

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

## Appendix B 2

### Tables and Graphs of the Power of selected methods in relation to $n_{ij}$ (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.

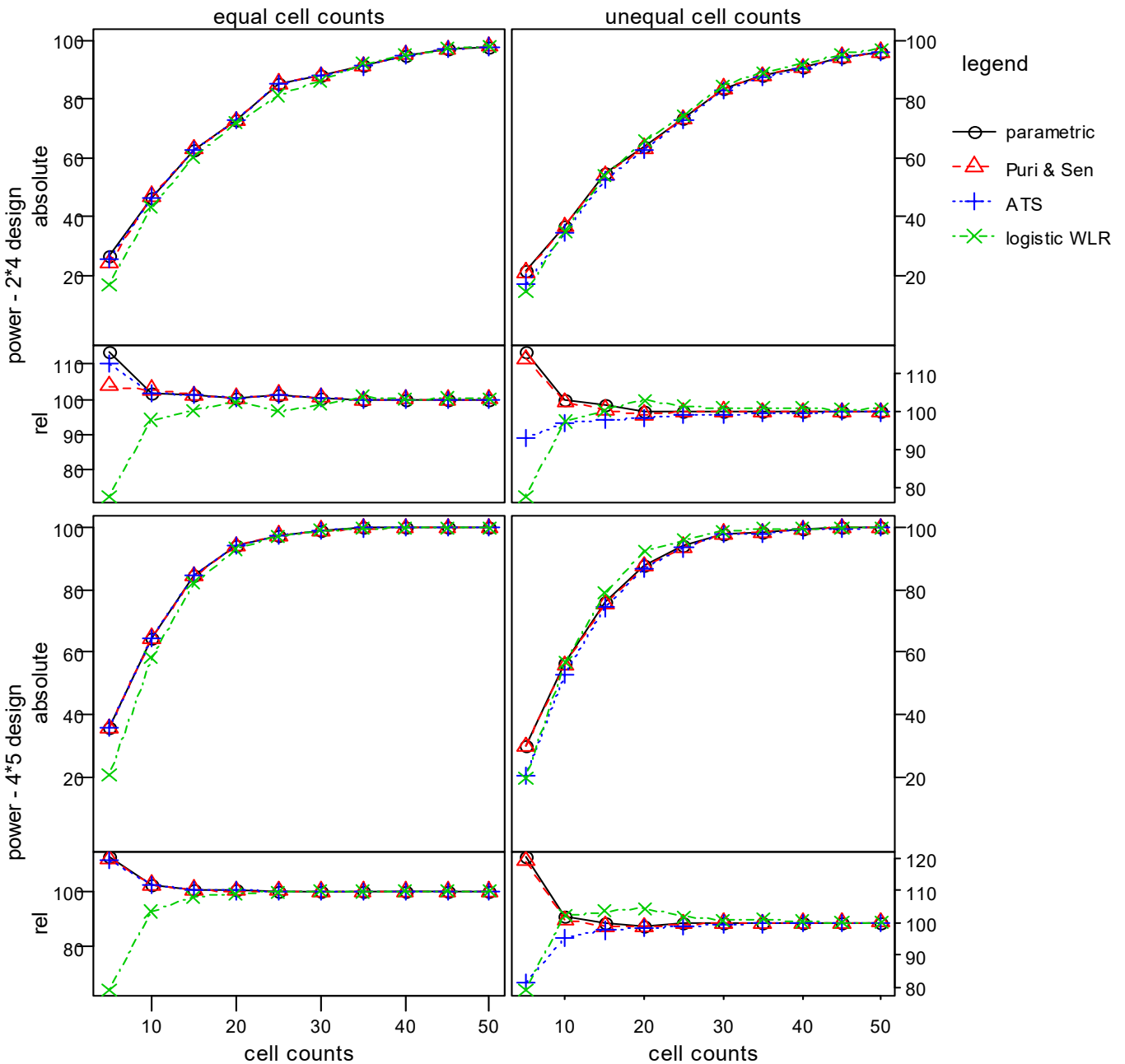
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## 2. 1. Main effect A (effects $a_i = 0.4*s$ )

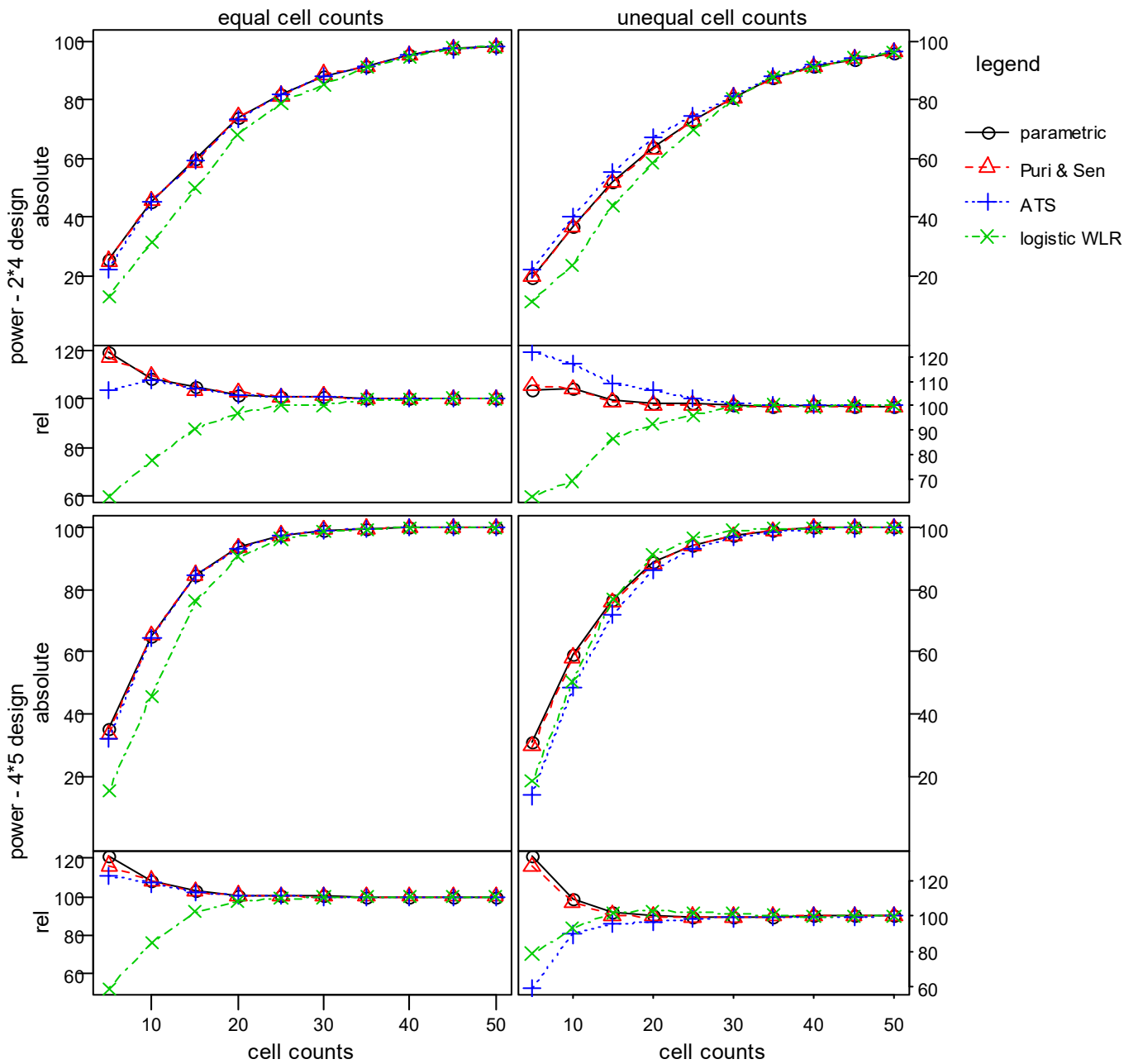
### 2. 1. 1 $p = 0.5$

design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	26.25	46.50	62.85	72.60	87.85	95.05	97.90	21.40	36.80	54.55	63.85	83.70	90.80	96.00
	Puri & Sen	23.95	46.95	62.85	72.60	87.85	95.05	97.90	21.00	36.55	53.95	63.30	83.65	90.70	96.00
	ATS	25.45	46.50	62.85	72.60	87.85	95.05	97.90	17.15	34.60	52.45	62.65	82.80	90.40	95.95
	logistic W-LR	16.65	43.05	60.15	71.90	86.10	94.95	98.00	14.30	34.70	53.90	65.70	84.45	91.75	96.80
4*5	parametric	35.90	64.45	84.55	94.25	99.10	99.95	99.95	30.00	56.55	76.10	87.80	98.10	99.30	99.95
	Puri & Sen	35.60	64.45	84.35	94.15	99.10	99.95	99.95	29.65	55.85	75.35	87.50	98.00	99.30	99.95
	ATS	35.55	64.40	84.55	94.20	99.10	99.95	99.95	20.30	52.90	74.30	87.00	97.75	99.30	99.90
	logistic W-LR	20.45	58.30	82.15	93.15	99.10	99.95	99.95	19.70	56.55	78.90	92.45	98.80	99.75	99.95



