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

Appendix B 1
Tables and Graphs of the Type I Error Rates of selected methods for fixed n_{ij} (5,10,..,50) in between subject designs

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

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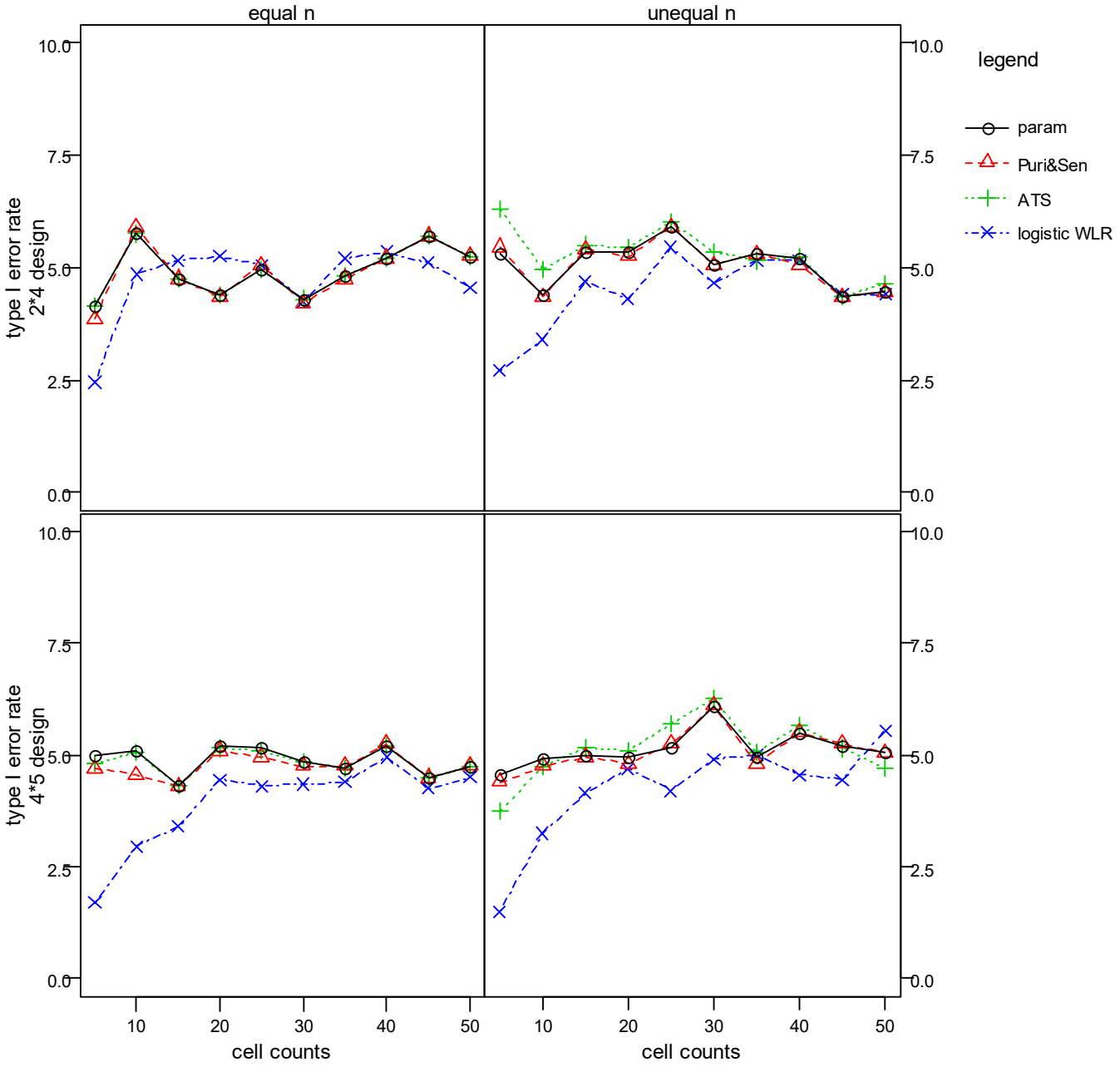
1. 1. Main effect A - null model

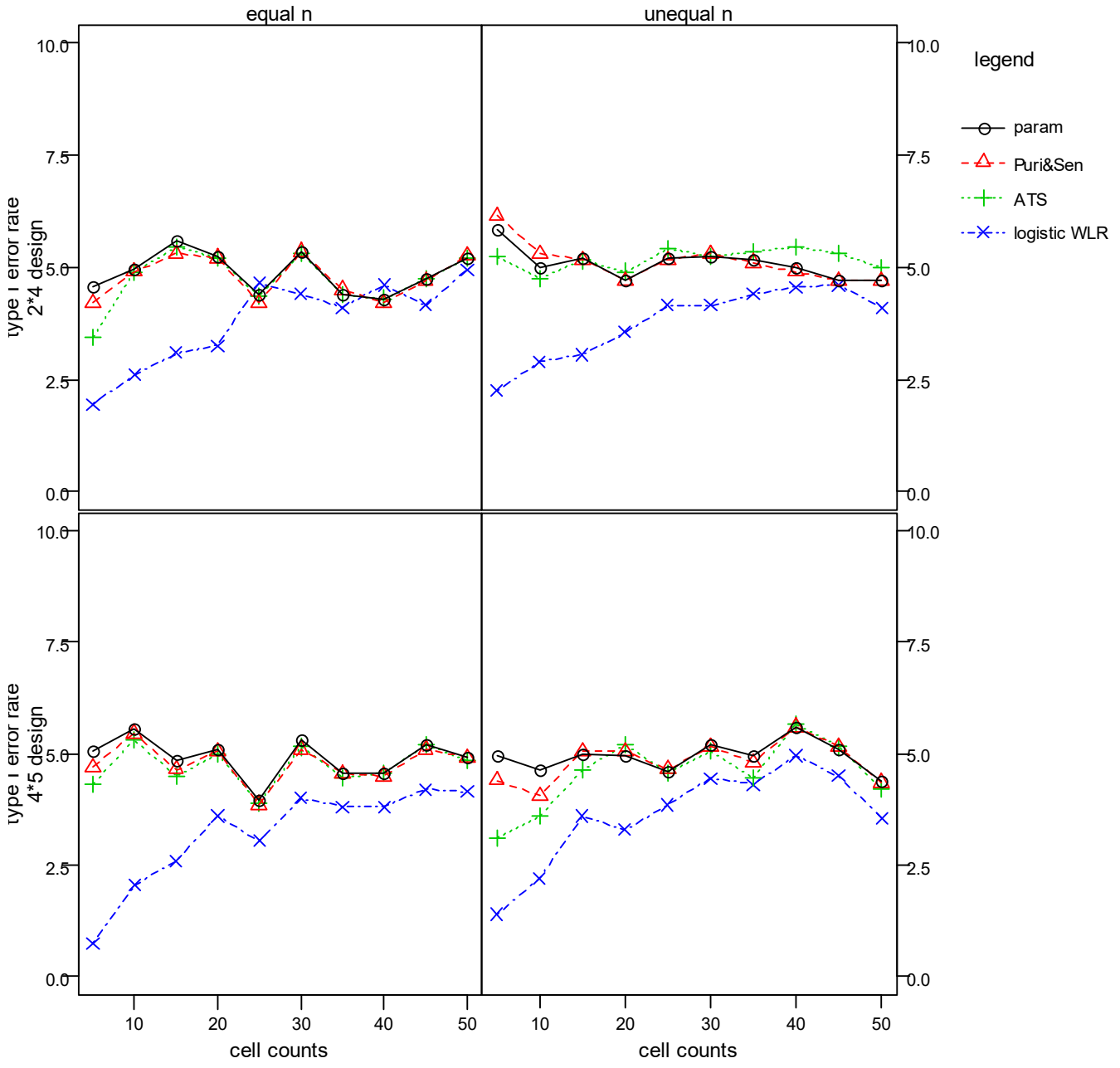
1. 1. 1 p = 0.5

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	4.15	5.75	4.75	4.40	4.30	5.20	5.25	5.30	4.40	5.35	5.35	5.05	5.20	4.45
	Puri & Sen	3.85	5.90	4.75	4.35	4.20	5.20	5.25	5.45	4.35	5.40	5.25	5.05	5.05	4.45
	ATS	4.15	5.75	4.75	4.40	4.30	5.20	5.25	6.30	4.95	5.50	5.45	5.35	5.25	4.65
	logistic W-LR	2.45	4.85	5.15	5.25	4.25	5.35	4.55	2.70	3.40	4.70	4.30	4.65	5.15	4.40
4*5	parametric	5.00	5.10	4.30	5.20	4.85	5.20	4.75	4.55	4.90	5.00	4.95	6.10	5.50	5.05
	Puri & Sen	4.70	4.55	4.30	5.10	4.75	5.25	4.75	4.40	4.75	4.95	4.80	6.10	5.50	5.05
	ATS	4.80	5.05	4.30	5.15	4.85	5.20	4.75	3.75	4.75	5.15	5.10	6.25	5.65	4.70
	logistic W-LR	1.70	2.95	3.40	4.45	4.35	4.95	4.50	1.50	3.25	4.15	4.70	4.90	4.55	5.55



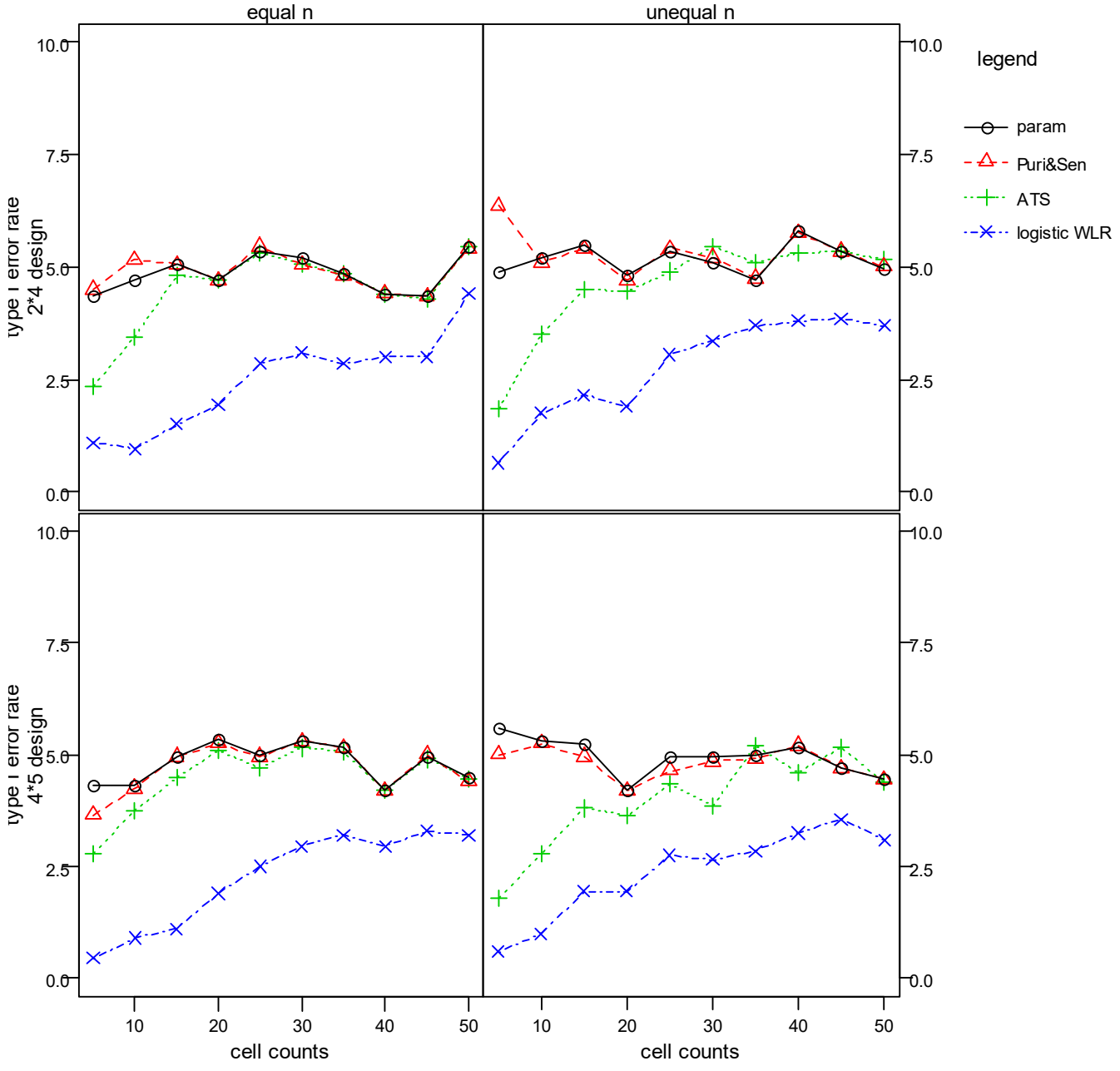
1. 1. 2 p = 0.8

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	4.55	4.95	5.60	5.25	5.35	4.30	5.20	5.85	5.00	5.20	4.70	5.25	5.00	4.70
	Puri & Sen	4.20	4.90	5.30	5.20	5.35	4.20	5.25	6.15	5.30	5.15	4.70	5.30	4.90	4.70
	ATS	3.45	4.90	5.45	5.20	5.30	4.30	5.20	5.25	4.75	5.15	4.90	5.25	5.45	5.00
	logistic W-LR	1.95	2.60	3.10	3.25	4.40	4.60	4.95	2.25	2.90	3.05	3.55	4.15	4.55	4.10
4*5	parametric	5.05	5.55	4.85	5.10	5.30	4.55	4.90	4.95	4.65	5.00	4.95	5.20	5.60	4.40
	Puri & Sen	4.70	5.45	4.65	5.05	5.10	4.50	4.90	4.40	4.05	5.05	5.05	5.15	5.60	4.35
	ATS	4.30	5.30	4.50	5.00	5.15	4.55	4.85	3.10	3.60	4.65	5.20	5.05	5.65	4.20
	logistic W-LR	0.75	2.05	2.60	3.60	4.00	3.80	4.15	1.40	2.20	3.60	3.30	4.45	4.95	3.55



1. 1. 3 p = 0.9

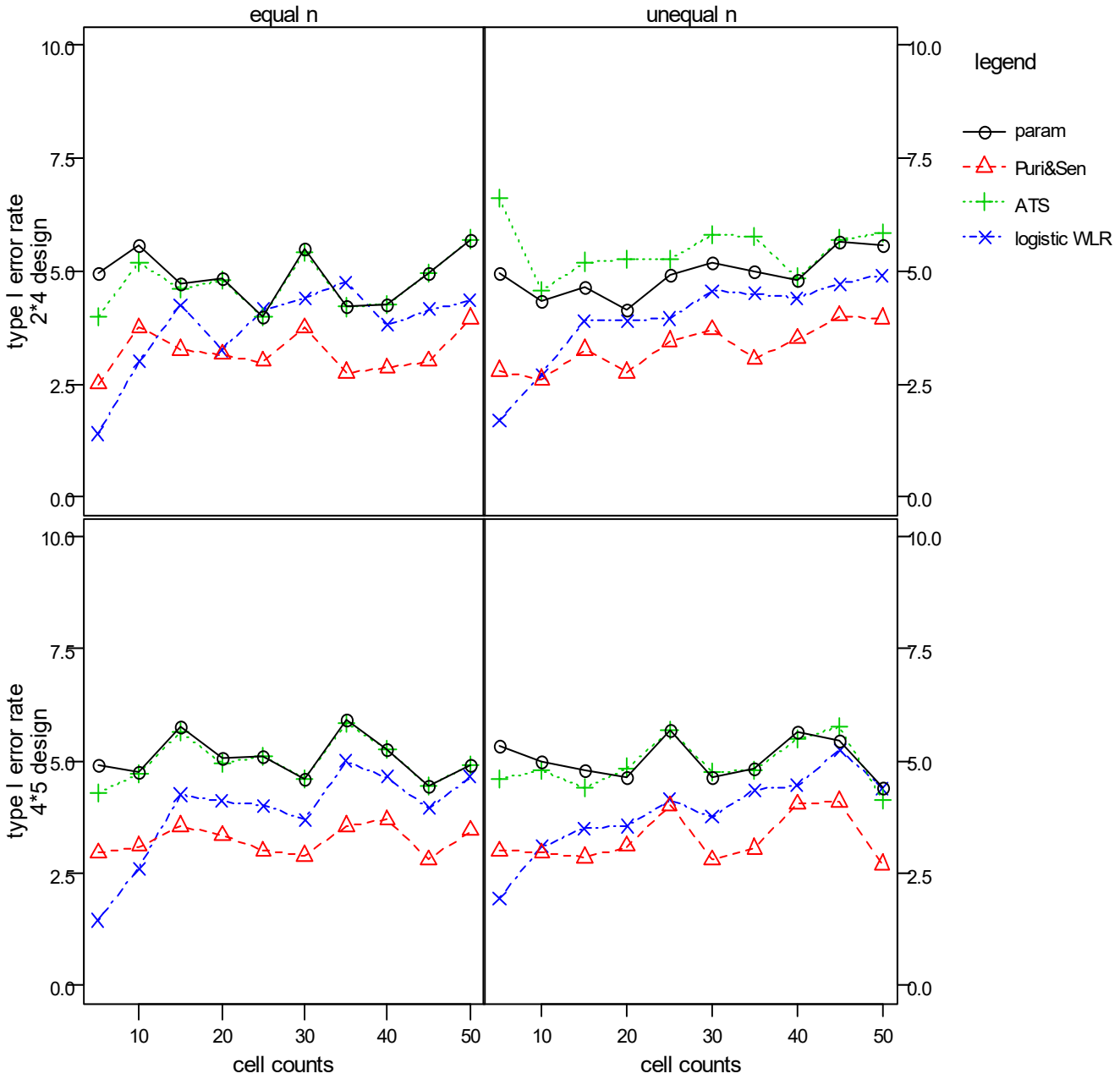
		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	4.35	4.70	5.05	4.70	5.20	4.40	5.45	4.90	5.20	5.50	4.80	5.10	5.80	4.95
	Puri & Sen	4.50	5.15	5.05	4.70	5.05	4.40	5.40	6.35	5.10	5.40	4.70	5.20	5.75	5.00
	ATS	2.35	3.45	4.80	4.70	5.05	4.40	5.45	1.85	3.50	4.50	4.45	5.45	5.30	5.15
	logistic W-LR	1.10	0.95	1.50	1.95	3.10	3.00	4.40	0.65	1.75	2.15	1.90	3.35	3.80	3.70
4*5	parametric	4.30	4.30	4.95	5.35	5.30	4.20	4.50	5.60	5.30	5.25	4.20	4.95	5.15	4.45
	Puri & Sen	3.65	4.25	4.95	5.25	5.30	4.20	4.40	5.00	5.25	4.95	4.20	4.85	5.20	4.45
	ATS	2.80	3.75	4.50	5.10	5.15	4.20	4.45	1.80	2.80	3.80	3.65	3.85	4.60	4.40
	logistic W-LR	0.45	0.90	1.10	1.90	2.95	2.95	3.20	0.60	1.00	1.95	1.95	2.65	3.25	3.10



