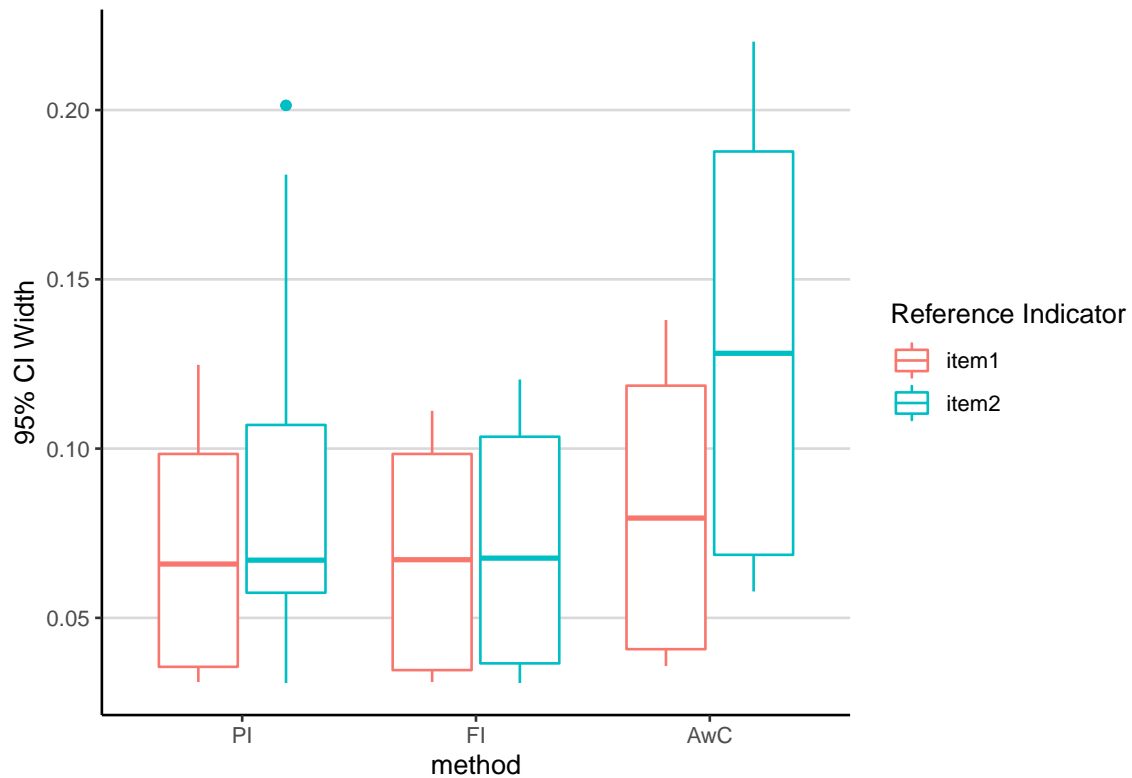
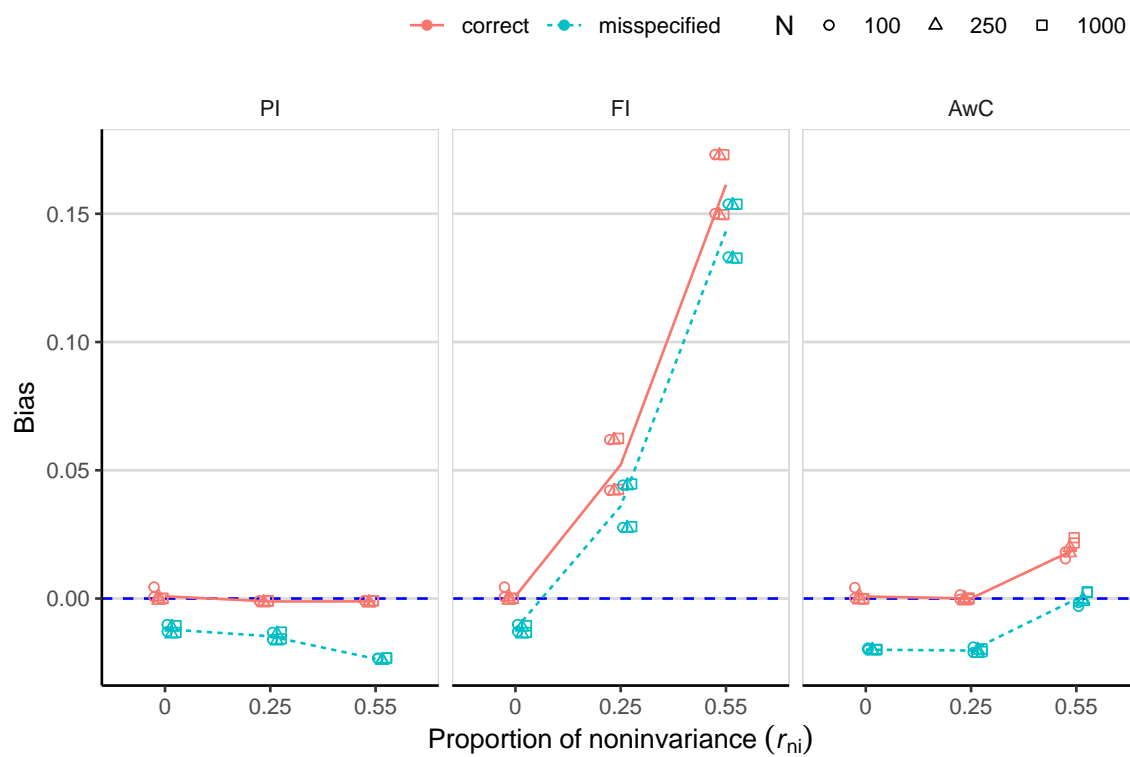