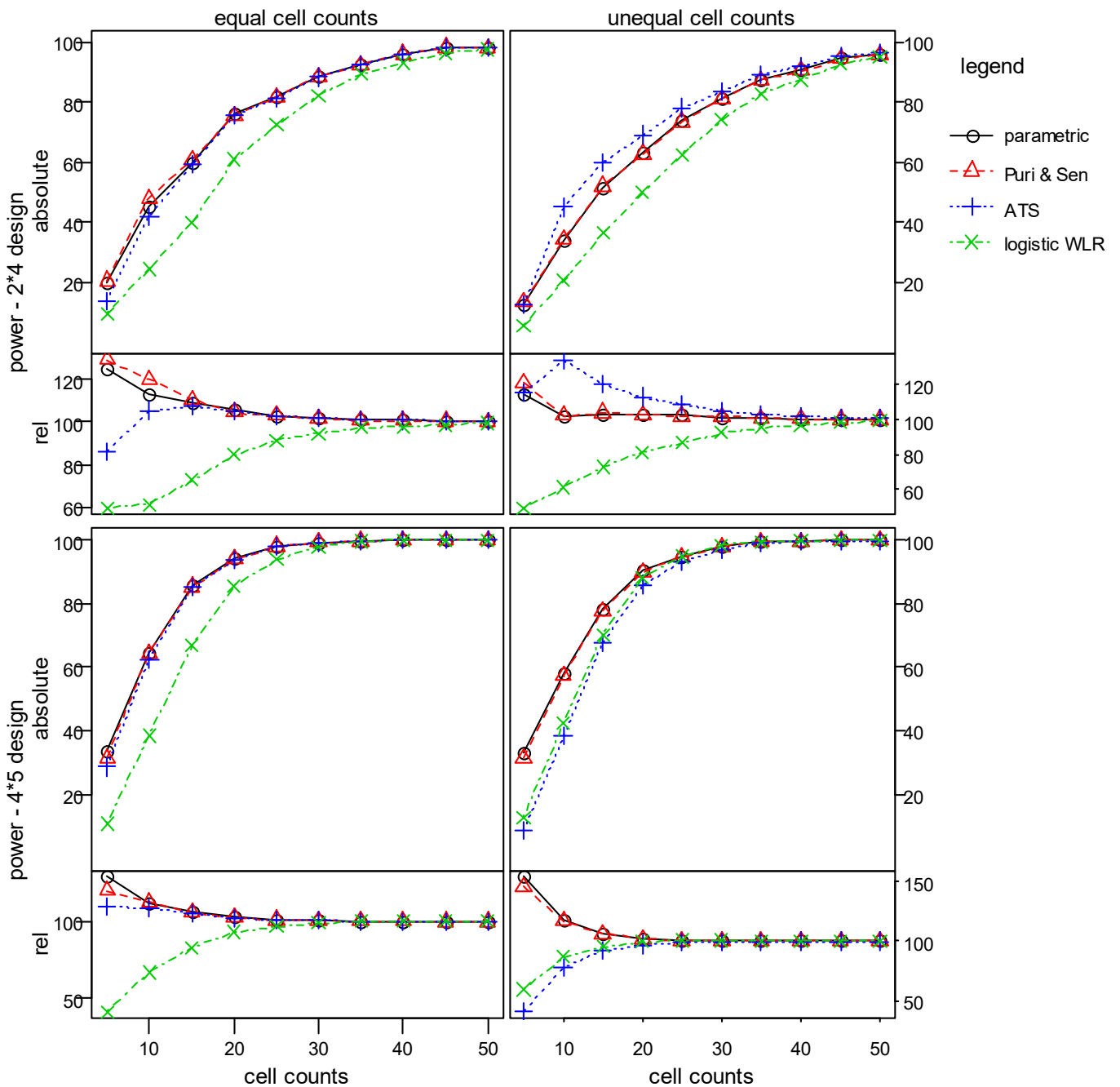
**2. 1. 2**      **p = 0.8**

design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	25.35	45.05	59.55	73.65	88.30	95.20	98.00	19.05	36.40	51.90	63.50	80.70	91.40	96.05
	Puri & Sen	24.85	45.55	58.65	74.35	88.55	95.10	98.00	19.35	36.45	51.60	63.20	80.65	91.20	96.10
	ATS	22.00	44.95	59.25	73.50	88.25	95.20	98.00	21.85	39.90	55.35	66.95	81.40	92.00	96.70
	logistic W-LR	12.70	31.10	49.85	68.10	85.15	94.65	98.00	11.20	23.55	43.90	58.25	80.15	91.10	96.35
4*5	parametric	35.00	65.10	84.90	93.45	99.25	99.90	99.95	30.95	59.00	76.80	88.80	97.40	99.85	99.90
	Puri & Sen	33.50	65.15	84.75	93.40	99.20	99.90	99.95	29.55	58.05	75.85	88.45	97.35	99.85	99.90
	ATS	31.95	64.25	84.70	93.30	99.20	99.90	99.95	13.65	48.45	72.15	86.05	96.75	99.75	99.95
	logistic W-LR	15.05	45.70	76.30	90.60	98.70	99.90	99.95	18.25	50.40	76.85	91.15	99.00	99.75	99.95



**2. 1. 3**      **p = 0.9**

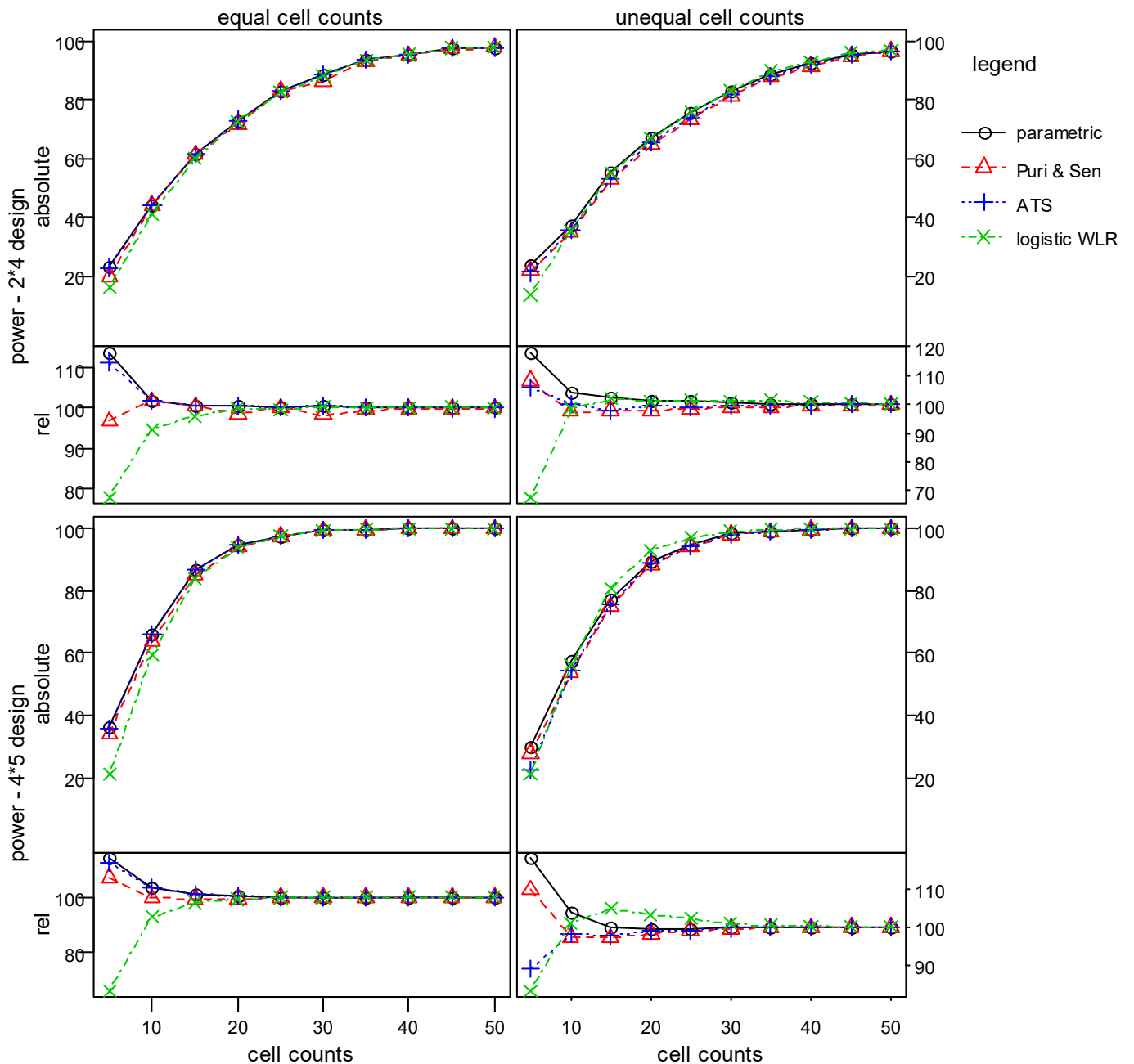
design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	19.60	45.00	59.85	76.10	88.50	96.10	98.10	12.40	34.00	51.45	62.95	81.00	90.60	95.95
	Puri & Sen	20.30	47.80	60.70	75.45	88.45	96.05	98.10	13.15	34.20	51.85	62.65	81.05	90.55	95.85
	ATS	13.50	41.95	59.15	75.80	88.35	96.10	98.10	12.50	44.85	59.95	69.10	83.35	92.15	96.65
	logistic W-LR	9.30	24.25	39.80	60.90	82.30	93.05	97.65	5.35	20.50	36.35	49.85	74.00	87.50	95.20
4*5	parametric	33.70	64.30	85.60	94.05	99.20	99.95	99.95	33.15	58.00	78.30	90.25	97.90	99.45	99.90
	Puri & Sen	31.25	64.35	85.30	93.95	99.20	99.95	99.95	31.20	57.30	77.55	89.85	97.70	99.45	99.90
	ATS	28.55	62.25	85.15	93.80	99.20	99.95	99.95	8.60	38.35	67.65	85.95	96.70	99.35	99.75
	logistic W-LR	10.75	38.35	67.00	85.50	97.70	99.85	99.95	12.70	42.45	70.15	88.30	98.30	99.70	99.95