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

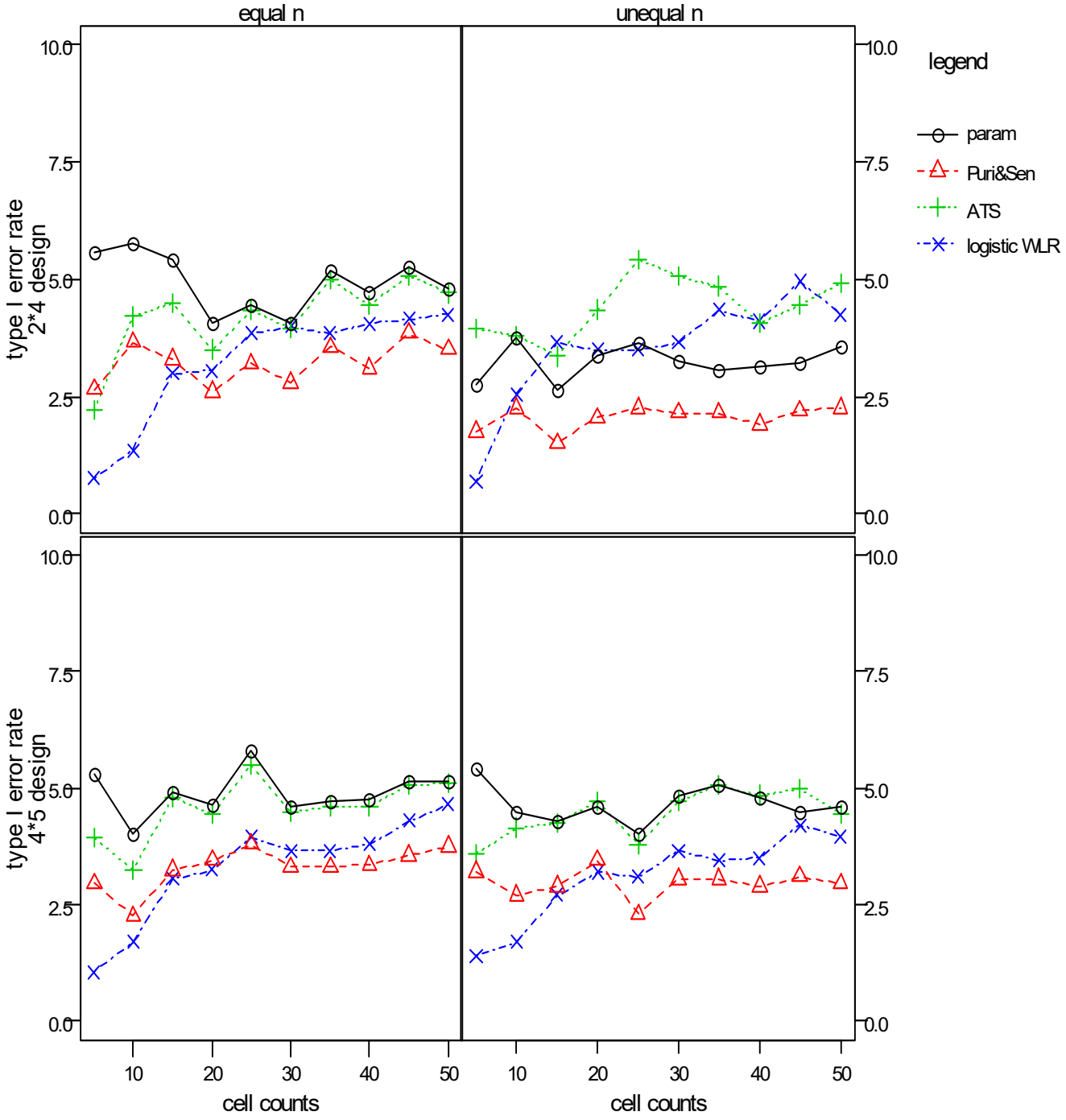
1. 2. 1 p = 0.5

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	4.95	5.55	4.70	4.85	5.50	4.25	5.70	4.95	4.35	4.65	4.15	5.20	4.80	5.55
	Puri & Sen	2.50	3.75	3.25	3.15	3.75	2.85	3.95	2.80	2.60	3.25	2.75	3.70	3.50	3.95
	ATS	4.00	5.20	4.60	4.80	5.40	4.25	5.70	6.60	4.55	5.20	5.25	5.80	4.85	5.85
	logistic W-LR	1.40	3.00	4.25	3.25	4.40	3.80	4.35	1.70	2.70	3.90	3.90	4.55	4.40	4.90
4*5	parametric	4.90	4.75	5.75	5.05	4.60	5.25	4.90	5.35	5.00	4.80	4.65	4.65	5.65	4.40
	Puri & Sen	2.95	3.10	3.55	3.35	2.90	3.70	3.45	3.00	2.95	2.85	3.10	2.80	4.05	2.70
	ATS	4.30	4.70	5.65	4.95	4.60	5.25	4.90	4.60	4.80	4.40	4.85	4.75	5.50	4.15
	logistic W-LR	1.45	2.60	4.25	4.10	3.70	4.65	4.65	1.95	3.10	3.50	3.55	3.75	4.45	4.40



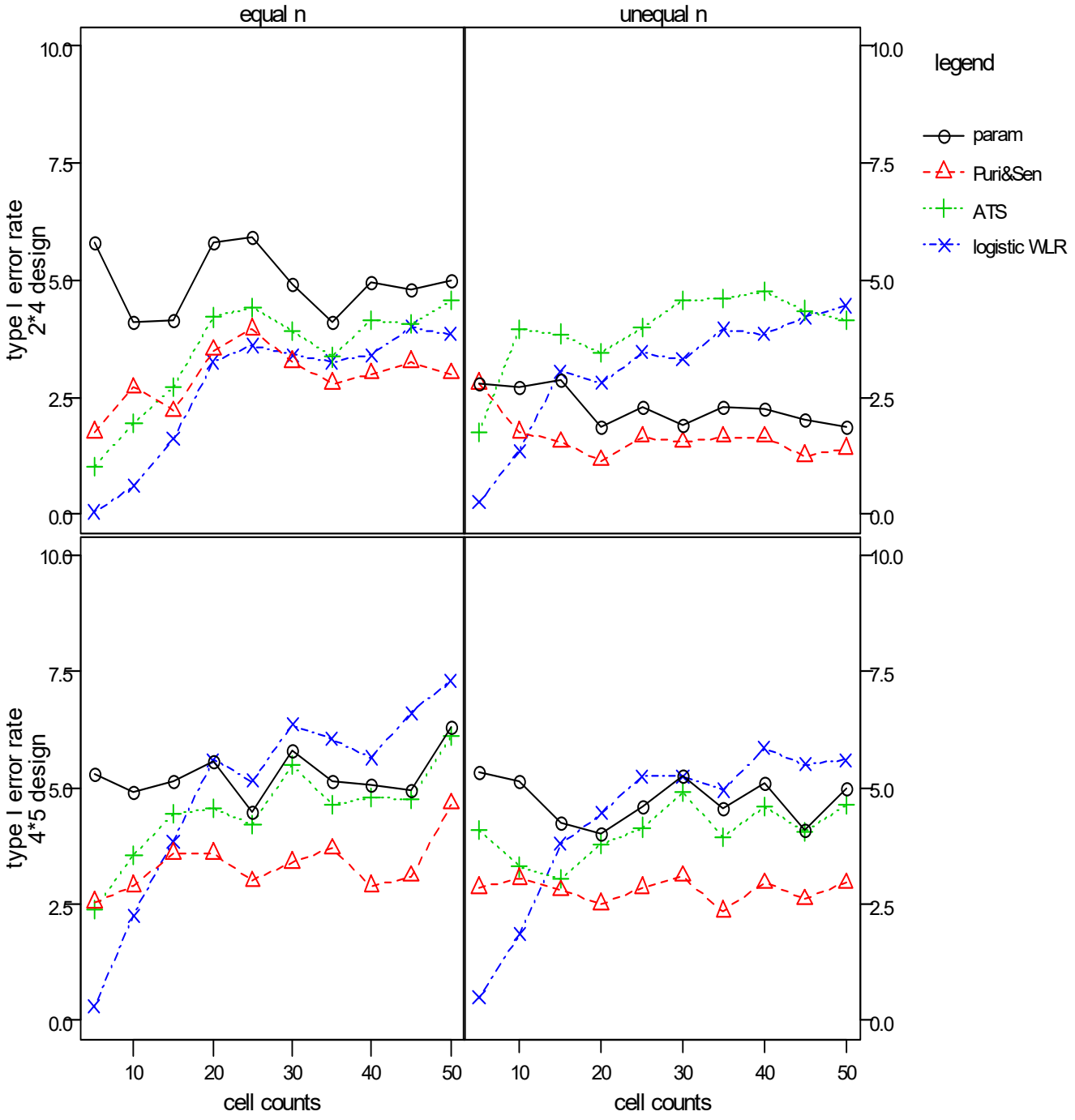
1. 2. 2 p = 0.8

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	5.55	5.75	5.40	4.05	4.05	4.70	4.80	2.75	3.75	2.65	3.35	3.25	3.15	3.55
	Puri & Sen	2.65	3.65	3.30	2.60	2.80	3.10	3.50	1.75	2.25	1.50	2.05	2.15	1.90	2.25
	ATS	2.20	4.20	4.50	3.50	3.95	4.45	4.70	3.95	3.80	3.35	4.35	5.05	4.05	4.90
	logistic W-LR	0.75	1.35	3.00	3.05	4.00	4.05	4.25	0.70	2.55	3.65	3.50	3.65	4.10	4.25
4*5	parametric	5.30	4.00	4.90	4.65	4.60	4.75	5.15	5.40	4.50	4.30	4.60	4.85	4.80	4.60
	Puri & Sen	2.95	2.25	3.25	3.45	3.30	3.35	3.75	3.20	2.70	2.90	3.45	3.05	2.90	2.95
	ATS	3.95	3.25	4.80	4.45	4.50	4.60	5.10	3.60	4.15	4.25	4.70	4.70	4.85	4.45
	logistic W-LR	1.05	1.70	3.05	3.25	3.65	3.80	4.65	1.40	1.70	2.70	3.20	3.65	3.50	3.95



1. 2. 3 p = 0.9

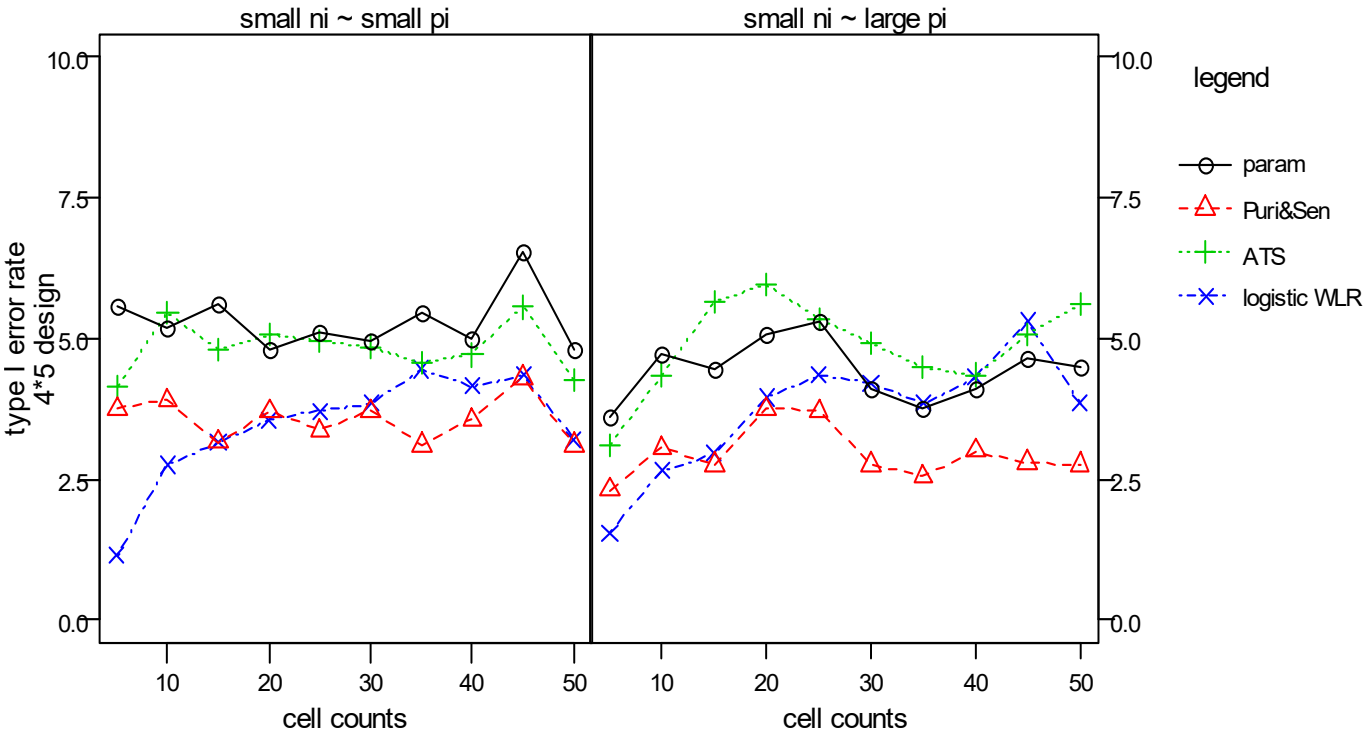
		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	5.80	4.10	4.15	5.80	4.90	4.95	5.00	2.80	2.70	2.85	1.85	1.90	2.25	1.85
	Puri & Sen	1.75	2.70	2.20	3.50	3.25	3.00	3.00	2.80	1.75	1.55	1.15	1.55	1.65	1.40
	ATS	1.00	1.95	2.70	4.20	3.90	4.15	4.55	1.75	3.95	3.85	3.45	4.55	4.75	4.15
	logistic W-LR	0.05	0.60	1.60	3.25	3.40	3.40	3.85	0.25	1.35	3.05	2.80	3.30	3.85	4.45
4*5	parametric	5.30	4.90	5.15	5.55	5.80	5.05	6.30	5.35	5.15	4.25	4.00	5.25	5.10	5.00
	Puri & Sen	2.55	2.90	3.60	3.60	3.40	2.90	4.65	2.85	3.05	2.80	2.50	3.10	2.95	2.95
	ATS	2.40	3.55	4.45	4.55	5.50	4.80	6.10	4.10	3.30	3.05	3.80	4.90	4.60	4.65
	logistic W-LR	0.30	2.25	3.85	5.60	6.35	5.65	7.30	0.50	1.85	3.80	4.45	5.25	5.85	5.60



1. 3. Main effect B - A significant (effects a_i = 0.6*s) small n_i ~ small p_i and small n_i ~ large p_i

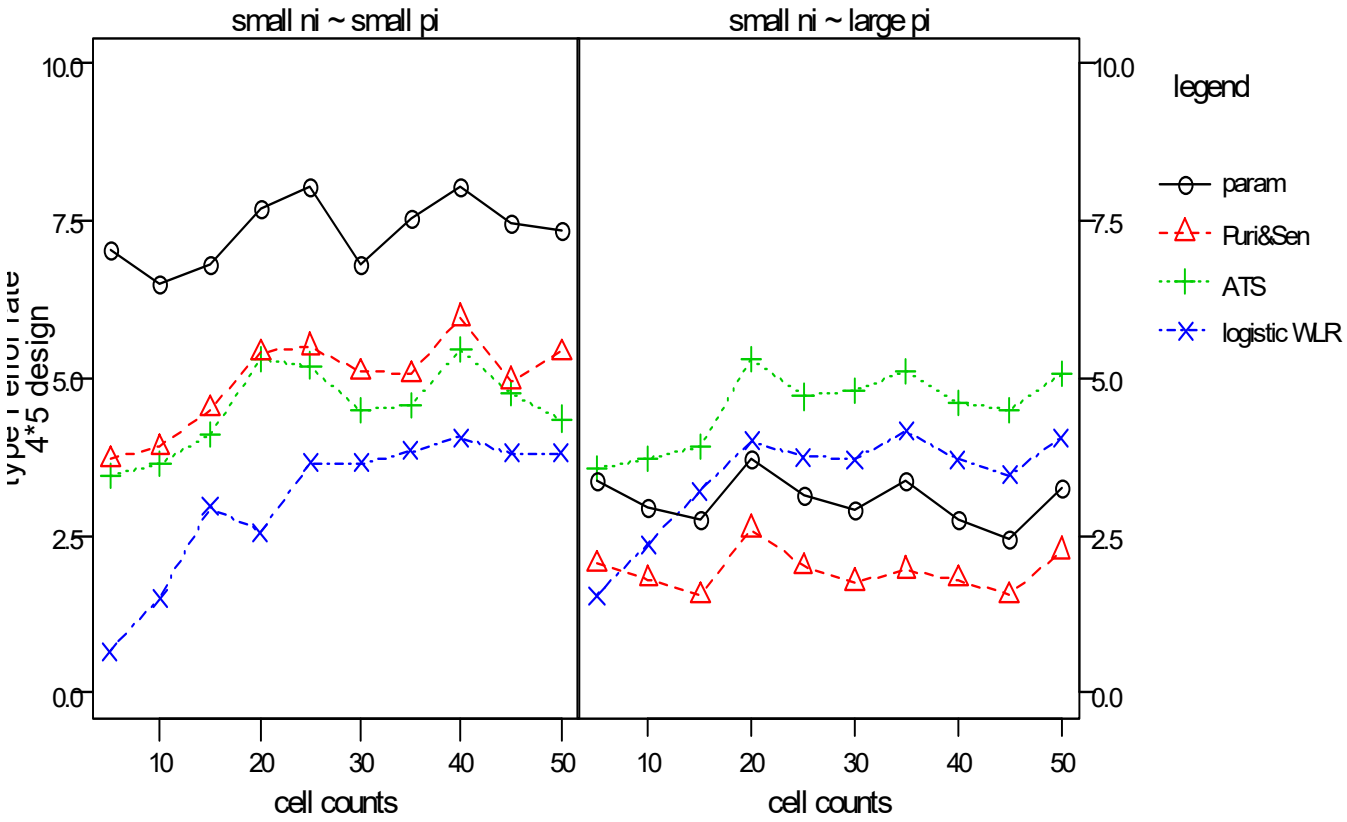
1. 3. 1 p = 0.6

		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	5.55	5.20	5.60	4.80	4.95	5.00	4.80	3.60	4.70	4.45	5.05	4.10	4.10	4.50
	Puri & Sen	3.75	3.90	3.15	3.70	3.70	3.55	3.10	2.30	3.05	2.75	3.75	2.75	3.00	2.75
	ATS	4.15	5.45	4.80	5.05	4.85	4.70	4.25	3.10	4.35	5.65	5.95	4.90	4.35	5.60
	logistic W-LR	1.15	2.75	3.15	3.55	3.85	4.15	3.20	1.55	2.65	2.95	3.95	4.20	4.30	3.85



