small p_i (levels = 4*5)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	11.65	9.50	9.65	9.35	8.80	9.95	10.05	9.95	9.95	10.05
	Puri & Sen	6.15	5.70	6.15	5.80	6.35	6.85	6.95	7.45	6.40	7.40
	ATS	3.50	3.05	3.35	3.45	3.90	4.10	4.65	4.95	4.40	3.70
	logistic Wald	0.05	0.05	0.55	0.45	0.95	1.40	2.00	2.20	2.45	1.80
	logistic LR	8.30	6.80	5.55	5.70	5.45	5.55	5.65	5.95	5.10	4.45
	logistic W-LR	0.25	1.80	3.40	3.55	4.75	5.75	6.30	5.80	4.85	5.15
	probit Wald	0.05	0.35	1.30	1.25	2.15	2.85	2.75	3.15	2.90	2.45
	probit LR	8.15	6.80	5.60	5.70	5.35	5.35	5.50	6.30	5.35	4.40
	probit W-LR	0.25	1.35	2.40	1.95	2.70	3.40	3.90	3.95	3.25	3.10
	chi-squared	3.30	4.90	5.15	6.90	6.65	10.35	11.70	12.55	13.85	13.90
0.01	parametric	3.95	2.85	2.65	2.25	2.95	3.20	3.05	3.55	2.75	2.35
	Puri & Sen	1.40	1.60	1.65	1.05	2.00	1.60	1.80	2.10	1.60	1.45
	ATS	1.05	0.50	0.80	0.30	0.80	0.85	0.80	0.85	0.80	0.55
	logistic Wald	0.05	0.05	0.05	0.10	0.10	0.40	0.05	0.35	0.25	0.20
	logistic LR	1.50	1.50	1.35	1.00	1.25	1.05	1.25	1.35	1.25	0.60
	logistic W-LR	0.05	0.15	0.40	0.45	0.70	0.60	1.00	1.30	0.95	0.70
	probit Wald	0.05	0.05	0.25	0.15	0.30	0.40	0.30	0.40	0.65	0.25
	probit LR	1.40	1.65	1.25	0.95	1.45	1.10	1.35	1.30	1.20	0.55
	probit W-LR	0.05	0.15	0.30	0.25	0.50	0.35	0.55	0.70	0.65	0.35
	chi-squared	0.50	0.90	0.80	0.90	1.65	1.90	3.05	3.00	3.65	3.65
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	3.85	2.00	2.00	1.95	2.30	1.90	2.10	1.45	2.15	1.75
	Puri & Sen	2.00	1.25	1.10	1.05	1.15	1.20	1.45	0.90	1.40	0.90
	ATS	3.80	2.45	3.05	4.10	4.05	4.55	5.30	3.55	4.45	4.70
	logistic Wald	0.05	0.35	0.80	1.55	1.70	1.80	2.45	1.90	2.70	2.45
	logistic LR	9.10	6.65	5.55	5.10	4.85	5.10	5.85	4.20	5.25	4.45
	logistic W-LR	0.75	2.00	2.90	3.45	4.20	4.10	4.90	3.75	4.75	4.00
	probit Wald	0.05	0.40	1.55	2.35	2.70	2.55	3.55	2.80	3.75	3.20
	probit LR	9.35	6.85	5.65	5.15	4.95	5.15	5.65	4.30	5.25	4.20
	probit W-LR	0.85	1.50	2.70	3.15	3.45	3.55	4.60	3.50	4.20	3.50
	chi-squared	4.80	4.90	6.45	8.15	8.50	10.45	10.75	11.15	13.05	13.80
0.01	parametric	0.70	0.30	0.40	0.25	0.20	0.45	0.30	0.10	0.15	0.25
	Puri & Sen	0.15	0.15	0.35	0.10	0.05	0.20	0.15	0.05	0.10	0.10
	ATS	1.30	0.35	0.50	0.60	0.75	1.00	0.55	0.45	0.70	0.60
	logistic Wald	0.05	0.05	0.05	0.15	0.05	0.05	0.25	0.10	0.15	0.30
	logistic LR	2.10	1.45	1.45	1.35	1.10	1.05	0.90	1.00	0.75	0.95
	logistic W-LR	0.05	0.05	0.50	0.45	0.70	0.60	0.75	0.50	0.45	0.70
	probit Wald	0.05	0.15	0.20	0.15	0.25	0.50	0.40	0.30	0.45	0.65
	probit LR	2.25	1.55	1.45	1.30	1.05	1.05	0.85	1.00	0.75	0.85
	probit W-LR	0.05	0.05	0.45	0.40	0.65	0.75	0.60	0.60	0.40	0.75
	chi-squared	1.15	1.15	1.15	2.00	2.05	2.70	3.75	3.40	4.20	4.15

Graphic for $\alpha=0.05$:



legend

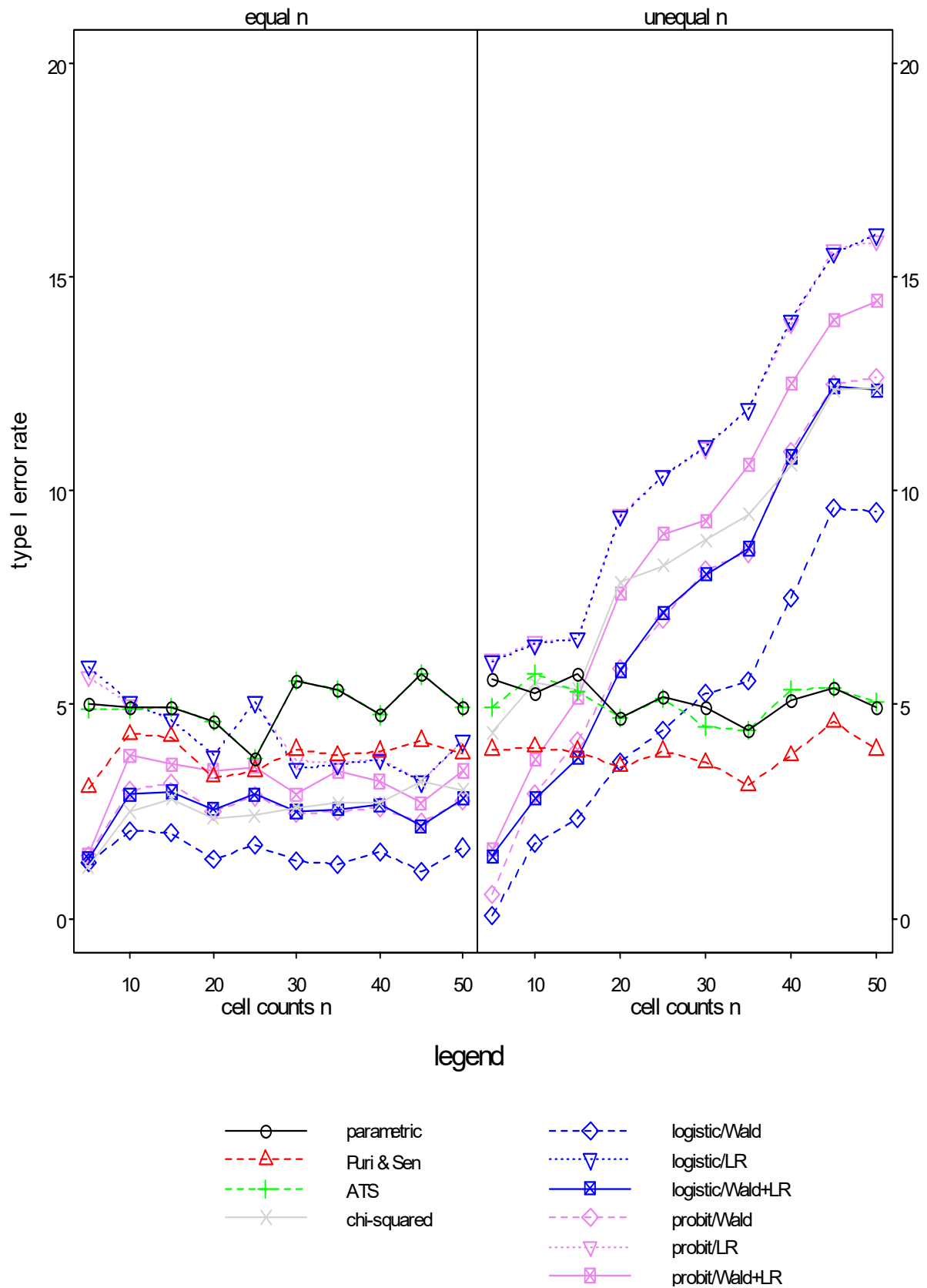
- | | | | |
|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Puri & Sen | ...▽... | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- - - | probit/Wald |
| | | ...▽... | probit/LR |
| | | —■— | probit/Wald+LR |

5. 4. Main effect A - Interaction significant (effects $ab_{ij} = 0.6*s$) n_i and p_i independent

5. 4. 1 $p = 0.5$

		equal cell counts (levels = 2*4)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	5.00	4.95	4.95	4.60	3.75	5.55	5.35	4.75	5.70	4.95
	Puri & Sen	3.05	4.30	4.25	3.30	3.45	3.95	3.80	3.90	4.15	3.85
	ATS	4.90	4.90	4.95	4.60	3.75	5.55	5.35	4.75	5.70	4.95
	logistic Wald	1.30	2.05	2.00	1.40	1.70	1.35	1.25	1.55	1.10	1.65
	logistic LR	5.90	5.05	4.65	3.80	5.05	3.50	3.60	3.70	3.20	4.15
	logistic W-LR	1.40	2.90	2.95	2.55	2.90	2.50	2.55	2.65	2.15	2.80
	probit Wald	1.45	3.00	3.15	2.50	2.85	2.45	2.50	2.60	2.25	2.75
	probit LR	5.65	5.00	4.65	3.80	5.05	3.70	3.60	3.75	3.20	4.15
	probit W-LR	1.50	3.80	3.60	3.45	3.55	2.90	3.45	3.20	2.70	3.45
	chi-squared	1.20	2.50	2.80	2.35	2.40	2.60	2.70	2.70	3.20	3.00
0.01	parametric	1.45	1.15	1.00	0.95	0.85	1.15	0.85	1.05	1.20	1.10
	Puri & Sen	0.50	0.70	0.55	0.55	0.30	0.95	0.35	0.60	0.90	0.95
	ATS	0.85	1.00	1.00	0.95	0.85	1.15	0.85	1.05	1.20	1.10
	logistic Wald	0.05	0.30	0.20	0.25	0.20	NA	0.20	0.05	0.25	0.10
	logistic LR	1.10	0.90	1.20	0.80	1.10	0.75	0.50	0.75	0.50	0.85
	logistic W-LR	0.05	0.35	0.60	0.40	0.45	0.60	0.40	0.30	0.45	0.25
	probit Wald	0.15	0.45	0.55	0.40	0.45	0.55	0.35	0.30	0.40	0.25
	probit LR	1.15	0.95	1.20	0.75	1.05	0.75	0.50	0.75	0.50	0.85
	probit W-LR	0.10	0.50	0.65	0.50	0.85	0.60	0.45	0.55	0.45	0.50
	chi-squared	0.15	0.30	0.30	0.35	0.25	0.80	0.25	0.45	0.60	0.65
		unequal cell counts (levels = 4*5)									
0.05	parametric	5.60	5.25	5.70	4.70	5.20	4.95	4.40	5.10	5.40	4.95
	Puri & Sen	3.95	4.00	3.90	3.55	3.90	3.65	3.10	3.80	4.60	3.95
	ATS	4.95	5.70	5.30	4.70	5.15	4.50	4.40	5.35	5.40	5.05
	logistic Wald	0.05	1.75	2.35	3.65	4.40	5.25	5.55	7.50	9.60	9.50
	logistic LR	6.00	6.40	6.55	9.40	10.35	11.05	11.90	14.00	15.55	16.00
	logistic W-LR	1.45	2.80	3.75	5.80	7.15	8.05	8.65	10.80	12.45	12.35
	probit Wald	0.55	2.90	4.15	5.85	7.00	8.15	8.55	10.90	12.50	12.65
	probit LR	6.05	6.45	6.55	9.45	10.35	11.00	11.90	13.90	15.65	15.85
	probit W-LR	1.60	3.70	5.15	7.60	9.00	9.30	10.60	12.50	14.00	14.45
	chi-squared	4.35	5.50	5.35	7.85	8.25	8.85	9.45	10.60	12.35	12.40
0.01	parametric	0.80	1.25	0.85	0.95	0.80	0.85	0.90	1.00	1.05	0.80
	Puri & Sen	0.35	0.55	0.55	0.75	0.70	0.55	0.60	0.75	0.75	0.55
	ATS	1.00	1.25	0.90	0.85	0.95	1.00	0.75	0.90	1.25	0.75
	logistic Wald	0.05	0.25	0.05	0.45	0.50	0.70	1.10	1.20	2.30	2.30
	logistic LR	1.35	1.30	1.45	2.10	2.25	2.70	3.25	4.20	5.00	5.20
	logistic W-LR	0.05	0.35	0.40	1.10	0.90	1.45	2.05	2.60	3.30	3.55
	probit Wald	0.05	0.40	0.50	1.05	0.90	1.45	2.15	2.60	3.30	3.65
	probit LR	1.35	1.30	1.50	2.15	2.25	2.70	3.25	4.10	4.95	5.15
	probit W-LR	0.10	0.65	0.80	1.35	1.55	1.90	2.50	3.20	4.15	4.50
	chi-squared	0.70	1.25	0.90	1.50	1.45	1.80	1.95	2.30	4.05	3.40

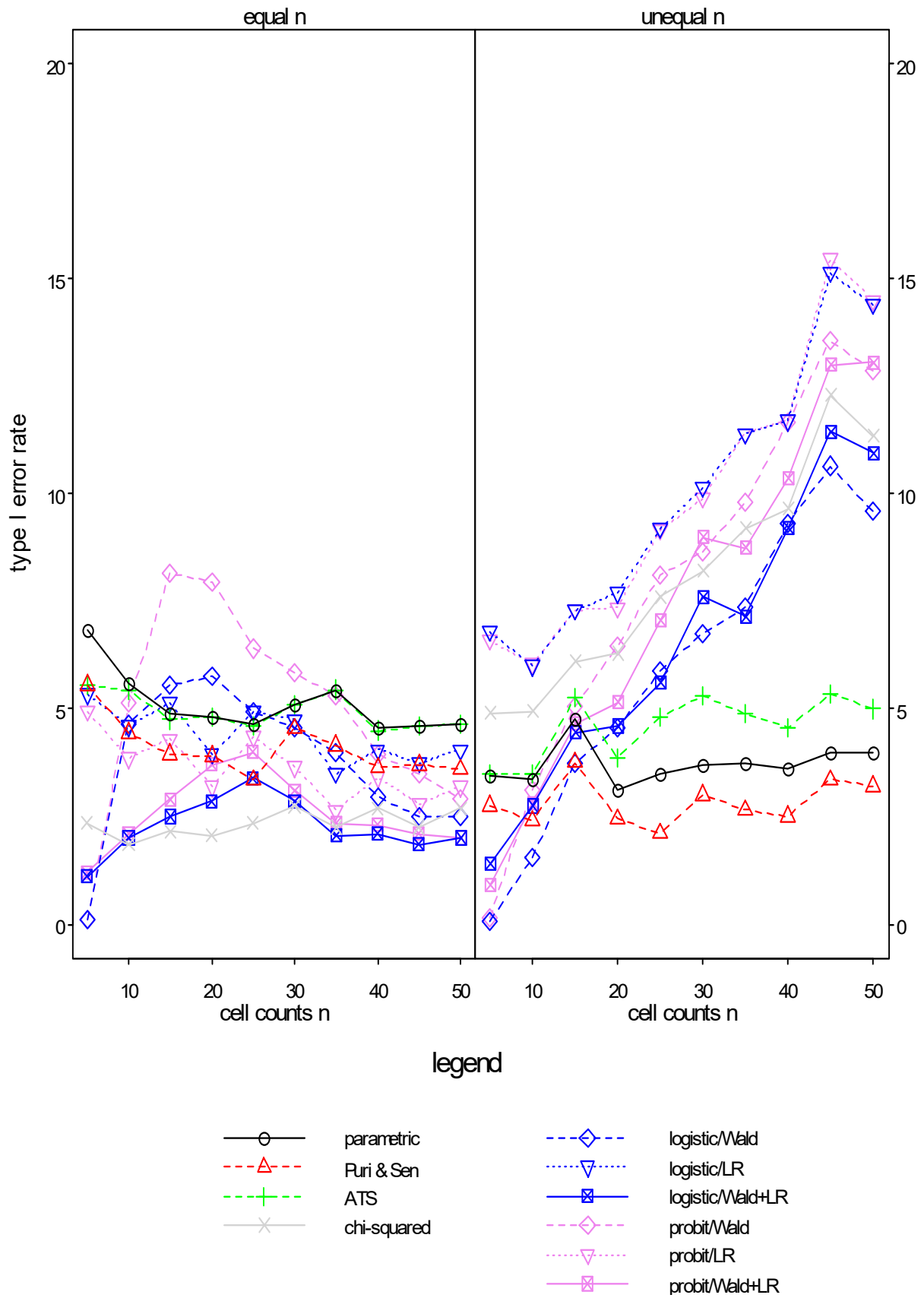
Graphic for $\alpha=0.05$:



5.4.2 p = 0.8

α	method	equal cell counts (levels = 2*4)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	6.85	5.60	4.90	4.80	4.65	5.10	5.45	4.55	4.60	4.65
	Puri & Sen	5.55	4.45	3.95	3.90	3.35	4.55	4.15	3.65	3.70	3.60
	ATS	5.55	5.45	4.75	4.80	4.60	5.10	5.45	4.50	4.60	4.65
	logistic Wald	0.10	4.65	5.55	5.75	4.95	4.55	4.00	2.95	2.50	2.50
	logistic LR	5.35	4.60	5.15	3.95	4.95	4.75	3.50	4.05	3.75	4.05
	logistic W-LR	1.10	2.00	2.50	2.85	3.40	2.85	2.05	2.10	1.85	2.00
	probit Wald	0.10	5.15	8.15	7.95	6.40	5.85	5.30	3.95	3.50	2.90
	probit LR	4.95	3.85	4.30	3.20	4.35	3.65	2.65	3.40	2.80	3.20
	probit W-LR	1.20	2.10	2.90	3.70	4.00	3.10	2.35	2.30	2.10	2.00
	chi-squared	2.35	1.85	2.15	2.05	2.35	2.75	2.25	2.70	2.25	2.70
0.01	parametric	1.55	1.05	1.20	0.95	1.10	0.85	1.00	1.00	0.85	1.15
	Puri & Sen	0.80	0.60	0.70	0.55	0.65	0.35	0.55	0.65	0.55	0.95
	ATS	0.65	0.95	1.15	0.95	1.05	0.85	1.00	1.00	0.85	1.15
	logistic Wald	0.10	0.30	1.10	1.75	1.70	1.25	1.25	0.65	0.55	0.55
	logistic LR	1.50	0.90	0.90	0.60	1.30	1.10	0.50	1.00	0.50	0.70
	logistic W-LR	0.15	0.05	0.05	0.20	0.30	0.50	0.35	0.30	0.25	0.35
	probit Wald	0.10	1.05	1.85	2.35	2.25	1.95	1.85	1.20	0.70	0.70
	probit LR	1.40	0.90	0.75	0.60	1.00	0.75	0.35	0.75	0.30	0.70
	probit W-LR	0.20	0.10	0.10	0.45	0.70	0.75	0.60	0.45	0.40	0.40
	chi-squared	0.10	0.35	0.35	0.45	0.40	0.20	0.25	0.40	0.25	0.65
		unequal cell counts (levels = 4*5)									
0.05	parametric	3.45	3.35	4.75	3.10	3.50	3.70	3.75	3.60	4.00	4.00
	Puri & Sen	2.75	2.40	3.75	2.45	2.10	3.00	2.65	2.50	3.35	3.20
	ATS	3.50	3.50	5.25	3.85	4.80	5.30	4.90	4.55	5.35	5.00
	logistic Wald	0.05	1.55	3.75	4.55	5.90	6.75	7.35	9.30	10.65	9.60
	logistic LR	6.80	6.00	7.30	7.70	9.20	10.15	11.40	11.70	15.15	14.40
	logistic W-LR	1.40	2.75	4.45	4.60	5.60	7.60	7.15	9.20	11.45	10.95
	probit Wald	0.15	3.10	5.05	6.45	8.10	8.65	9.80	11.65	13.55	12.85
	probit LR	6.60	6.05	7.30	7.35	9.15	9.90	11.40	11.70	15.45	14.50
	probit W-LR	0.90	2.80	4.65	5.15	7.05	9.00	8.75	10.35	13.00	13.05
	chi-squared	4.90	4.95	6.10	6.30	7.60	8.20	9.20	9.65	12.30	11.35
0.01	parametric	0.80	0.55	1.10	0.60	0.60	1.00	0.65	0.65	0.95	0.60
	Puri & Sen	0.30	0.25	0.65	0.40	0.45	0.70	0.30	0.30	0.80	0.20
	ATS	1.10	0.65	1.10	0.80	0.95	1.35	0.95	0.55	1.25	1.00
	logistic Wald	0.05	0.10	0.70	0.75	1.15	1.40	1.75	1.65	2.50	2.75
	logistic LR	1.45	1.45	1.80	1.65	1.70	3.10	2.95	3.65	4.15	4.95
	logistic W-LR	0.10	0.40	0.45	0.75	1.05	1.50	1.70	2.00	2.50	2.90
	probit Wald	0.05	0.40	0.70	1.55	2.15	2.70	2.40	2.70	3.80	3.55
	probit LR	1.55	1.35	1.60	1.55	1.85	3.10	2.85	3.55	4.25	4.95
	probit W-LR	0.10	0.25	0.45	0.95	1.45	2.05	1.95	2.60	2.90	3.55
	chi-squared	0.85	1.20	1.40	1.15	1.20	2.20	1.75	2.35	2.95	3.35