## 2. 2. Main effect A - B significant (effects $a_i = 0.4*s$ $b_j = 0.4*s$ )

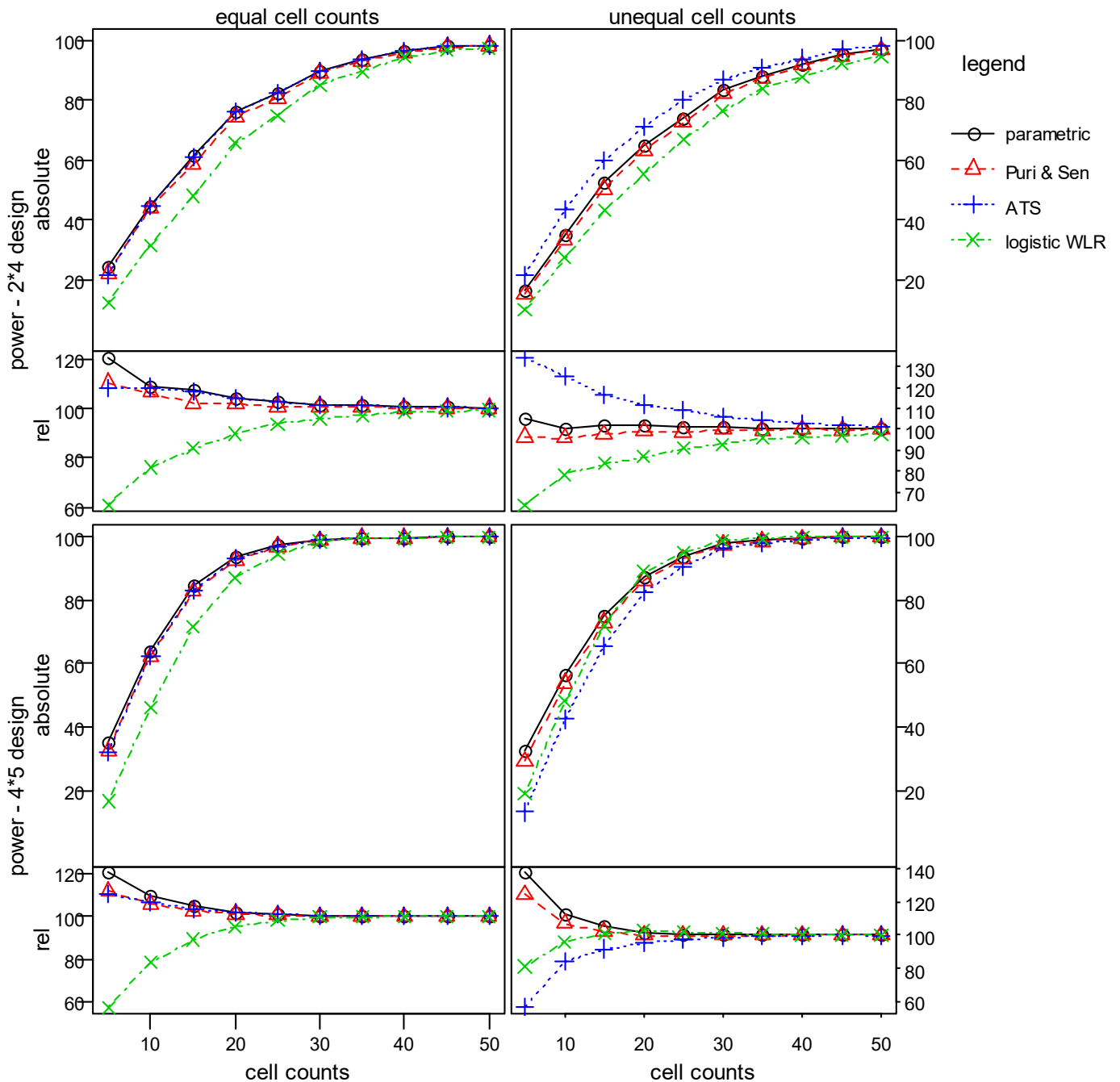
### 2. 2. 1 $p = 0.5$

design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	23.30	44.00	61.55	73.05	88.55	95.40	97.90	23.60	37.25	55.10	66.95	82.75	92.30	96.75
	Puri & Sen	19.80	44.00	61.40	71.60	86.50	95.10	97.85	21.60	34.90	52.70	64.55	81.30	91.50	96.45
	ATS	22.80	44.00	61.55	73.05	88.55	95.40	97.90	21.15	35.75	52.80	65.60	81.80	91.75	96.65
	logistic W-LR	15.95	40.95	59.95	72.55	88.25	95.35	97.90	13.50	35.25	54.90	66.70	83.20	92.90	96.80
4*5	parametric	36.30	66.10	86.70	94.95	99.45	99.95	99.95	29.90	57.40	76.95	89.45	98.30	99.65	99.95
	Puri & Sen	34.00	63.55	85.15	93.90	99.30	99.95	99.95	27.75	53.90	74.85	88.45	97.95	99.55	99.95
	ATS	35.70	65.95	86.60	94.95	99.45	99.95	99.95	22.50	54.30	75.35	89.15	98.10	99.70	99.95
	logistic W-LR	21.00	59.20	83.95	93.80	99.35	99.95	99.95	21.05	56.00	80.70	92.95	99.25	99.90	99.95