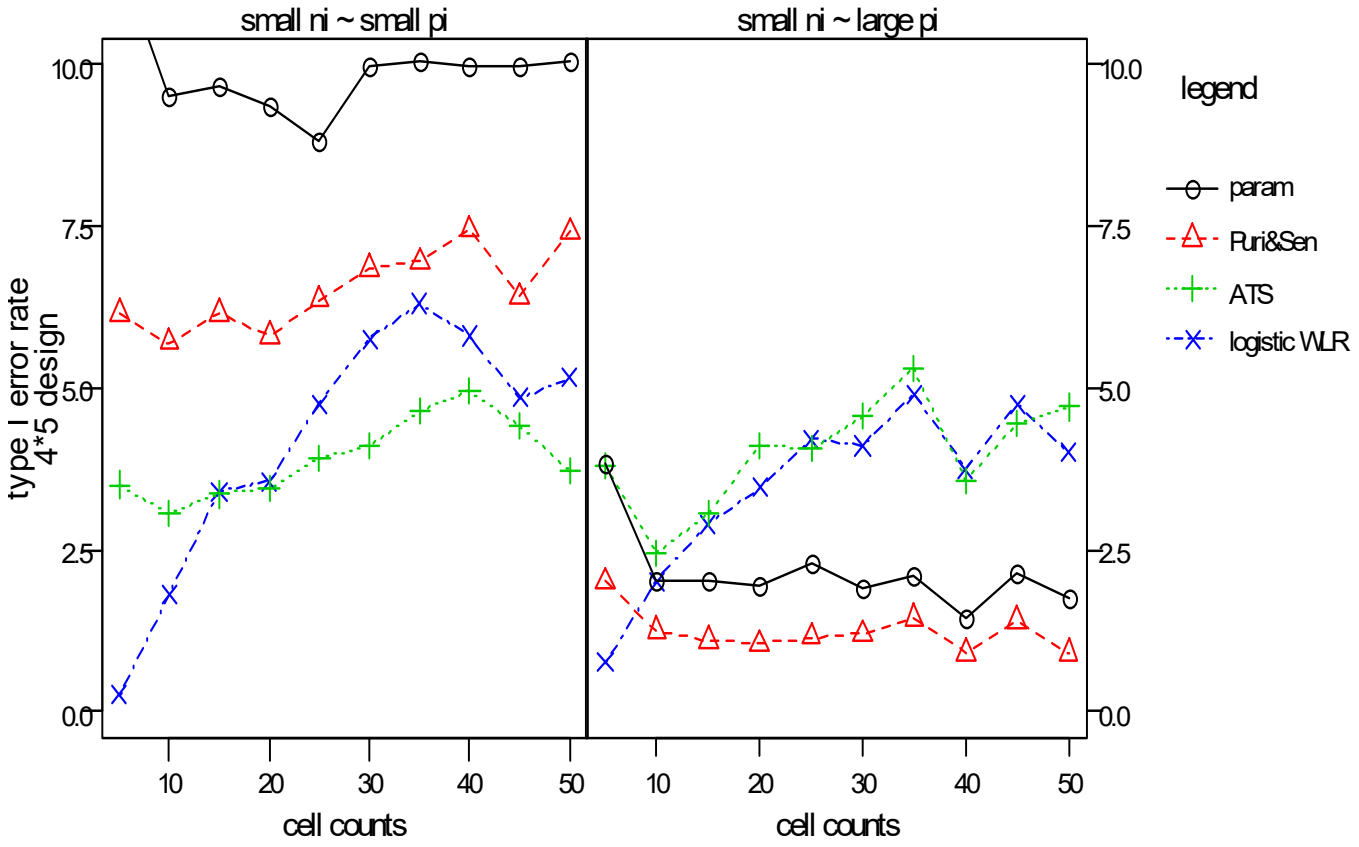
1. 3. 2 p = 0.8

		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	7.05	6.50	6.80	7.70	6.80	8.05	7.35	3.35	2.95	2.75	3.7	2.90	2.75	3.25
	Puri & Sen	3.70	3.90	4.50	5.40	5.10	5.95	5.40	2.05	1.80	1.55	2.6	1.75	1.80	2.25
	ATS	3.45	3.65	4.10	5.30	4.50	5.45	4.35	3.55	3.70	3.90	5.3	4.80	4.60	5.05
	logistic W-LR	0.65	1.50	2.95	2.55	3.65	4.05	3.80	1.55	2.35	3.20	4.0	3.70	3.70	4.05



1. 3. 3 p = 0.9

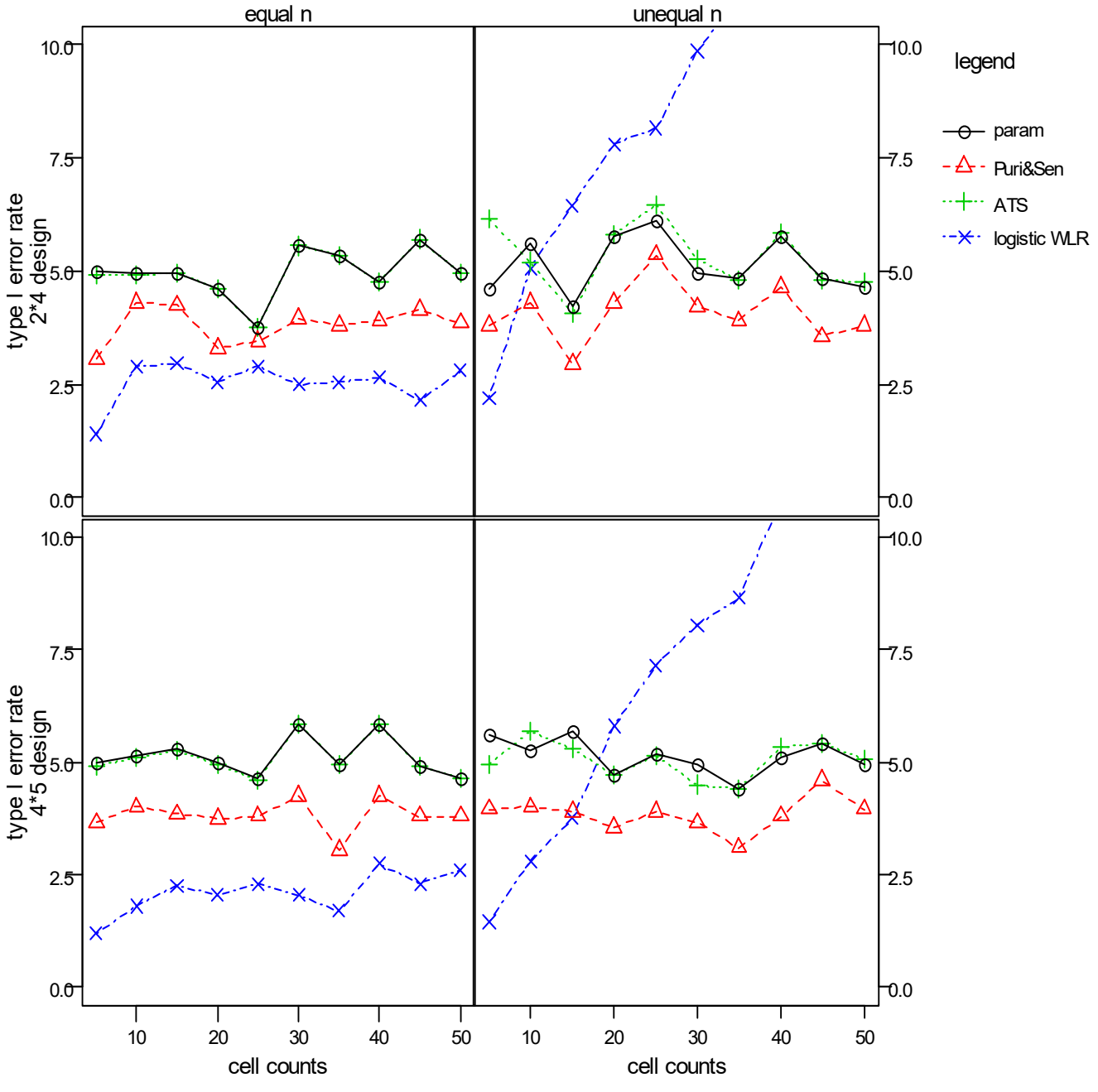
		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	11.65	9.50	9.65	9.35	9.95	9.95	10.05	3.85	2.00	2.00	1.95	1.90	1.45	1.75
	Puri & Sen	6.15	5.70	6.15	5.80	6.85	7.45	7.40	2.00	1.25	1.10	1.05	1.20	0.90	0.90
	ATS	3.50	3.05	3.35	3.45	4.10	4.95	3.70	3.80	2.45	3.05	4.10	4.55	3.55	4.70
	logistic W-LR	0.25	1.80	3.40	3.55	5.75	5.80	5.15	0.75	2.00	2.90	3.45	4.10	3.75	4.00



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

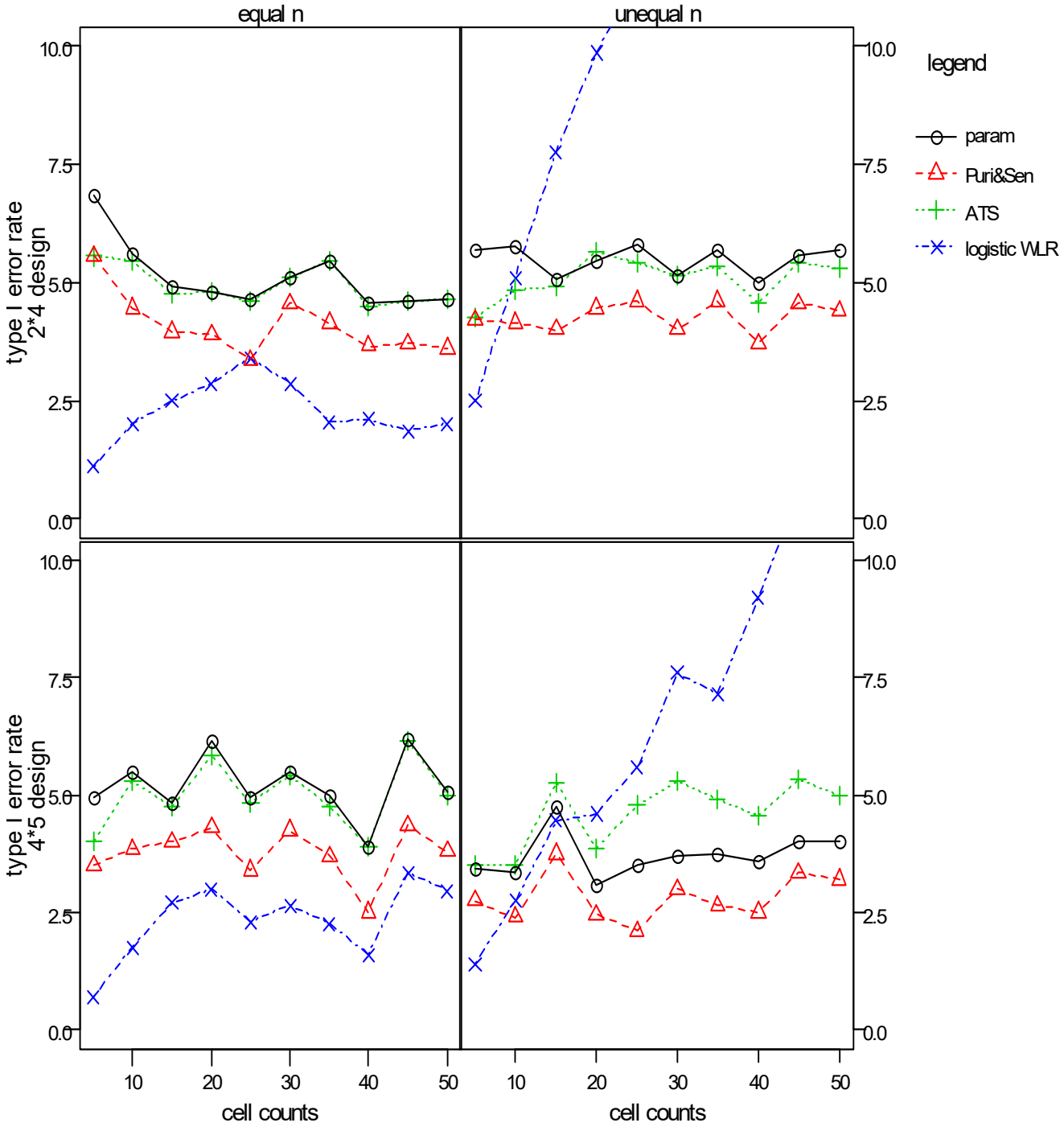
1. 4. 1 p = 0.5

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	5.00	4.95	4.95	4.60	5.55	4.75	4.95	4.60	5.60	4.20	5.75	4.95	5.75	4.65
	Puri & Sen	3.05	4.30	4.25	3.30	3.95	3.90	3.85	3.80	4.30	2.95	4.30	4.20	4.65	3.80
	ATS	4.90	4.90	4.95	4.60	5.55	4.75	4.95	6.15	5.20	4.05	5.80	5.25	5.85	4.75
	logistic W-LR	1.40	2.90	2.95	2.55	2.50	2.65	2.80	2.20	5.05	6.45	7.80	9.85	13.45	15.70
4*5	parametric	5.00	5.15	5.30	5.00	5.85	5.85	4.65	5.60	5.25	5.70	4.70	4.95	5.10	4.95
	Puri & Sen	3.65	4.00	3.85	3.75	4.25	4.25	3.80	3.95	4.00	3.90	3.55	3.65	3.80	3.95
	ATS	4.90	5.10	5.25	4.95	5.85	5.85	4.65	4.95	5.70	5.30	4.70	4.50	5.35	5.05
	logistic W-LR	1.20	1.80	2.25	2.05	2.05	2.75	2.60	1.45	2.80	3.75	5.80	8.05	10.80	12.35