## Supplemental Simulation Results Using Item 2 as Reference Indicator

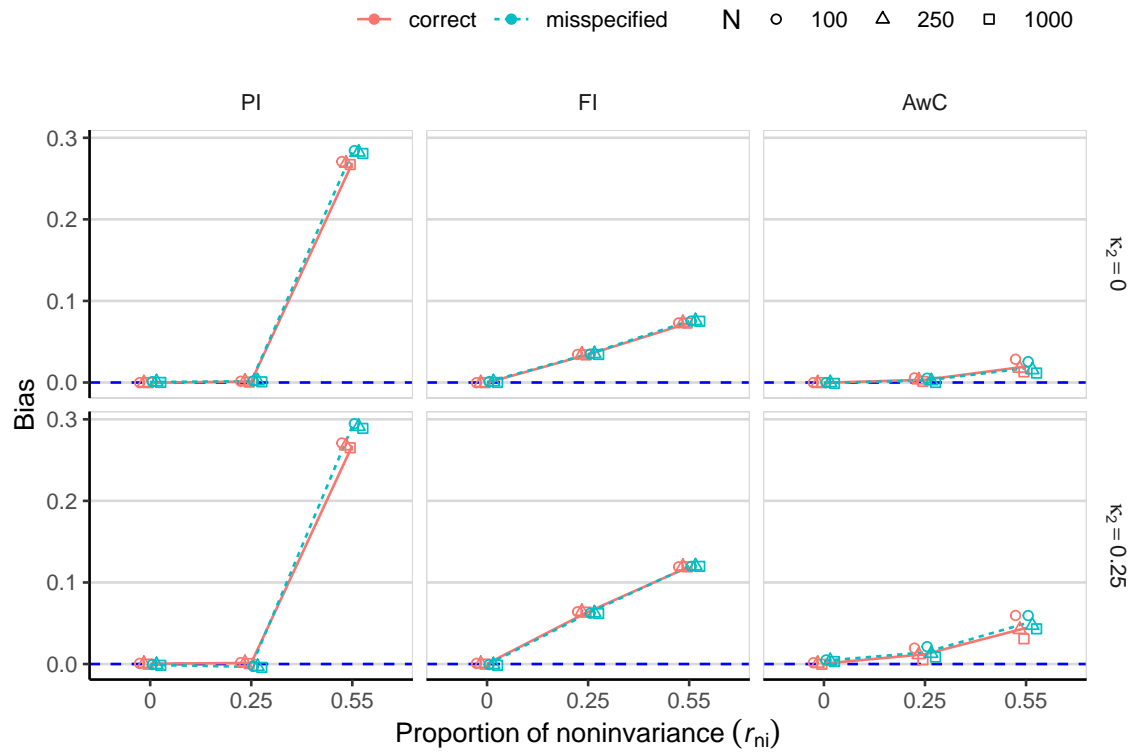


**Figure 1**

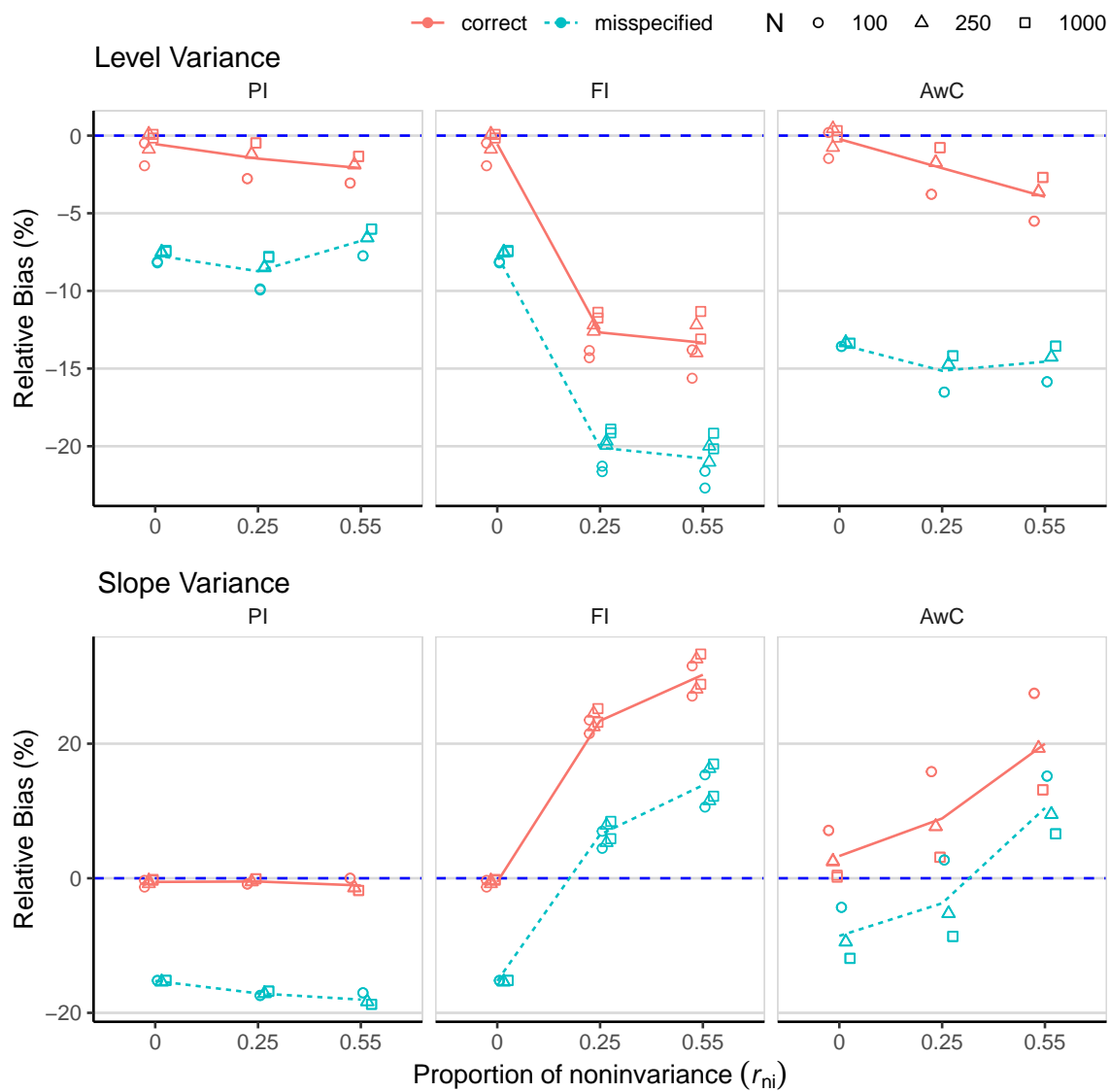
*Comparing widths of sample 95% confidence intervals for mean slope ( $\kappa_2$ ) with respect to different reference indicators. PI = partial strong invariance model. FI = full strong invariance model. AwC = alignment-within-confirmatory factor analysis.*