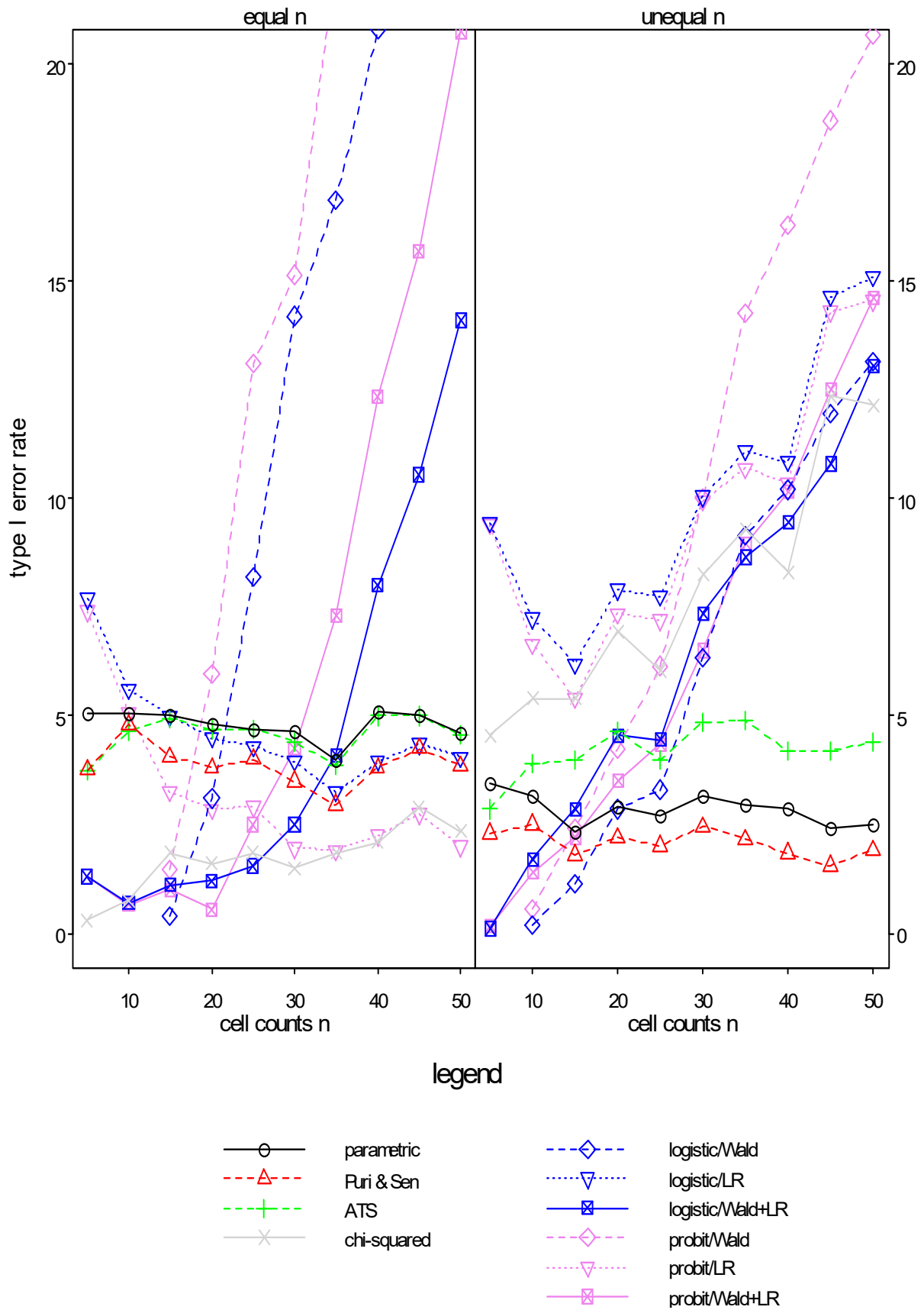
Graphic for $\alpha=0.05$:



5.4.3 p = 0.9

α	method	equal cell counts (levels = 2*4)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	5.05	5.05	5.00	4.80	4.70	4.65	4.00	5.10	5.00	4.60
	Puri & Sen	3.75	4.80	4.05	3.80	4.00	3.50	2.95	3.80	4.25	3.85
	ATS	3.75	4.65	4.95	4.70	4.70	4.40	3.85	5.00	5.00	4.55
	logistic Wald	0.05	0.05	0.40	3.10	8.20	14.20	16.85	20.80	26.75	31.45
	logistic LR	7.70	5.60	5.00	4.50	4.30	3.95	3.25	3.95	4.35	4.05
	logistic W-LR	1.30	0.70	1.10	1.20	1.55	2.50	4.10	8.00	10.55	14.10
	probit Wald	0.05	0.05	1.45	5.95	13.10	15.15	22.55	26.50	31.80	35.55
	probit LR	7.40	5.05	3.25	2.85	2.90	1.95	1.90	2.25	2.75	2.00
	probit W-LR	1.30	0.65	1.00	0.55	2.50	4.25	7.30	12.35	15.70	20.75
	chi-squared	0.30	0.75	1.85	1.60	1.85	1.50	1.85	2.10	2.90	2.35
0.01	parametric	0.95	0.65	1.25	1.05	0.95	0.85	0.80	1.05	1.10	0.95
	Puri & Sen	0.25	0.20	0.65	0.80	0.65	0.50	0.25	0.85	0.65	0.60
	ATS	0.40	0.55	0.95	1.05	0.85	0.80	0.75	1.00	1.10	0.90
	logistic Wald	0.05	0.05	0.05	0.10	0.90	2.15	3.75	7.35	9.70	14.35
	logistic LR	2.20	1.00	1.60	1.05	0.90	0.60	0.40	0.90	1.00	0.60
	logistic W-LR	0.10	0.05	0.05	0.10	0.05	0.10	0.25	0.15	0.55	1.50
	probit Wald	0.05	0.05	0.05	0.40	2.60	4.80	7.05	12.85	16.35	22.25
	probit LR	2.20	0.70	0.75	0.50	0.45	0.20	0.15	0.30	0.35	0.25
	probit W-LR	0.10	0.05	0.05	0.10	0.10	0.25	0.50	1.15	2.45	4.45
	chi-squared	0.05	0.05	0.20	0.15	0.40	0.20	0.20	0.40	0.35	0.25
		unequal cell counts (levelös = 4*5)									
0.05	parametric	3.45	3.15	2.35	2.90	2.70	3.15	2.95	2.85	2.40	2.50
	Puri & Sen	2.30	2.50	1.80	2.20	2.00	2.45	2.15	1.85	1.55	1.90
	ATS	2.85	3.90	4.00	4.65	4.00	4.85	4.90	4.20	4.20	4.40
	logistic Wald	0.05	0.20	1.15	2.85	3.30	6.35	9.15	10.20	11.95	13.15
	logistic LR	9.45	7.25	6.20	7.90	7.75	10.05	11.10	10.85	14.65	15.10
	logistic W-LR	0.10	1.70	2.85	4.55	4.45	7.35	8.65	9.45	10.80	13.05
	probit Wald	0.05	0.55	2.40	4.25	6.15	10.00	14.25	16.30	18.70	20.65
	probit LR	9.40	6.65	5.40	7.35	7.20	9.95	10.70	10.35	14.30	14.55
	probit W-LR	0.15	1.40	2.20	3.50	4.35	6.50	8.95	10.15	12.50	14.60
	chi-squared	4.55	5.40	5.40	6.95	6.05	8.25	9.30	8.30	12.35	12.15
0.01	parametric	0.75	0.80	0.70	0.40	0.25	0.50	0.40	0.55	0.25	0.60
	Puri & Sen	0.30	0.55	0.35	0.25	0.15	0.35	0.25	0.15	0.15	0.40
	ATS	0.65	0.65	0.55	0.75	0.65	0.85	1.10	0.80	0.60	1.00
	logistic Wald	0.05	0.05	0.05	0.20	0.50	1.15	1.80	2.45	3.35	4.10
	logistic LR	1.20	2.10	1.20	2.05	1.65	2.50	3.05	2.90	3.90	4.00
	logistic W-LR	0.05	0.10	0.25	0.55	0.75	1.20	1.60	1.85	2.15	2.95
	probit Wald	0.05	0.05	0.20	0.60	1.15	1.55	4.25	5.95	7.55	8.90
	probit LR	1.15	2.00	1.20	2.10	1.45	2.60	2.90	2.65	3.75	3.75
	probit W-LR	0.05	0.10	0.25	0.55	0.70	1.10	2.15	2.35	2.70	3.85
	chi-squared	0.40	1.35	0.95	1.40	1.20	1.75	2.30	2.05	2.60	3.30

Graphic for $\alpha=0.05$:

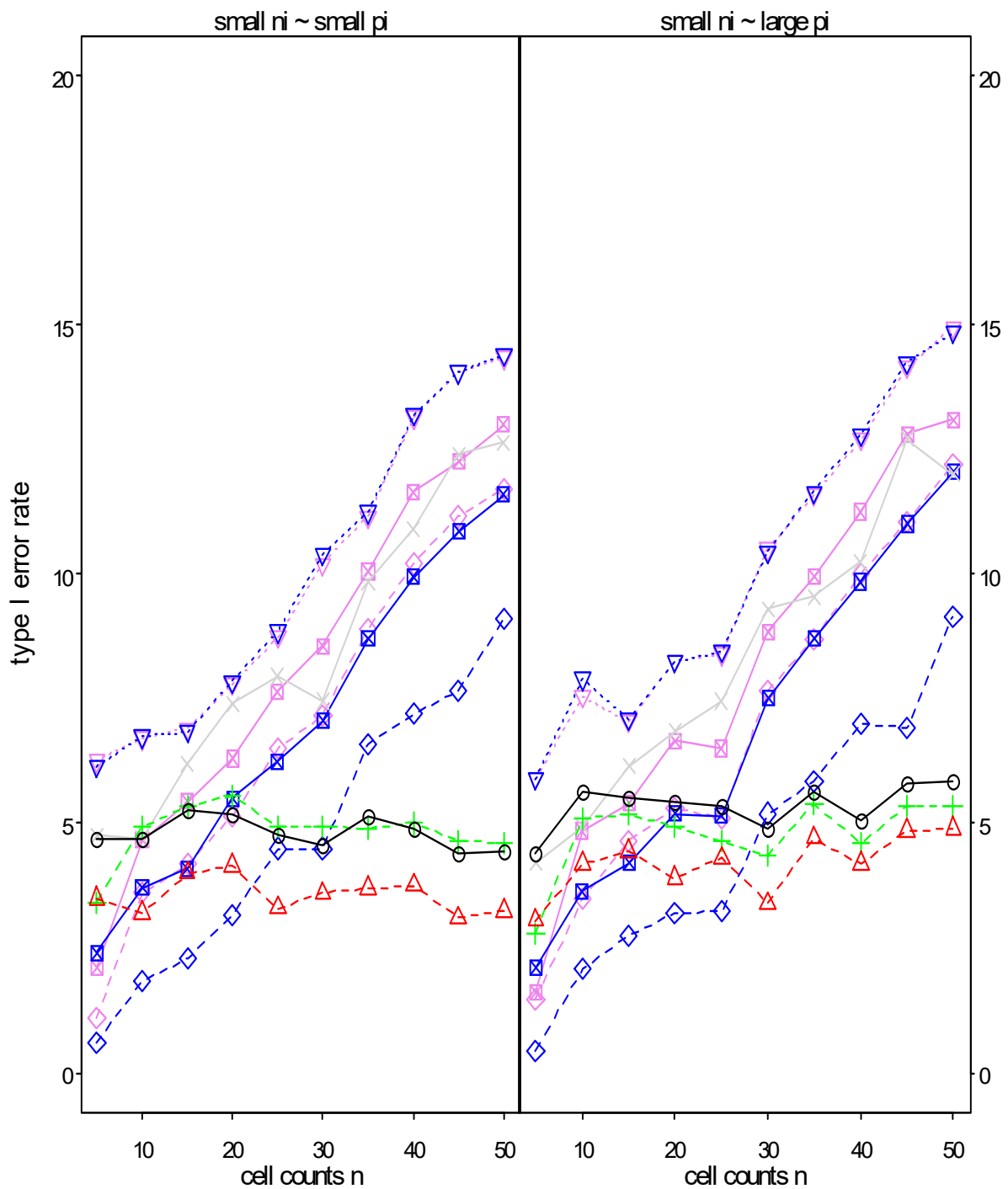


5. 5. Main effect A - Interaction significant (effects $ab_{ij} = 0.6*s$) small $n_i \sim$ small p_i and small $n_i \sim$ large p_i

5. 5. 1 $p = 0.6$

α	method	small $n_i \sim$ small p_i (levels = 4*5)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	4.40	5.65	5.50	5.45	5.35	4.90	5.65	5.05	5.80	5.85
	Puri & Sen	3.05	4.20	4.45	3.90	4.30	3.40	4.70	4.20	4.85	4.90
	ATS	2.80	5.10	5.20	4.95	4.65	4.35	5.40	4.60	5.35	5.35
	logistic Wald	0.45	1.35	3.00	2.85	2.90	4.85	5.25	5.40	7.75	7.75
	logistic LR	5.30	6.85	7.75	7.80	8.80	10.80	11.10	12.35	14.80	15.00
	logistic W-LR	1.85	2.80	4.65	4.80	5.15	7.05	7.80	8.50	10.80	10.80
	probit Wald	0.95	2.65	4.70	4.35	4.80	6.90	7.60	8.35	10.65	10.75
	probit LR	5.45	6.80	7.50	7.50	8.60	10.55	11.05	12.10	14.10	14.65
	probit W-LR	1.60	3.80	5.55	6.15	6.60	8.85	9.35	10.10	12.60	12.95
	chi-squared	4.20	4.95	6.15	6.85	7.45	9.30	9.55	10.25	12.70	12.00
0.01	parametric	0.70	1.20	1.00	1.35	1.25	1.25	1.20	1.15	1.20	1.05
	Puri & Sen	0.40	0.70	0.65	0.80	0.70	0.70	0.65	0.85	0.65	0.70
	ATS	0.70	1.10	0.95	1.25	1.15	0.90	0.95	0.85	0.95	0.85
	logistic Wald	NA	0.10	0.20	0.40	0.30	0.75	1.25	1.10	1.35	1.65
	logistic LR	1.20	1.50	2.15	1.85	1.60	3.15	3.05	3.50	3.90	4.55
	logistic W-LR	0.05	0.45	1.00	1.10	0.70	1.85	2.10	1.90	2.25	2.70
	probit Wald	0.15	0.50	1.05	0.95	0.55	1.75	2.05	1.90	2.25	2.70
	probit LR	1.05	1.55	2.10	1.90	1.60	2.95	3.05	3.50	3.75	4.45
	probit W-LR	0.05	0.70	1.75	1.40	1.05	2.30	2.55	2.65	3.15	3.50
	chi-squared	0.85	1.05	1.55	1.40	1.40	2.05	2.65	2.65	3.50	3.85
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	4.40	5.65	5.50	5.45	5.35	4.90	5.65	5.05	5.80	5.85
	Puri & Sen	3.05	4.20	4.45	3.90	4.30	3.40	4.70	4.20	4.85	4.90
	ATS	2.80	5.10	5.20	4.95	4.65	4.35	5.40	4.60	5.35	5.35
	logistic Wald	0.60	1.85	2.30	3.15	4.50	4.50	6.60	7.20	7.65	9.10
	logistic LR	6.15	6.75	6.85	7.85	8.85	10.40	11.25	13.20	14.05	14.40
	logistic W-LR	2.40	3.70	4.10	5.50	6.25	7.05	8.70	9.95	10.85	11.60
	probit Wald	1.10	3.60	4.20	5.15	6.50	7.15	8.90	10.20	11.15	11.70
	probit LR	6.25	6.70	6.90	7.80	8.75	10.20	11.15	13.15	14.05	14.35
	probit W-LR	2.10	4.65	5.45	6.30	7.65	8.55	10.05	11.65	12.25	13.00
	chi-squared	4.20	4.95	6.15	6.85	7.45	9.30	9.55	10.25	12.70	12.00
0.01	parametric	0.70	1.20	1.00	1.35	1.25	1.25	1.20	1.15	1.20	1.05
	Puri & Sen	0.40	0.70	0.65	0.80	0.70	0.70	0.65	0.85	0.65	0.70
	ATS	0.70	1.10	0.95	1.25	1.15	0.90	0.95	0.85	0.95	0.85
	logistic Wald	NA	0.20	0.40	0.25	0.80	0.95	1.15	1.60	1.60	1.40
	logistic LR	1.70	1.70	1.60	2.30	2.85	2.75	3.75	4.25	3.85	4.95
	logistic W-LR	0.05	0.45	0.85	1.25	1.65	1.70	2.30	2.65	2.85	3.30
	probit Wald	0.15	0.50	1.00	1.35	1.55	1.75	2.25	2.70	2.85	3.30
	probit LR	1.70	1.70	1.60	2.30	2.85	2.70	3.70	4.25	3.85	4.90
	probit W-LR	0.05	0.65	1.35	1.60	2.40	1.85	2.70	3.35	3.25	3.95
	chi-squared	0.85	1.05	1.55	1.40	1.40	2.05	2.65	2.65	3.50	3.85

Graphic for $\alpha=0.05$:



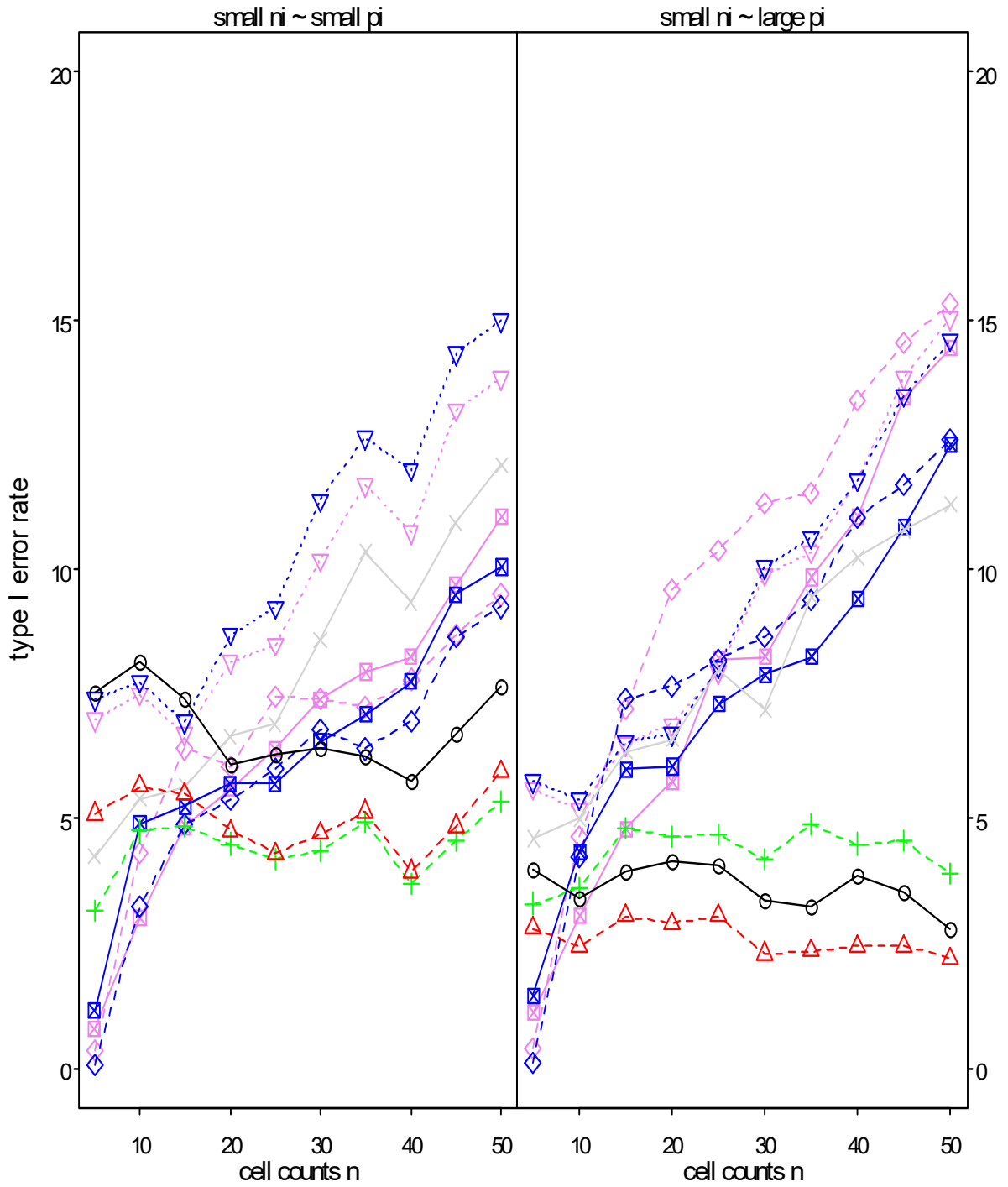
legend

- | | | | |
|---------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| ---△--- | Furi & Sen | ⋯▽⋯ | logistic/LR |
| ---+--- | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | ---◇--- | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5.5.2 $p = 0.8$

α	method	small $n_i \sim$ small p_i (levels = 4*5)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	7.55	8.15	7.40	6.10	6.30	6.40	6.25	5.75	6.70	7.65
	Puri & Sen	5.10	5.65	5.50	4.75	4.30	4.70	5.15	3.95	4.85	5.95
	ATS	3.15	4.75	4.85	4.50	4.20	4.35	4.95	3.70	4.55	5.35
	logistic Wald	0.05	3.25	4.90	5.40	6.00	6.80	6.40	6.95	8.65	9.25
	logistic LR	7.40	7.75	6.95	8.70	9.25	11.40	12.65	12.00	14.35	15.00
	logistic W-LR	1.15	4.90	5.25	5.70	5.70	6.55	7.10	7.75	9.50	10.05
	probit Wald	0.35	4.30	6.40	6.05	7.45	7.40	7.25	7.80	8.70	9.50
	probit LR	7.00	7.50	6.70	8.15	8.50	10.20	11.70	10.75	13.20	13.85
	probit W-LR	0.80	3.00	4.85	5.60	6.40	7.40	7.95	8.25	9.70	11.05
	chi-squared	4.25	5.40	5.65	6.65	6.90	8.60	10.35	9.35	10.95	12.10
0.01	parametric	2.40	1.60	2.10	1.40	1.35	1.70	1.85	1.20	1.35	1.85
	Puri & Sen	1.15	0.95	1.25	0.85	0.75	1.00	1.25	0.80	0.90	1.15
	ATS	0.95	0.80	1.20	0.85	0.65	0.95	1.05	0.75	0.80	1.00
	logistic Wald	0.05	0.40	0.80	1.15	0.95	2.00	1.10	1.30	1.90	2.00
	logistic LR	2.15	1.75	1.85	2.05	1.90	2.35	3.10	3.45	3.65	4.75
	logistic W-LR	0.10	0.55	0.75	0.80	0.70	1.55	1.15	1.60	1.65	2.50
	probit Wald	0.05	0.55	1.50	1.65	1.70	2.10	1.15	1.55	1.65	2.05
	probit LR	2.00	1.75	1.60	1.85	1.70	2.10	2.75	3.10	3.30	4.25
	probit W-LR	0.05	0.40	0.65	0.75	0.80	1.65	1.25	1.95	1.45	2.90
	chi-squared	0.80	1.00	0.85	1.55	1.15	1.85	2.35	2.20	2.80	3.45
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	4.00	3.40	3.95	4.15	4.05	3.35	3.25	3.85	3.55	2.80
	Puri & Sen	2.80	2.45	3.05	2.90	3.05	2.30	2.35	2.45	2.45	2.20
	ATS	3.30	3.60	4.80	4.65	4.70	4.20	4.90	4.50	4.55	3.90
	logistic Wald	0.10	4.25	7.40	7.65	8.20	8.65	9.40	11.05	11.70	12.60
	logistic LR	5.75	5.40	6.55	6.70	8.05	10.05	10.65	11.80	13.50	14.60
	logistic W-LR	1.45	4.35	6.00	6.05	7.30	7.90	8.25	9.40	10.85	12.50
	probit Wald	0.40	4.65	7.20	9.60	10.40	11.35	11.55	13.40	14.55	15.35
	probit LR	5.60	5.20	6.50	6.90	7.95	9.90	10.35	11.80	13.85	15.05
	probit W-LR	1.10	3.05	4.80	5.75	8.20	8.25	9.85	11.05	13.45	14.45
	chi-squared	4.60	5.00	6.35	6.60	8.00	7.20	9.45	10.25	10.80	11.30
0.01	parametric	0.95	0.65	0.70	0.65	0.75	0.35	0.55	0.60	0.60	0.40
	Puri & Sen	0.60	0.45	0.45	0.40	0.55	0.20	0.20	0.30	0.45	0.35
	ATS	1.00	0.75	0.80	0.75	0.95	0.65	0.65	0.85	0.75	0.45
	logistic Wald	NA	0.85	1.70	2.25	2.05	2.40	2.85	3.25	2.65	3.70
	logistic LR	1.55	1.05	1.25	1.55	1.85	2.05	2.90	3.25	3.20	4.55
	logistic W-LR	0.15	0.60	0.95	1.10	0.90	1.40	2.35	2.25	2.70	3.40
	probit Wald	0.05	1.15	1.90	2.70	2.90	3.30	3.95	3.65	3.65	4.60
	probit LR	1.50	1.15	1.20	1.70	1.70	2.20	2.95	3.35	3.35	4.60
	probit W-LR	0.10	0.50	0.70	1.15	1.35	1.70	2.65	2.95	3.20	4.00
	chi-squared	0.60	1.15	1.40	1.25	1.80	1.80	2.20	2.70	3.15	2.05