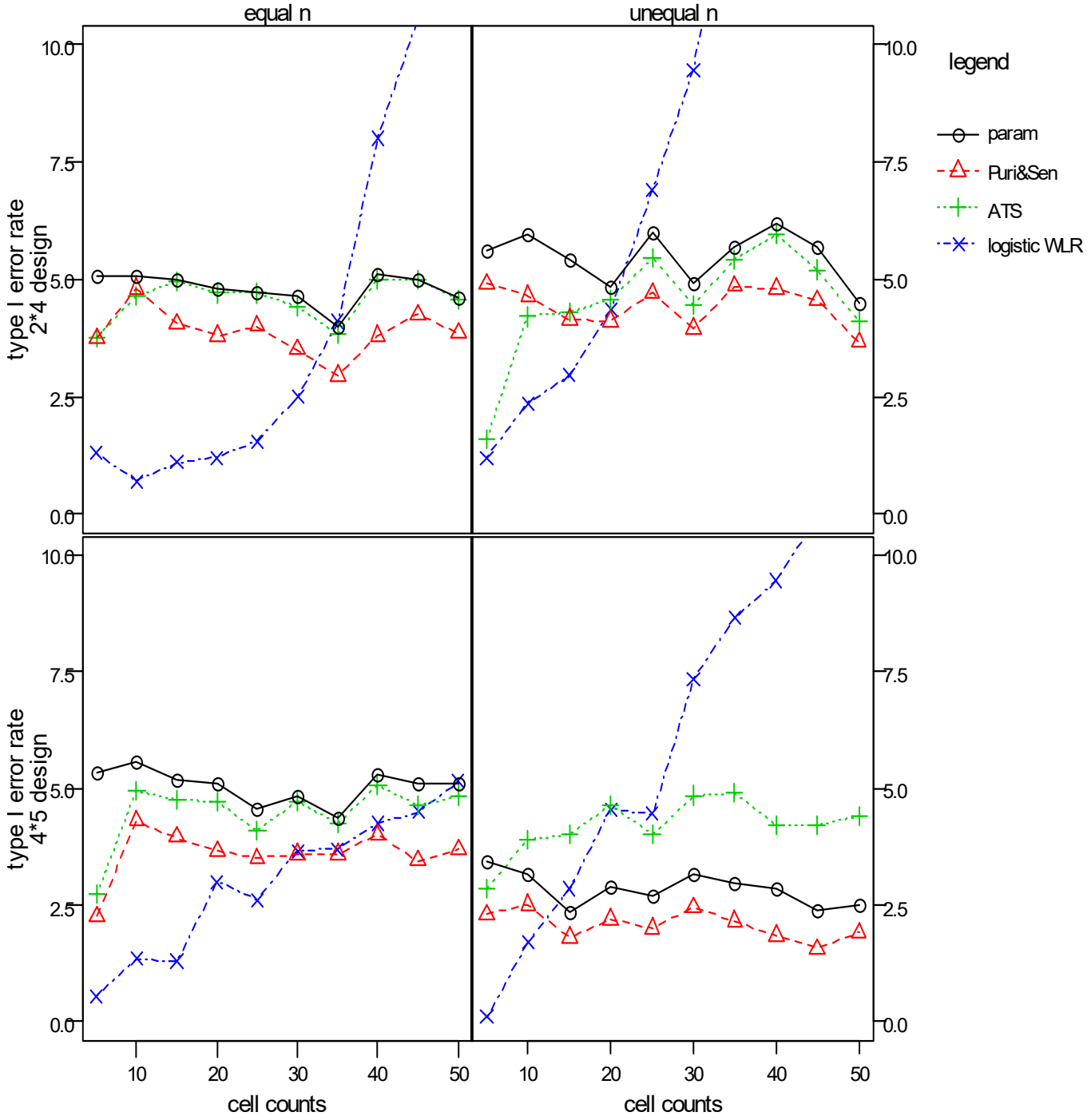
1. 4. 2 p = 0.8

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	6.85	5.60	4.90	4.80	5.10	4.55	4.65	5.70	5.75	5.05	5.45	5.15	5.00	5.70
	Puri & Sen	5.55	4.45	3.95	3.90	4.55	3.65	3.60	4.20	4.15	4.00	4.45	4.00	3.70	4.40
	ATS	5.55	5.45	4.75	4.80	5.10	4.50	4.65	4.25	4.85	4.90	5.65	5.15	4.55	5.30
	logistic W-LR	1.10	2.00	2.50	2.85	2.85	2.10	2.00	2.50	5.10	7.75	9.85	13.00	17.40	17.45
4*5	parametric	4.95	5.50	4.85	6.15	5.50	3.90	5.05	3.45	3.35	4.75	3.10	3.70	3.60	4.00
	Puri & Sen	3.50	3.85	4.00	4.30	4.25	2.50	3.80	2.75	2.40	3.75	2.45	3.00	2.50	3.20
	ATS	4.00	5.30	4.75	5.85	5.40	3.90	5.00	3.50	3.50	5.25	3.85	5.30	4.55	5.00
	logistic W-LR	0.70	1.75	2.70	3.00	2.65	1.60	2.95	1.40	2.75	4.45	4.60	7.60	9.20	10.95



1. 4. 3 p = 0.9

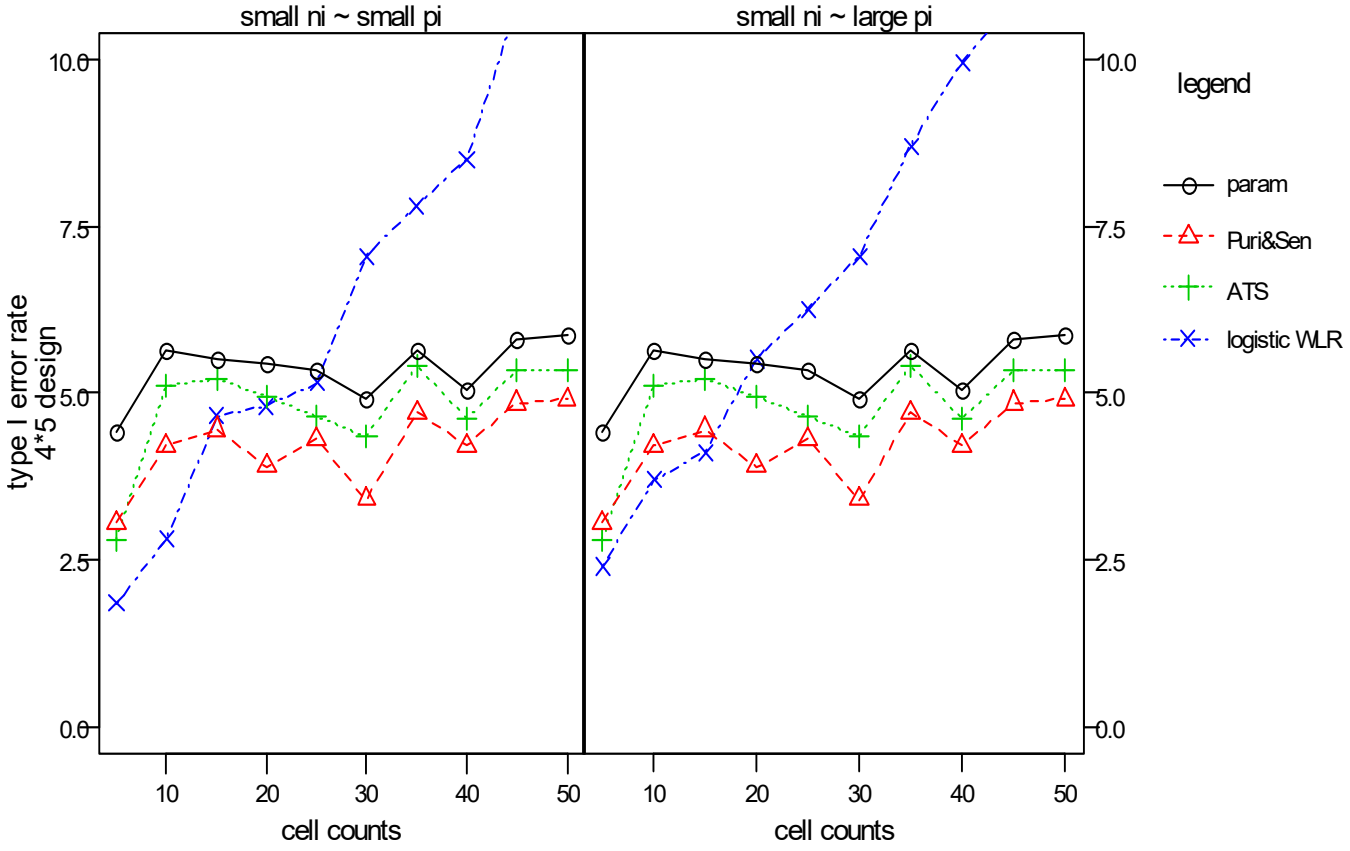
		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	5.05	5.05	5.00	4.80	4.65	5.10	4.60	5.60	5.95	5.40	4.85	4.90	6.20	4.50
	Puri & Sen	3.75	4.80	4.05	3.80	3.50	3.80	3.85	4.90	4.65	4.15	4.10	3.95	4.80	3.65
	ATS	3.75	4.65	4.95	4.70	4.40	5.00	4.55	1.60	4.20	4.30	4.55	4.45	5.95	4.10
	logistic W-LR	1.30	0.70	1.10	1.20	2.50	8.00	14.10	1.20	2.35	2.95	4.35	9.45	17.25	27.10
4*5	parametric	5.35	5.55	5.20	5.10	4.85	5.30	5.10	3.45	3.15	2.35	2.90	3.15	2.85	2.50
	Puri & Sen	2.25	4.30	3.95	3.65	3.60	4.00	3.70	2.30	2.50	1.80	2.20	2.45	1.85	1.90
	ATS	2.75	4.95	4.75	4.70	4.70	5.05	4.85	2.85	3.90	4.00	4.65	4.85	4.20	4.40
	logistic W-LR	0.55	1.35	1.30	3.00	3.65	4.25	5.15	0.10	1.70	2.85	4.55	7.35	9.45	13.05



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

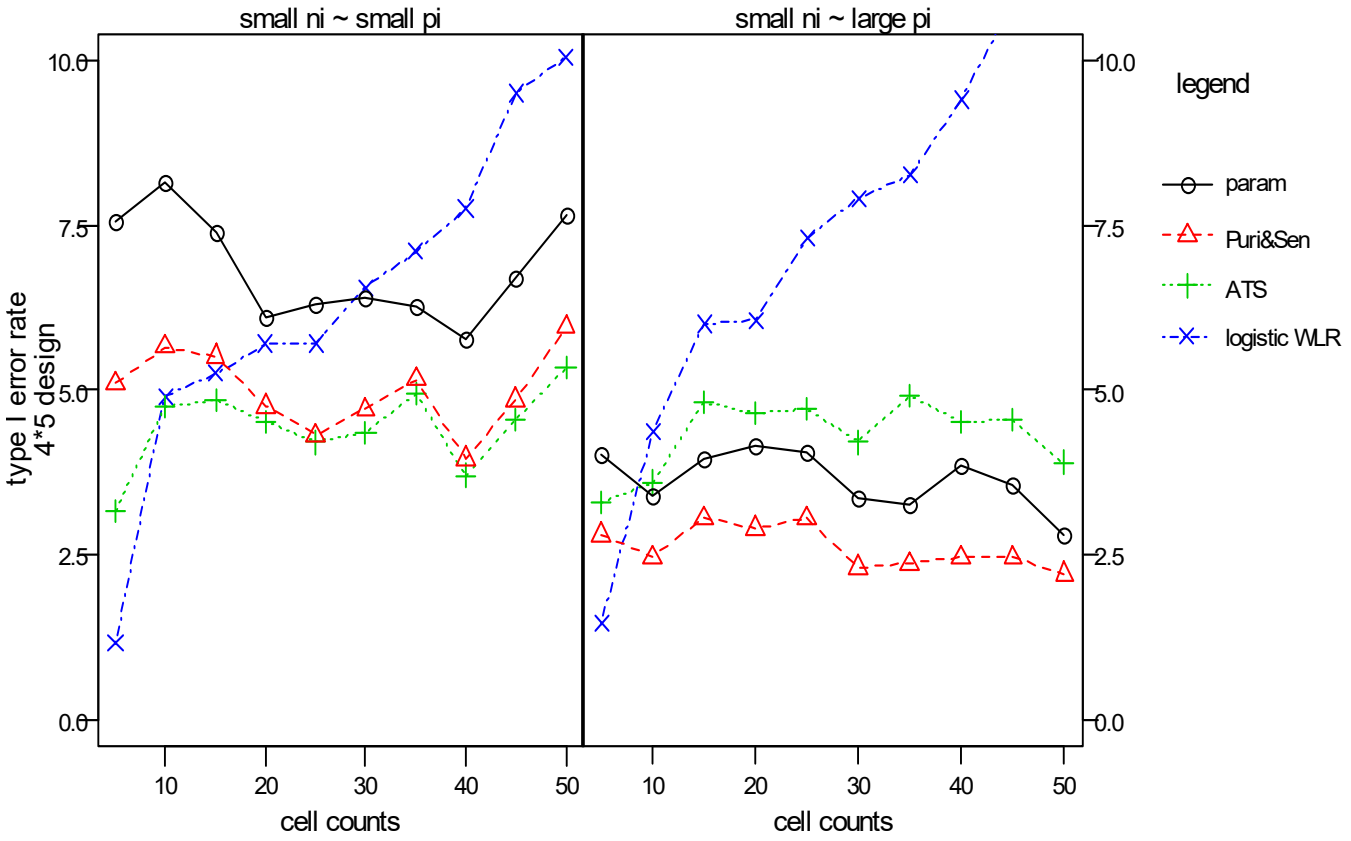
1. 5. 1 p = 0.6

		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	4.40	5.65	5.50	5.45	4.90	5.05	5.85	4.40	5.65	5.50	5.45	4.90	5.05	5.85
	Puri & Sen	3.05	4.20	4.45	3.90	3.40	4.20	4.90	3.05	4.20	4.45	3.90	3.40	4.20	4.90
	ATS	2.80	5.10	5.20	4.95	4.35	4.60	5.35	2.80	5.10	5.20	4.95	4.35	4.60	5.35
	logistic W-LR	1.85	2.80	4.65	4.80	7.05	8.50	10.80	2.40	3.70	4.10	5.50	7.05	9.95	11.60



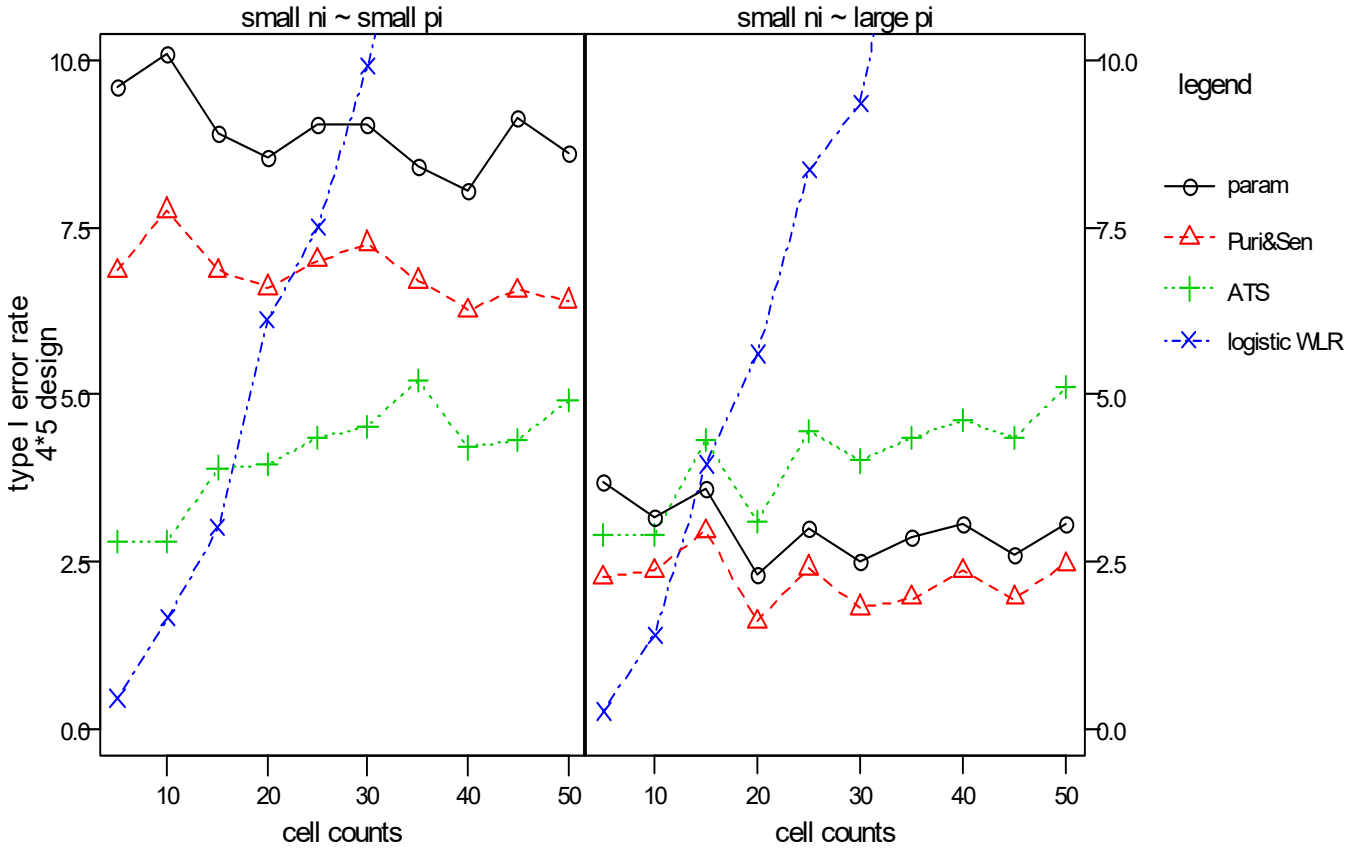
1. 5. 2 p = 0.8

		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	7.55	8.15	7.40	6.10	6.40	5.75	7.65	4.00	3.40	3.95	4.15	3.35	3.85	2.8
	Puri & Sen	5.10	5.65	5.50	4.75	4.70	3.95	5.95	2.80	2.45	3.05	2.90	2.30	2.45	2.2
	ATS	3.15	4.75	4.85	4.50	4.35	3.70	5.35	3.30	3.60	4.80	4.65	4.20	4.50	3.9
	logistic W-LR	1.15	4.90	5.25	5.70	6.55	7.75	10.05	1.45	4.35	6.00	6.05	7.90	9.40	12.5