**Figure 2**

*Bias for estimating mean level ( $\kappa_1$ ). PI = partial strong invariance model. FI = full strong invariance model. AwC = alignment-within-confirmatory factor analysis.*

**Figure 3**

*Bias for estimating mean slope ( $\kappa_2$ ). PI = partial strong invariance model. FI = full strong invariance model. AwC = alignment-within-confirmatory factor analysis.*

**Figure 4**

Percentage relative bias for estimating level and slope variance ( $\phi_1$  and  $\phi_2$ ). PI = partial strong invariance model. FI = full strong invariance model. AwC = alignment-within-confirmatory factor analysis.

**Table 1**

*Root mean squared error (RMSE) and error rates of 95% confidence intervals (CIs) for mean level ( $\kappa_1$ ) and level variance ( $\phi_1$ ).*

Model	$N$	$r_{\text{ni}}$	Mean Level ( $\kappa_1$ )						Level Variance ( $\phi_1$ )					
			RMSE			CI Error Rate			RMSE			CI Error Rate		
			PI	FI	AwC	PI	FI	AwC	PI	FI	AwC	PI	FI	AwC
C	100	0.00	0.10	0.10	0.11	0.9	0.9	0.1	0.15	0.15	0.16	4.7	4.7	1.7
	100	0.25	0.10	0.12	0.11	1.1	1.7	0.4	0.15	0.17	0.16	5.0	<b>12.3</b>	2.2
	100	0.55	0.11	0.19	0.11	0.4	<b>12.4</b>	0.5	0.15	0.17	0.16	4.2	<b>12.0</b>	2.1
	250	0.00	0.06	0.06	0.07	0.7	0.7	0.1	0.10	0.10	0.10	3.5	3.5	1.3
	250	0.25	0.07	0.08	0.07	0.8	2.8	0.1	0.10	0.11	0.10	4.2	<b>13.1</b>	1.6
	250	0.55	0.07	0.18	0.07	0.1	<b>38.3</b>	0.3	0.10	0.12	0.10	3.2	<b>13.8</b>	1.5
	1,000	0.00	0.03	0.03	0.03	0.7	0.7	0.1	0.05	0.05	0.05	2.5	2.5	0.6
	1,000	0.25	0.03	0.06	0.04	0.9	<b>14.7</b>	0.3	0.05	0.07	0.05	2.8	<b>22.7</b>	1.0
	1,000	0.55	0.04	0.17	0.04	0.3	<b>96.9</b>	0.9	0.05	0.08	0.05	2.3	<b>23.9</b>	1.2
M	100	0.00	0.10	0.10	0.11	1.1	1.1	0.0	0.16	0.16	0.18	<b>8.7</b>	<b>8.7</b>	4.8
	100	0.25	0.10	0.11	0.11	1.4	1.3	0.2	0.16	0.19	0.18	<b>8.7</b>	<b>18.7</b>	5.4
	100	0.55	0.11	0.18	0.11	0.2	<b>9.8</b>	0.2	0.16	0.19	0.18	6.8	<b>18.6</b>	3.7
	250	0.00	0.06	0.06	0.07	0.8	0.8	0.0	0.10	0.10	0.12	7.4	7.4	5.2
	250	0.25	0.07	0.08	0.07	1.2	1.6	0.0	0.10	0.14	0.13	<b>8.4</b>	<b>23.0</b>	6.2
	250	0.55	0.07	0.16	0.07	0.2	<b>29.6</b>	0.0	0.10	0.15	0.13	6.3	<b>23.7</b>	3.7
	1,000	0.00	0.03	0.03	0.04	1.1	1.1	0.0	0.06	0.06	0.08	<b>12.4</b>	<b>12.4</b>	<b>13.2</b>
	1,000	0.25	0.04	0.05	0.04	1.7	6.6	0.0	0.06	0.11	0.09	<b>12.5</b>	<b>53.6</b>	<b>15.0</b>
	1,000	0.55	0.04	0.15	0.04	0.2	<b>92.2</b>	0.0	0.06	0.11	0.09	<b>7.8</b>	<b>53.8</b>	<b>8.3</b>