Graphic for $\alpha=0.05$:



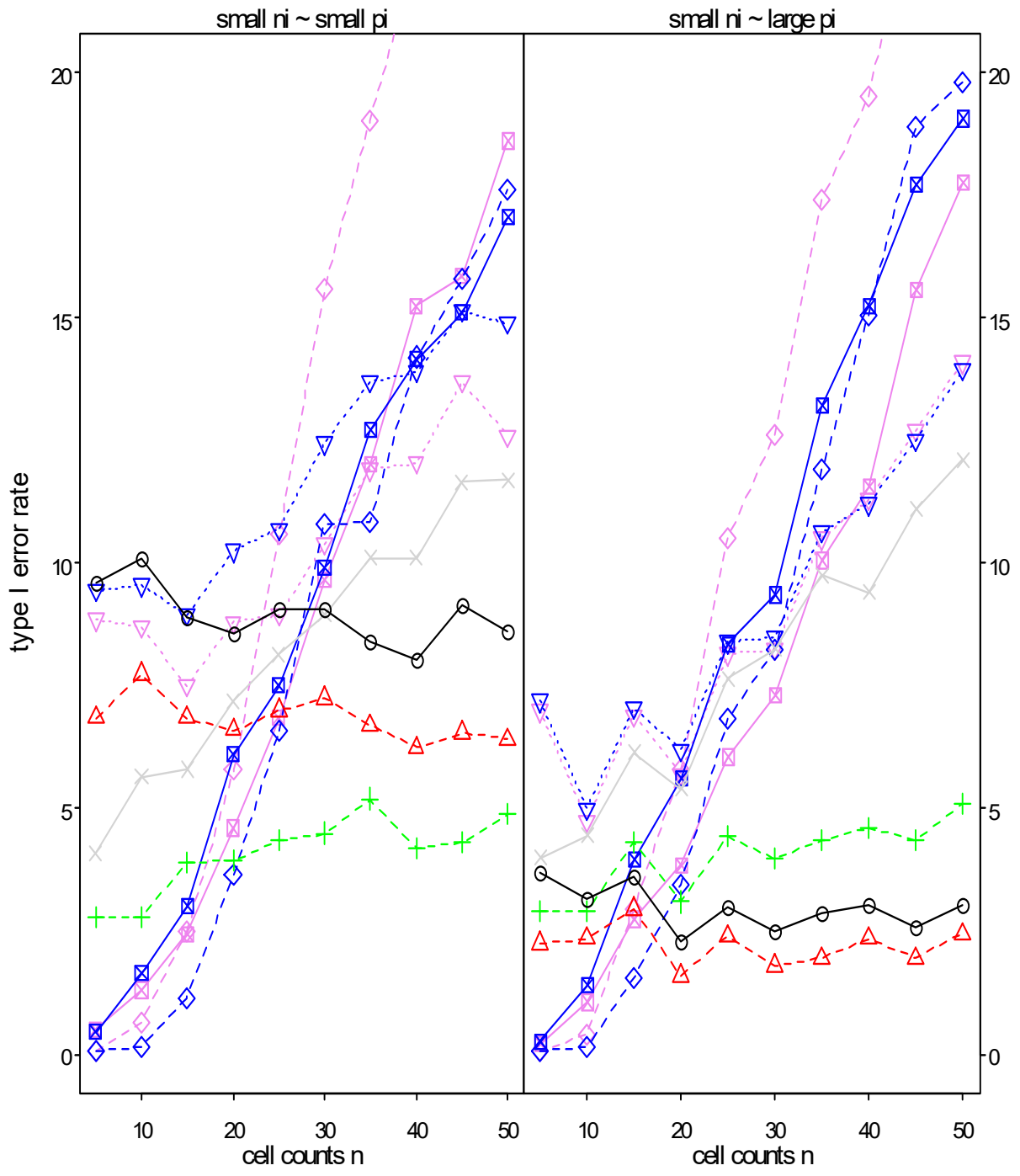
legend

- | | | | |
|---------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| ---△--- | Furi & Sen | ---▽--- | logistic/LR |
| ---+--- | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | ---◇--- | probit/Wald |
| | | ---▽--- | probit/LR |
| | | —■— | probit/Wald+LR |

5.5.3 $p = 0.9$

α	method	small $n_i \sim$ small p_i (levels = 4*5)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	9.60	10.10	8.90	8.55	9.05	9.05	8.40	8.05	9.15	8.60
	Puri & Sen	6.85	7.75	6.85	6.60	7.00	7.25	6.70	6.25	6.55	6.40
	ATS	2.80	2.80	3.90	3.95	4.35	4.50	5.20	4.20	4.30	4.90
	logistic Wald	0.05	0.15	1.15	3.65	6.60	10.80	10.85	14.20	15.80	17.60
	logistic LR	9.45	9.55	8.95	10.25	10.70	12.45	13.70	13.90	15.15	14.90
	logistic W-LR	0.45	1.65	3.00	6.10	7.50	9.90	12.70	14.15	15.10	17.05
	probit Wald	0.05	0.65	2.50	5.80	10.60	15.60	19.00	22.45	24.30	27.35
	probit LR	8.85	8.70	7.50	8.80	8.95	10.40	11.90	12.05	13.70	12.60
	probit W-LR	0.50	1.30	2.45	4.60	6.85	9.65	12.00	15.25	15.85	18.60
	chi-squared	4.10	5.65	5.80	7.20	8.15	8.95	10.10	10.10	11.65	11.70
0.01	parametric	4.00	3.25	2.75	1.95	2.05	1.85	2.40	2.25	2.25	2.60
	Puri & Sen	2.05	1.75	1.75	1.05	1.00	1.30	1.60	1.05	1.50	1.80
	ATS	0.90	0.35	0.60	0.50	0.45	0.80	0.60	0.50	0.70	1.30
	logistic Wald	0.05	0.05	0.10	0.35	1.80	1.85	3.95	4.80	5.80	6.75
	logistic LR	2.15	2.65	2.15	2.80	2.65	3.85	3.80	3.95	4.65	4.95
	logistic W-LR	0.05	0.15	0.20	0.75	1.10	2.10	2.35	2.75	3.40	4.10
	probit Wald	0.05	0.05	0.40	1.35	3.10	5.90	7.20	10.00	10.95	13.35
	probit LR	2.05	2.50	1.70	2.10	2.10	3.40	3.20	2.90	3.70	4.40
	probit W-LR	0.05	0.05	0.30	0.75	1.05	2.25	2.60	3.70	4.00	5.70
	chi-squared	0.55	0.95	0.65	1.90	1.45	2.05	2.70	2.70	3.15	3.90
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	3.70	3.15	3.60	2.30	3.00	2.50	2.85	3.05	2.60	3.05
	Puri & Sen	2.25	2.35	2.95	1.60	2.40	1.80	1.95	2.35	1.95	2.45
	ATS	2.90	2.90	4.30	3.10	4.45	4.00	4.35	4.60	4.35	5.10
	logistic Wald	0.05	0.15	1.55	3.45	6.85	8.25	11.90	15.05	18.90	19.80
	logistic LR	7.20	5.00	7.05	6.20	8.40	8.50	10.65	11.20	12.50	13.95
	logistic W-LR	0.25	1.40	3.95	5.60	8.35	9.35	13.20	15.25	17.70	19.05
	probit Wald	0.05	0.40	2.95	5.80	10.50	12.60	17.40	19.50	23.90	25.30
	probit LR	7.00	4.75	6.90	5.70	8.15	8.25	10.50	11.30	12.70	14.10
	probit W-LR	0.20	1.05	2.75	3.85	6.05	7.30	10.05	11.55	15.55	17.75
	chi-squared	4.00	4.45	6.15	5.40	7.65	8.25	9.75	9.40	11.10	12.10
0.01	parametric	1.05	0.50	0.60	0.30	0.40	0.50	0.50	0.30	0.40	0.55
	Puri & Sen	0.45	0.30	0.20	0.25	0.30	0.30	0.30	0.25	0.15	0.45
	ATS	1.05	0.55	0.75	0.40	0.65	0.50	0.80	0.70	0.85	1.15
	logistic Wald	0.05	0.05	0.15	0.30	1.00	1.65	2.85	4.70	5.75	6.75
	logistic LR	1.15	1.30	1.85	1.40	2.65	2.00	2.65	3.35	3.65	4.20
	logistic W-LR	0.05	0.05	0.40	0.65	1.45	1.70	2.15	3.75	4.95	4.55
	probit Wald	0.05	0.05	0.40	1.10	1.95	4.00	6.10	7.60	11.00	12.00
	probit LR	1.00	1.20	1.80	1.35	2.65	2.25	2.60	3.40	3.60	4.20
	probit W-LR	0.05	0.05	0.30	0.40	1.00	1.40	2.30	3.05	4.60	5.10
	chi-squared	0.30	0.95	1.85	0.95	2.10	2.10	2.20	3.00	3.20	3.15

Graphic for $\alpha=0.05$:



legend

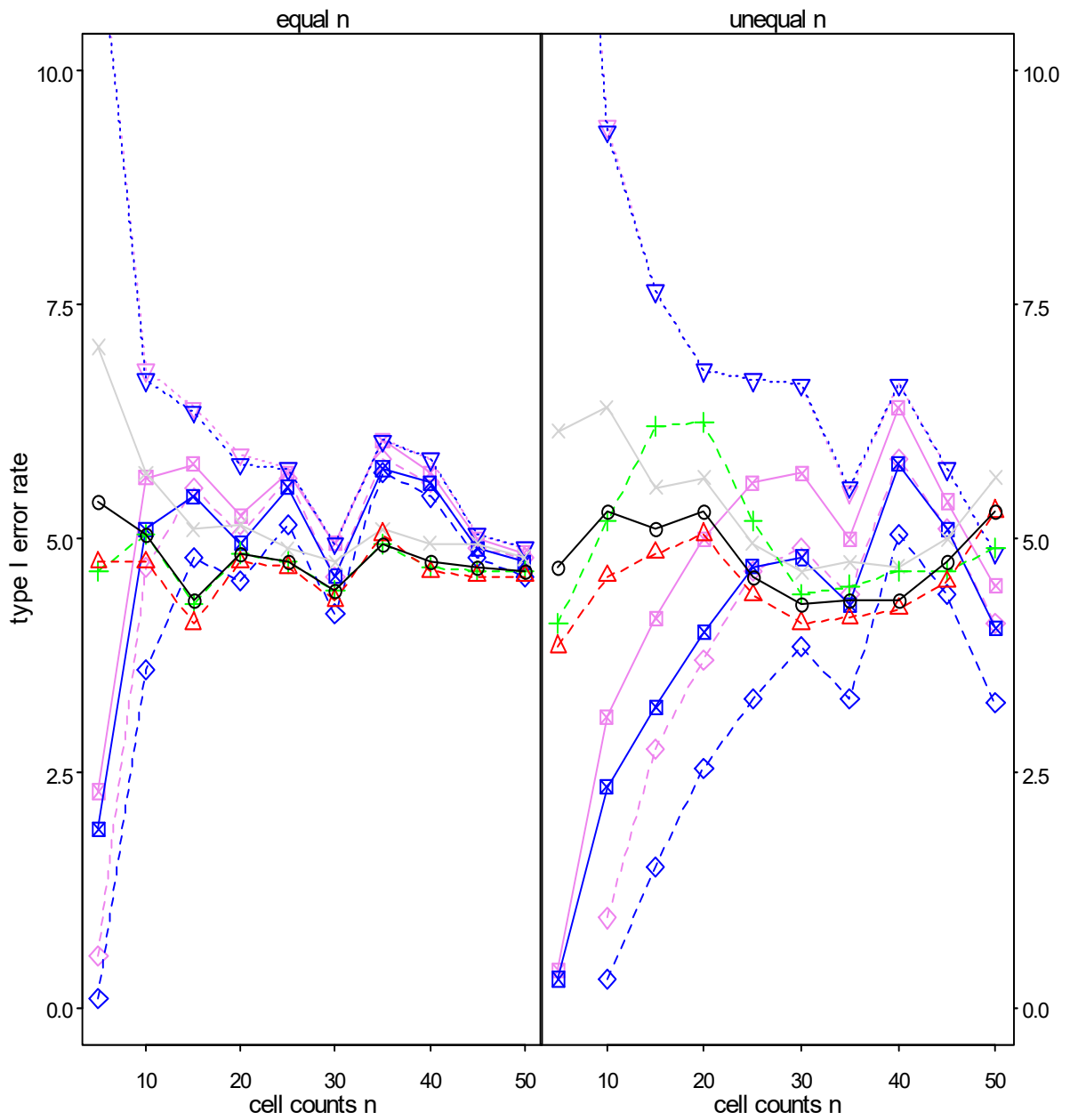
- | | | | |
|---------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| ---△--- | Furi & Sen | ---▽--- | logistic/LR |
| ---+--- | ATS | —■— | logistic/Wald+LR |
| ---×--- | chi-squared | ---◇--- | probit/Wald |
| | | ---▽--- | probit/LR |
| | | ---■--- | probit/Wald+LR |

5. 6. Interaction AB - null model

5. 6. 1 $p = 0.5$

		equal cell counts (levels = 2*4)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	5.40	5.05	4.35	4.85	4.75	4.45	4.95	4.75	4.70	4.65
	Puri & Sen	4.75	4.75	4.10	4.75	4.70	4.35	5.05	4.65	4.60	4.60
	ATS	4.65	5.05	4.30	4.85	4.75	4.45	4.95	4.70	4.65	4.65
	logistic Wald	0.10	3.60	4.80	4.55	5.15	4.20	5.70	5.45	4.80	4.60
	logistic LR	11.65	6.70	6.35	5.80	5.75	4.95	6.05	5.85	5.05	4.90
	logistic W-LR	1.90	5.10	5.45	4.95	5.55	4.60	5.75	5.60	4.90	4.75
	probit Wald	0.55	4.70	5.55	5.05	5.65	4.60	5.85	5.60	4.90	4.80
	probit LR	11.65	6.80	6.40	5.90	5.75	4.95	6.05	5.85	5.05	4.90
	probit W-LR	2.30	5.65	5.80	5.25	5.70	4.95	6.05	5.70	5.00	4.85
	chi-squared	7.05	5.70	5.10	5.15	4.90	4.75	5.10	4.95	4.95	4.80
0.01	parametric	1.00	1.10	1.05	0.95	1.00	0.90	0.90	0.85	0.75	1.10
	Puri & Sen	0.75	0.75	0.90	0.80	0.90	0.85	0.90	0.75	0.75	1.05
	ATS	0.70	1.00	1.05	0.95	1.00	0.90	0.90	0.85	0.75	1.10
	logistic Wald	0.05	0.25	0.50	0.95	0.70	0.60	0.90	0.90	0.95	0.75
	logistic LR	2.75	1.75	1.35	1.10	1.00	1.15	1.15	1.20	1.15	1.00
	logistic W-LR	0.10	0.75	0.75	0.95	0.80	0.75	1.10	1.10	1.00	0.80
	probit Wald	0.05	0.75	0.75	0.95	0.80	0.85	1.15	1.15	1.00	0.80
	probit LR	2.80	1.70	1.35	1.10	1.00	1.15	1.15	1.20	1.15	1.00
	probit W-LR	0.10	1.00	1.05	1.05	0.85	1.05	1.15	1.15	1.00	0.90
	chi-squared	1.40	1.25	1.10	1.10	1.00	0.90	0.90	0.80	0.80	1.15
		unequal cell counts (levels = 4*5)									
0.05	parametric	4.70	5.30	5.10	5.30	4.60	4.30	4.35	4.35	4.75	5.30
	Puri & Sen	3.85	4.60	4.85	5.05	4.40	4.10	4.15	4.25	4.55	5.30
	ATS	4.10	5.20	6.20	6.25	5.20	4.40	4.50	4.65	4.65	4.90
	logistic Wald	0.05	0.30	1.50	2.55	3.30	3.85	3.30	5.05	4.40	3.25
	logistic LR	16.00	9.35	7.65	6.80	6.70	6.65	5.55	6.65	5.75	4.85
	logistic W-LR	0.30	2.35	3.20	4.00	4.70	4.80	4.30	5.80	5.10	4.05
	probit Wald	0.05	0.95	2.75	3.70	4.65	4.90	4.40	5.85	5.10	4.10
	probit LR	16.00	9.40	7.65	6.80	6.70	6.65	5.50	6.65	5.75	4.85
	probit W-LR	0.40	3.10	4.15	5.00	5.60	5.70	5.00	6.40	5.40	4.50
	chi-squared	6.15	6.40	5.55	5.65	4.95	4.65	4.75	4.70	5.00	5.65
0.01	parametric	1.20	1.30	0.95	0.75	1.10	0.75	0.85	0.70	0.75	1.10
	Puri & Sen	0.55	0.60	0.70	0.60	1.05	0.70	0.70	0.70	0.65	1.05
	ATS	1.15	1.25	1.65	1.35	1.35	0.75	0.85	0.95	1.00	1.05
	logistic Wald	0.05	0.05	0.05	0.20	0.45	0.80	0.85	0.60	0.75	0.5
	logistic LR	5.10	2.25	1.40	1.50	1.90	1.85	1.35	1.25	1.20	0.7
	logistic W-LR	0.05	0.25	0.40	0.70	0.90	1.40	1.00	0.80	0.90	0.6
	probit Wald	0.05	0.05	0.20	0.65	0.95	1.40	1.00	0.85	0.90	0.6
	probit LR	5.05	2.30	1.40	1.50	1.90	1.85	1.35	1.25	1.20	0.7
	probit W-LR	0.05	0.40	0.70	1.00	1.15	1.60	1.15	1.05	0.95	0.6
	chi-squared	1.35	1.35	1.00	0.80	1.15	0.75	0.90	0.75	0.70	1.15

Graphic for $\alpha=0.05$:



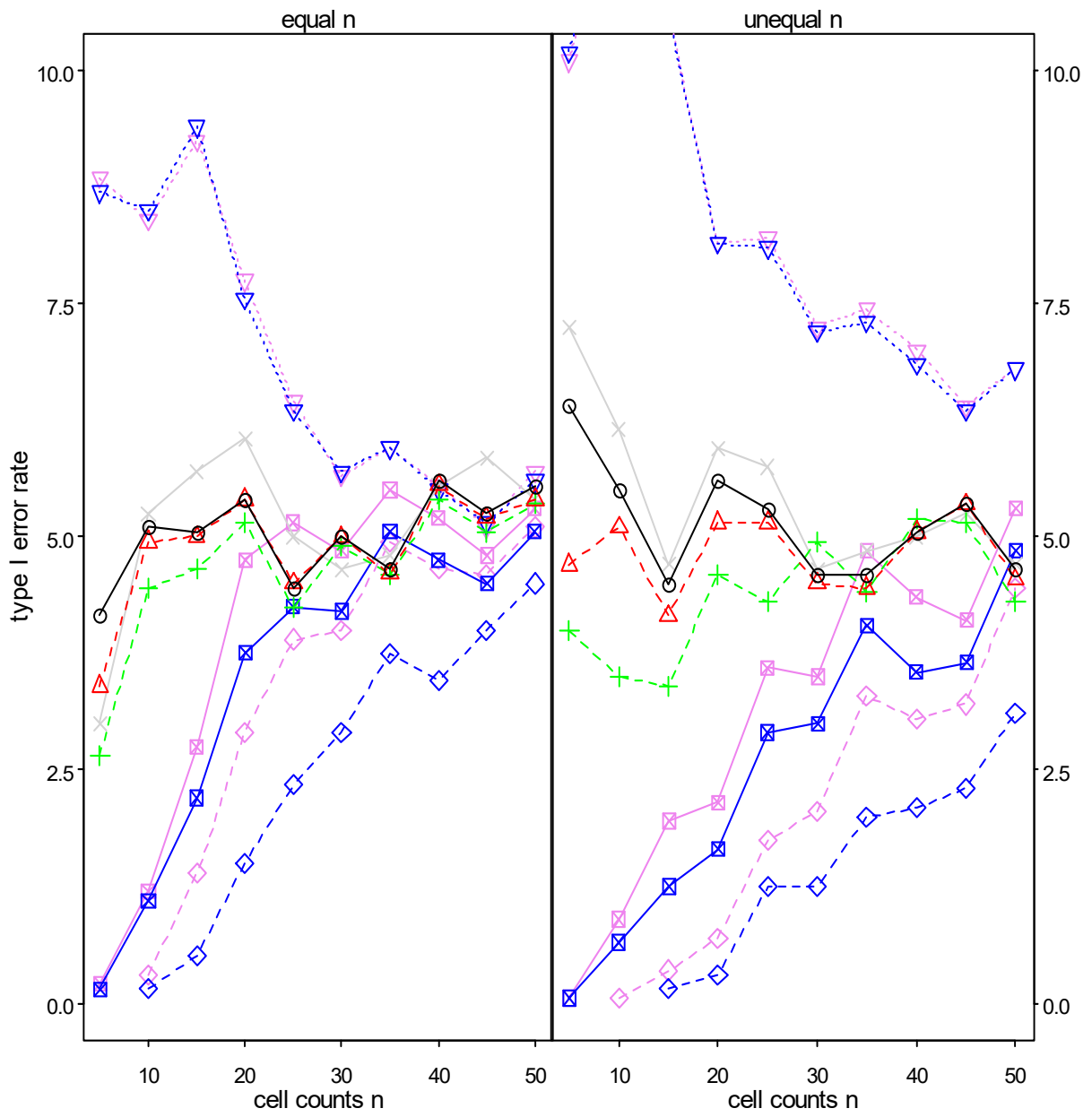
legend

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|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Puri & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- - - | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5.6.2 p = 0.8

		equal cell counts (levels = 2*4)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	4.15	5.10	5.05	5.40	4.45	5.00	4.65	5.60	5.25	5.55
	Puri & Sen	3.40	4.95	5.00	5.40	4.50	5.00	4.60	5.55	5.20	5.40
	ATS	2.65	4.45	4.65	5.15	4.25	4.90	4.60	5.40	5.05	5.35
	logistic Wald	0.05	0.15	0.50	1.50	2.35	2.90	3.75	3.45	4.00	4.50
	logistic LR	8.70	8.50	9.40	7.55	6.35	5.70	5.95	5.50	5.15	5.60
	logistic W-LR	0.15	1.10	2.20	3.75	4.25	4.20	5.05	4.75	4.50	5.05
	probit Wald	0.05	0.30	1.40	2.90	3.90	4.00	4.95	4.65	4.60	5.10
	probit LR	8.85	8.40	9.25	7.75	6.45	5.65	5.95	5.55	5.10	5.70
	probit W-LR	0.20	1.20	2.75	4.75	5.15	4.85	5.50	5.20	4.80	5.30
	chi-squared	3.00	5.25	5.70	6.05	5.00	4.65	4.80	5.55	5.85	5.40
0.01	parametric	0.75	0.60	1.30	0.70	1.05	1.00	1.00	0.90	0.85	1.45
	Puri & Sen	0.30	0.50	1.35	0.55	1.05	0.70	0.95	0.90	0.85	1.30
	ATS	0.20	0.50	1.00	0.55	0.95	0.75	1.00	0.90	0.80	1.25
	logistic Wald	0.05	0.05	0.05	0.05	0.20	0.25	0.35	0.35	0.6	0.65
	logistic LR	1.60	1.90	2.05	1.85	1.55	1.45	1.55	1.25	1.1	1.10
	logistic W-LR	0.05	0.05	0.20	0.30	0.60	0.65	0.90	0.65	0.8	0.85
	probit Wald	0.05	0.05	0.20	0.25	0.50	0.60	0.70	0.70	0.8	0.85
	probit LR	1.85	2.05	2.05	1.80	1.55	1.40	1.55	1.25	1.1	1.05
	probit W-LR	0.05	0.10	0.30	0.50	0.90	1.00	1.10	1.00	0.9	0.95
	chi-squared	0.25	0.45	1.15	0.65	1.05	0.90	0.90	1.35	0.95	1.20
		unequal cell counts (levels = 4*5)									
0.05	parametric	6.40	5.50	4.50	5.60	5.30	4.60	4.60	5.05	5.35	4.65
	Puri & Sen	4.70	5.10	4.15	5.15	5.15	4.50	4.45	5.05	5.35	4.55
	ATS	4.00	3.50	3.40	4.60	4.30	4.95	4.40	5.20	5.15	4.30
	logistic Wald	0.05	0.05	0.15	0.30	1.25	1.25	2.00	2.10	2.30	3.10
	logistic LR	10.20	12.10	10.60	8.15	8.10	7.20	7.30	6.85	6.35	6.80
	logistic W-LR	0.05	0.65	1.25	1.65	2.90	3.00	4.05	3.55	3.65	4.85
	probit Wald	0.05	0.05	0.35	0.70	1.75	2.05	3.30	3.05	3.20	4.45
	probit LR	10.10	12.20	10.65	8.15	8.20	7.25	7.45	7.00	6.40	6.80
	probit W-LR	0.05	0.90	1.95	2.15	3.60	3.50	4.85	4.35	4.10	5.30
	chi-squared	7.25	6.15	4.70	5.95	5.75	4.65	4.85	5.00	5.25	4.70
0.01	parametric	1.95	1.65	1.00	1.40	0.85	0.85	0.90	1.20	0.90	0.85
	Puri & Sen	0.85	1.35	0.75	1.25	0.85	0.85	0.85	1.15	0.90	0.85
	ATS	1.25	0.80	0.60	1.15	0.65	0.95	0.75	0.95	1.30	0.90
	logistic Wald	0.05	0.05	0.05	0.05	99.95	99.95	0.10	0.30	0.45	0.40
	logistic LR	1.85	2.55	2.40	1.85	1.30	1.55	1.15	1.65	1.40	1.90
	logistic W-LR	0.05	0.05	0.15	0.25	0.15	0.35	0.20	0.70	0.80	0.75
	probit Wald	0.05	0.05	0.05	0.05	0.15	0.15	0.15	0.55	0.55	0.65
	probit LR	1.85	2.55	2.40	1.85	1.35	1.55	1.15	1.75	1.35	1.90
	probit W-LR	0.05	0.05	0.20	0.25	0.35	0.55	0.35	0.85	0.95	1.20
	chi-squared	2.20	1.60	1.10	1.15	0.95	1.15	0.90	1.10	1.15	1.10

Graphic for $\alpha=0.05$:



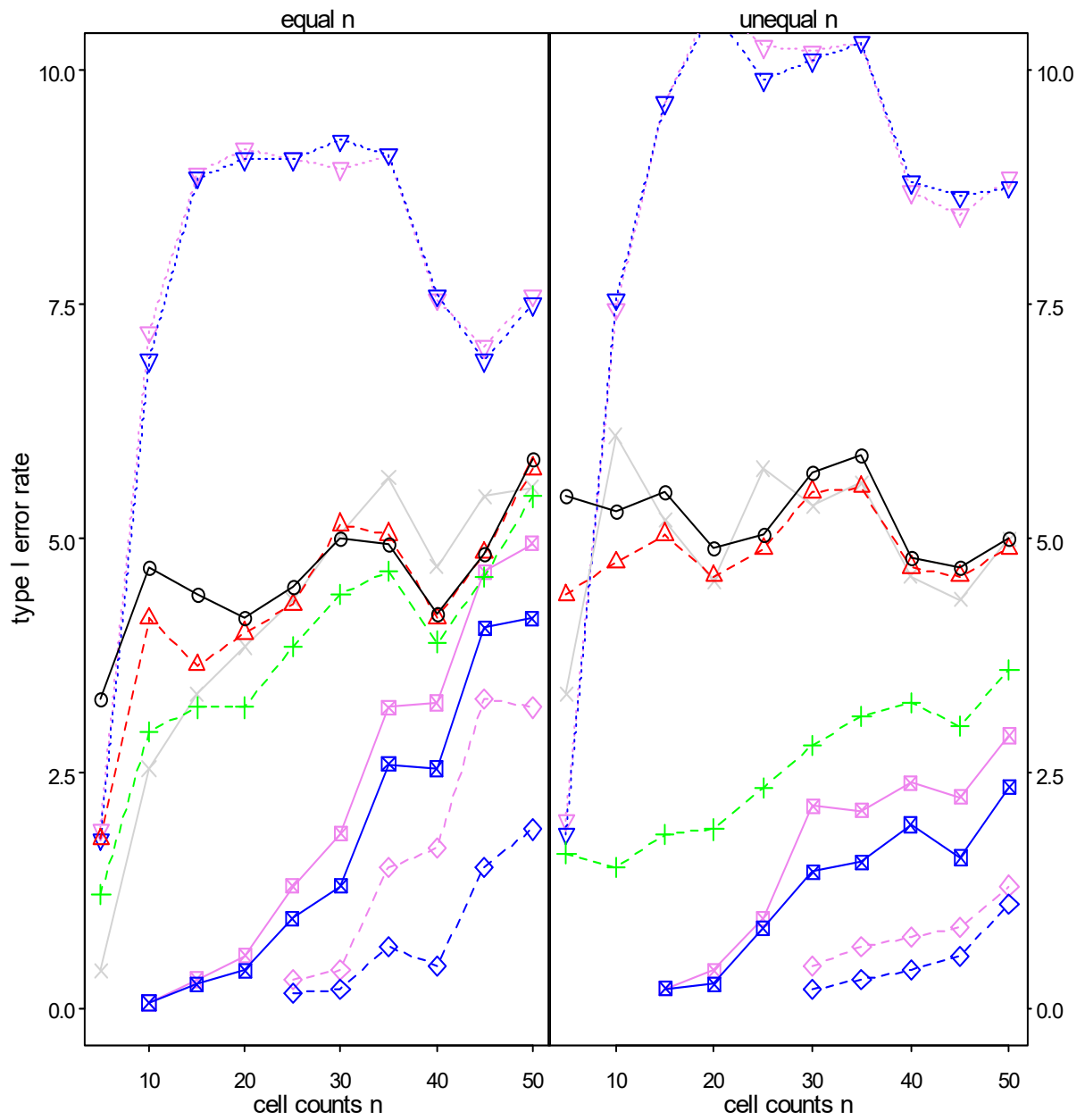
legend

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|----------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- | Puri & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5.6.3 p = 0.9

α	method	equal cell counts (levels = 2*4)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	3.3	4.70	4.40	4.15	4.50	5.00	4.95	4.20	4.85	5.85
	Puri & Sen	1.8	4.15	3.65	4.00	4.30	5.15	5.05	4.15	4.85	5.75
	ATS	1.2	2.95	3.20	3.20	3.85	4.40	4.65	3.90	4.60	5.45
	logistic Wald	0.05	0.05	0.05	0.05	0.15	0.20	0.65	0.45	1.50	1.90
	logistic LR	1.80	6.90	8.85	9.05	9.05	9.25	9.10	7.60	6.90	7.50
	logistic W-LR	0.05	0.05	0.25	0.40	0.95	1.30	2.60	2.55	4.05	4.15
	probit Wald	0.05	0.05	0.05	0.05	0.30	0.40	1.50	1.70	3.30	3.20
	probit LR	1.90	7.20	8.90	9.15	9.05	8.95	9.10	7.55	7.05	7.60
	probit W-LR	0.05	0.05	0.30	0.55	1.30	1.85	3.20	3.25	4.65	4.95
	chi-squared	0.4	2.55	3.35	3.85	4.35	5.05	5.65	4.70	5.45	5.55
0.01	parametric	0.70	0.90	0.80	0.75	0.85	0.95	1.10	0.60	1.30	1.20
	Puri & Sen	0.20	0.70	0.65	0.65	0.85	0.85	1.00	0.50	1.25	1.20
	ATS	0.10	0.05	0.40	0.30	0.65	0.60	0.90	0.45	1.15	0.95
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.05	0.10	0.10
	logistic LR	0.15	0.90	1.65	1.80	1.95	1.95	2.35	1.75	2.00	2.05
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.10	0.20	0.10	0.70	0.40
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.05	0.45	0.30
	probit LR	0.15	0.85	1.65	1.80	2.00	1.95	2.40	1.85	2.00	1.90
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.15	0.30	0.20	0.75	0.85
	chi-squared	0.05	0.20	0.30	0.30	0.40	0.60	1.10	0.75	1.10	1.35
		unequal cell counts (levels = 4*5)									
0.05	parametric	5.45	5.30	5.50	4.90	5.05	5.70	5.90	4.80	4.70	5.00
	Puri & Sen	4.40	4.75	5.05	4.60	4.90	5.50	5.55	4.70	4.60	4.90
	ATS	1.65	1.50	1.85	1.90	2.35	2.80	3.10	3.25	3.00	3.60
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.20	0.30	0.40	0.55	1.10
	logistic LR	1.85	7.55	9.65	10.65	9.90	10.10	10.30	8.80	8.65	8.75
	logistic W-LR	0.05	0.05	0.20	0.25	0.85	1.45	1.55	1.95	1.60	2.35
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.45	0.65	0.75	0.85	1.30
	probit LR	2.00	7.45	9.65	10.75	10.25	10.20	10.30	8.70	8.45	8.85
	probit W-LR	0.05	0.05	0.20	0.40	0.95	2.15	2.10	2.40	2.25	2.90
	chi-squared	3.35	6.10	5.20	4.55	5.75	5.35	5.60	4.60	4.35	5.00
0.01	parametric	1.90	1.55	1.60	0.90	1.00	1.55	1.25	1.20	0.85	1.45
	Puri & Sen	1.15	1.10	1.35	0.80	0.85	1.40	1.25	1.05	0.85	1.45
	ATS	0.40	0.10	0.25	0.20	0.35	0.20	0.70	0.50	0.50	0.40
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.05
	logistic LR	0.20	0.90	2.25	1.85	2.70	2.60	2.35	1.90	1.55	1.75
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.20	0.15	0.20	0.40	0.50
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.25	0.10
	probit LR	0.20	1.05	2.30	1.90	2.55	2.55	2.25	1.90	1.60	1.80
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.30	0.15	0.25	0.45	0.55
	chi-squared	0.95	0.95	1.30	0.85	1.25	1.05	1.05	0.95	0.85	1.15

Graphic for $\alpha=0.05$:



legend

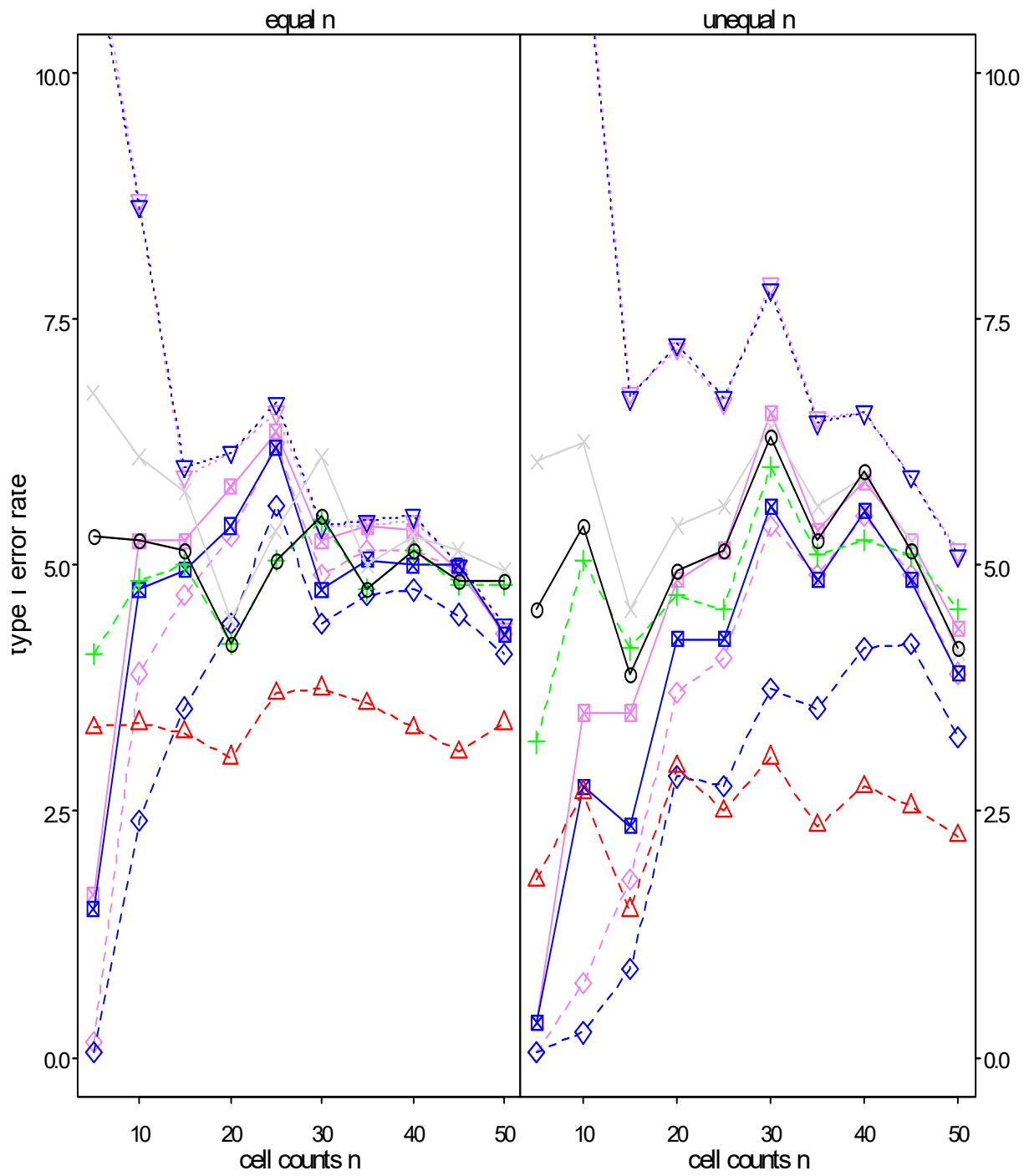
- | | | | |
|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Puri & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- - - | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5. 7. Interaction AB - A significant (effects $a_i = 0.6*s$) n_i and p_i independent

5. 7. 1 $p = 0.5$

		equal cell counts (levels = 2*4)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	5.30	5.25	5.15	4.20	5.05	5.50	4.75	5.15	4.85	4.85
	Puri & Sen	3.35	3.40	3.30	3.05	3.70	3.75	3.60	3.35	3.10	3.40
	ATS	4.10	4.85	5.00	4.20	5.05	5.45	4.75	5.15	4.80	4.80
	logistic Wald	0.05	2.40	3.55	4.40	5.60	4.40	4.70	4.75	4.50	4.10
	logistic LR	11.35	8.65	6.00	6.15	6.65	5.40	5.45	5.50	5.00	4.40
	logistic W-LR	1.50	4.75	4.95	5.40	6.20	4.75	5.05	5.00	5.00	4.30
	probit Wald	0.15	3.90	4.70	5.30	6.25	4.90	5.15	5.15	4.95	4.30
	probit LR	11.55	8.70	5.90	6.15	6.55	5.40	5.40	5.45	5.00	4.35
	probit W-LR	1.65	5.25	5.25	5.80	6.35	5.25	5.40	5.35	4.95	4.30
chi-squared	6.75	6.10	5.75	4.45	5.35	6.10	5.00	5.30	5.15	4.95	
0.01	parametric	1.30	1.25	0.8	0.90	0.95	1.10	0.90	1.00	0.60	1.2
	Puri & Sen	0.50	0.25	0.5	0.45	0.60	0.65	0.60	0.60	0.35	0.6
	ATS	0.75	1.10	0.7	0.80	0.95	1.10	0.90	1.00	0.60	1.2
	logistic Wald	0.05	0.25	0.2	0.80	1.05	0.75	0.70	0.65	0.75	0.80
	logistic LR	2.95	2.00	1.2	1.50	1.55	1.15	1.10	0.70	1.05	1.00
	logistic W-LR	0.05	0.50	0.5	1.05	1.20	1.00	0.90	0.65	1.00	0.90
	probit Wald	0.05	0.45	0.5	1.00	1.25	1.00	0.85	0.65	0.95	0.90
	probit LR	3.00	2.05	1.3	1.50	1.55	1.20	1.10	0.70	1.05	0.95
	probit W-LR	0.10	0.65	0.8	1.25	1.45	1.10	1.05	0.65	1.05	0.95
chi-squared	1.65	1.40	0.8	1.00	1.05	1.20	0.95	1.05	0.70	1.2	
		unequal cell counts (levels = 4*5)									
0.05	parametric	4.55	5.40	3.90	4.95	5.15	6.30	5.25	5.95	5.15	4.15
	Puri & Sen	1.80	2.70	1.50	2.95	2.50	3.05	2.35	2.75	2.55	2.25
	ATS	3.20	5.05	4.15	4.70	4.55	6.00	5.10	5.25	5.10	4.55
	logistic Wald	0.05	0.25	0.90	2.85	2.75	3.75	3.55	4.15	4.20	3.25
	logistic LR	15.70	11.40	6.70	7.25	6.70	7.80	6.45	6.55	5.90	5.10
	logistic W-LR	0.35	2.75	2.35	4.25	4.25	5.60	4.85	5.55	4.85	3.90
	probit Wald	0.05	0.75	1.80	3.70	4.05	5.40	4.90	5.50	4.90	3.90
	probit LR	15.85	11.50	6.75	7.20	6.65	7.85	6.50	6.55	5.90	5.15
	probit W-LR	0.35	3.50	3.50	4.85	5.15	6.55	5.35	5.85	5.25	4.35
chi-squared	6.05	6.25	4.55	5.40	5.60	6.40	5.60	5.90	5.25	4.10	
0.01	parametric	0.85	1.30	0.70	1.35	0.65	1.35	0.75	1.15	0.90	1.05
	Puri & Sen	0.15	0.40	0.10	0.35	0.30	0.70	0.30	0.50	0.30	0.40
	ATS	0.45	1.40	1.00	1.15	1.00	1.60	0.95	1.20	0.95	1.00
	logistic Wald	0.05	0.05	0.05	0.25	0.30	0.60	0.30	0.40	0.40	0.85
	logistic LR	4.45	3.25	1.25	2.10	1.20	1.80	1.10	1.25	1.25	1.15
	logistic W-LR	0.05	0.25	0.45	1.00	0.55	1.00	0.55	0.90	0.85	1.05
	probit Wald	0.05	0.15	0.20	0.80	0.55	0.90	0.55	0.85	0.85	1.05
	probit LR	4.35	3.20	1.25	2.15	1.20	1.80	1.10	1.25	1.25	1.15
	probit W-LR	0.05	0.50	0.60	1.30	0.60	1.20	0.80	1.05	1.05	1.10
chi-squared	0.90	1.60	0.70	1.35	0.75	1.35	0.85	1.15	0.95	1.10	

Graphic for $\alpha=0.05$:



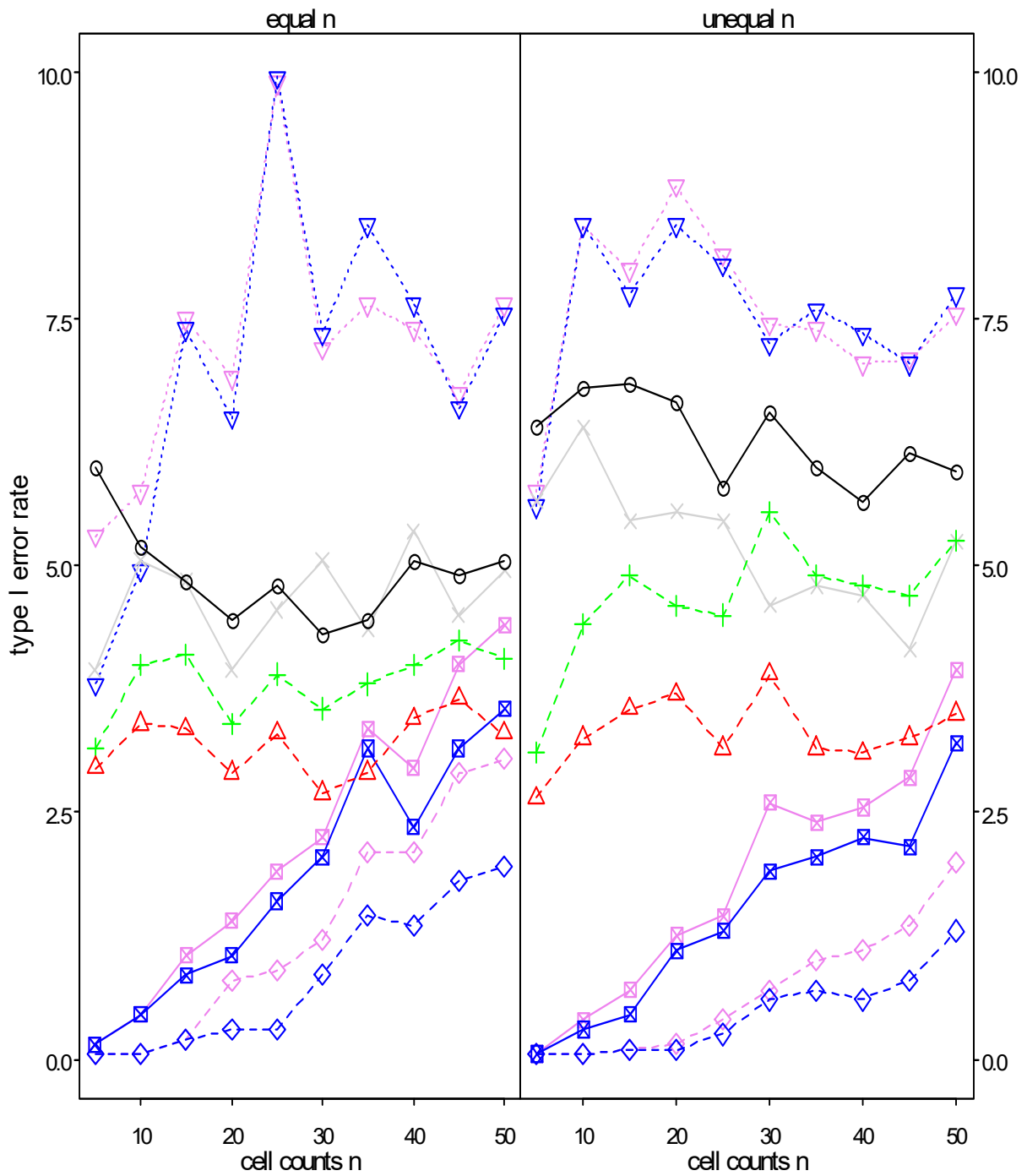
legend

- | | | | |
|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Puri & Sen |▽..... | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | ---◇--- | probit/Wald |
| | |▽..... | probit/LR |
| | | —■— | probit/Wald+LR |

5.7.2 $p = 0.8$

α	method	equal cell counts (levels = 2*4)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	6.00	5.20	4.85	4.45	4.80	4.30	4.45	5.05	4.90	5.05
	Puri & Sen	2.95	3.40	3.35	2.90	3.30	2.70	2.90	3.45	3.65	3.30
	ATS	3.15	4.00	4.10	3.40	3.90	3.55	3.80	4.00	4.25	4.05
	logistic Wald	0.05	0.05	0.20	0.30	0.30	0.85	1.45	1.35	1.80	1.95
	logistic LR	3.80	4.95	7.40	6.50	9.95	7.35	8.45	7.65	6.60	7.55
	logistic W-LR	0.15	0.45	0.85	1.05	1.60	2.05	3.15	2.35	3.15	3.55
	probit Wald	0.05	0.05	0.20	0.80	0.90	1.20	2.10	2.10	2.90	3.05
	probit LR	5.30	5.75	7.50	6.90	9.90	7.20	7.65	7.40	6.75	7.65
	probit W-LR	0.15	0.45	1.05	1.40	1.90	2.25	3.35	2.95	4.00	4.40
	chi-squared	3.95	5.05	4.85	3.95	4.55	5.05	4.35	5.35	4.50	4.95
0.01	parametric	1.35	1.20	0.95	0.80	1.15	0.70	0.85	1.35	1.10	1.20
	Puri & Sen	0.20	0.45	0.40	0.40	0.65	0.45	0.30	0.80	0.35	0.75
	ATS	0.30	0.50	0.40	0.55	0.60	0.55	0.60	1.00	0.55	0.85
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.15	0.20	0.10	0.20	0.40
	logistic LR	0.70	0.95	1.55	0.55	1.35	1.85	2.05	1.60	2.15	1.90
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.30	0.35	0.25	0.55	0.65
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.20	0.30	0.25	0.35	0.45
	probit LR	0.80	1.05	1.60	0.80	1.30	1.80	1.95	1.55	2.15	1.70
	probit W-LR	0.05	0.05	0.05	0.05	0.15	0.45	0.65	0.40	0.75	0.70
	chi-squared	0.90	1.25	0.80	0.90	1.00	0.95	0.95	1.20	0.75	0.80
		unequal cell counts (levels = 4*5)									
0.05	parametric	6.40	6.80	6.85	6.65	5.80	6.55	6.00	5.65	6.15	5.95
	Puri & Sen	2.65	3.25	3.55	3.70	3.15	3.90	3.15	3.10	3.25	3.50
	ATS	3.10	4.40	4.90	4.60	4.50	5.55	4.90	4.80	4.70	5.25
	logistic Wald	0.05	0.05	0.10	0.10	0.25	0.60	0.70	0.60	0.80	1.30
	logistic LR	5.60	8.45	7.75	8.45	8.05	7.25	7.60	7.35	7.05	7.75
	logistic W-LR	0.05	0.30	0.45	1.10	1.30	1.90	2.05	2.25	2.15	3.20
	probit Wald	0.05	0.05	0.10	0.15	0.40	0.70	1.00	1.10	1.35	2.00
	probit LR	5.75	8.45	8.00	8.85	8.15	7.45	7.40	7.05	7.10	7.55
	probit W-LR	0.05	0.40	0.70	1.25	1.45	2.60	2.40	2.55	2.85	3.95
	chi-squared	5.65	6.40	5.45	5.55	5.45	4.60	4.80	4.70	4.15	5.25
0.01	parametric	1.85	1.85	1.35	1.75	1.45	1.75	1.40	1.40	1.20	1.35
	Puri & Sen	0.45	0.75	0.60	0.50	0.55	0.70	0.65	0.50	0.65	0.70
	ATS	0.60	1.20	1.05	1.00	1.10	1.30	1.05	1.25	1.10	1.10
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.15	0.10	0.05	0.05	0.15
	logistic LR	0.75	1.35	1.80	1.85	1.60	1.55	1.65	1.65	1.20	1.80
	logistic W-LR	0.05	0.05	0.10	0.15	0.05	0.30	0.35	0.20	0.25	0.45
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.20	0.25	0.10	0.15	0.30
	probit LR	0.75	1.25	1.85	1.80	1.50	1.40	1.45	1.65	1.30	1.80
	probit W-LR	0.05	0.05	0.15	0.20	0.10	0.35	0.40	0.30	0.40	0.45
	chi-squared	1.30	1.65	1.00	1.25	1.35	1.20	1.05	0.80	0.80	0.80

Graphic for $\alpha=0.05$:



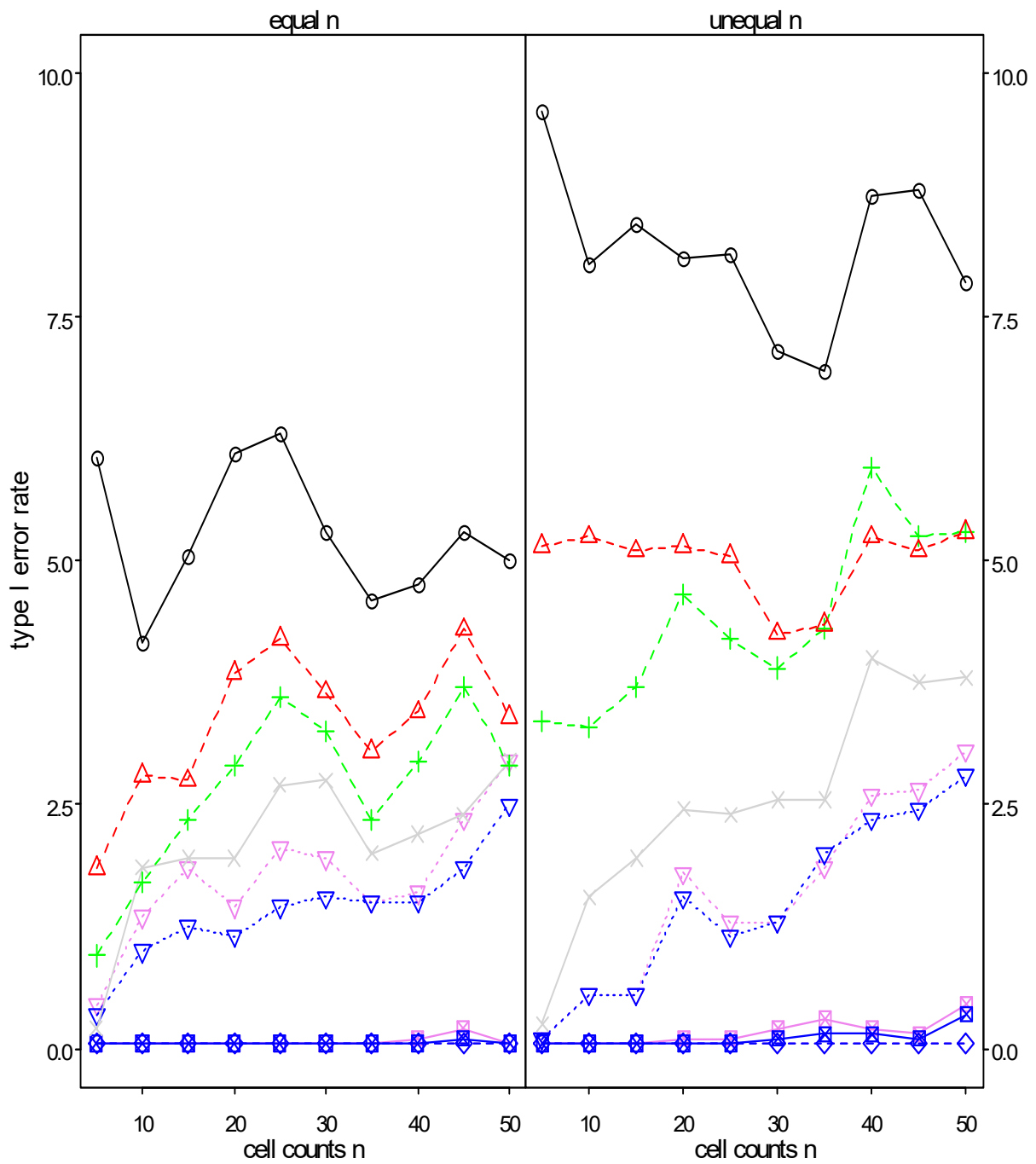
legend

- | | | | |
|----------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- | Furi & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - | ATS | —■— | logistic/Wald+LR |
| - - -x- | chi-squared | - - -◇- | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5.7.3 $p = 0.9$

		equal cell counts (levels = 2*4)										
α	method	5	10	15	20	25	30	35	40	45	50	
0.05	parametric	6.05	4.15	5.05	6.10	6.3	5.30	4.60	4.75	5.3	5.00	
	Puri & Sen	1.85	2.80	2.75	3.85	4.2	3.65	3.05	3.45	4.3	3.40	
	ATS	0.95	1.70	2.35	2.90	3.6	3.25	2.35	2.95	3.7	2.90	
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	logistic LR	0.35	1.00	1.25	1.15	1.45	1.55	1.50	1.50	1.85	2.50	
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.05
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit LR	0.45	1.35	1.85	1.45	2.05	1.95	1.50	1.60	2.35	2.95	
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.20	0.05
	chi-squared	0.20	1.85	1.95	1.95	2.7	2.75	2.00	2.20	2.4	2.95	
0.01	parametric	1.60	0.85	1.05	1.10	1.30	0.95	0.50	1.10	1.15	1.25	
	Puri & Sen	0.05	0.30	0.40	0.30	0.60	0.25	0.20	0.55	0.50	0.45	
	ATS	0.05	0.10	0.20	0.10	0.35	0.05	0.10	0.15	0.25	0.25	
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	logistic LR	0.05	0.15	0.15	0.10	0.10	0.25	0.10	0.05	0.15	0.15	
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	probit LR	0.05	0.20	0.20	0.10	0.15	0.35	0.10	0.15	0.10	0.25	
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	chi-squared	0.05	0.45	0.75	0.35	0.80	0.50	0.15	0.35	0.30	0.35	
		unequal cell counts (levels = 4*5)										
0.05	parametric	9.60	8.05	8.45	8.10	8.15	7.15	6.95	8.75	8.80	7.85	
	Puri & Sen	5.15	5.25	5.10	5.15	5.05	4.25	4.35	5.25	5.10	5.30	
	ATS	3.35	3.30	3.70	4.65	4.20	3.90	4.30	5.95	5.25	5.30	
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	logistic LR	0.10	0.55	0.55	1.55	1.15	1.30	2.00	2.35	2.45	2.80	
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.10	0.15	0.15	0.10	0.35	
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	probit LR	0.10	0.55	0.55	1.80	1.30	1.30	1.85	2.60	2.65	3.05	
	probit W-LR	0.05	0.05	0.05	0.10	0.10	0.20	0.30	0.20	0.15	0.45	
	chi-squared	0.25	1.55	1.95	2.45	2.40	2.55	2.55	4.00	3.75	3.80	
0.01	parametric	4.00	3.50	2.95	2.55	2.70	2.55	2.35	2.85	2.55	2.70	
	Puri & Sen	1.50	1.45	1.00	1.50	1.45	1.05	1.40	1.85	1.05	1.55	
	ATS	1.65	0.70	0.50	0.65	1.15	0.85	0.85	1.50	1.20	1.15	
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	logistic LR	0.05	0.05	0.05	0.35	0.15	0.15	0.40	0.25	0.25	0.45	
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	probit LR	0.05	0.05	0.05	0.35	0.25	0.20	0.40	0.25	0.25	0.65	
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	chi-squared	0.05	0.50	0.50	0.65	0.90	0.70	0.80	0.85	0.85	0.80	

Graphic for $\alpha=0.05$:



legend

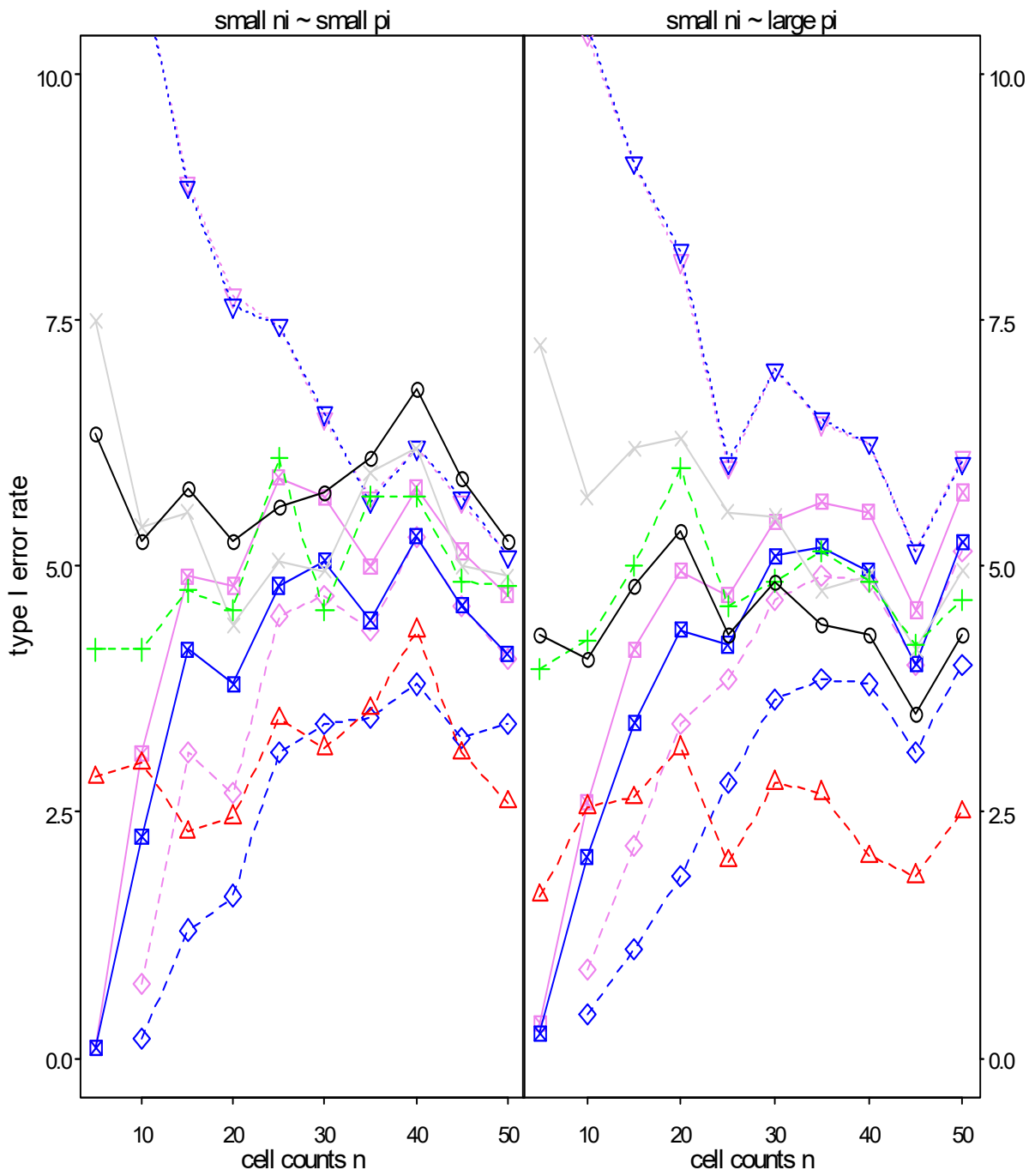
- | | | | |
|---------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| ---△--- | Furi & Sen | ---▽--- | logistic/LR |
| ---+--- | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | ---◇--- | probit/Wald |
| | | ---▽--- | probit/LR |
| | | —■— | probit/Wald+LR |

5. 8. Interaction AB - A significant (effects $a_i = 0.6*s$) small $n_i \sim$ small p_i and small $n_i \sim$ large p_i

5. 8. 1 $p = 0.6$

α	method	small $n_i \sim$ small p_i (levels = 4*5)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	6.35	5.25	5.80	5.25	5.60	5.75	6.10	6.80	5.90	5.25
	Puri & Sen	2.85	3.00	2.30	2.45	3.45	3.15	3.55	4.35	3.10	2.60
	ATS	4.15	4.15	4.75	4.55	6.10	4.55	5.70	5.70	4.85	4.80
	logistic Wald	0.05	0.20	1.30	1.65	3.10	3.40	3.45	3.8	3.25	3.40
	logistic LR	15.45	11.00	8.85	7.65	7.45	6.55	5.65	6.2	5.70	5.10
	logistic W-LR	0.10	2.25	4.15	3.80	4.80	5.05	4.45	5.3	4.60	4.10
	probit Wald	0.05	0.75	3.10	2.70	4.50	4.70	4.35	5.3	4.60	4.05
	probit LR	15.60	11.05	8.90	7.75	7.45	6.50	5.70	6.2	5.65	5.10
	probit W-LR	0.10	3.10	4.90	4.80	5.90	5.70	5.00	5.8	5.15	4.70
chi-squared	7.50	5.40	5.55	4.40	5.05	4.95	5.95	6.20	5.00	4.90	
0.01	parametric	1.75	1.50	1.00	1.00	1.55	1.5	1.60	1.65	0.95	1.15
	Puri & Sen	0.45	0.65	0.40	0.25	0.50	0.7	0.40	0.60	0.50	0.50
	ATS	1.40	1.40	1.15	1.15	1.70	1.2	1.30	1.50	1.30	0.80
	logistic Wald	0.05	0.05	0.10	0.10	0.25	0.40	0.4	0.70	0.55	0.90
	logistic LR	4.65	3.20	2.10	1.90	1.30	1.50	1.1	1.15	1.00	1.40
	logistic W-LR	0.05	0.10	0.55	0.45	0.50	0.90	0.6	0.85	0.75	0.95
	probit Wald	0.05	0.10	0.25	0.35	0.45	0.75	0.6	0.85	0.75	1.00
	probit LR	4.65	3.10	2.10	1.90	1.30	1.50	1.1	1.15	1.00	1.40
	probit W-LR	0.05	0.15	0.80	0.60	0.75	1.05	0.8	0.95	0.85	1.10
chi-squared	1.90	1.45	0.80	0.90	1.45	1.3	1.05	1.30	0.90	1.20	
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	4.30	4.05	4.80	5.35	4.30	4.85	4.40	4.30	3.50	4.30
	Puri & Sen	1.65	2.55	2.65	3.15	2.00	2.80	2.70	2.05	1.85	2.50
	ATS	3.95	4.25	5.00	6.00	4.60	4.85	5.15	4.85	4.20	4.65
	logistic Wald	0.05	0.45	1.10	1.85	2.80	3.65	3.85	3.80	3.10	4.00
	logistic LR	16.40	10.50	9.10	8.20	6.05	7.00	6.50	6.25	5.15	6.05
	logistic W-LR	0.25	2.05	3.40	4.35	4.20	5.10	5.20	4.95	4.00	5.25
	probit Wald	0.05	0.90	2.15	3.40	3.85	4.65	4.90	4.85	4.00	5.15
	probit LR	16.20	10.40	9.10	8.10	6.00	7.00	6.45	6.25	5.15	6.10
	probit W-LR	0.35	2.60	4.15	4.95	4.70	5.45	5.65	5.55	4.55	5.75
chi-squared	7.25	5.70	6.20	6.30	5.55	5.50	4.75	4.90	4.15	4.95	
0.01	parametric	0.70	0.95	1.25	1.25	0.95	1.05	1.1	0.70	0.55	0.85
	Puri & Sen	0.20	0.20	0.50	0.60	0.20	0.40	0.5	0.40	0.20	0.30
	ATS	1.05	0.95	1.30	1.50	1.15	1.25	0.9	0.90	1.15	1.10
	logistic Wald	0.05	0.05	0.05	0.05	0.45	0.45	0.60	0.65	0.40	0.75
	logistic LR	4.2	3.05	2.30	1.95	1.55	2.10	1.65	1.25	1.05	1.70
	logistic W-LR	0.05	0.50	0.50	0.65	0.85	1.00	0.95	0.80	0.65	0.95
	probit Wald	0.05	0.10	0.20	0.35	0.80	0.90	0.95	0.75	0.65	0.90
	probit LR	4.1	3.00	2.30	1.95	1.50	2.15	1.65	1.30	1.05	1.70
	probit W-LR	0.05	0.60	0.60	0.80	1.25	1.30	1.10	1.00	0.90	1.20
chi-squared	1.55	1.30	1.45	1.45	0.90	1.25	1.3	0.75	0.65	1.15	