1. 5. 3 p = 0.9

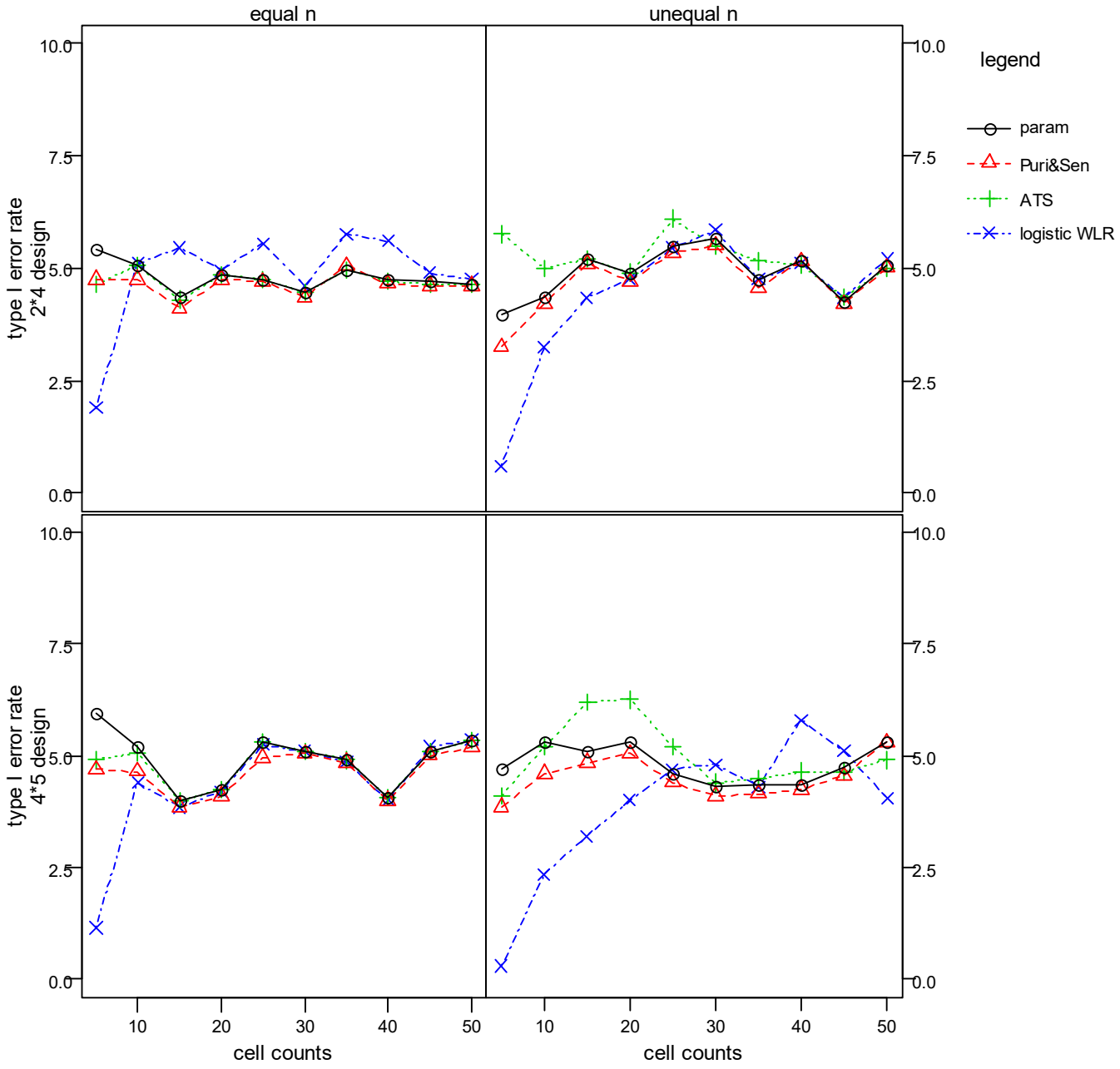
		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	9.60	10.10	8.90	8.55	9.05	8.05	8.60	3.70	3.15	3.60	2.3	2.50	3.05	3.05
	Puri & Sen	6.85	7.75	6.85	6.60	7.25	6.25	6.40	2.25	2.35	2.95	1.6	1.80	2.35	2.45
	ATS	2.80	2.80	3.90	3.95	4.50	4.20	4.90	2.90	2.90	4.30	3.1	4.00	4.60	5.10
	logistic W-LR	0.45	1.65	3.00	6.10	9.90	14.15	17.05	0.25	1.40	3.95	5.6	9.35	15.25	19.05



1. 6. Interaction AB - null model

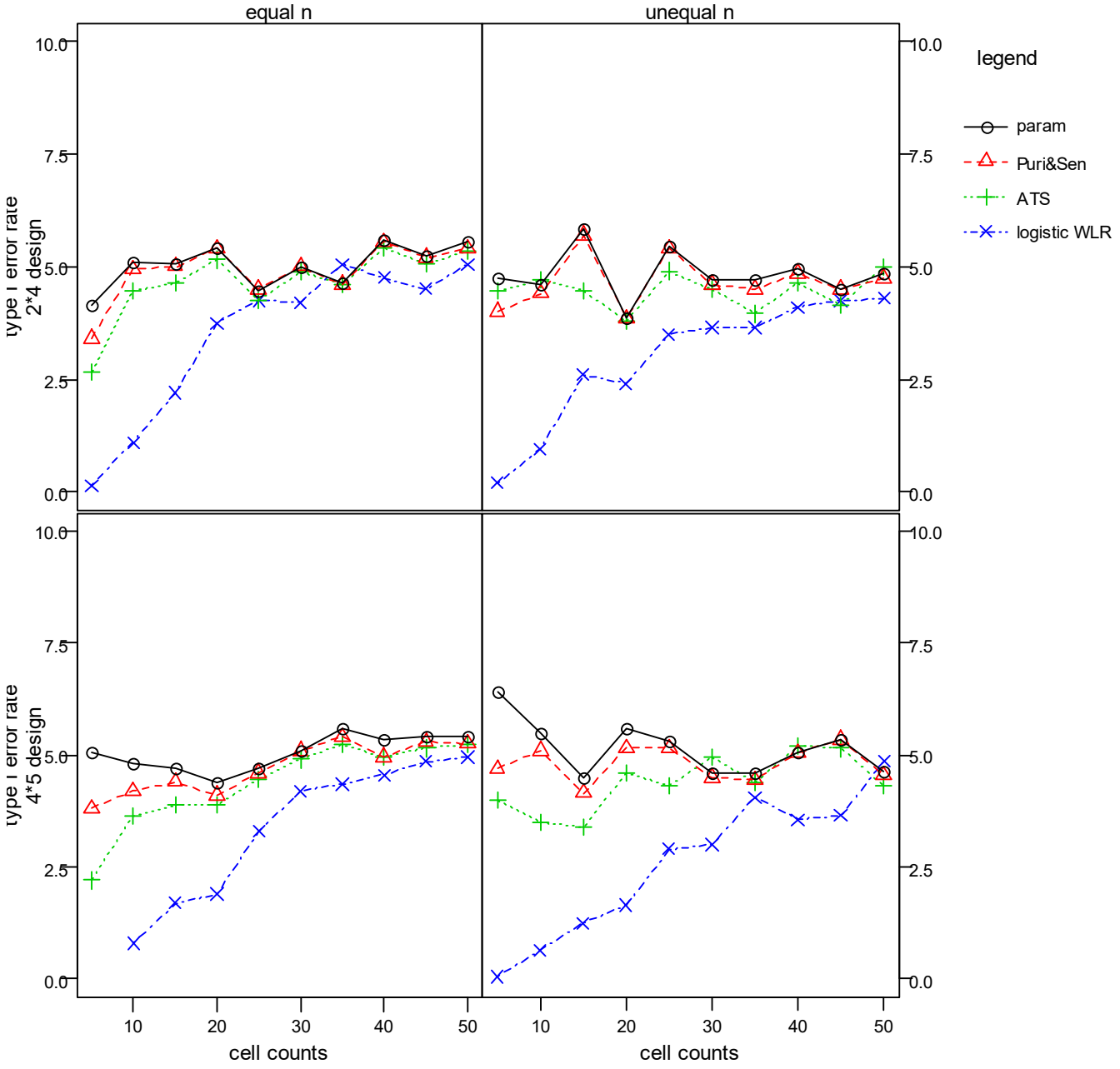
1. 6. 1 p = 0.5

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	5.40	5.05	4.35	4.85	4.45	4.75	4.65	3.95	4.35	5.20	4.90	5.65	5.15	5.05
	Puri & Sen	4.75	4.75	4.10	4.75	4.35	4.65	4.60	3.25	4.20	5.10	4.70	5.50	5.15	5.00
	ATS	4.65	5.05	4.30	4.85	4.45	4.70	4.65	5.75	5.00	5.20	4.90	5.50	5.05	5.00
	logistic W-LR	1.90	5.10	5.45	4.95	4.60	5.60	4.75	0.60	3.25	4.35	4.75	5.85	5.10	5.20
4*5	parametric	5.95	5.20	4.00	4.25	5.10	4.05	5.35	4.70	5.30	5.10	5.30	4.30	4.35	5.30
	Puri & Sen	4.70	4.65	3.85	4.10	5.05	4.00	5.20	3.85	4.60	4.85	5.05	4.10	4.25	5.30
	ATS	4.90	5.05	4.00	4.25	5.10	4.05	5.35	4.10	5.20	6.20	6.25	4.40	4.65	4.90
	logistic W-LR	1.15	4.40	3.85	4.20	5.10	4.00	5.35	0.30	2.35	3.20	4.00	4.80	5.80	4.05



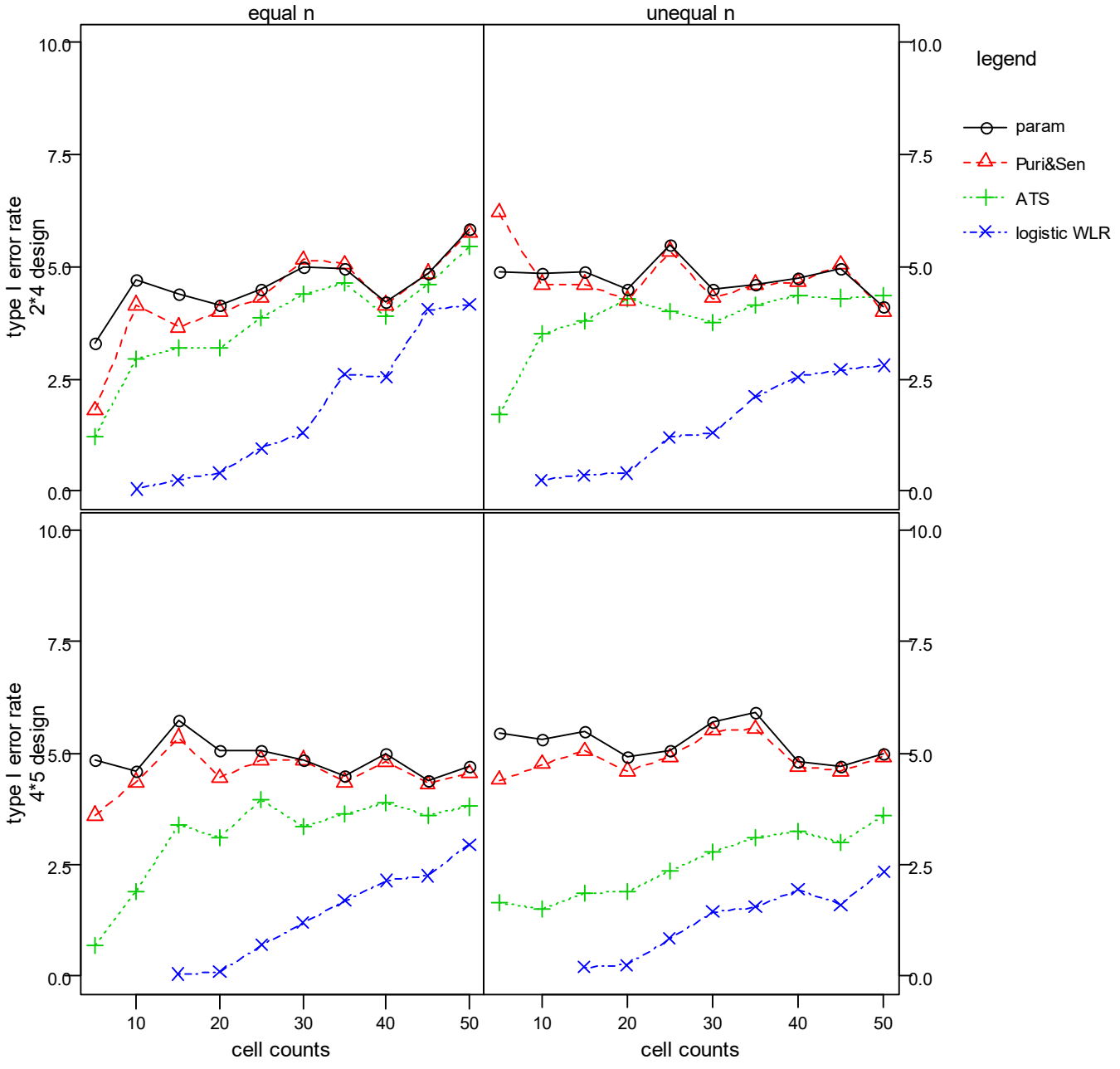
1. 6. 2 p = 0.8

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	4.15	5.10	5.05	5.40	5.0	5.60	5.55	4.75	4.60	5.85	3.85	4.70	4.95	4.85
	Puri & Sen	3.40	4.95	5.00	5.40	5.0	5.55	5.40	4.00	4.40	5.70	3.85	4.60	4.85	4.75
	ATS	2.65	4.45	4.65	5.15	4.9	5.40	5.35	4.45	4.70	4.45	3.80	4.50	4.65	5.00
	logistic W-LR	0.15	1.10	2.20	3.75	4.2	4.75	5.05	0.20	0.95	2.60	2.40	3.65	4.10	4.30
4*5	parametric	5.05	4.80	4.70	4.40	5.1	5.35	5.40	6.40	5.50	4.50	5.60	4.60	5.05	4.65
	Puri & Sen	3.80	4.20	4.40	4.10	5.1	4.95	5.25	4.70	5.10	4.15	5.15	4.50	5.05	4.55
	ATS	2.20	3.65	3.90	3.90	4.9	4.95	5.25	4.00	3.50	3.40	4.60	4.95	5.20	4.30
	logistic W-LR	NA	0.80	1.70	1.90	4.2	4.55	4.95	0.05	0.65	1.25	1.65	3.00	3.55	4.85



1. 6. 3 p = 0.9

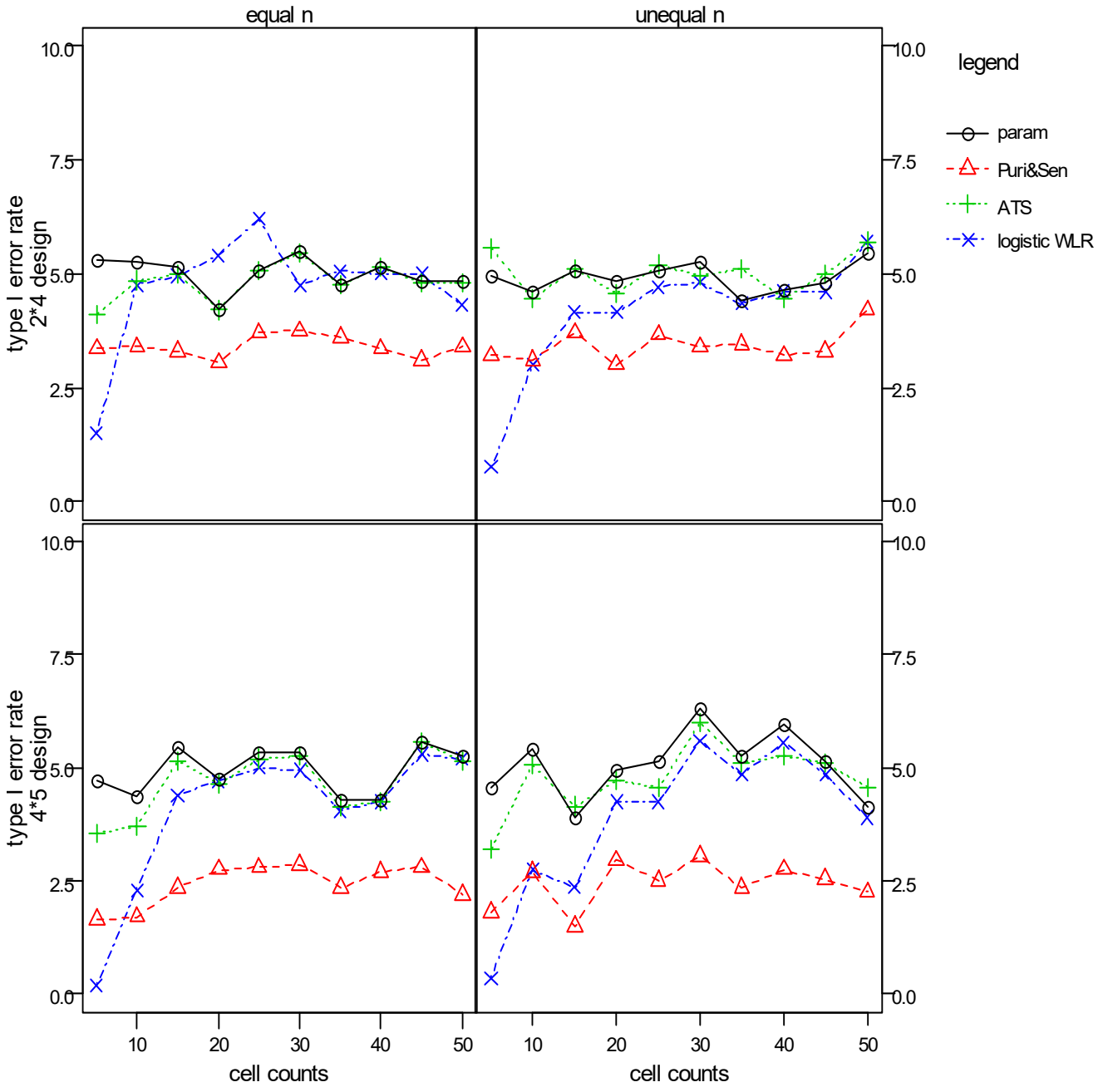
		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	3.30	4.70	4.40	4.15	5.00	4.20	5.85	4.90	4.85	4.90	4.50	4.50	4.75	4.10
	Puri & Sen	1.80	4.15	3.65	4.00	5.15	4.15	5.75	6.20	4.60	4.60	4.25	4.30	4.65	4.00
	ATS	1.20	2.95	3.20	3.20	4.40	3.90	5.45	1.70	3.50	3.80	4.30	3.75	4.35	4.35
	logistic W-LR	NA	0.05	0.25	0.40	1.30	2.55	4.15	NA	0.25	0.35	0.40	1.30	2.55	2.80
4*5	parametric	4.85	4.60	5.75	5.05	4.85	5.00	4.70	5.45	5.30	5.50	4.90	5.70	4.80	5.00
	Puri & Sen	3.60	4.35	5.35	4.45	4.85	4.80	4.55	4.40	4.75	5.05	4.60	5.50	4.70	4.90
	ATS	0.70	1.90	3.40	3.10	3.35	3.90	3.80	1.65	1.50	1.85	1.90	2.80	3.25	3.60
	logistic W-LR	NA	NA	0.05	0.10	1.20	2.15	2.95	NA	NA	0.20	0.25	1.45	1.95	2.35