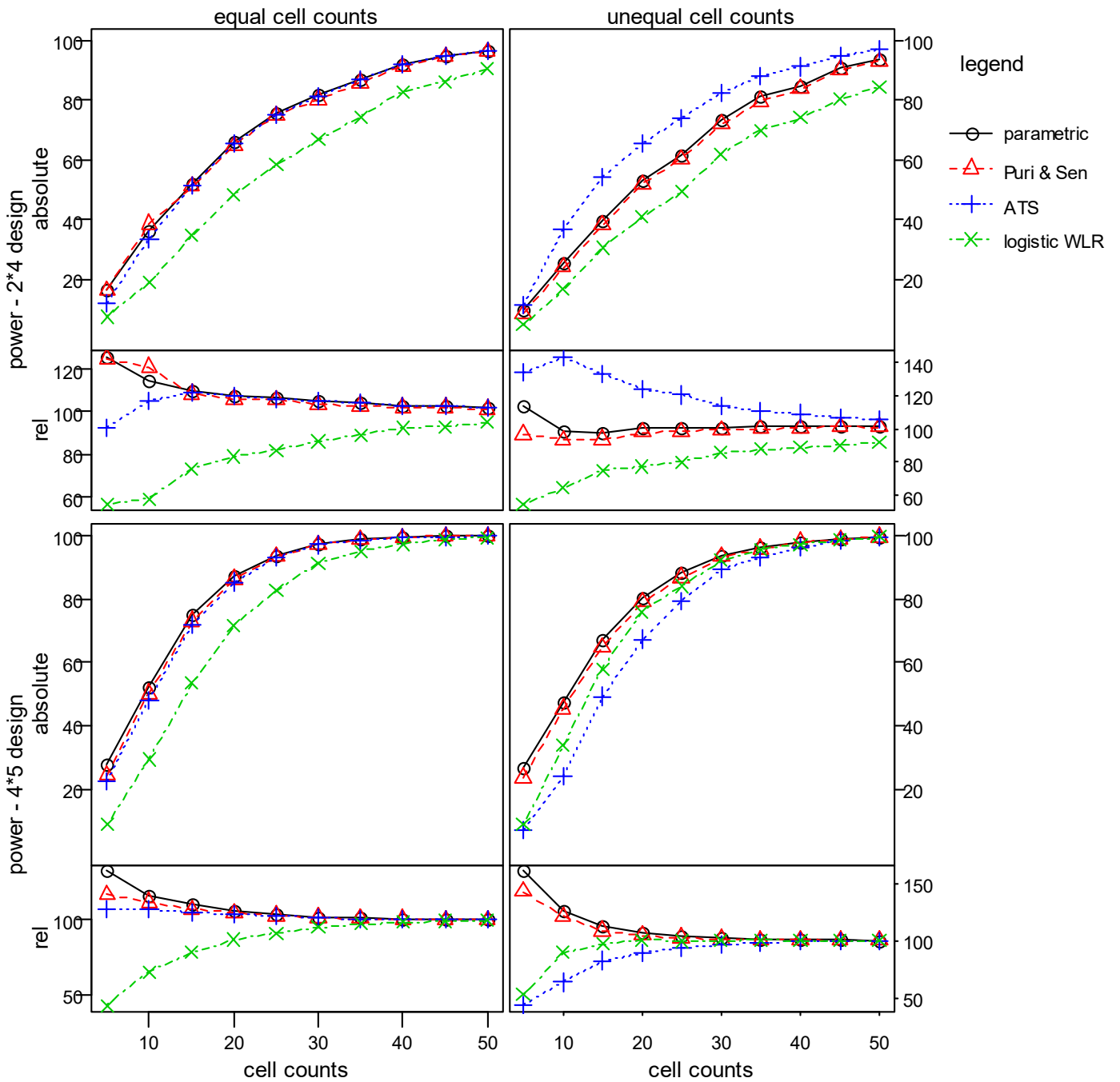
**2. 2. 2**      **p = 0.8**

design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	24.20	44.75	61.25	76.10	89.95	96.40	98.45	16.50	35.05	52.55	64.80	83.40	92.10	97.30
	Puri & Sen	22.10	43.75	58.40	74.50	89.20	95.85	98.35	15.15	33.35	50.35	63.00	82.05	91.60	96.85
	ATS	21.65	44.60	61.00	75.95	89.90	96.35	98.45	21.15	43.60	59.85	71.25	86.85	93.95	97.95
	logistic W-LR	12.20	31.30	47.95	65.60	84.95	94.45	97.55	10.00	27.25	43.05	55.30	76.35	87.85	94.55
4*5	parametric	35.05	64.15	84.45	93.50	99.15	99.75	99.95	32.45	56.70	75.15	87.55	97.80	99.50	99.95
	Puri & Sen	32.40	62.15	82.70	92.70	98.90	99.65	99.95	29.25	53.75	72.90	86.25	97.40	99.45	99.90
	ATS	32.05	62.55	83.15	93.00	98.95	99.70	99.95	13.15	42.40	65.40	82.35	96.25	99.20	99.80
	logistic W-LR	16.60	45.90	71.80	87.25	98.45	99.50	99.95	19.00	48.20	71.90	89.15	98.75	99.85	99.95



**2. 2. 3**      **p = 0.9**

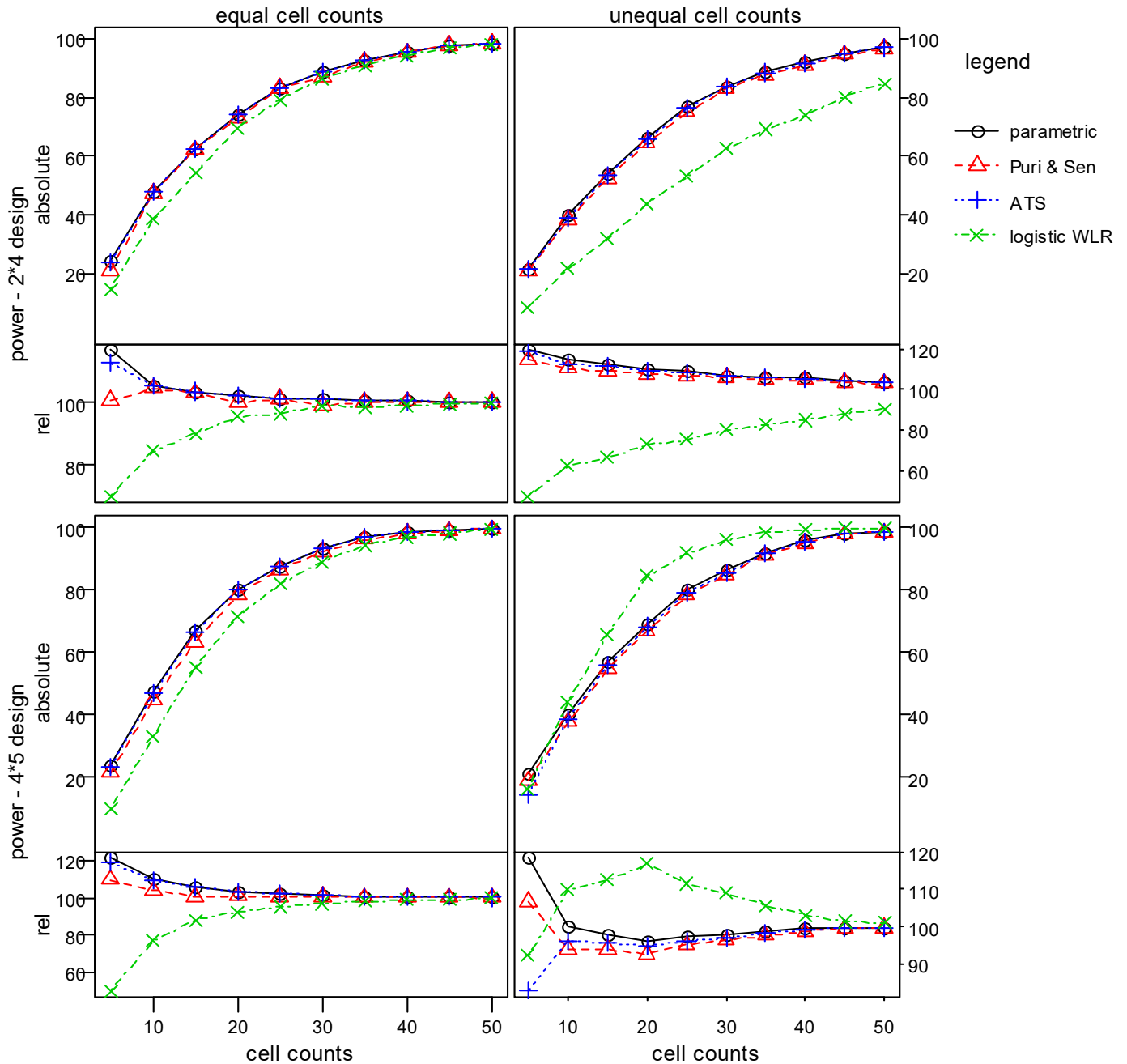
design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	16.25	36.35	51.70	65.80	81.60	91.90	96.70	9.75	25.25	39.75	52.90	73.15	84.70	93.75
	Puri & Sen	16.10	38.30	50.95	64.70	80.10	91.35	96.25	8.25	23.90	38.00	51.75	71.90	83.75	93.05
	ATS	11.95	33.40	51.25	65.45	81.35	91.75	96.65	11.45	36.85	53.95	65.65	82.55	91.15	97.05
	logistic W-LR	7.30	18.70	34.50	48.30	66.75	82.75	90.45	4.65	16.50	30.40	40.80	61.95	74.00	84.55
4*5	parametric	27.60	52.10	75.30	87.15	97.55	99.50	99.95	26.55	47.35	66.85	80.55	93.80	98.20	99.75
	Puri & Sen	24.25	50.10	72.90	86.20	97.25	99.45	99.95	23.50	45.45	64.75	79.00	93.35	98.00	99.70
	ATS	22.30	47.95	71.75	85.40	97.15	99.35	99.90	7.05	23.90	49.25	67.35	89.50	96.55	99.35
	logistic W-LR	8.85	29.30	53.50	71.75	91.35	97.45	99.45	8.70	33.75	57.95	75.95	92.35	97.35	99.65