*Note.*  $r_{\text{ni}}$  = proportion of noninvariant parameters. PI = partial strong invariance model. FI = full strong invariance model. AwC = alignment-within-confirmatory factor analysis. C = correctly specified model. M = misspecified model. Bolded values indicate error rates > 7.5%.

**Table 2**

Root mean squared error (RMSE) and error rates of 95% confidence intervals (CIs) for mean level ( $\kappa_2$ ) and slope variance ( $\phi_2$ ).

Model	$\kappa_2$	$N$	$r_{ni}$	Mean Slope ( $\kappa_2$ )						Slope Variance ( $\phi_2$ )					
				RMSE			CI Error Rate			RMSE			CI Error Rate		
				PI	FI	AwC	PI	FI	AwC	PI	FI	AwC	PI	FI	AwC
C	0.00	100	.00	0.05	0.05	0.05	5.3	5.3	0.0	0.04	0.04	0.05	5.5	5.5	6.0
			.25	0.05	0.06	0.06	5.3	<b>11.0</b>	0.2	0.04	0.05	0.05	6.2	4.7	6.1
			.55	0.29	0.09	0.08	<b>83.5</b>	<b>28.4</b>	2.0	0.04	0.05	0.06	6.7	6.2	4.6
		250	.00	0.03	0.03	0.03	5.4	5.4	0.0	0.02	0.02	0.03	4.1	4.1	6.2
			.25	0.03	0.05	0.03	5.0	<b>18.4</b>	0.2	0.02	0.04	0.03	4.8	<b>8.5</b>	5.3
			.55	0.28	0.08	0.05	<b>99.6</b>	<b>56.8</b>	1.8	0.03	0.04	0.04	5.3	<b>12.4</b>	5.8
		1000	.00	0.02	0.02	0.02	5.0	5.0	0.0	0.01	0.01	0.01	3.8	3.8	5.5
			.25	0.02	0.04	0.02	5.4	<b>52.1</b>	0.0	0.01	0.03	0.01	4.5	<b>36.5</b>	5.3
			.55	0.27	0.08	0.03	<b>100.0</b>	<b>98.2</b>	3.1	0.01	0.03	0.02	5.4	<b>51.3</b>	<b>10.4</b>
	0.25	100	.00	0.05	0.05	0.06	3.9	3.9	0.3	0.04	0.04	0.05	5.4	5.4	7.0
			.25	0.05	0.09	0.06	4.5	<b>18.6</b>	0.8	0.04	0.05	0.05	6.3	5.4	6.1
			.55	0.29	0.13	0.10	<b>82.2</b>	<b>50.6</b>	6.3	0.04	0.06	0.06	6.7	6.6	4.6
		250	.00	0.03	0.03	0.03	4.2	4.2	0.2	0.02	0.02	0.03	4.4	4.4	5.8
			.25	0.03	0.07	0.04	4.0	<b>42.6</b>	0.3	0.02	0.04	0.03	4.9	<b>10.3</b>	5.3
			.55	0.28	0.13	0.06	<b>99.4</b>	<b>88.5</b>	6.9	0.03	0.04	0.04	5.3	<b>15.0</b>	5.8
		1000	.00	0.02	0.02	0.02	3.9	3.9	0.1	0.01	0.01	0.01	4.3	4.3	6.2
			.25	0.02	0.07	0.02	4.1	<b>93.9</b>	0.2	0.01	0.03	0.01	4.5	<b>43.7</b>	5.3