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

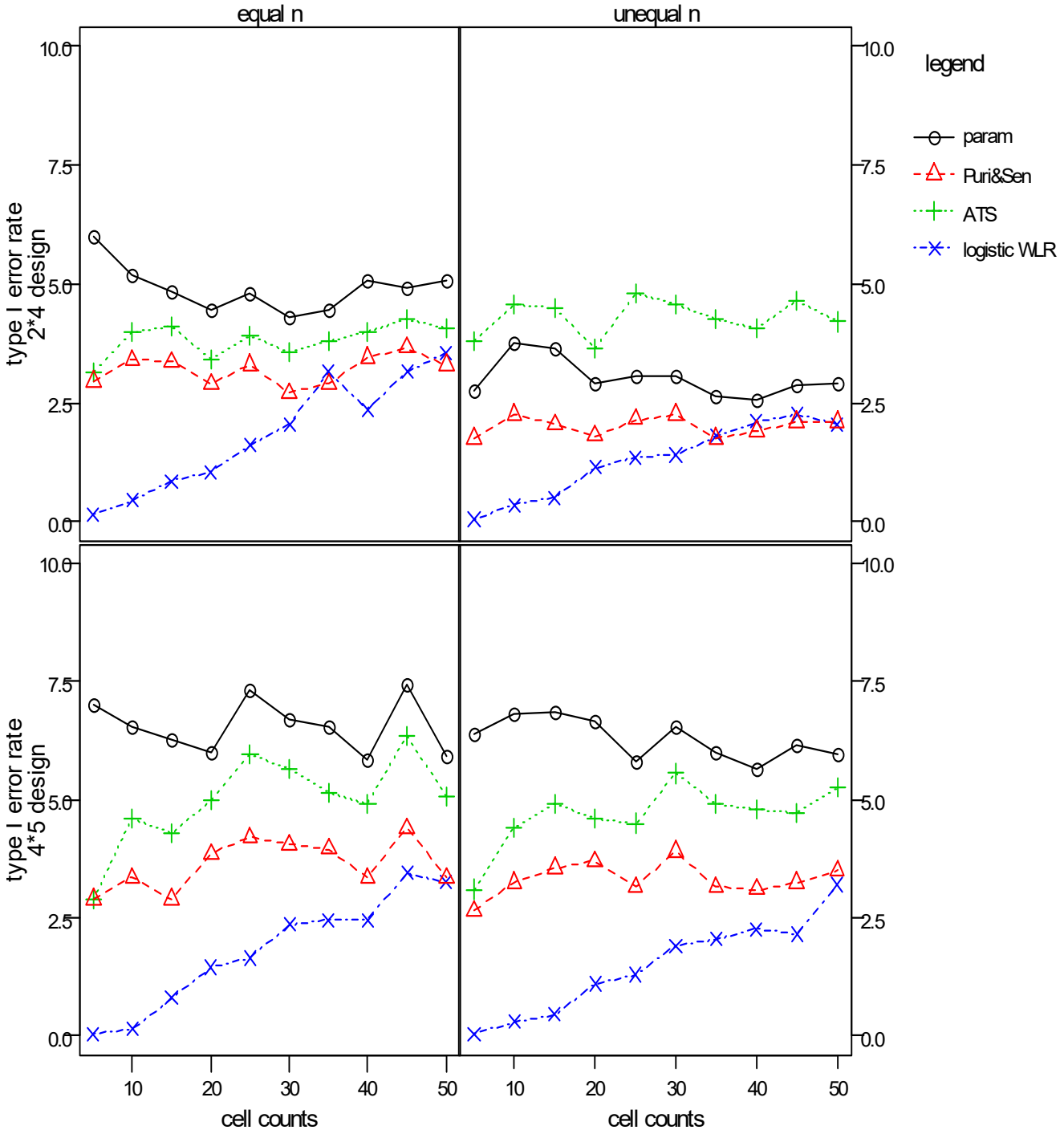
1. 7. 1 p = 0.5

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	5.30	5.25	5.15	4.20	5.50	5.15	4.85	4.95	4.60	5.05	4.85	5.25	4.65	5.45
	Puri & Sen	3.35	3.40	3.30	3.05	3.75	3.35	3.40	3.20	3.10	3.70	3.00	3.40	3.20	4.20
	ATS	4.10	4.85	5.00	4.20	5.45	5.15	4.80	5.55	4.45	5.10	4.55	4.95	4.45	5.70
	logistic W-LR	1.50	4.75	4.95	5.40	4.75	5.00	4.30	0.75	3.00	4.15	4.15	4.80	4.60	5.70
4*5	parametric	4.70	4.35	5.45	4.75	5.35	4.30	5.25	4.55	5.40	3.90	4.95	6.30	5.95	4.15
	Puri & Sen	1.65	1.70	2.35	2.75	2.85	2.70	2.20	1.80	2.70	1.50	2.95	3.05	2.75	2.25
	ATS	3.55	3.70	5.15	4.65	5.25	4.25	5.15	3.20	5.05	4.15	4.70	6.00	5.25	4.55
	logistic W-LR	0.20	2.30	4.40	4.70	4.95	4.25	5.20	0.35	2.75	2.35	4.25	5.60	5.55	3.90



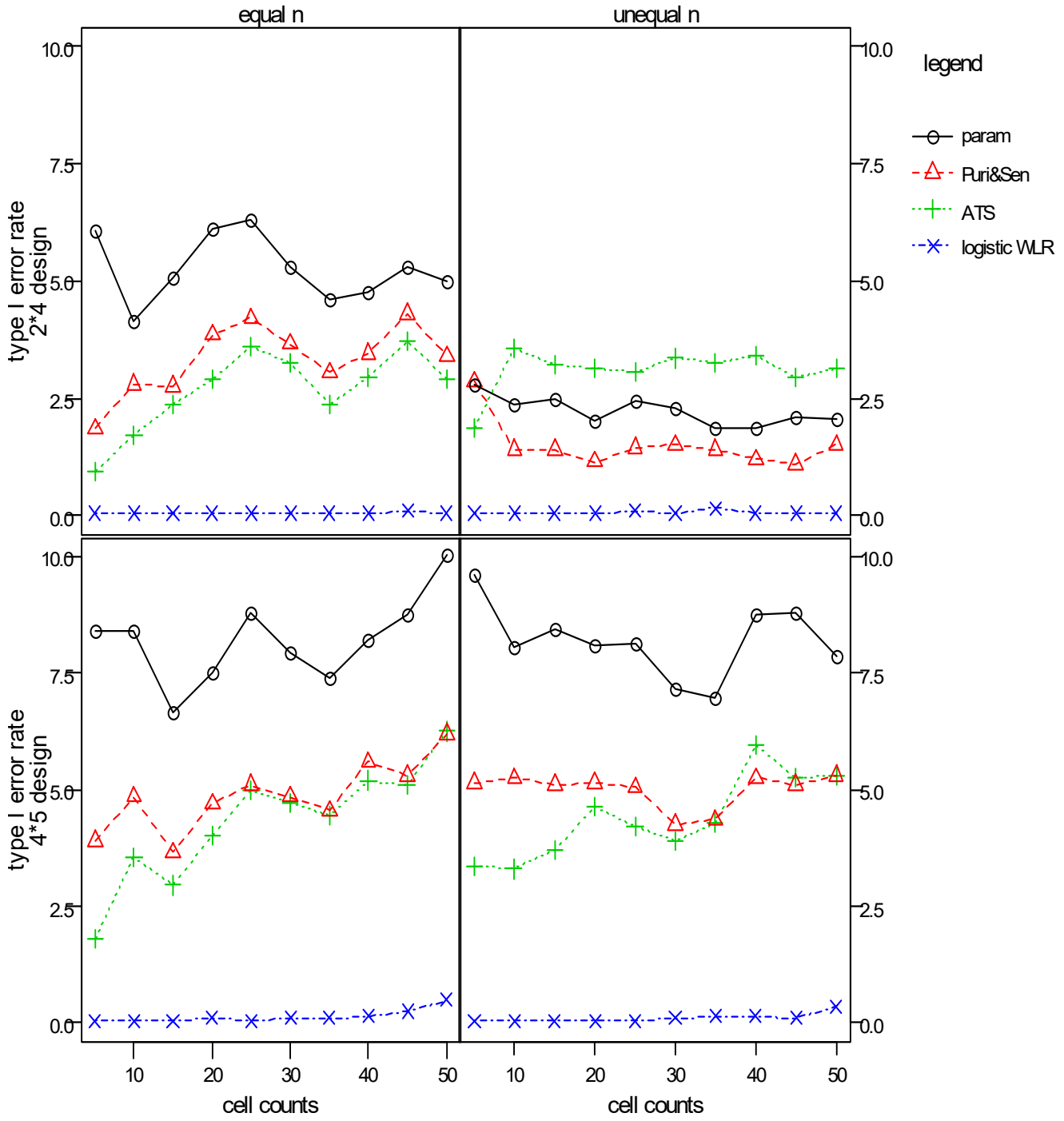
1. 7. 2 p = 0.8

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	6.00	5.20	4.85	4.45	4.30	5.05	5.05	2.75	3.75	3.65	2.90	3.05	2.55	2.90
	Puri & Sen	2.95	3.40	3.35	2.90	2.70	3.45	3.30	1.75	2.25	2.05	1.80	2.25	1.90	2.10
	ATS	3.15	4.00	4.10	3.40	3.55	4.00	4.05	3.80	4.55	4.50	3.65	4.55	4.05	4.20
	logistic W-LR	0.15	0.45	0.85	1.05	2.05	2.35	3.55	0.05	0.35	0.50	1.15	1.40	2.10	2.05
4*5	parametric	7.00	6.55	6.25	6.00	6.70	5.85	5.90	6.40	6.80	6.85	6.65	6.55	5.65	5.95
	Puri & Sen	2.90	3.35	2.90	3.85	4.05	3.35	3.35	2.65	3.25	3.55	3.70	3.90	3.10	3.50
	ATS	2.90	4.60	4.30	5.00	5.65	4.90	5.05	3.10	4.40	4.90	4.60	5.55	4.80	5.25
	logistic W-LR	0.05	0.15	0.80	1.45	2.35	2.45	3.25	0.05	0.30	0.45	1.10	1.90	2.25	3.20



1. 7. 3 p = 0.9

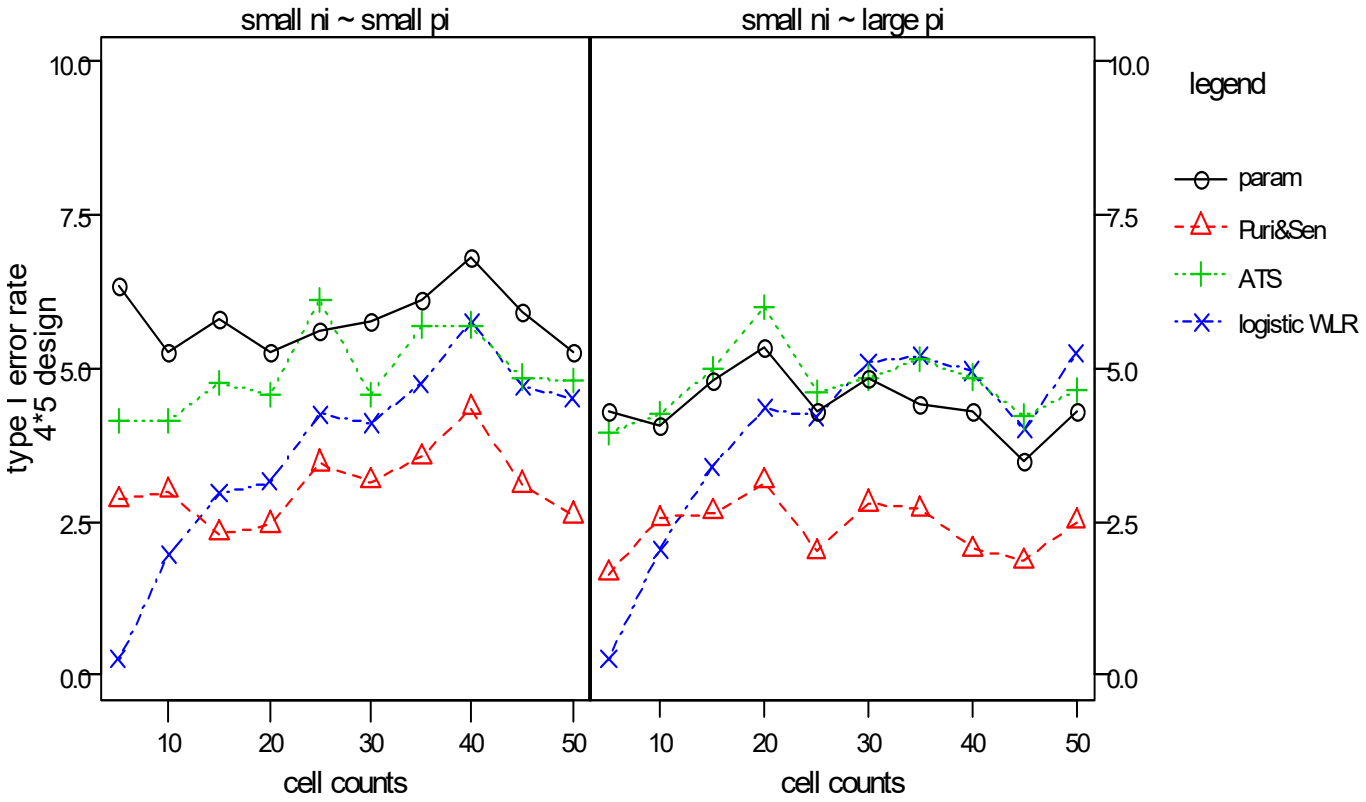
		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	6.05	4.15	5.05	6.10	5.30	4.75	5.00	2.80	2.35	2.50	2.00	2.30	1.85	2.05
	Puri & Sen	1.85	2.80	2.75	3.85	3.65	3.45	3.40	2.85	1.40	1.40	1.15	1.50	1.20	1.50
	ATS	0.95	1.70	2.35	2.90	3.25	2.95	2.90	1.85	3.55	3.20	3.15	3.35	3.40	3.15
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
4*5	parametric	8.40	8.40	6.65	7.50	7.95	8.20	10.05	9.60	8.05	8.45	8.10	7.15	8.75	7.85
	Puri & Sen	3.90	4.85	3.65	4.70	4.85	5.60	6.20	5.15	5.25	5.10	5.15	4.25	5.25	5.30
	ATS	1.80	3.55	2.95	4.00	4.70	5.20	6.25	3.35	3.30	3.70	4.65	3.90	5.95	5.30
	logistic W-LR	0.05	0.05	0.05	0.10	0.10	0.15	0.50	0.05	0.05	0.05	0.05	0.10	0.15	0.35



1. 8. Interaction AB - A significant (effects a_i = 0.6*s) small n_i ~ small p_i and small n_i ~ large p_i

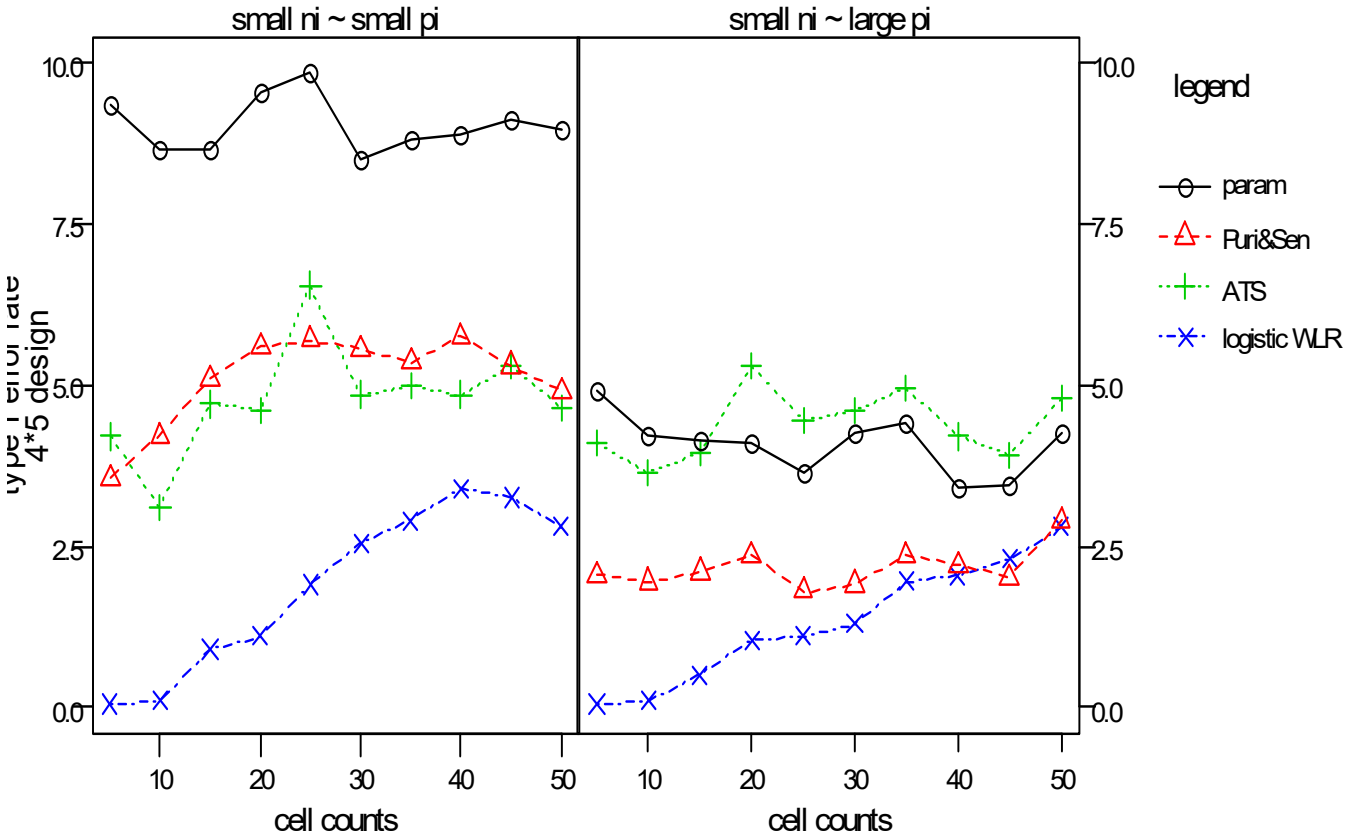
1. 8. 1 p = 0.6

		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	6.35	5.25	5.80	5.25	5.75	6.80	5.25	4.30	4.05	4.80	5.35	4.85	4.30	4.30
	Puri & Sen	2.85	3.00	2.30	2.45	3.15	4.35	2.60	1.65	2.55	2.65	3.15	2.80	2.05	2.50
	ATS	4.15	4.15	4.75	4.55	4.55	5.70	4.80	3.95	4.25	5.00	6.00	4.85	4.85	4.65
	logistic W-LR	0.25	1.95	2.95	3.15	4.10	5.75	4.50	0.25	2.05	3.40	4.35	5.10	4.95	5.25