### 2. 3. Main effect A - AB significant (effects $a_i = 0.4*s$ $ab_{ij} = 0.4*s$ )

#### 2. 3. 1 $p = 0.5$

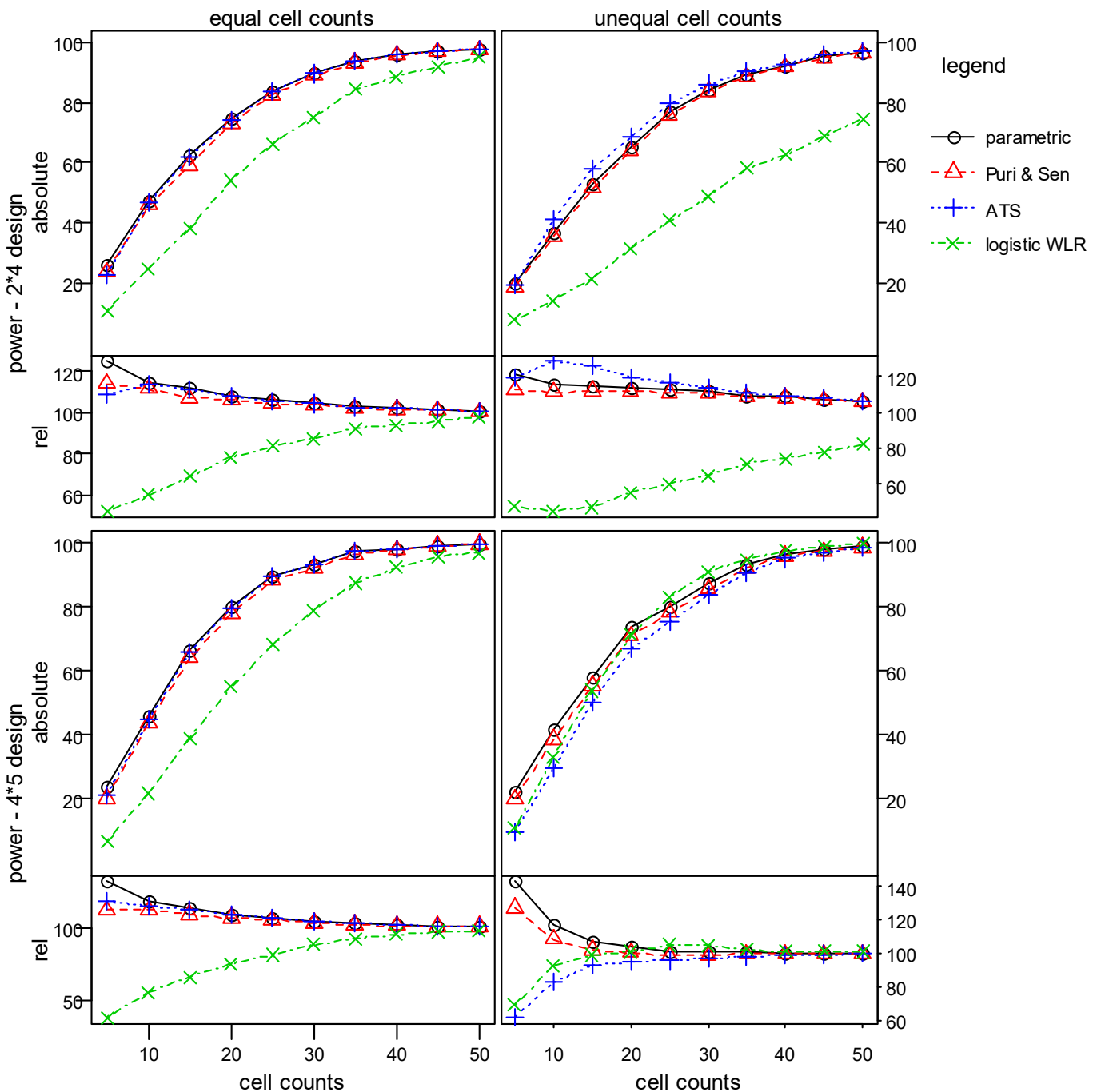
design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	24.50	47.95	62.4	74.40	88.55	95.30	98.25	21.75	40.10	53.80	66.30	83.80	91.90	96.90
	Puri & Sen	21.15	47.50	62.2	72.80	86.85	95.20	98.20	20.85	38.40	52.35	64.65	82.90	91.10	96.70
	ATS	23.70	47.95	62.4	74.40	88.55	95.30	98.25	21.65	39.10	53.40	65.85	83.60	91.40	96.85
	logistic W-LR	14.75	38.50	54.3	69.55	86.55	94.05	97.85	8.60	21.70	31.80	43.90	62.70	73.85	84.70
4*5	parametric	23.75	47.40	66.7	80.30	93.05	98.40	99.70	20.90	40.20	57.15	69.25	86.35	95.85	98.45
	Puri & Sen	21.40	44.60	63.3	78.30	92.30	98.15	99.50	18.80	37.65	54.75	66.80	84.90	94.90	98.35
	ATS	23.20	47.00	66.5	80.25	93.05	98.40	99.70	14.55	38.60	55.80	68.25	85.45	95.40	98.40
	logistic W-LR	9.70	33.15	55.2	71.50	89.00	97.00	99.35	16.25	44.10	65.70	84.50	96.10	99.20	99.85





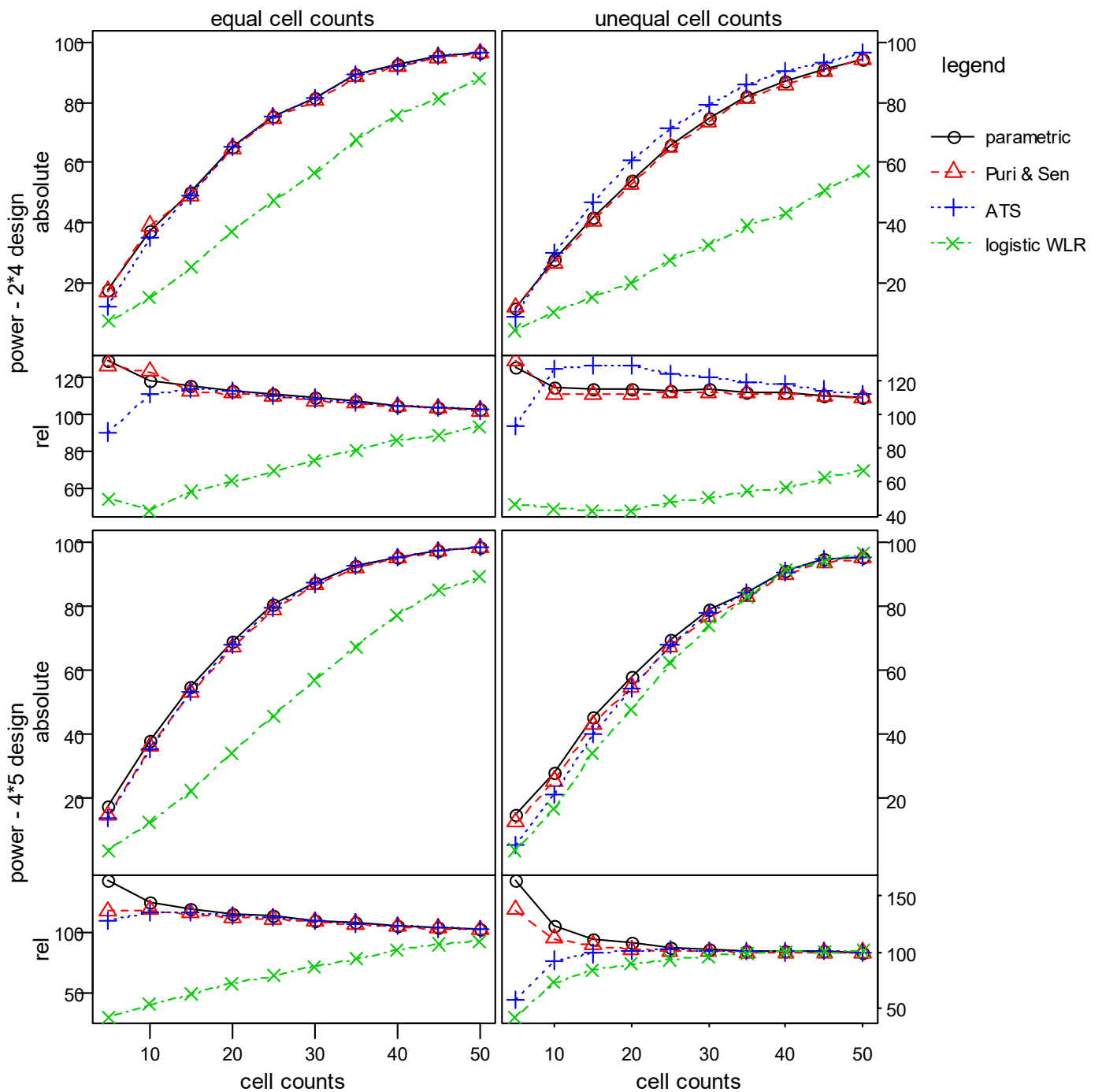
**2.3.2 p = 0.8**

design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	26.05	47.10	62.30	74.55	89.65	96.15	97.85	20.00	37.00	52.80	65.10	84.50	92.30	96.60
	Puri & Sen	23.80	45.95	59.15	73.20	88.95	95.70	97.50	18.60	35.55	51.45	63.85	83.75	91.90	96.35
	ATS	22.70	46.80	61.70	74.40	89.60	96.10	97.85	19.65	41.05	58.00	68.40	86.20	92.90	96.90
	logistic W-LR	10.90	24.75	38.30	54.05	75.15	88.50	95.10	7.80	14.30	21.55	31.60	48.80	62.65	74.65
4*5	parametric	23.85	45.90	66.45	79.90	93.10	98.20	99.70	22.35	41.60	58.20	73.75	87.50	96.45	98.85
	Puri & Sen	20.25	43.60	63.95	77.95	92.30	97.90	99.65	19.85	38.65	55.40	70.90	85.60	96.00	98.60
	ATS	21.35	44.75	65.90	79.60	93.10	98.15	99.70	9.55	29.65	50.35	66.90	83.95	95.15	98.55
	logistic W-LR	6.85	21.65	38.80	54.90	78.95	92.35	96.85	10.75	33.00	53.75	71.25	91.05	97.55	99.65