Graphic for $\alpha=0.05$:



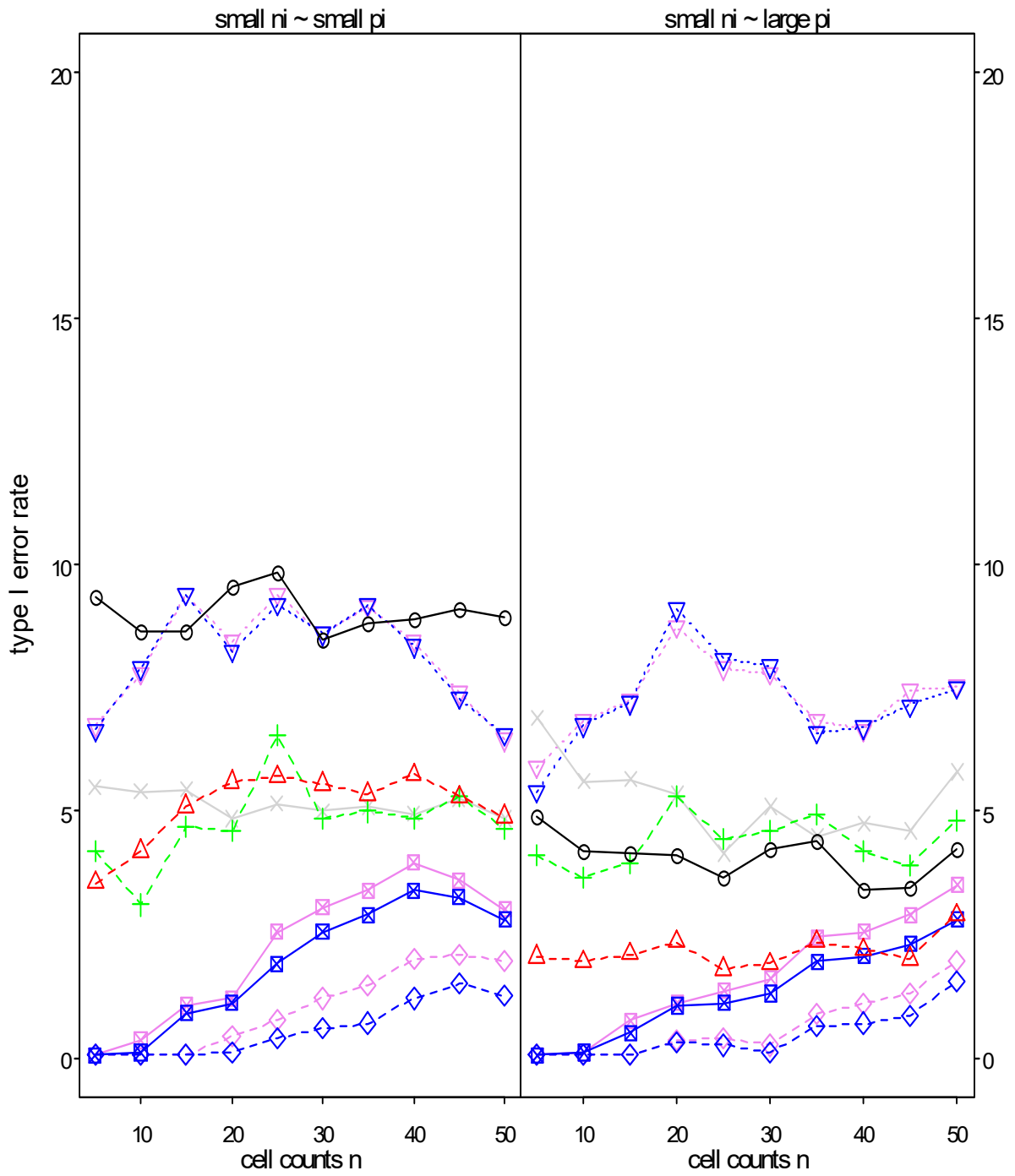
legend

- | | | | |
|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Furi & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- - - | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5.8.2 $p = 0.8$

		small $n_i \sim$ small p_i (levels = 4*5)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	9.35	8.65	8.65	9.55	9.85	8.50	8.80	8.90	9.10	8.95
	Puri & Sen	3.55	4.20	5.10	5.60	5.70	5.55	5.35	5.75	5.30	4.90
	ATS	4.20	3.10	4.70	4.60	6.55	4.85	5.00	4.85	5.30	4.65
	logistic Wald	0.05	0.05	0.05	0.10	0.40	0.60	0.70	1.20	1.50	1.25
	logistic LR	6.65	7.90	9.40	8.25	9.20	8.60	9.20	8.35	7.30	6.55
	logistic W-LR	0.05	0.10	0.90	1.10	1.90	2.55	2.90	3.40	3.25	2.80
	probit Wald	0.05	0.05	0.05	0.45	0.75	1.20	1.45	2.00	2.10	1.95
	probit LR	6.75	7.80	9.40	8.45	9.40	8.60	9.15	8.45	7.40	6.45
	probit W-LR	0.05	0.35	1.05	1.20	2.55	3.05	3.40	3.95	3.60	3.00
	chi-squared	5.50	5.40	5.45	4.85	5.15	5.00	5.10	4.95	5.25	4.85
0.01	parametric	2.55	1.95	3.00	3.35	3.70	2.70	2.40	2.55	2.80	2.25
	Puri & Sen	0.65	0.70	1.15	1.45	1.85	1.35	0.90	1.00	1.40	1.10
	ATS	0.95	0.35	1.00	1.55	1.65	1.00	1.15	1.10	1.25	1.10
	logistic Wald	0.05	0.05	0.05	0.05	0.15	0.10	0.10	0.05	0.05	0.25
	logistic LR	0.95	1.50	2.70	1.60	2.15	1.75	2.25	1.95	1.40	1.15
	logistic W-LR	0.05	0.05	0.05	0.05	0.30	0.30	0.40	0.40	0.35	0.35
	probit Wald	0.05	0.05	0.05	0.05	0.15	0.15	0.20	0.25	0.15	0.25
	probit LR	1.00	1.45	2.85	1.55	2.00	1.65	2.15	1.95	1.55	1.20
	probit W-LR	0.05	0.05	0.05	0.15	0.45	0.40	0.55	0.55	0.50	0.50
	chi-squared	1.90	1.55	1.00	1.30	1.40	1.20	1.25	1.25	1.15	0.45
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	4.90	4.20	4.15	4.10	3.65	4.25	4.40	3.40	3.45	4.25
	Puri & Sen	2.05	1.95	2.10	2.35	1.80	1.90	2.35	2.20	2.00	2.90
	ATS	4.10	3.65	3.95	5.30	4.45	4.60	4.95	4.20	3.90	4.80
	logistic Wald	0.05	0.05	0.05	0.30	0.25	0.10	0.65	0.70	0.85	1.55
	logistic LR	5.40	6.75	7.20	9.10	8.10	7.95	6.60	6.70	7.15	7.50
	logistic W-LR	0.05	0.10	0.50	1.05	1.10	1.30	1.95	2.05	2.30	2.80
	probit Wald	0.05	0.05	0.05	0.35	0.40	0.25	0.90	1.10	1.30	1.95
	probit LR	5.90	6.85	7.25	8.75	7.90	7.80	6.85	6.65	7.45	7.55
	probit W-LR	0.05	0.10	0.75	1.10	1.35	1.60	2.45	2.55	2.90	3.50
	chi-squared	6.90	5.60	5.65	5.35	4.15	5.10	4.50	4.75	4.60	5.80
0.01	parametric	1.25	0.90	1.05	0.85	0.90	0.60	0.80	0.80	1.00	1.15
	Puri & Sen	0.65	0.35	0.35	0.50	0.45	0.20	0.45	0.55	0.35	0.60
	ATS	0.90	0.75	0.40	1.20	0.90	1.00	1.15	0.85	0.95	1.40
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.10	0.05	0.20
	logistic LR	1.20	1.50	1.35	1.60	1.30	1.60	1.35	1.80	1.40	1.70
	logistic W-LR	0.05	0.05	0.05	0.05	0.25	0.05	0.25	0.40	0.10	0.50
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.15	0.05	0.25
	probit LR	1.25	1.45	1.35	1.70	1.40	1.45	1.55	1.75	1.50	1.60
	probit W-LR	0.05	0.05	0.05	0.20	0.30	0.10	0.35	0.45	0.20	0.55
	chi-squared	2.65	1.40	1.35	1.30	0.95	0.80	1.15	1.05	0.50	1.40

Graphic for $\alpha=0.05$:



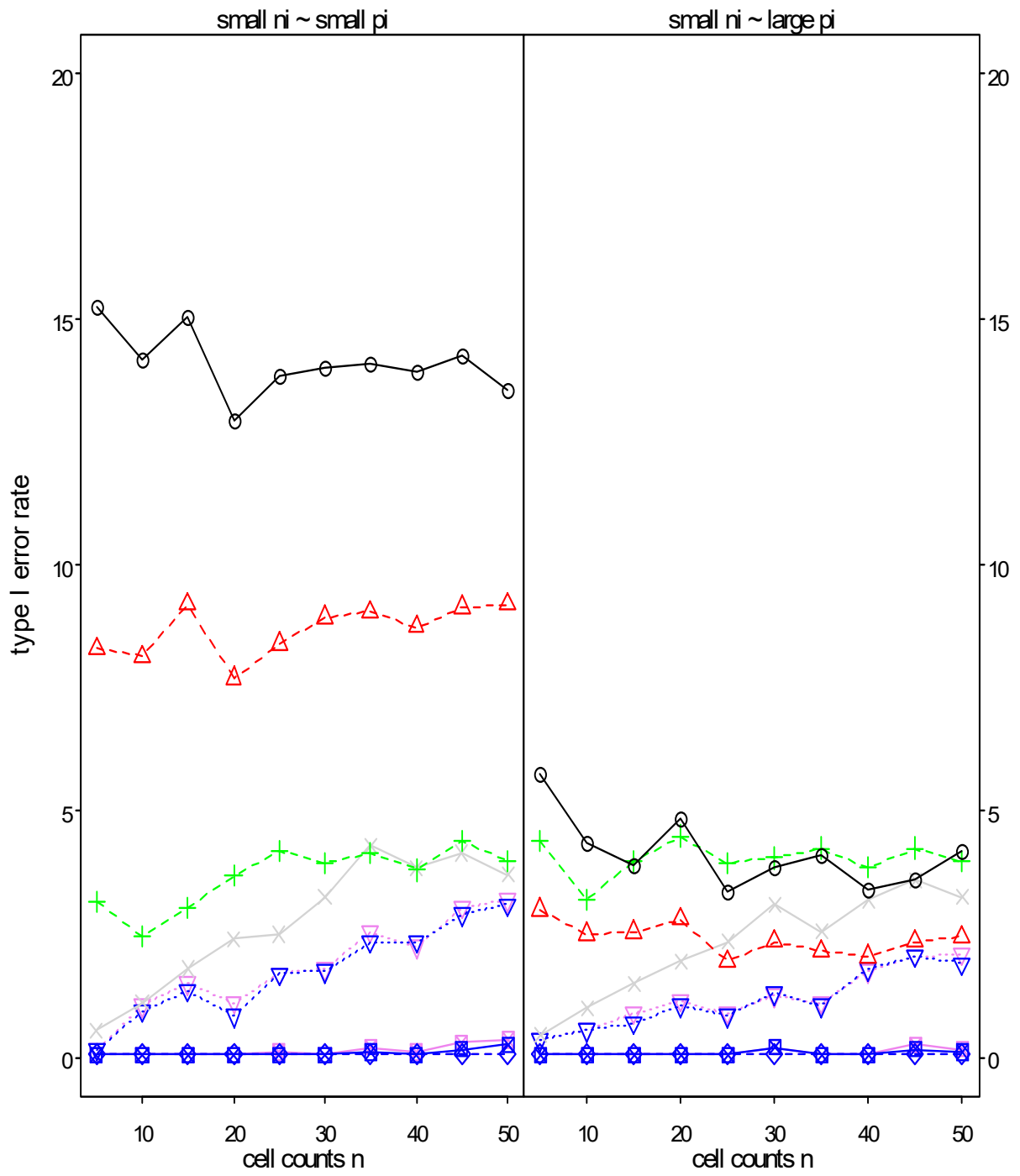
legend

- | | | | |
|----------|-------------|---------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- | Furi & Sen | ...▽... | logistic/LR |
| - - -+ - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- | probit/Wald |
| | | ...▽... | probit/LR |
| | | —■— | probit/Wald+LR |

5.8.3 $p = 0.9$

α	method	small $n_i \sim$ small p_i (levels = 4*5)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	15.25	14.20	15.05	12.95	13.85	14.00	14.10	13.95	14.25	13.55
	Puri & Sen	8.30	8.15	9.20	7.70	8.40	8.95	9.05	8.75	9.15	9.20
	ATS	3.15	2.45	3.05	3.70	4.20	3.95	4.15	3.80	4.40	4.00
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	logistic LR	0.15	0.95	1.35	0.85	1.70	1.75	2.35	2.35	2.90	3.10
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.05	0.15	0.25
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit LR	0.15	1.05	1.50	1.10	1.70	1.80	2.55	2.25	3.05	3.20
	probit W-LR	0.05	0.05	0.05	0.05	0.10	0.05	0.20	0.10	0.30	0.35
	chi-squared	0.55	1.10	1.80	2.40	2.50	3.25	4.30	3.85	4.15	3.70
0.01	parametric	7.30	6.25	6.05	4.95	5.35	5.40	5.7	5.05	5.65	5.60
	Puri & Sen	3.15	3.20	2.95	2.80	2.60	2.85	3.0	2.80	3.20	3.50
	ATS	1.20	0.40	0.60	0.50	0.75	0.75	0.7	0.55	1.00	1.05
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	logistic LR	0.05	0.15	0.30	0.10	0.20	0.05	0.35	0.50	0.60	0.55
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit LR	0.05	0.15	0.30	0.10	0.20	0.05	0.35	0.50	0.65	0.50
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	chi-squared	0.25	0.30	0.65	0.80	0.90	0.75	1.4	0.90	1.25	1.20
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	5.75	4.35	3.90	4.85	3.35	3.85	4.10	3.40	3.60	4.20
	Puri & Sen	3.00	2.50	2.55	2.80	1.95	2.35	2.15	2.05	2.35	2.45
	ATS	4.40	3.20	4.00	4.50	3.95	4.05	4.25	3.85	4.25	4.00
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	logistic LR	0.35	0.55	0.70	1.05	0.85	1.30	1.05	1.80	2.05	1.90
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.20	0.05	0.05	0.15	0.10
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit LR	0.35	0.55	0.90	1.15	0.90	1.25	1.10	1.75	2.05	2.10
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.20	0.05	0.05	0.25	0.15
	chi-squared	0.45	1.00	1.50	1.95	2.35	3.10	2.55	3.20	3.60	3.25
0.01	parametric	1.95	1.50	1.30	1.15	1.10	0.85	0.75	1.05	1.25	0.80
	Puri & Sen	0.90	0.75	0.40	0.45	0.40	0.45	0.30	0.25	0.80	0.45
	ATS	1.75	0.30	0.45	0.80	0.85	0.70	0.85	0.75	1.25	1.15
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	logistic LR	0.10	0.05	0.05	0.15	0.10	0.25	0.10	0.35	0.60	0.10
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit LR	0.10	0.10	0.05	0.15	0.10	0.25	0.05	0.35	0.60	0.15
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	chi-squared	0.20	0.35	0.50	0.40	0.80	0.80	0.80	0.50	1.25	0.80

Graphic for $\alpha=0.05$:



legend

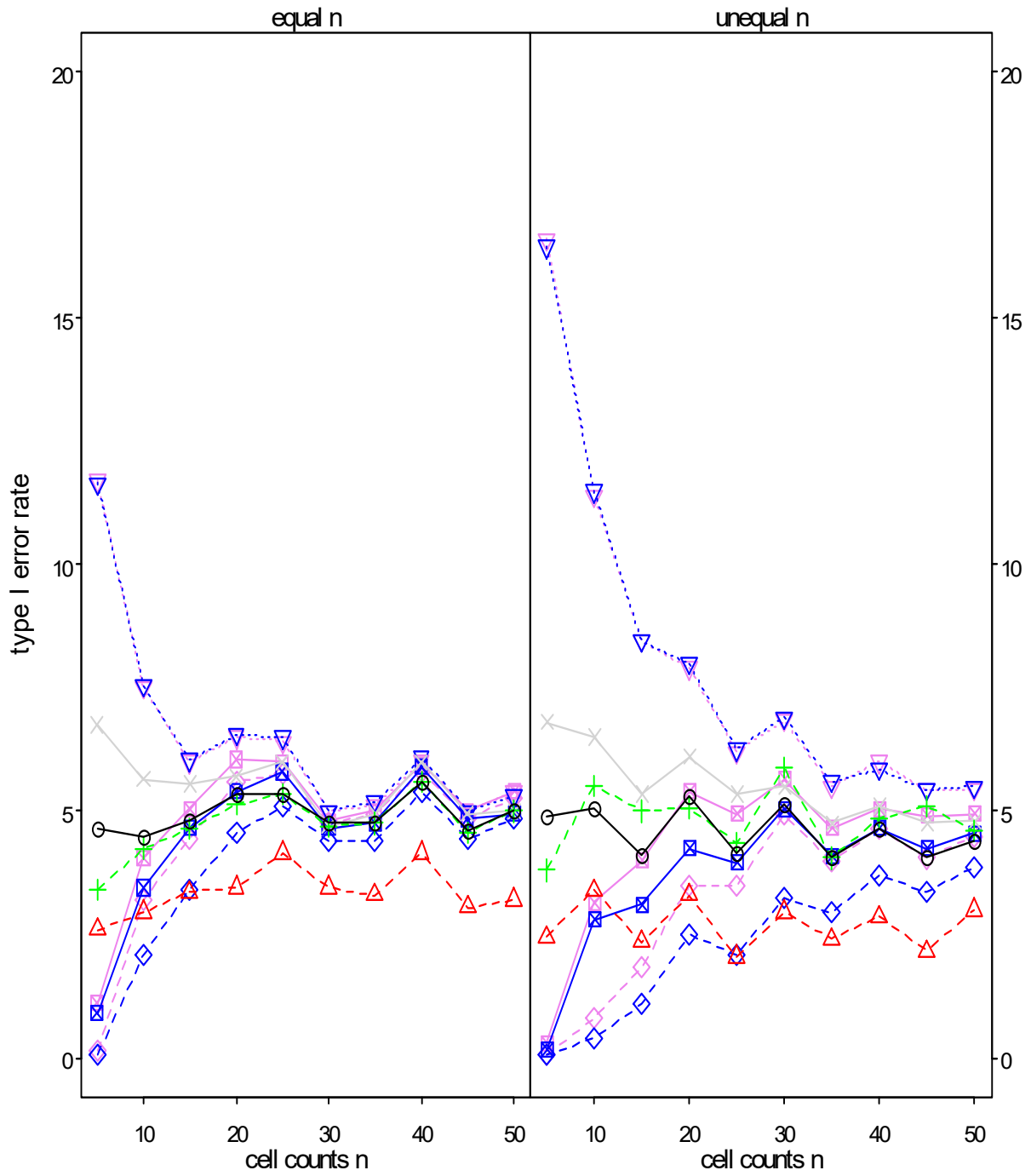
- | | | | |
|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Furi & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- - - | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5. 9. Interaction AB - A and B significant (effects $a_i = 0.4*s$ $b_j = 0.4*s$) - n_i and p_i independent)