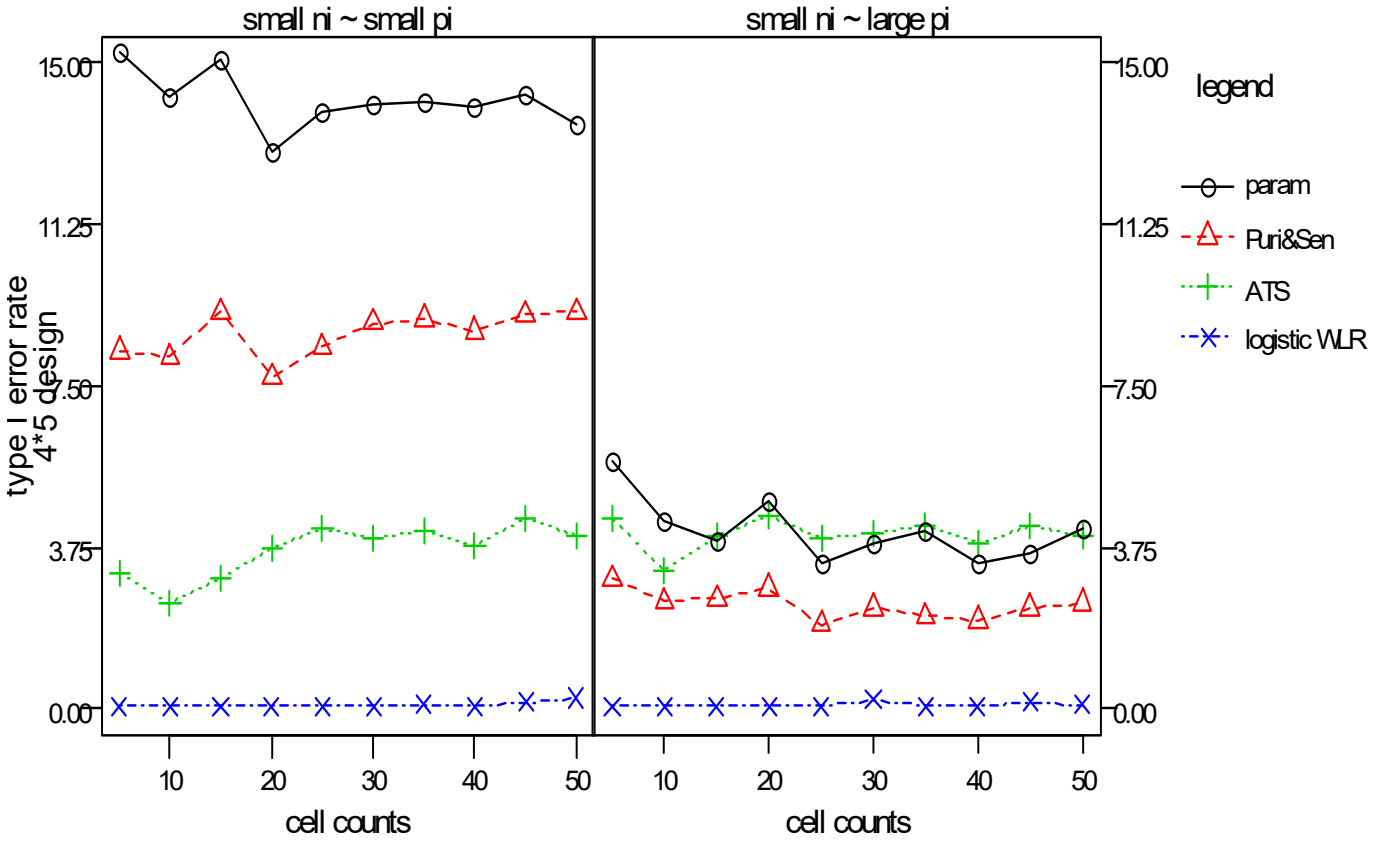
1. 8. 2 p = 0.8

		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	9.35	8.65	8.65	9.55	8.50	8.90	8.95	4.90	4.20	4.15	4.10	4.25	3.40	4.25
	Puri & Sen	3.55	4.20	5.10	5.60	5.55	5.75	4.90	2.05	1.95	2.10	2.35	1.90	2.20	2.90
	ATS	4.20	3.10	4.70	4.60	4.85	4.85	4.65	4.10	3.65	3.95	5.30	4.60	4.20	4.80
	logistic W-LR	0.05	0.10	0.90	1.10	2.55	3.40	2.80	0.05	0.10	0.50	1.05	1.30	2.05	2.80



1. 8. 3 p = 0.9

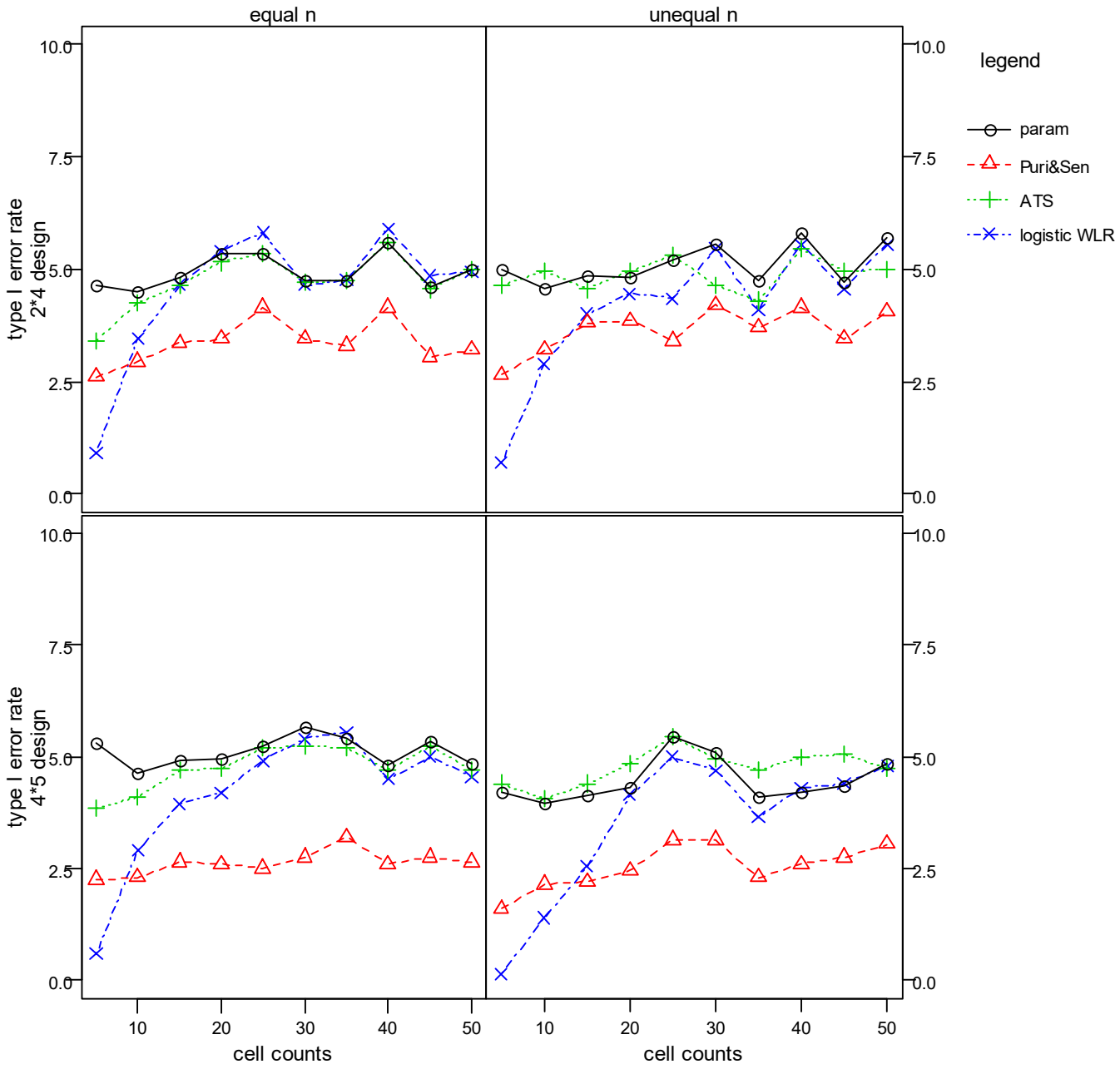
		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	15.25	14.20	15.05	12.95	14.00	13.95	13.55	5.75	4.35	3.90	4.85	3.85	3.40	4.20
	Puri & Sen	8.30	8.15	9.20	7.70	8.95	8.75	9.20	3.00	2.50	2.55	2.80	2.35	2.05	2.45
	ATS	3.15	2.45	3.05	3.70	3.95	3.80	4.00	4.40	3.20	4.00	4.50	4.05	3.85	4.00
	logistic W-LR	0.05	0.05	0.05	0.05	0.05	0.05	0.25	0.05	0.05	0.05	0.05	0.20	0.05	0.10



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

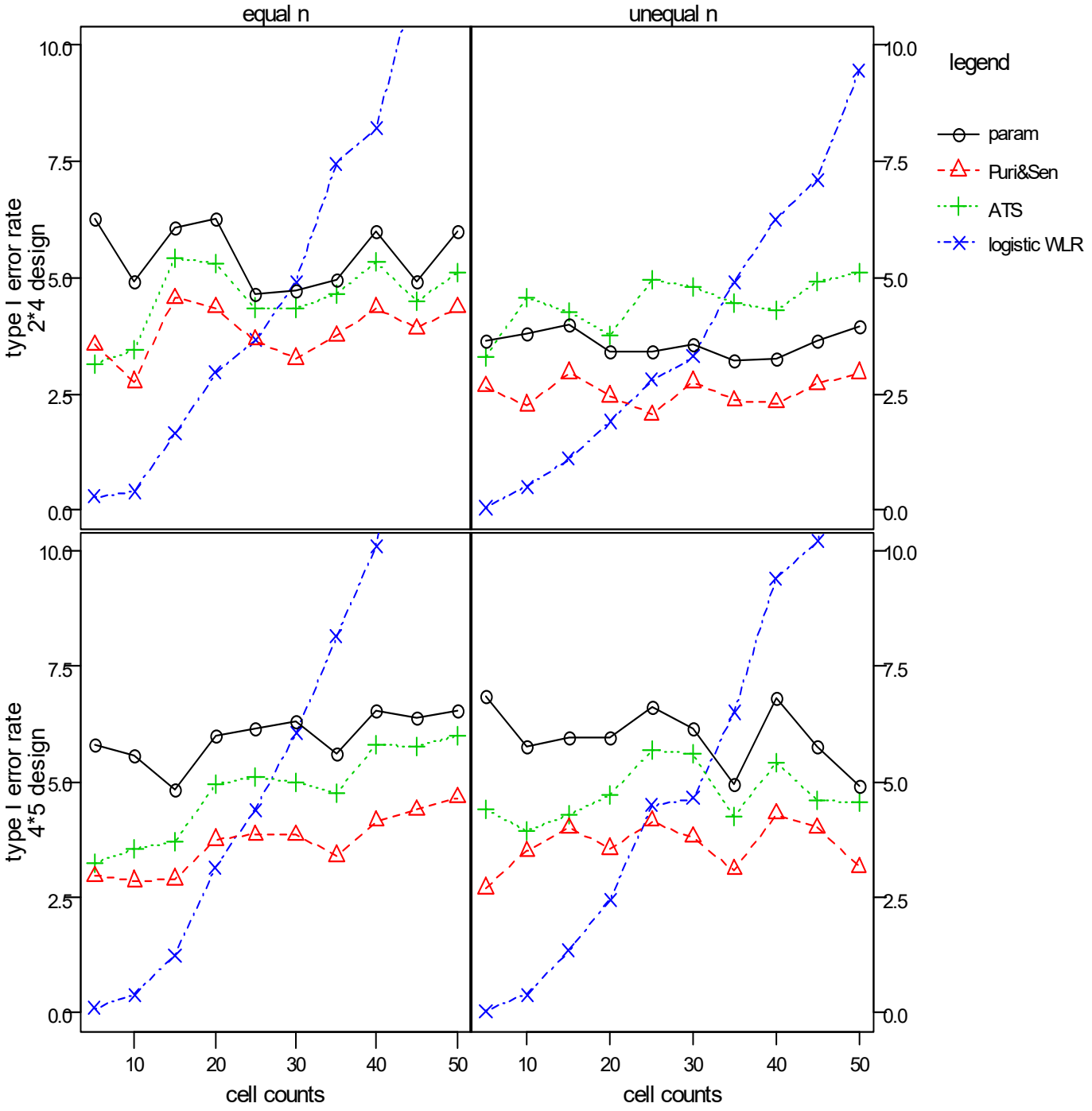
1. 9. 1 p = 0.5

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	4.65	4.50	4.80	5.35	4.75	5.60	5.00	5.00	4.55	4.85	4.80	5.55	5.80	5.70
	Puri & Sen	2.60	2.95	3.35	3.45	3.45	4.15	3.20	2.65	3.20	3.80	3.85	4.20	4.15	4.05
	ATS	3.40	4.25	4.65	5.15	4.70	5.60	5.00	4.65	4.95	4.55	4.95	4.65	5.45	5.00
	logistic W-LR	0.90	3.45	4.65	5.40	4.65	5.90	4.95	0.70	2.90	4.00	4.45	5.45	5.55	5.55
4*5	parametric	5.30	4.65	4.90	4.95	5.65	4.80	4.85	4.20	3.95	4.15	4.30	5.10	4.20	4.85
	Puri & Sen	2.25	2.30	2.65	2.60	2.75	2.60	2.65	1.60	2.15	2.20	2.45	3.15	2.60	3.05
	ATS	3.85	4.10	4.70	4.75	5.25	4.70	4.70	4.40	4.05	4.40	4.85	4.95	5.00	4.75
	logistic W-LR	0.60	2.90	3.95	4.20	5.40	4.50	4.55	0.15	1.40	2.55	4.15	4.70	4.30	4.80



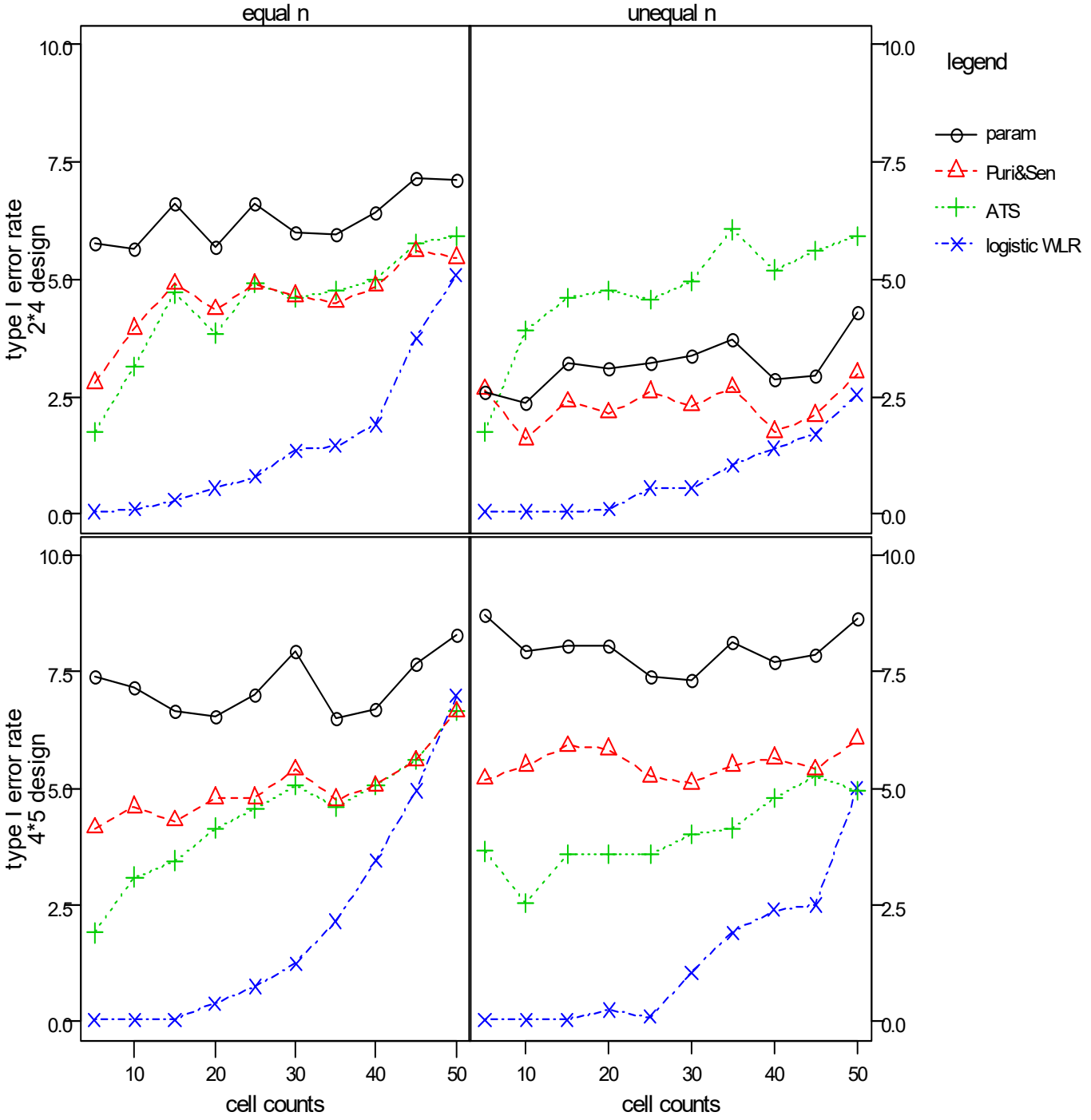
1. 9. 2 p = 0.8

		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	6.25	4.90	6.05	6.25	4.70	6.00	6.00	3.65	3.80	4.00	3.40	3.55	3.25	3.95
	Puri & Sen	3.55	2.75	4.55	4.35	3.25	4.35	4.35	2.65	2.25	2.95	2.45	2.75	2.30	2.95
	ATS	3.15	3.45	5.40	5.30	4.35	5.35	5.10	3.30	4.55	4.25	3.75	4.80	4.30	5.10
	logistic W-LR	0.30	0.40	1.65	2.95	4.90	8.20	13.20	0.05	0.50	1.10	1.90	3.30	6.25	9.45
4*5	parametric	5.80	5.55	4.85	6.00	6.30	6.55	6.55	6.85	5.75	5.95	5.95	6.15	6.80	4.90
	Puri & Sen	2.95	2.85	2.90	3.75	3.85	4.15	4.65	2.70	3.50	4.00	3.55	3.80	4.30	3.15
	ATS	3.25	3.55	3.70	4.95	5.00	5.80	6.00	4.40	3.95	4.30	4.70	5.60	5.40	4.55
	logistic W-LR	0.10	0.40	1.25	3.15	6.05	10.10	16.25	0.05	0.40	1.35	2.45	4.65	9.40	12.50