**2.3.3 p = 0.9**

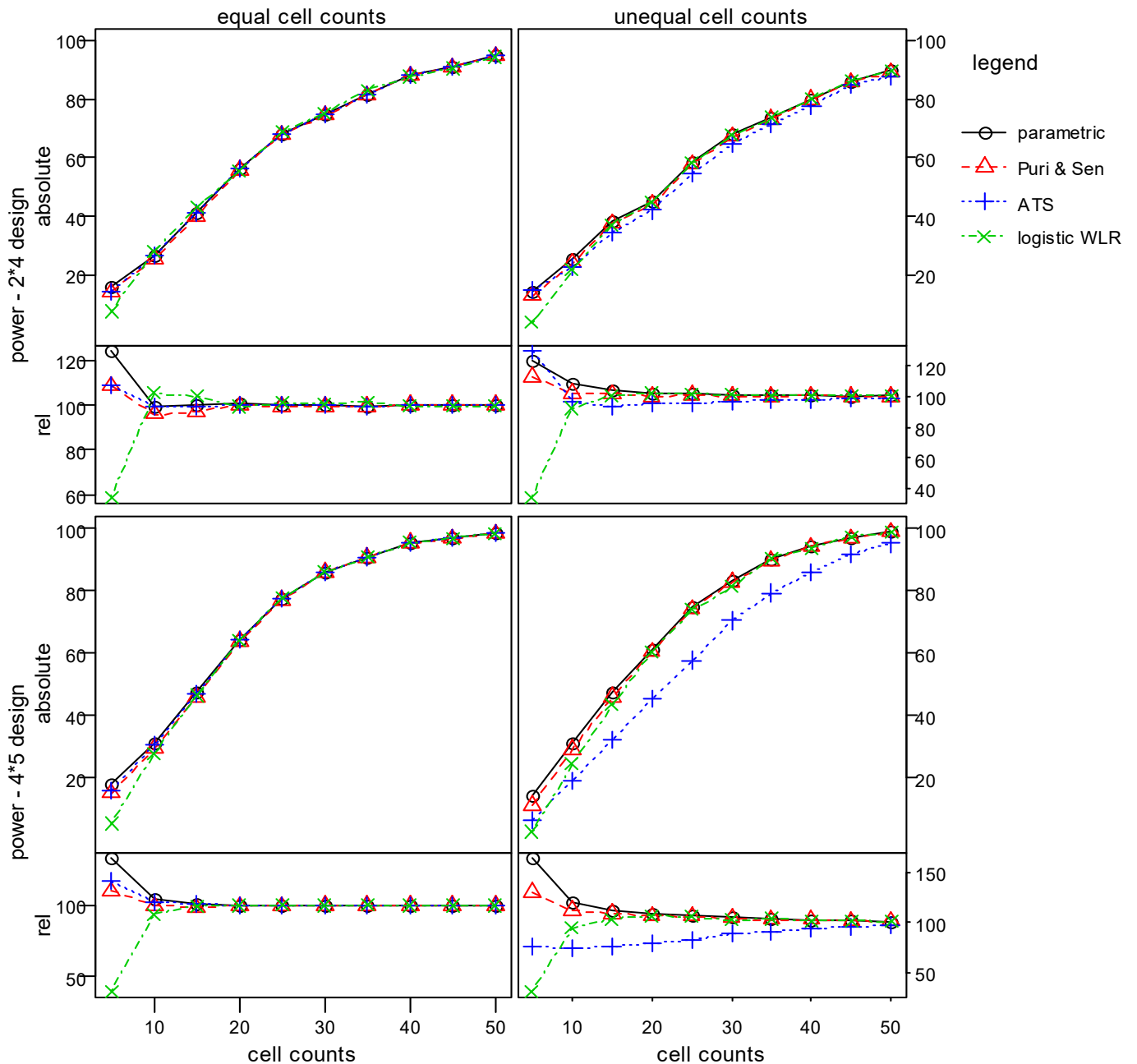
design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	17.45	37.45	50.15	65.45	81.55	92.40	96.65	11.70	27.50	41.70	54.15	74.80	86.90	94.55
	Puri & Sen	17.15	38.95	49.00	64.65	80.55	91.95	96.25	12.05	26.55	40.40	52.80	73.65	86.10	94.10
	ATS	12.25	34.95	49.30	65.35	81.40	92.30	96.60	8.50	30.15	46.65	60.80	79.45	90.50	96.35
	logistic W-LR	7.35	15.10	25.25	37.10	56.40	75.65	88.10	4.25	10.30	15.30	20.00	32.60	42.95	57.05
4*5	parametric	17.70	38.00	54.80	69.10	87.70	95.50	98.60	14.85	27.80	45.55	57.95	79.00	91.00	95.60
	Puri & Sen	14.55	36.15	52.95	67.15	86.65	95.10	98.35	12.45	25.35	43.15	54.90	77.10	89.90	95.10
	ATS	13.60	35.55	53.25	68.15	87.25	95.30	98.60	5.15	20.95	40.20	54.55	77.80	90.90	95.55
	logistic W-LR	3.65	12.30	22.20	34.20	56.90	77.40	89.15	3.75	16.50	34.15	47.90	73.85	91.40	96.65



## 2. 4. Interaction AB (effects $ab_{ij} = 0.4*s$ )

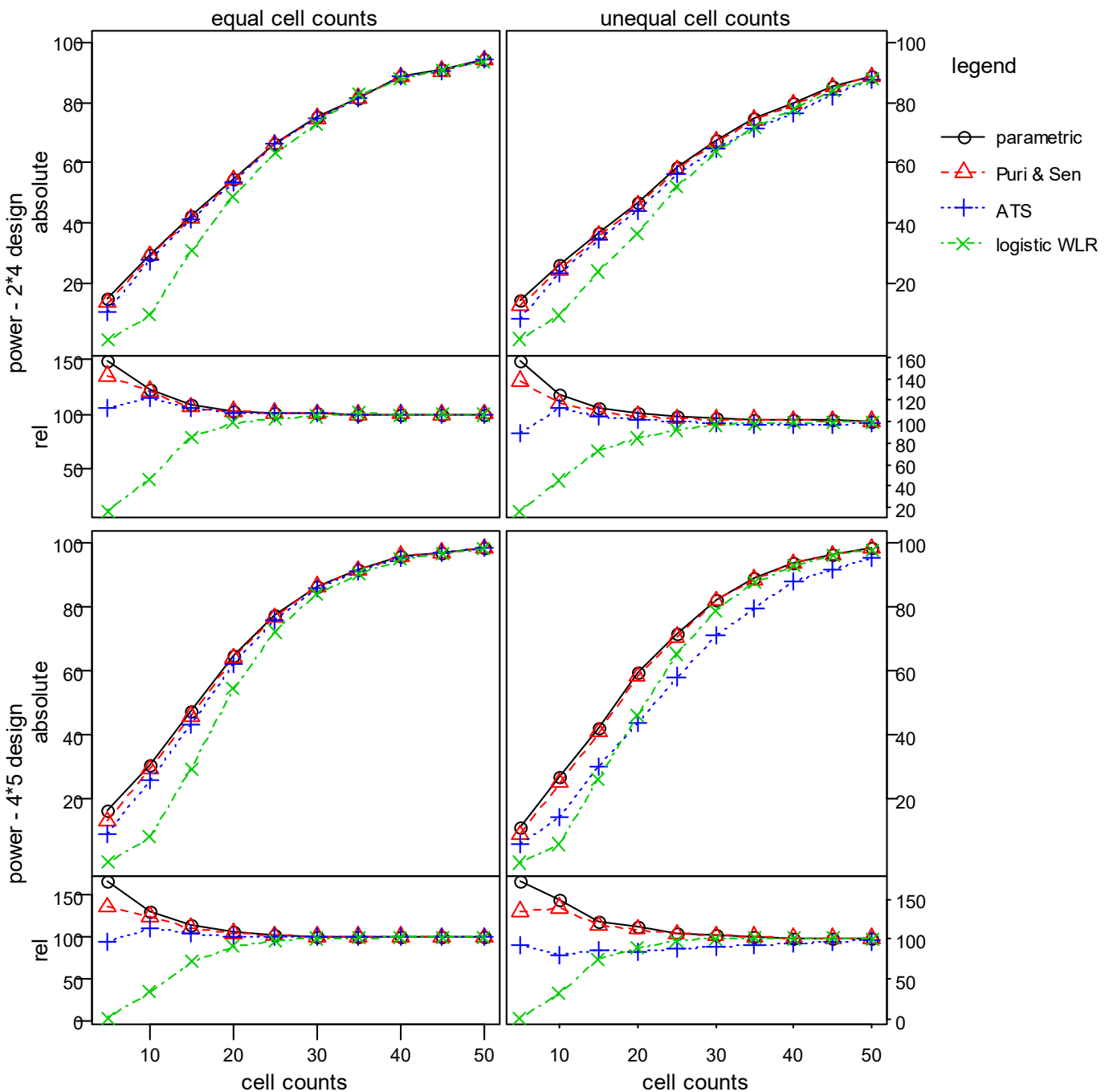
### 2. 4. 1 $p = 0.5$

design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	16.15	26.50	41.25	56.25	74.90	88.05	94.80	14.1	25.65	38.45	44.95	67.80	80.00	89.60
	Puri & Sen	14.15	25.60	40.15	55.90	74.45	88.00	94.75	12.9	24.05	37.60	44.15	67.10	79.75	88.95
	ATS	14.15	26.45	41.05	56.15	74.90	88.05	94.80	14.8	22.70	34.55	42.05	64.70	77.50	87.75
	logistic W-LR	7.65	28.15	43.00	55.65	75.20	87.65	94.30	3.9	21.75	37.15	45.00	67.70	80.00	89.55
4*5	parametric	18.15	30.95	47.25	64.45	86.15	95.60	98.40	14.3	31.15	47.45	61.35	83.35	94.45	98.85
	Puri & Sen	15.00	29.55	46.05	63.90	85.90	95.35	98.40	11.3	29.00	45.90	60.40	82.90	94.20	98.75
	ATS	15.95	30.45	47.05	64.40	86.10	95.55	98.40	6.6	19.10	32.05	45.30	70.40	85.75	95.15
	logistic W-LR	5.40	27.80	46.40	64.25	86.05	95.50	98.40	2.7	24.50	43.40	60.40	81.35	93.55	98.65