			.55	0.27	0.12	0.04	<b>100.0</b>	<b>100.0</b>	<b>15.2</b>	0.01	0.04	0.02	5.4	<b>61.8</b>	<b>10.5</b>
M	0.00	100	.00	0.05	0.05	0.05	5.0	5.0	0.0	0.04	0.04	0.05	<b>11.3</b>	<b>11.3</b>	<b>11.0</b>
			.25	0.05	0.06	0.06	5.2	<b>11.2</b>	0.0	0.04	0.04	0.05	<b>12.8</b>	7.3	<b>8.4</b>
			.55	0.30	0.10	0.08	<b>79.8</b>	<b>30.2</b>	1.2	0.04	0.05	0.06	<b>13.4</b>	7.4	5.6
		250	.00	0.03	0.03	0.03	6.0	6.0	0.0	0.03	0.03	0.03	<b>13.5</b>	<b>13.5</b>	<b>11.1</b>
			.25	0.03	0.05	0.03	5.1	<b>19.2</b>	0.0	0.03	0.03	0.03	<b>15.3</b>	5.6	<b>9.6</b>
			.55	0.29	0.08	0.05	<b>99.2</b>	<b>60.1</b>	0.7	0.03	0.03	0.04	<b>15.9</b>	7.2	4.7
		1000	.00	0.02	0.02	0.02	5.4	5.4	0.0	0.02	0.02	0.02	<b>26.8</b>	<b>26.8</b>	<b>19.4</b>
			.25	0.02	0.04	0.02	5.1	<b>54.6</b>	0.0	0.02	0.01	0.02	<b>31.8</b>	6.8	<b>13.7</b>
			.55	0.28	0.08	0.03	<b>100.0</b>	<b>99.1</b>	0.8	0.02	0.02	0.02	<b>36.3</b>	<b>14.2</b>	6.1
	0.25	100	.00	0.05	0.05	0.06	3.9	3.9	0.2	0.04	0.04	0.05	<b>11.3</b>	<b>11.3</b>	<b>11.0</b>
			.25	0.05	0.08	0.07	4.4	<b>17.8</b>	0.3	0.04	0.04	0.05	<b>12.9</b>	7.1	<b>8.4</b>
			.55	0.32	0.13	0.10	<b>81.0</b>	<b>52.1</b>	3.6	0.04	0.05	0.06	<b>13.4</b>	6.4	5.6
		250	.00	0.03	0.03	0.04	4.4	4.4	0.1	0.03	0.03	0.03	<b>13.4</b>	<b>13.4</b>	<b>11.1</b>
			.25	0.03	0.07	0.04	4.0	<b>40.6</b>	0.1	0.03	0.03	0.03	<b>15.2</b>	6.0	<b>9.6</b>
			.55	0.30	0.13	0.07	<b>99.3</b>	<b>90.1</b>	5.8	0.03	0.03	0.04	<b>15.9</b>	<b>7.6</b>	4.8
		1000	.00	0.02	0.02	0.02	3.8	3.8	0.0	0.02	0.02	0.02	<b>26.8</b>	<b>26.8</b>	<b>19.4</b>
			.25	0.02	0.06	0.02	5.1	<b>93.5</b>	0.1	0.02	0.02	0.02	<b>31.9</b>	<b>9.1</b>	<b>13.7</b>
			.55	0.29	0.12	0.05	<b>100.0</b>	<b>100.0</b>	<b>19.7</b>	0.02	0.02	0.02	<b>36.3</b>	<b>21.6</b>	6.1

*Note.*  $r_{ni}$  = proportion of noninvariant parameters. PI = partial strong invariance model. FI = full strong invariance model. AwC = alignment-within-confirmatory factor analysis. C = correctly specified model. M = misspecified model. Bolded values indicate error rates > 7.5%.