1. 9. 3 p = 0.9

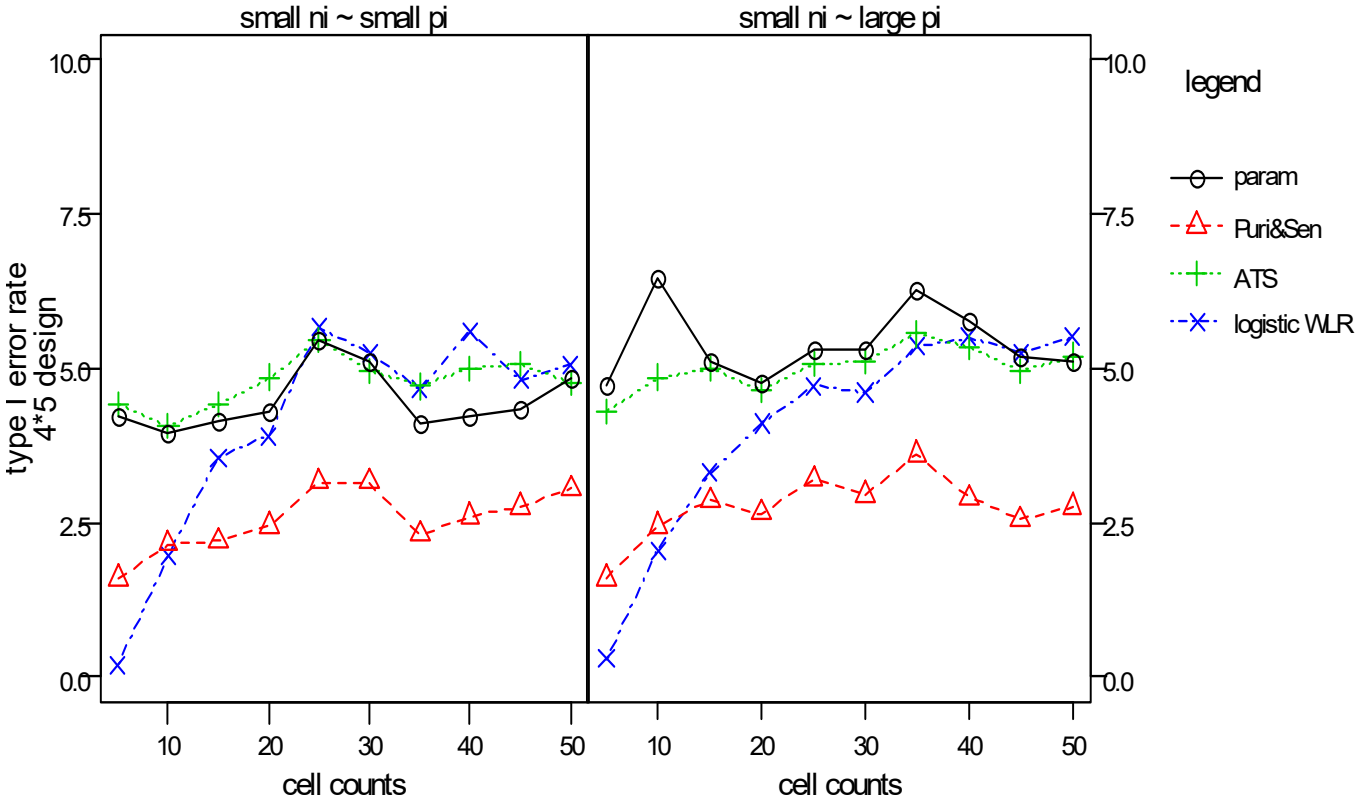
		equal cell counts							unequal cell counts						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	5.75	5.65	6.60	5.70	6.00	6.40	7.10	2.60	2.35	3.20	3.10	3.35	2.85	4.30
	Puri & Sen	2.80	3.95	4.90	4.35	4.65	4.85	5.45	2.65	1.60	2.40	2.15	2.30	1.75	3.00
	ATS	1.75	3.15	4.70	3.85	4.60	5.00	5.90	1.75	3.90	4.60	4.75	4.95	5.20	5.90
	logistic W-LR	0.05	0.10	0.30	0.55	1.35	1.90	5.10	0.05	0.05	0.05	0.10	0.55	1.40	2.55
4*5	parametric	7.40	7.15	6.65	6.55	7.95	6.70	8.30	8.70	7.95	8.05	8.05	7.30	7.70	8.65
	Puri & Sen	4.15	4.60	4.30	4.80	5.40	5.05	6.65	5.20	5.50	5.90	5.85	5.10	5.65	6.05
	ATS	1.90	3.10	3.45	4.15	5.05	5.05	6.65	3.65	2.55	3.60	3.60	4.00	4.80	4.95
	logistic W-LR	0.05	0.05	0.05	0.40	1.25	3.45	7.00	0.05	0.05	0.05	0.25	1.05	2.40	5.00



1. 10. Interaction AB - A and B significant (a_i = 0.4*s b_j = 0.4*s) small n_i ~ small p_i and small n_i ~ large p_i

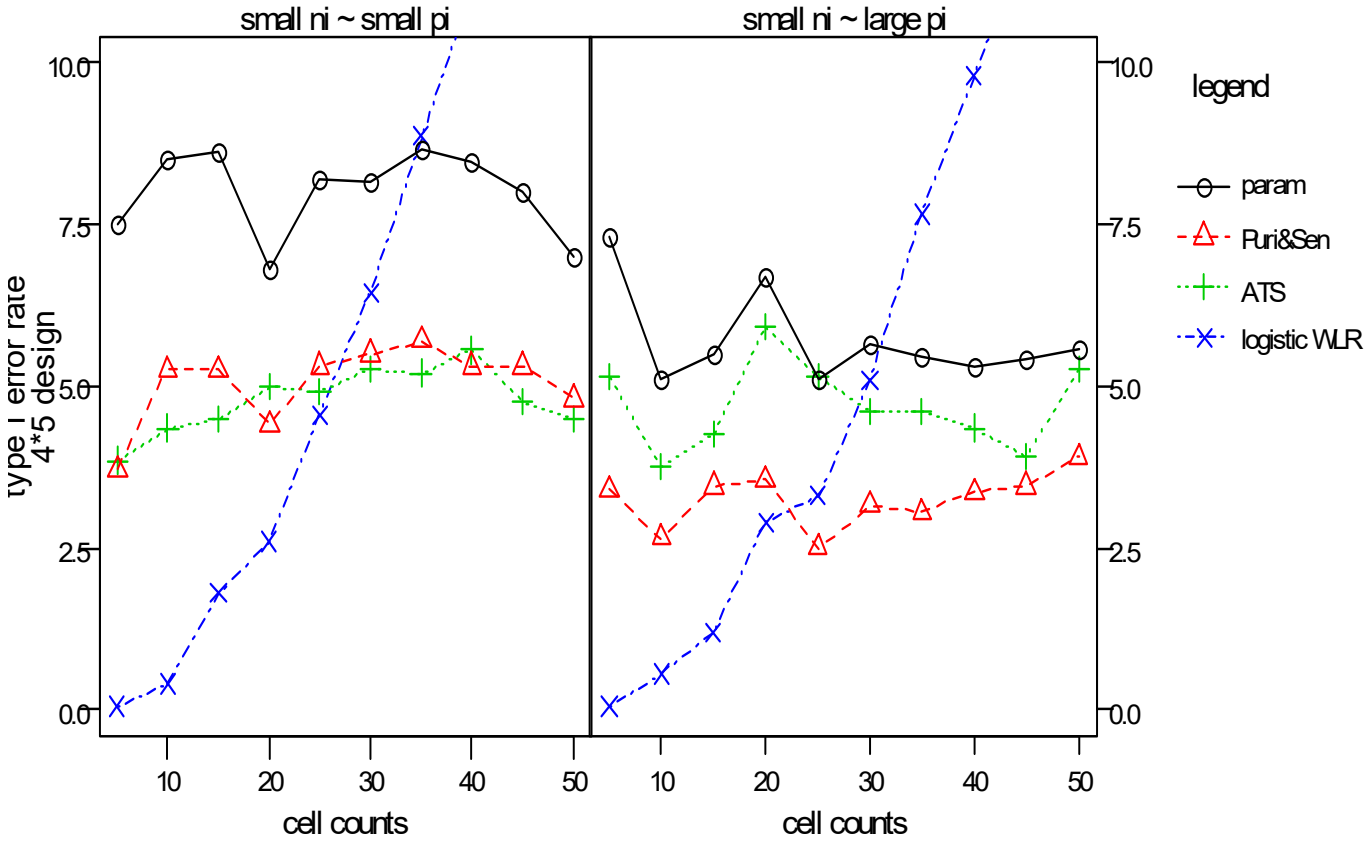
1. 10. 1 p = 0.6

		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	4.2	3.95	4.15	4.30	5.10	4.2	4.85	4.7	6.45	5.10	4.75	5.30	5.75	5.10
	Puri & Sen	1.6	2.15	2.20	2.45	3.15	2.6	3.05	1.6	2.45	2.85	2.65	2.95	2.90	2.75
	ATS	4.4	4.05	4.40	4.85	4.95	5.0	4.75	4.3	4.85	5.00	4.65	5.10	5.35	5.20
	logistic W-LR	0.2	1.95	3.55	3.90	5.25	5.6	5.05	0.3	2.05	3.30	4.10	4.60	5.50	5.50



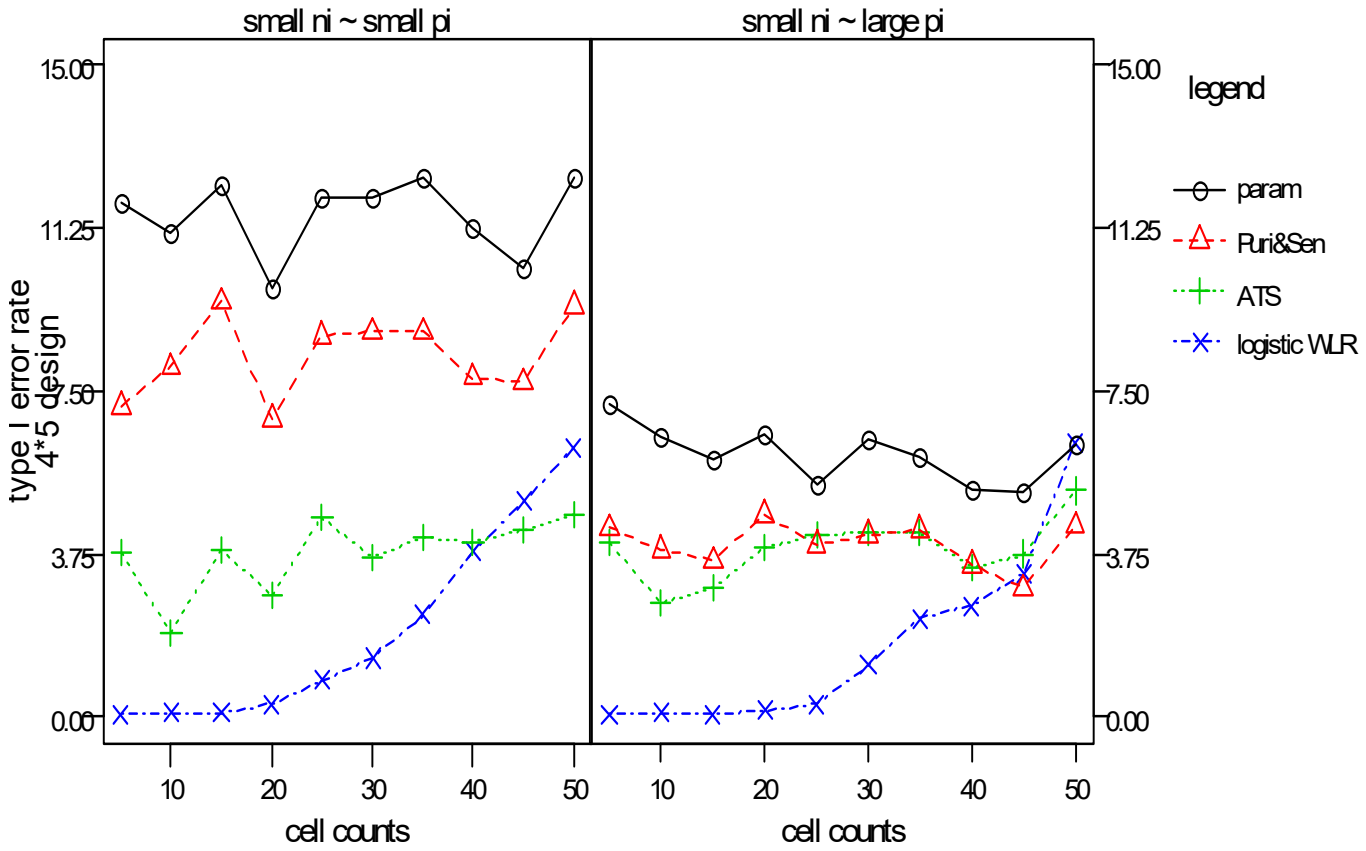
1. 10. 2 p = 0.8

		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	7.50	8.50	8.60	6.8	8.15	8.45	7.0	7.30	5.10	5.50	6.70	5.65	5.30	5.55
	Puri & Sen	3.70	5.25	5.25	4.4	5.50	5.30	4.8	3.40	2.65	3.45	3.55	3.15	3.35	3.90
	ATS	3.85	4.35	4.50	5.0	5.25	5.55	4.5	5.15	3.75	4.25	5.90	4.60	4.35	5.25
	logistic W-LR	0.05	0.40	1.80	2.6	6.45	11.15	15.1	0.05	0.55	1.20	2.90	5.10	9.80	16.10



1. 10. 3 p = 0.9

		unequal cell counts small n_i ~ small p_i							unequal cell counts small n_i ~ large p_i						
design	method	5	10	15	20	30	40	50	5	10	15	20	30	40	50
4*5	parametric	11.80	11.10	12.20	9.85	11.95	11.25	12.40	7.20	6.45	5.90	6.50	6.40	5.20	6.25
	Puri & Sen	7.15	8.05	9.55	6.85	8.85	7.80	9.45	4.35	3.85	3.60	4.65	4.20	3.50	4.40
	ATS	3.80	1.95	3.85	2.80	3.65	4.00	4.65	4.00	2.60	2.95	3.90	4.25	3.45	5.20
	logistic W-LR	0.05	0.10	0.10	0.30	1.35	3.80	6.20	0.05	0.10	0.05	0.15	1.20	2.55	6.30



1. 11. Summary of error rates for *p*=0.9

Maximum smoothed type I error rates for all methods in all situations, partitioned for designs

- with small and large number of cells,
- with positively correlated and negatively correlated n_i and p_i ,
- with equal and unequal cell counts

effect model	parametric		Puri & Sen		ATS		logistic	
	small	large	small	large	small	large	small	large
A	5.41	5.50	5.94	5.27	5.29	5.27	3.94	4.04
B (A sig, n_i and p_i indep)	5.62	5.31	3.66	3.45	4.62	5.10	4.37	6.54
A (AB sig)	5.95	5.42	4.82	3.96	5.62	4.80	25.65	12.31
AB	5.52	5.59	5.67	5.36	5.17	4.84	4.12	3.52
AB (A sig, n_i and p_i indep)	6.00	9.09	3.98	5.60	3.34	5.44	0.10	0.29
AB (A sig, B sig)	7.12	8.45	5.50	5.84	5.85	5.80	4.65	5.09
	$n_i \sim p_i$	$n_i \mid p_i$	$n_i \sim p_i$	$n_i \mid p_i$	$n_i \sim p_i$	$n_i \mid p_i$	$n_i \sim p_i$	$n_i \mid p_i$
B (A sig, n_i and p_i dep)	10.94	3.24	7.07	1.75	4.74	4.67	6.04	4.41
AB (A sig, n_i and p_i dep)	14.90	5.29	9.18	2.84	4.15	4.24	0.22	0.12
	equal	unequal	equal	unequal	equal	unequal	equal	unequal
A	5.29	5.50	5.27	5.94	5.27	5.29	4.04	3.80
B (A sig, n_i and p_i indep)	5.62	5.28	3.66	2.94	5.10	4.62	6.54	5.61
A (AB sig)	5.42	5.95	4.35	4.82	4.89	5.62	12.93	25.65
AB	5.52	5.59	5.45	5.67	5.17	4.33	4.12	2.77
AB (A sig, n_i and p_i indep)	8.94	9.09	5.60	5.23	5.41	5.44	0.29	0.27
AB (A sig, B sig)	7.12	8.45	5.50	5.84	5.85	5.80	4.65	5.09