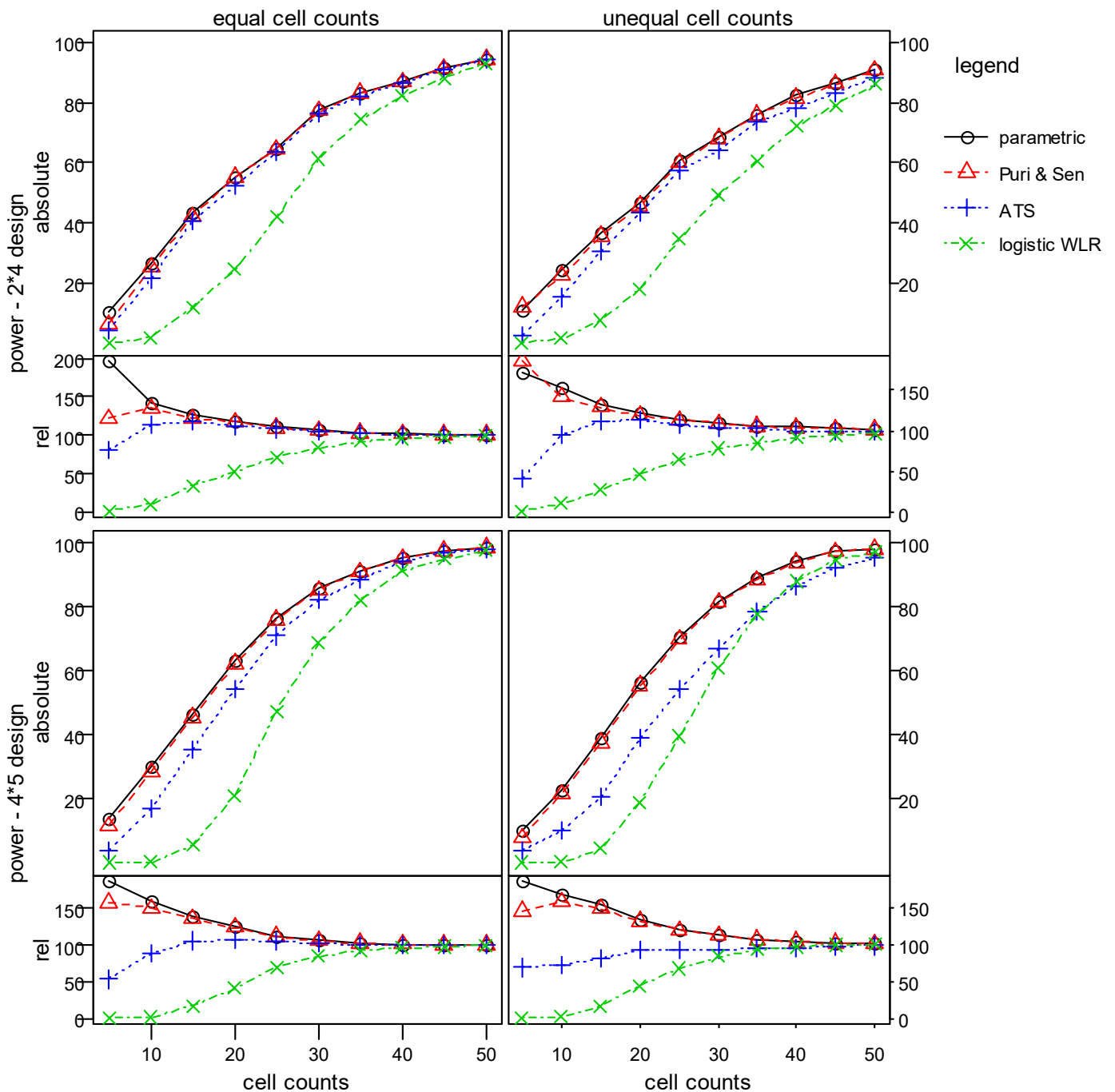
**2.4.2 p = 0.8**

design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	14.75	29.60	42.35	54.50	75.15	88.65	94.20	14.40	25.95	36.90	46.75	67.50	79.80	88.90
	Puri & Sen	13.45	29.15	41.50	54.30	74.85	88.60	94.05	12.75	24.30	35.85	45.75	66.95	79.45	88.60
	ATS	10.45	27.50	41.30	53.60	74.85	88.60	94.15	8.20	23.40	34.70	44.15	64.75	76.70	87.40
	logistic W-LR	1.05	9.60	30.80	48.75	72.90	87.75	93.60	1.50	9.35	23.90	36.65	63.80	77.80	87.85
4*5	parametric	16.15	30.80	47.40	65.00	86.60	95.95	98.45	11.25	26.75	42.15	59.80	82.45	93.80	98.40
	Puri & Sen	13.15	29.45	46.00	64.20	86.45	95.90	98.40	8.80	25.05	40.85	58.45	82.00	93.55	98.20
	ATS	9.20	26.05	43.50	62.05	85.95	95.50	98.40	6.00	14.40	30.05	43.90	71.25	87.90	95.45
	logistic W-LR	0.30	8.25	29.40	54.45	84.20	95.00	98.15	0.10	5.85	26.30	46.25	78.90	92.95	97.95



### 2.4.3 $p = 0.9$

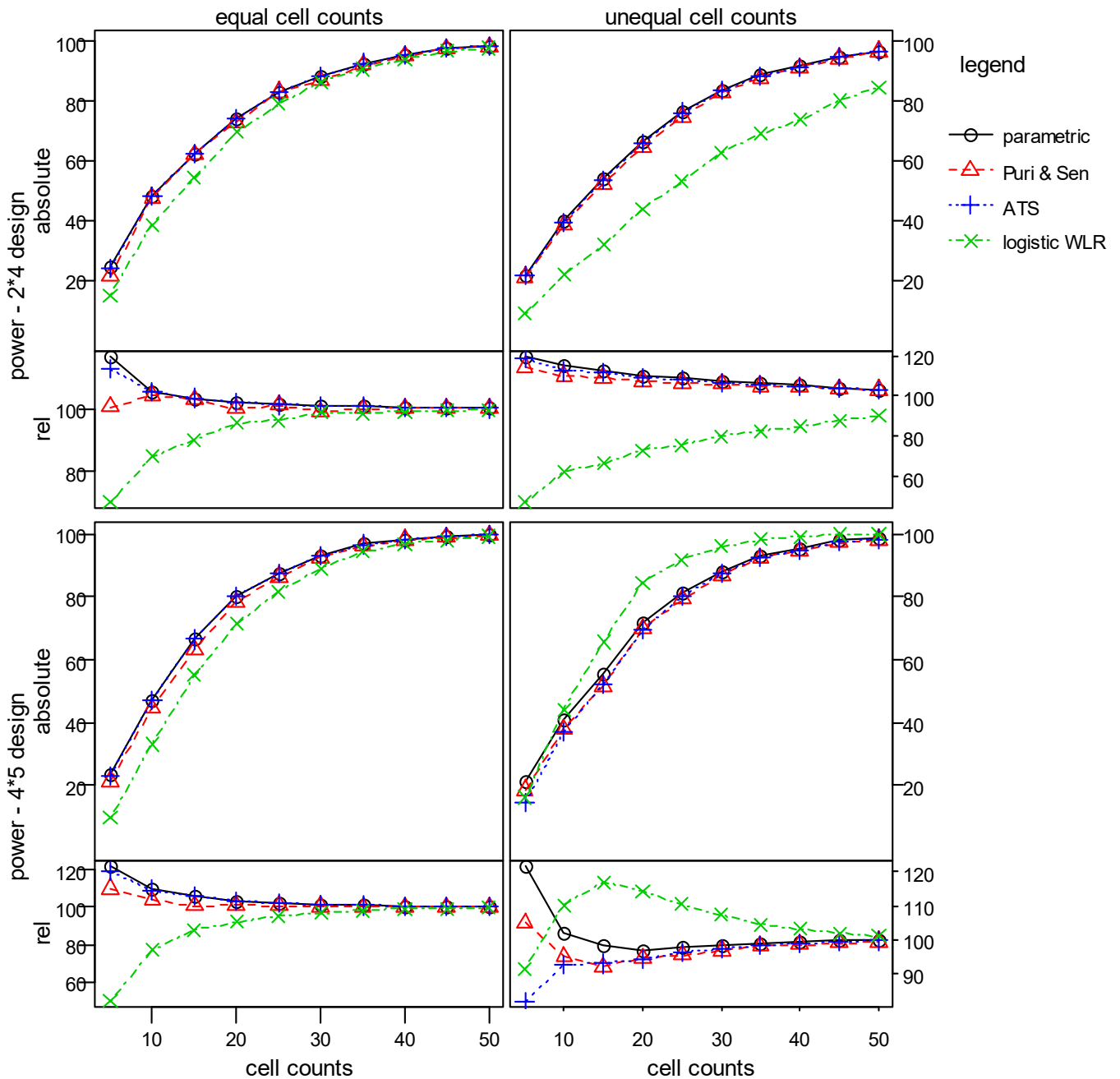
design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	10.40	26.50	43.50	55.15	77.60	87.00	94.60	11.20	24.15	36.75	46.90	68.60	82.35	90.90
	Puri & Sen	6.45	25.35	42.05	55.20	77.25	86.75	94.40	12.10	22.45	35.65	45.75	68.05	81.50	90.65
	ATS	4.30	21.35	40.45	52.55	76.40	86.25	94.35	2.75	15.20	30.75	43.65	64.15	77.95	88.20
	logistic W-LR	0.05	1.90	11.85	24.55	61.30	82.15	93.05	0.10	1.75	7.60	18.05	49.20	72.05	86.20
4*5	parametric	13.70	30.10	46.65	63.05	85.70	95.35	98.50	9.95	22.90	39.25	56.35	81.90	94.15	98.15
	Puri & Sen	11.55	28.45	45.45	62.35	85.30	95.30	98.50	7.80	21.50	37.60	55.35	81.40	93.95	98.15
	ATS	3.90	16.85	35.30	54.35	82.25	94.50	98.20	3.70	9.95	20.45	38.90	67.15	86.45	95.35
	logistic W-LR	0.05	0.30	5.55	21.00	68.65	91.25	97.55	0.05	0.35	4.45	18.80	60.90	88.00	97.10