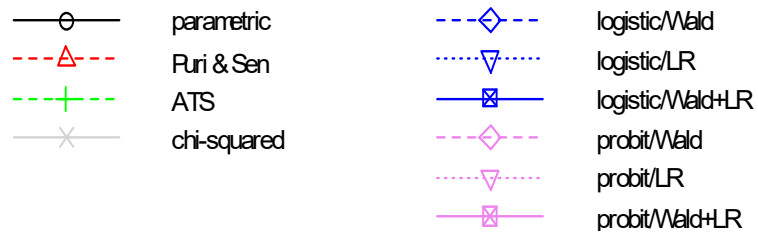
5. 9. 1 $p = 0.5$

α	method	equal cell counts (levels = 2*4)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	4.65	4.50	4.80	5.35	5.35	4.75	4.75	5.60	4.60	5.00
	Puri & Sen	2.60	2.95	3.35	3.45	4.15	3.45	3.30	4.15	3.05	3.20
	ATS	3.40	4.25	4.65	5.15	5.35	4.70	4.75	5.60	4.55	5.00
	logistic Wald	0.05	2.10	3.40	4.55	5.10	4.40	4.40	5.40	4.45	4.85
	logistic LR	11.65	7.55	6.05	6.55	6.50	5.00	5.20	6.10	5.00	5.30
	logistic W-LR	0.90	3.45	4.65	5.40	5.80	4.65	4.75	5.90	4.85	4.95
	probit Wald	0.15	3.20	4.45	5.60	5.75	4.75	4.95	5.80	4.85	5.25
	probit LR	11.70	7.50	6.00	6.50	6.40	5.00	5.10	6.00	5.00	5.40
	probit W-LR	1.10	4.05	5.05	6.05	6.00	4.80	5.00	5.95	5.00	5.40
chi-squared	6.75	5.65	5.55	5.70	6.00	4.70	4.95	6.00	4.95	5.00	
0.01	parametric	0.70	0.75	0.90	0.85	1.10	0.90	0.95	0.75	0.70	0.80
	Puri & Sen	0.30	0.30	0.65	0.65	0.70	0.50	0.75	0.45	0.40	0.65
	ATS	0.45	0.65	0.90	0.80	1.00	0.90	0.90	0.75	0.70	0.80
	logistic Wald	0.05	0.15	0.55	0.60	0.85	0.55	0.80	0.60	0.55	0.85
	logistic LR	2.20	1.40	1.35	1.20	1.55	1.15	1.10	1.10	0.65	0.85
	logistic W-LR	0.10	0.30	0.60	0.70	1.15	0.85	1.05	0.75	0.60	0.85
	probit Wald	0.05	0.20	0.65	0.75	1.20	1.00	0.95	0.75	0.60	0.85
	probit LR	2.25	1.35	1.35	1.20	1.55	1.20	1.10	1.10	0.65	0.85
	probit W-LR	0.15	0.65	0.85	1.00	1.35	1.05	1.05	1.00	0.65	0.85
chi-squared	0.95	0.70	1.05	0.85	1.35	1.05	1.05	0.85	0.65	0.90	
		unequal cell counts (levels = 4*5)									
0.05	parametric	4.90	5.05	4.10	5.30	4.15	5.15	4.05	4.65	4.05	4.40
	Puri & Sen	2.45	3.40	2.35	3.30	2.05	2.95	2.40	2.85	2.15	3.00
	ATS	3.80	5.50	5.00	5.05	4.35	5.90	4.05	4.85	5.10	4.60
	logistic Wald	0.05	0.40	1.10	2.50	2.10	3.25	2.95	3.70	3.35	3.85
	logistic LR	16.45	11.50	8.45	8.00	6.25	6.90	5.60	5.85	5.45	5.50
	logistic W-LR	0.15	2.80	3.10	4.25	3.95	5.05	4.10	4.65	4.25	4.55
	probit Wald	0.05	0.80	1.85	3.50	3.50	4.95	4.00	4.65	4.05	4.50
	probit LR	16.60	11.40	8.45	7.90	6.20	6.85	5.50	6.00	5.45	5.45
	probit W-LR	0.30	3.15	4.00	5.40	4.95	5.65	4.65	5.05	4.90	4.95
chi-squared	6.80	6.50	5.35	6.10	5.35	5.50	4.75	5.10	4.75	4.80	
0.01	parametric	0.90	1.55	0.85	0.85	0.25	1.05	0.60	0.60	1.00	1.10
	Puri & Sen	0.20	0.30	0.25	0.30	0.15	0.55	0.15	0.40	0.50	0.55
	ATS	0.90	1.45	0.85	0.95	0.80	1.30	0.90	0.75	1.10	1.55
	logistic Wald	0.05	0.05	0.05	0.35	0.10	0.55	0.20	0.55	0.50	0.80
	logistic LR	4.50	3.50	1.90	2.20	0.95	1.75	1.00	1.00	1.20	1.65
	logistic W-LR	0.05	0.30	0.40	0.55	0.30	0.90	0.45	0.55	0.85	1.15
	probit Wald	0.05	0.20	0.30	0.50	0.30	0.85	0.50	0.55	0.95	1.20
	probit LR	4.55	3.55	1.85	2.15	0.95	1.75	1.00	1.05	1.15	1.65
	probit W-LR	0.05	0.50	0.70	0.85	0.40	1.30	0.75	0.70	0.95	1.25
chi-squared	1.25	1.60	1.15	1.25	0.50	1.25	0.80	0.65	1.15	1.20	

Graphic for $\alpha=0.05$:



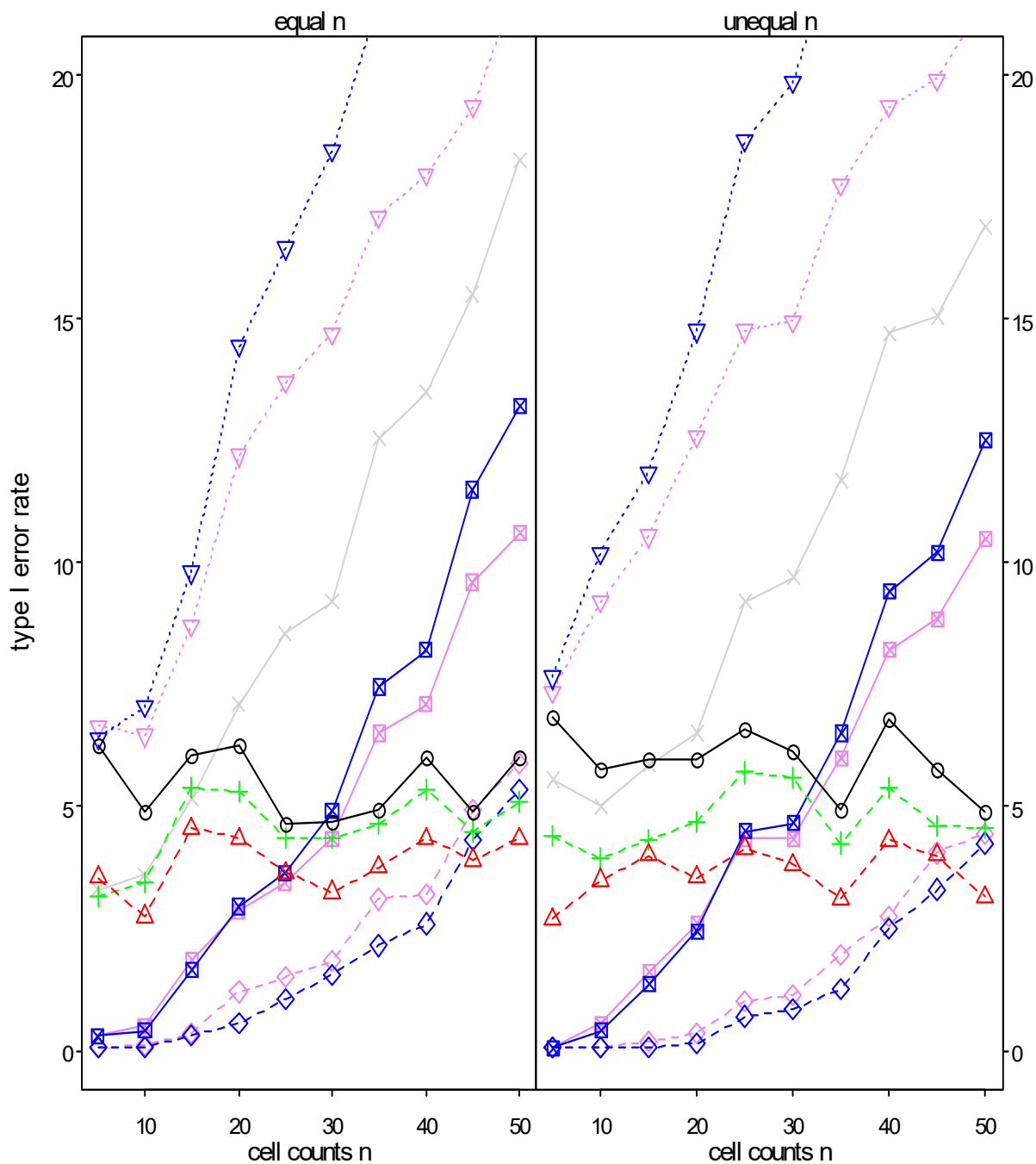
legend



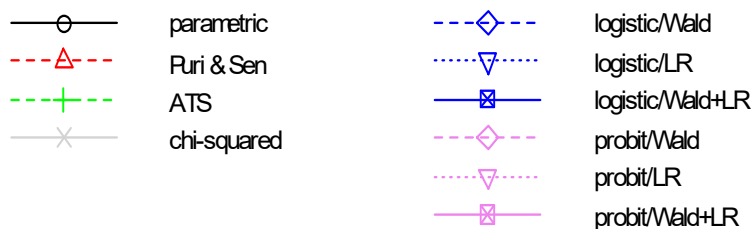
5.9.2 $p = 0.8$

		equal cell counts (levels = 2*4)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	6.25	4.90	6.05	6.25	4.65	4.70	4.95	6.00	4.90	6.00
	Puri & Sen	3.55	2.75	4.55	4.35	3.65	3.25	3.75	4.35	3.90	4.35
	ATS	3.15	3.45	5.40	5.30	4.35	4.35	4.65	5.35	4.50	5.10
	logistic Wald	0.05	0.05	0.30	0.55	1.05	1.55	2.15	2.60	4.30	5.35
	logistic LR	6.40	7.05	9.80	14.45	16.45	18.45	21.50	23.10	25.20	28.30
	logistic W-LR	0.30	0.40	1.65	2.95	3.65	4.90	7.45	8.20	11.50	13.20
	probit Wald	0.05	0.10	0.35	1.20	1.50	1.85	3.10	3.20	4.95	5.90
	probit LR	6.65	6.45	8.70	12.20	13.70	14.70	17.10	17.95	19.35	22.00
	probit W-LR	0.30	0.50	1.85	2.85	3.45	4.35	6.50	7.10	9.60	10.60
	chi-squared	3.30	3.60	5.15	7.10	8.55	9.20	12.55	13.50	15.50	18.25
0.01	parametric	1.90	1.10	1.45	1.20	0.95	1.10	1.10	0.95	1.15	1.30
	Puri & Sen	0.70	0.55	0.95	0.60	0.55	0.75	0.90	0.25	0.80	0.75
	ATS	0.45	0.65	1.10	0.80	0.65	0.95	1.00	0.70	0.75	1.05
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.15	0.25	0.15	0.75	0.80
	logistic LR	1.25	0.95	2.00	2.95	3.95	5.55	7.30	8.20	10.10	10.55
	logistic W-LR	0.05	0.05	0.20	0.25	0.25	0.65	1.15	1.00	2.70	2.45
	probit Wald	0.05	0.05	0.10	0.15	0.10	0.25	0.40	0.25	1.25	0.95
	probit LR	1.35	0.95	1.75	2.45	2.85	4.20	4.95	5.95	7.20	7.25
	probit W-LR	0.05	0.05	0.30	0.35	0.25	0.70	1.10	0.85	2.35	2.05
	chi-squared	0.90	0.55	1.10	1.30	1.40	2.05	2.60	3.25	4.65	4.50
		unequal cell counts (levels = 4*5)									
0.05	parametric	6.85	5.75	5.95	5.95	6.60	6.15	4.95	6.80	5.75	4.90
	Puri & Sen	2.70	3.50	4.00	3.55	4.15	3.80	3.10	4.30	4.00	3.15
	ATS	4.40	3.95	4.30	4.70	5.70	5.60	4.25	5.40	4.60	4.55
	logistic Wald	0.05	0.05	0.05	0.15	0.70	0.85	1.25	2.50	3.30	4.25
	logistic LR	7.65	10.20	11.85	14.75	18.65	19.85	23.15	25.10	26.60	28.00
	logistic W-LR	0.05	0.40	1.35	2.45	4.50	4.65	6.50	9.40	10.20	12.50
	probit Wald	0.05	0.05	0.20	0.35	1.00	1.15	1.95	2.75	4.05	4.45
	probit LR	7.35	9.20	10.55	12.60	14.75	14.95	17.75	19.35	19.90	21.55
	probit W-LR	0.05	0.55	1.60	2.60	4.35	4.35	6.00	8.20	8.85	10.50
	chi-squared	5.55	5.00	5.85	6.50	9.20	9.70	11.70	14.70	15.05	16.90
0.01	parametric	1.50	1.60	1.95	1.40	1.70	1.25	1.35	1.50	1.15	1.10
	Puri & Sen	0.35	0.75	1.00	0.55	0.75	0.50	0.70	1.00	0.55	0.50
	ATS	1.00	1.15	1.45	0.80	1.35	1.15	1.00	1.65	1.05	0.95
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.20	0.25	0.30
	logistic LR	1.15	2.00	2.70	3.80	5.20	5.45	7.10	8.95	9.40	11.05
	logistic W-LR	0.05	0.05	0.05	0.15	0.40	0.80	1.10	1.80	2.30	2.45
	probit Wald	0.05	0.05	0.05	0.05	0.10	0.15	0.20	0.25	0.50	0.20
	probit LR	1.20	1.90	2.40	2.95	3.95	3.95	4.95	6.05	5.95	7.10
	probit W-LR	0.05	0.05	0.10	0.20	0.35	0.70	0.85	1.65	2.05	1.60
	chi-squared	1.70	1.00	1.30	1.25	2.35	1.95	2.80	3.50	4.20	4.65

Graphic for $\alpha=0.05$:



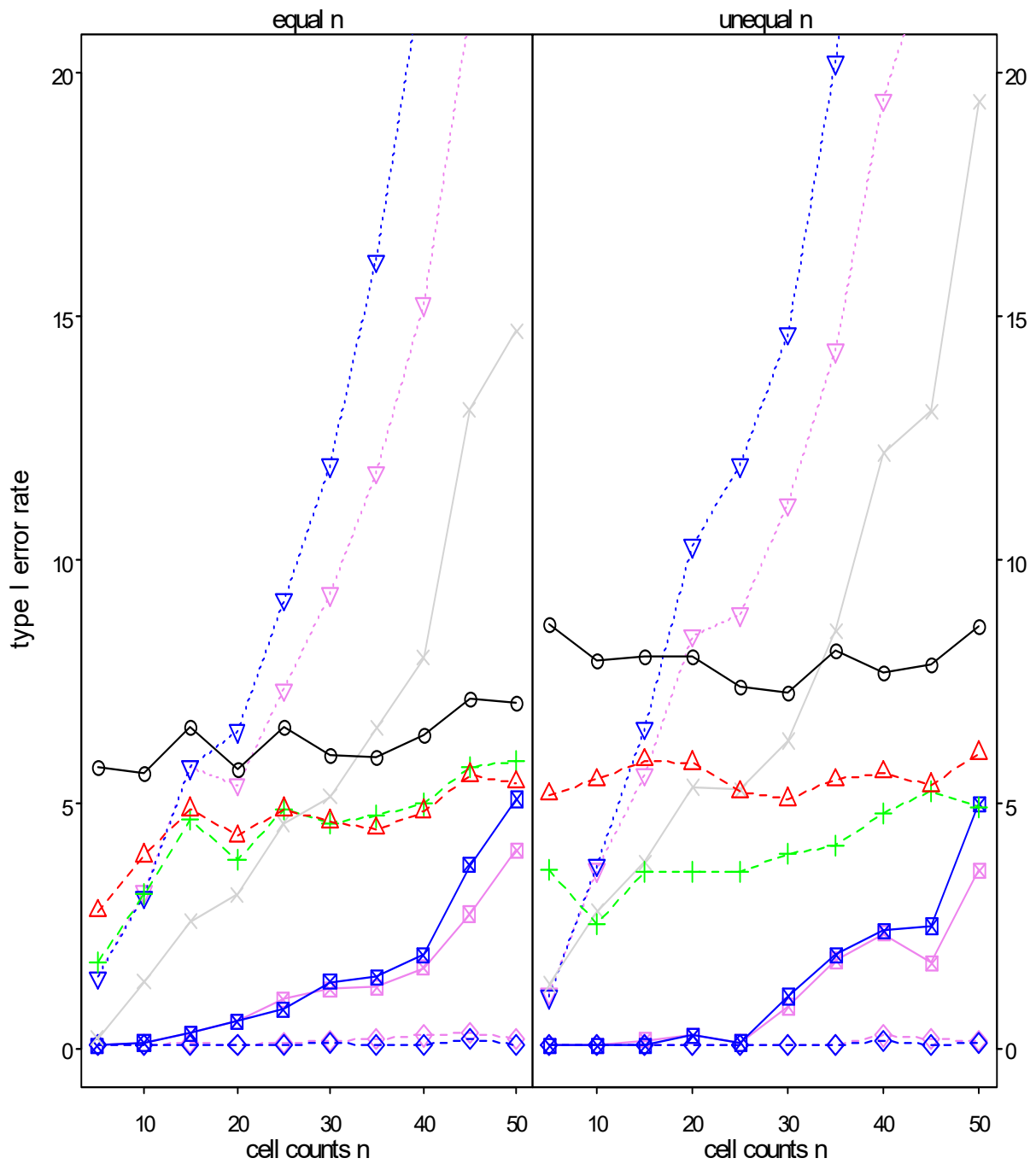
legend



5.9.3 p = 0.9

α	method	equal cell counts (levels = 2*4)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	5.75	5.65	6.60	5.70	6.60	6.00	5.95	6.40	7.15	7.10
	Puri & Sen	2.80	3.95	4.90	4.35	4.90	4.65	4.50	4.85	5.60	5.45
	ATS	1.75	3.15	4.70	3.85	4.90	4.60	4.75	5.00	5.75	5.90
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.10	0.05	0.05	0.20	0.05
	logistic LR	1.45	3.10	5.75	6.50	9.20	11.95	16.15	22.05	30.40	36.40
	logistic W-LR	0.05	0.10	0.30	0.55	0.80	1.35	1.45	1.90	3.75	5.10
	probit Wald	0.05	0.05	0.10	0.05	0.10	0.15	0.20	0.25	0.30	0.20
	probit LR	1.45	3.20	5.75	5.40	7.35	9.30	11.80	15.25	21.30	26.30
	probit W-LR	0.05	0.10	0.30	0.55	1.00	1.20	1.25	1.65	2.75	4.05
	chi-squared	0.20	1.35	2.60	3.15	4.60	5.15	6.55	8.00	13.10	14.70
0.01	parametric	1.85	1.05	2.30	1.65	1.95	1.85	1.40	1.75	1.80	2.20
	Puri & Sen	0.60	0.50	1.15	0.95	1.05	1.15	0.90	1.15	1.20	1.40
	ATS	0.30	0.25	0.75	0.60	0.85	1.05	0.85	0.95	1.00	1.20
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	logistic LR	0.20	0.30	1.15	0.95	1.65	2.60	3.30	3.90	7.95	9.50
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.35	0.35	0.55
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit LR	0.20	0.30	1.10	1.00	1.45	2.05	2.60	2.65	5.35	6.50
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.35	0.35	0.50
	chi-squared	0.05	0.25	0.45	0.60	0.50	1.05	1.05	1.25	2.10	2.85
		unequal cell counts (levels = 4*5)									
0.05	parametric	8.70	7.95	8.05	8.05	7.40	7.30	8.15	7.70	7.85	8.65
	Puri & Sen	5.20	5.50	5.90	5.85	5.25	5.10	5.50	5.65	5.40	6.05
	ATS	3.65	2.55	3.60	3.60	3.60	4.00	4.15	4.80	5.25	4.95
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.05	0.10
	logistic LR	1.05	3.75	6.55	10.30	11.95	14.65	20.20	28.00	34.35	44.15
	logistic W-LR	0.05	0.05	0.05	0.25	0.10	1.05	1.90	2.40	2.50	5.00
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.20	0.15
	probit LR	1.10	3.65	5.60	8.45	8.90	11.15	14.30	19.45	22.65	30.35
	probit W-LR	0.05	0.05	0.15	0.25	0.10	0.85	1.80	2.35	1.75	3.65
	chi-squared	1.30	2.80	3.80	5.35	5.30	6.30	8.55	12.20	13.05	19.40
0.01	parametric	3.40	2.85	2.60	2.40	1.90	2.35	2.40	2.95	2.45	2.60
	Puri & Sen	1.35	1.70	1.45	1.60	1.10	1.35	1.65	2.00	1.40	1.65
	ATS	1.55	0.70	0.75	0.65	0.90	0.80	1.05	1.15	1.00	0.85
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	logistic LR	0.05	0.35	1.30	2.30	1.85	3.30	5.55	7.80	8.95	15.75
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.35	0.40	0.45
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit LR	0.05	0.35	1.10	1.70	1.40	2.40	3.80	5.10	5.35	8.70
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.35	0.40	0.45
	chi-squared	0.50	0.55	0.95	1.15	1.05	1.50	2.15	2.75	2.35	4.40

Graphic for $\alpha=0.05$:



legend

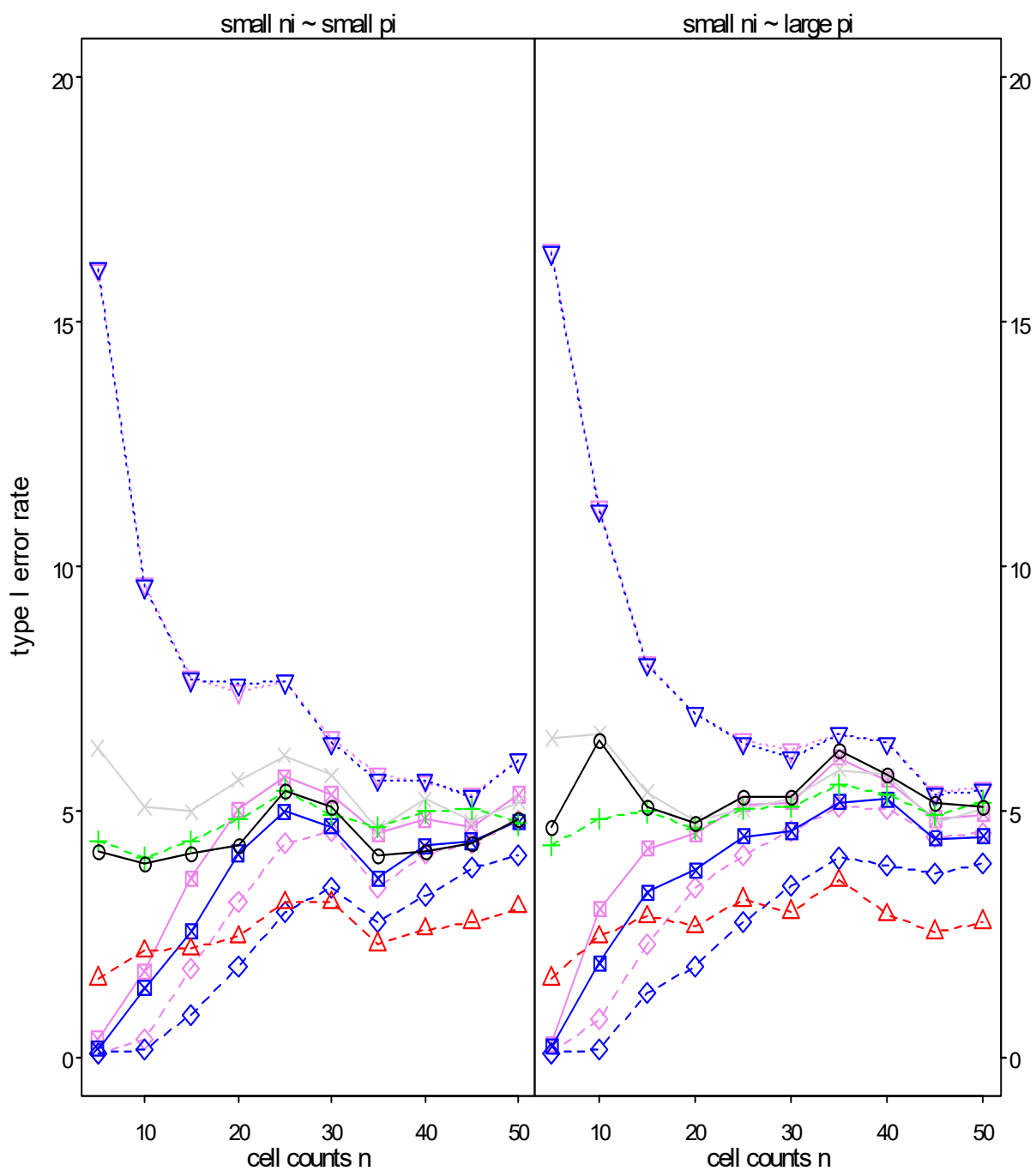
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|----------|-------------|---------|------------------|
| —○— | parametric | - -◇- - | logistic/Wald |
| - -△- - | Puri & Sen | ...▽... | logistic/LR |
| - -+ - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - -◇- - | probit/Wald |
| | | ...▽... | probit/LR |
| | | —■— | probit/Wald+LR |