## 2.5. Interaction AB - A significant (effects $ab_{ij} = 0.4*s$ $a_i = 0.4*s$ )

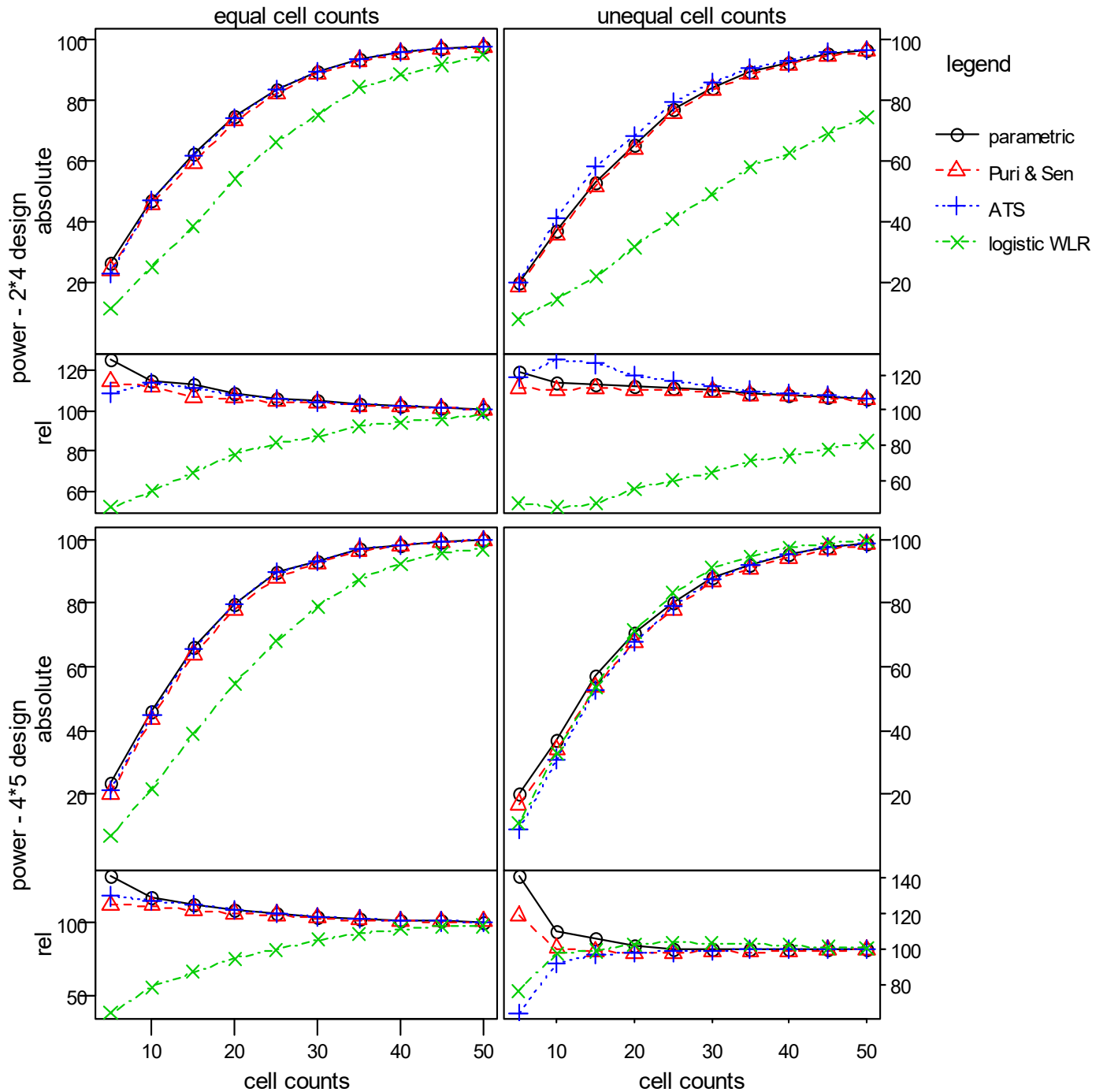
### 2.5.1 $p = 0.5$

design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	17.15	30.60	42.55	57.55	76.20	88.35	95.10	11.70	25.05	38.95	48.90	69.15	80.25	91.10
	Puri & Sen	13.95	26.95	38.15	54.45	73.25	87.40	94.35	9.15	22.05	35.55	45.60	66.85	78.45	89.20
	ATS	14.70	30.00	42.15	57.40	76.15	88.35	95.10	13.20	22.85	37.60	46.45	67.50	78.85	89.45
	logistic W-LR	6.35	29.90	44.50	57.60	77.45	89.15	94.75	2.80	18.25	36.00	47.75	69.15	80.55	91.05
4*5	parametric	19.45	37.50	57.80	75.85	93.45	98.65	99.85	16.80	36.05	55.60	72.10	90.25	97.85	99.80
	Puri & Sen	14.80	32.85	53.50	73.50	92.15	98.25	99.80	11.25	30.60	50.50	68.10	88.30	97.40	99.60
	ATS	16.35	36.90	57.45	75.70	93.35	98.60	99.85	6.25	22.40	38.60	55.20	80.15	93.75	98.50
	logistic W-LR	4.75	33.00	57.05	75.50	93.40	98.60	99.85	2.90	27.20	52.00	70.75	90.20	97.85	99.75



**2.5.2 p = 0.8**

design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	14.70	29.75	43.05	58.60	77.40	88.85	95.55	10.90	22.20	32.85	43.70	66.40	79.65	89.15
	Puri & Sen	11.40	26.50	40.25	55.80	75.00	87.60	94.90	8.85	18.80	30.20	40.30	64.45	77.70	87.65
	ATS	9.15	26.10	41.05	56.80	75.85	87.95	95.25	8.60	21.50	35.65	47.45	71.10	83.85	91.05
	logistic W-LR	0.50	7.35	26.40	46.05	76.55	91.25	97.00	0.90	4.40	15.75	29.50	61.05	81.00	91.35
4*5	parametric	21.10	38.30	59.65	77.00	94.70	98.90	99.65	17.30	37.95	56.45	74.30	91.10	98.50	99.80
	Puri & Sen	16.25	33.85	54.75	73.85	93.25	98.65	99.65	12.80	33.10	52.05	70.45	89.30	97.85	99.60
	ATS	12.65	32.05	54.30	74.05	93.55	98.85	99.65	6.75	17.90	35.75	52.60	77.25	93.60	97.85
	logistic W-LR	0.30	8.75	32.50	62.10	94.30	99.20	99.85	0.15	8.05	31.15	59.80	91.00	99.00	99.95



**2.5.3 p = 0.9**

design	method	equal cell counts							unequal cell counts						
		5	10	15	20	30	40	50	5	10	15	20	30	40	50
2*4	parametric	10.85	21.00	34.90	47.20	66.80	81.95	89.60	9.20	15.00	23.20	30.85	51.55	67.35	81.05
	Puri & Sen	5.45	18.40	30.90	45.05	64.70	80.50	88.40	7.80	13.50	21.00	28.70	49.20	65.25	79.10
	ATS	3.80	15.25	29.30	41.55	62.50	79.25	87.55	3.20	9.85	20.75	32.60	55.55	73.50	86.30
	logistic W-LR	0.05	0.85	5.30	11.10	34.15	61.15	81.05	0.10	0.45	2.30	5.50	19.70	40.45	63.70
4*5	parametric	15.15	28.85	47.40	62.70	86.05	96.15	98.85	14.00	28.10	46.35	62.80	84.80	94.55	98.30
	Puri & Sen	11.15	25.85	43.90	59.35	84.80	95.85	98.55	9.85	23.55	41.30	58.95	82.30	93.30	97.90
	ATS	4.35	17.15	35.05	53.75	82.05	94.90	98.10	4.00	9.35	19.50	35.90	61.60	81.10	91.40
	logistic W-LR	0.05	0.05	2.70	11.80	49.60	82.80	96.05	0.05	0.25	2.65	10.40	45.25	80.50	96.0