5. 10. Interaction AB - A and B significant ($a_i = 0.4*s$ $b_j = 0.4*s$) small $n_i \sim$ small p_i and small $n_i \sim$ large p_i

5. 10. 1 $p = 0.5$

		small $n_i \sim$ small p_i (levels = 4*5)									
α	method	5	10	15	20	25	30	35	40	45	50
0.05	parametric	4.20	3.95	4.15	4.30	5.45	5.10	4.10	4.20	4.35	4.85
	Puri & Sen	1.60	2.15	2.20	2.45	3.15	3.15	2.30	2.60	2.75	3.05
	ATS	4.40	4.05	4.40	4.85	5.45	4.95	4.70	5.00	5.05	4.75
	logistic Wald	0.05	0.15	0.85	1.85	2.95	3.45	2.75	3.30	3.85	4.10
	logistic LR	16.10	9.60	7.70	7.60	7.65	6.40	5.65	5.65	5.30	6.05
	logistic W-LR	0.15	1.40	2.55	4.15	5.00	4.70	3.65	4.30	4.40	4.80
	probit Wald	0.05	0.35	1.80	3.15	4.35	4.60	3.45	4.15	4.35	4.80
	probit LR	16.05	9.65	7.75	7.45	7.65	6.50	5.75	5.60	5.35	6.05
	probit W-LR	0.35	1.75	3.65	5.05	5.70	5.35	4.55	4.85	4.70	5.35
chi-squared	6.30	5.10	5.00	5.65	6.15	5.75	4.65	5.25	4.80	5.20	
0.01	parametric	0.95	0.95	0.50	0.90	1.25	1.25	0.55	0.80	0.90	0.90
	Puri & Sen	0.10	0.35	0.15	0.50	0.55	0.60	0.25	0.35	0.50	0.50
	ATS	1.15	0.90	0.80	0.85	1.40	1.50	0.95	1.05	1.15	1.05
	logistic Wald	0.05	0.05	0.05	0.30	0.40	0.55	0.3	0.40	0.60	0.65
	logistic LR	4.15	2.45	1.55	1.75	1.90	1.65	1.1	1.05	1.05	1.15
	logistic W-LR	0.05	0.15	0.15	0.55	0.75	1.05	0.5	0.60	0.80	0.85
	probit Wald	0.05	0.05	0.10	0.35	0.65	1.05	0.5	0.65	0.80	0.75
	probit LR	4.15	2.45	1.60	1.85	1.95	1.65	1.1	1.10	1.10	1.15
	probit W-LR	0.05	0.25	0.30	0.85	1.10	1.30	0.7	0.90	0.90	0.85
chi-squared	1.60	1.05	0.65	1.15	1.25	1.35	0.75	0.85	0.90	0.95	
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	4.70	6.45	5.10	4.75	5.30	5.30	6.25	5.75	5.20	5.10
	Puri & Sen	1.60	2.45	2.85	2.65	3.20	2.95	3.60	2.90	2.55	2.75
	ATS	4.30	4.85	5.00	4.65	5.05	5.10	5.55	5.35	4.95	5.20
	logistic Wald	0.05	0.15	1.30	1.85	2.75	3.50	4.05	3.90	3.75	3.95
	logistic LR	16.40	11.15	8.00	7.00	6.40	6.10	6.60	6.40	5.35	5.45
	logistic W-LR	0.20	1.90	3.35	3.80	4.50	4.60	5.20	5.25	4.45	4.50
	probit Wald	0.05	0.75	2.30	3.45	4.10	4.60	5.10	5.05	4.50	4.55
	probit LR	16.45	11.20	8.05	7.00	6.45	6.25	6.60	6.40	5.40	5.50
	probit W-LR	0.25	3.00	4.25	4.55	5.15	5.20	6.10	5.65	4.85	4.95
chi-squared	6.50	6.60	5.40	4.80	5.05	5.25	5.85	5.75	4.75	5.05	
0.01	parametric	0.95	1.25	1.15	1.45	1.35	1.00	1.75	0.90	1.0	0.95
	Puri & Sen	0.20	0.30	0.35	0.65	0.55	0.40	0.85	0.55	0.5	0.35
	ATS	0.90	1.05	1.15	1.10	1.30	1.30	1.60	0.90	0.8	0.95
	logistic Wald	0.05	0.05	0.05	0.50	0.30	0.30	1.05	0.60	0.7	0.45
	logistic LR	4.10	2.95	2.30	1.75	1.75	1.35	2.00	1.00	1.3	0.95
	logistic W-LR	0.05	0.30	0.60	0.85	0.90	0.80	1.35	0.80	1.0	0.60
	probit Wald	0.05	0.05	0.35	0.70	0.80	0.65	1.35	0.75	1.0	0.65
	probit LR	4.20	2.95	2.30	1.80	1.65	1.35	2.00	1.00	1.3	1.05
	probit W-LR	0.05	0.40	0.90	1.00	1.10	1.05	1.60	0.85	1.0	0.75
chi-squared	1.10	1.05	1.25	1.35	1.30	0.90	1.55	0.85	1.0	0.85	

Graphic for $\alpha=0.05$:



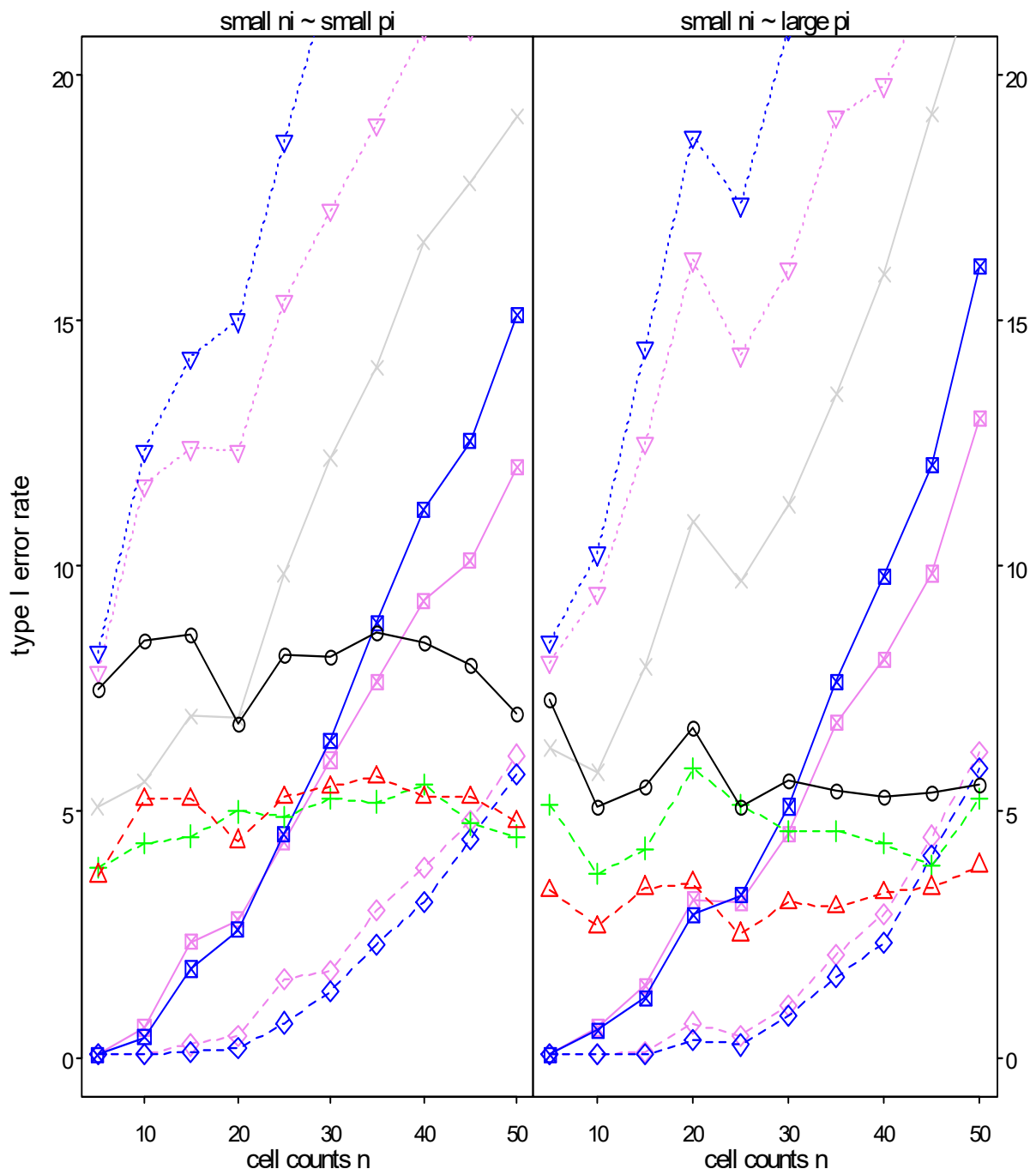
legend

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|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Furi & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- - - | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |

5. 10. 2 $p = 0.8$

α	method	small $n_i \sim$ small p_i (levels = 4*5)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	7.50	8.50	8.60	6.80	8.20	8.15	8.65	8.45	8.00	7.00
	Puri & Sen	3.70	5.25	5.25	4.40	5.30	5.50	5.70	5.30	5.30	4.80
	ATS	3.85	4.35	4.50	5.00	4.90	5.25	5.20	5.55	4.75	4.50
	logistic Wald	0.05	0.05	0.10	0.20	0.70	1.35	2.30	3.15	4.45	5.75
	logistic LR	8.25	12.35	14.25	15.00	18.65	22.10	25.30	26.60	27.50	30.20
	logistic W-LR	0.05	0.40	1.80	2.60	4.55	6.45	8.85	11.15	12.55	15.10
	probit Wald	0.05	0.05	0.25	0.45	1.60	1.75	3.00	3.85	4.80	6.15
	probit LR	7.85	11.65	12.40	12.35	15.40	17.25	19.00	20.95	20.95	22.10
	probit W-LR	0.05	0.60	2.35	2.80	4.40	6.05	7.65	9.30	10.10	12.00
	chi-squared	5.10	5.60	6.95	6.90	9.85	12.20	14.05	16.60	17.80	19.15
0.01	parametric	2.50	2.30	2.45	1.95	2.60	2.65	2.60	2.15	2.35	2.25
	Puri & Sen	0.70	1.00	1.05	0.85	1.10	1.50	1.25	1.25	1.35	1.20
	ATS	1.20	0.90	1.45	1.05	1.80	1.35	1.35	1.75	1.20	1.25
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.20	0.30	0.55	0.95	0.9
	logistic LR	1.45	2.50	3.60	4.20	6.15	7.10	8.30	9.95	11.15	12.5
	logistic W-LR	0.05	0.05	0.25	0.25	0.65	1.25	1.55	1.80	3.25	3.8
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.40	0.40	0.70	0.95	1.0
	probit LR	1.50	2.30	2.90	3.25	4.35	5.05	5.85	6.50	7.55	8.0
	probit W-LR	0.05	0.05	0.25	0.35	0.75	1.30	1.45	1.65	2.60	3.2
	chi-squared	1.25	1.15	1.45	1.70	2.50	2.95	3.85	4.10	5.15	6.75
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	7.30	5.10	5.50	6.70	5.10	5.65	5.45	5.30	5.40	5.55
	Puri & Sen	3.40	2.65	3.45	3.55	2.50	3.15	3.05	3.35	3.45	3.90
	ATS	5.15	3.75	4.25	5.90	5.15	4.60	4.60	4.35	3.90	5.25
	logistic Wald	0.05	0.05	0.05	0.35	0.25	0.85	1.65	2.35	4.10	5.90
	logistic LR	8.45	10.25	14.45	18.75	17.35	20.95	25.15	26.10	30.00	32.25
	logistic W-LR	0.05	0.55	1.20	2.90	3.30	5.10	7.65	9.80	12.05	16.10
	probit Wald	0.05	0.05	0.10	0.70	0.45	1.05	2.10	2.90	4.50	6.20
	probit LR	8.05	9.45	12.50	16.25	14.30	16.05	19.15	19.80	21.95	23.95
	probit W-LR	0.05	0.60	1.45	3.20	3.15	4.55	6.80	8.10	9.85	13.00
	chi-squared	6.30	5.80	7.95	10.90	9.70	11.25	13.50	15.95	19.20	22.35
0.01	parametric	2.05	1.50	1.55	1.75	0.90	1.00	1.05	1.40	1.15	1.25
	Puri & Sen	0.75	0.55	0.65	0.65	0.35	0.35	0.55	0.60	0.50	0.65
	ATS	1.85	0.75	0.50	1.10	1.25	1.35	1.10	1.15	0.65	1.10
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.45	0.55	0.90
	logistic LR	1.90	2.45	3.75	5.60	5.55	6.30	7.40	8.70	12.05	12.90
	logistic W-LR	0.05	0.05	0.10	0.25	0.30	0.40	1.30	1.95	2.60	4.45
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.10	0.20	0.60	0.80	1.15
	probit LR	2.00	2.25	3.35	4.45	4.50	4.60	5.55	6.50	8.20	8.70
	probit W-LR	0.05	0.05	0.20	0.30	0.40	0.50	1.05	1.65	1.85	3.50
	chi-squared	1.75	1.45	1.95	2.35	2.00	2.80	3.40	4.60	6.05	7.50

Graphic for $\alpha=0.05$:



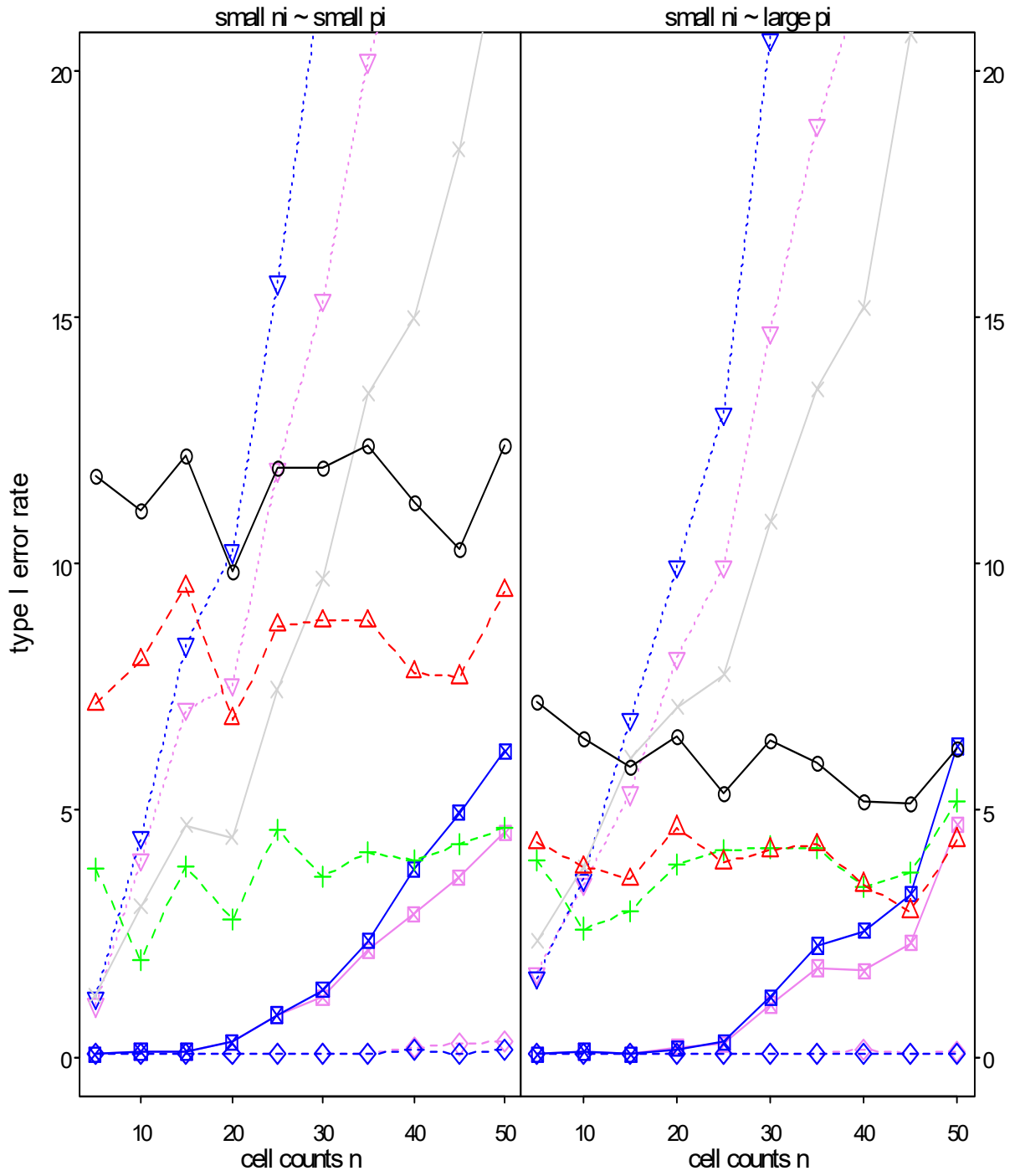
legend

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|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Furi & Sen | ...▽... | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- - - | probit/Wald |
| | | ...▽... | probit/LR |
| | | —■— | probit/Wald+LR |

5. 10. 3 $p = 0.9$

α	method	small $n_i \sim$ small p_i (levels = 4*5)									
		5	10	15	20	25	30	35	40	45	50
0.05	parametric	11.80	11.10	12.20	9.85	11.95	11.95	12.40	11.25	10.30	12.40
	Puri & Sen	7.15	8.05	9.55	6.85	8.75	8.85	8.85	7.80	7.70	9.45
	ATS	3.80	1.95	3.85	2.80	4.60	3.65	4.15	4.00	4.30	4.65
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.05	0.15
	logistic LR	1.20	4.45	8.35	10.25	15.70	21.95	29.65	34.15	42.95	50.50
	logistic W-LR	0.05	0.10	0.10	0.30	0.85	1.35	2.35	3.80	4.95	6.20
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.25	0.30
	probit LR	1.05	4.00	7.05	7.55	11.90	15.35	20.20	23.40	28.05	34.30
	probit W-LR	0.05	0.10	0.10	0.30	0.85	1.20	2.15	2.90	3.65	4.55
	chi-squared	1.25	3.05	4.70	4.45	7.45	9.70	13.45	15.00	18.40	23.05
0.01	parametric	4.75	4.10	5.20	3.35	4.20	3.80	3.70	3.90	3.80	3.85
	Puri & Sen	1.90	2.20	3.05	1.70	2.60	2.35	2.50	2.50	2.60	2.60
	ATS	1.35	0.40	0.65	0.50	0.95	0.65	0.60	1.05	0.85	0.95
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	logistic LR	0.15	0.60	1.85	1.70	3.90	6.65	8.45	11.35	14.65	20.25
	logistic W-LR	0.05	0.05	0.05	0.05	0.10	0.05	0.30	0.40	0.75	0.80
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit LR	0.15	0.55	1.65	1.25	3.10	4.05	5.50	7.30	7.90	11.20
	probit W-LR	0.05	0.05	0.05	0.05	0.10	0.05	0.20	0.35	0.55	0.75
	chi-squared	0.35	0.80	1.20	0.60	1.90	2.25	2.60	3.85	4.80	5.70
		small $n_i \sim$ large p_i (levels = 4*5)									
0.05	parametric	7.20	6.45	5.90	6.50	5.35	6.40	5.95	5.20	5.15	6.25
	Puri & Sen	4.35	3.85	3.60	4.65	3.95	4.20	4.30	3.50	2.95	4.40
	ATS	4.00	2.60	2.95	3.90	4.20	4.25	4.25	3.45	3.75	5.20
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	logistic LR	1.60	3.60	6.85	9.95	13.05	20.65	26.10	33.10	40.90	51.25
	logistic W-LR	0.05	0.10	0.05	0.15	0.30	1.20	2.25	2.55	3.30	6.30
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.05	0.10
	probit LR	1.70	3.50	5.35	8.10	9.95	14.70	18.90	22.10	28.60	34.95
	probit W-LR	0.05	0.10	0.05	0.20	0.25	1.05	1.80	1.75	2.30	4.70
	chi-squared	2.35	3.85	6.05	7.10	7.75	10.85	13.55	15.20	20.75	25.25
0.01	parametric	2.65	1.65	1.35	1.95	1.15	1.70	2.10	1.20	0.95	1.70
	Puri & Sen	1.45	0.75	0.60	1.00	0.50	0.95	1.15	0.55	0.45	0.95
	ATS	1.35	0.35	0.30	0.70	0.45	0.65	1.00	0.65	0.60	0.65
	logistic Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	logistic LR	0.25	0.60	0.85	2.10	2.70	4.80	7.70	9.45	14.30	20.20
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.25	0.15	0.95
	probit Wald	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	probit LR	0.30	0.65	0.55	1.55	2.00	3.70	5.10	5.85	8.10	12.55
	probit W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.25	0.05	0.60
	chi-squared	1.15	1.15	1.90	1.55	1.70	2.55	3.95	4.15	4.80	8.25

Graphic for $\alpha=0.05$:



legend

- | | | | |
|--------------|-------------|-------------|------------------|
| —○— | parametric | ---◇--- | logistic/Wald |
| - - -△- - - | Furi & Sen | ⋯▽⋯ | logistic/LR |
| - - -+ - - - | ATS | —■— | logistic/Wald+LR |
| —×— | chi-squared | - - -◇- - - | probit/Wald |
| | | ⋯▽⋯ | probit/LR |
| | | —■— | probit/Wald+LR |