Supplementary Appendix

to "Joint Tests for Dynamic and Spatial Effects in Short Panels with Fixed Effects and Heteroskedasticity"

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This `Supplementary Appendix` presents detailed proofs of the theorems, corollaries, and lemmas that appeared in the main text, including the full expressions of the two 'Hessian' matrices. It also presents a more comprehensive set of Monte Carlo results.

Proof Theorem 2.1: The proof of Theorem 2.1 follows closely the proofs of Theorems 3.2 and 3.3 of Yang (2018a), and is typically simpler as under H_0^{M} the model becomes simpler. The Hessian matrix $H^*(\psi) = \frac{\partial}{\partial \psi'} S^*(\psi)$ used to estimate $\Sigma^*(\psi_0)$ is given in Yang (2018a, Proof of Theorem 3.2), but three components, $H_{\lambda_1 \rho}^*$, $H_{\lambda_2 \rho}^*$, and $H_{\lambda_2 \lambda_1}^*$ are missing as $H_{\text{STLE}}^*(\psi)$ is asymmetric in $(\rho, \lambda_1, \lambda_2)$. The full expression of $H^*(\psi)$ is reproduced here to facilitate the applications.

$$H_{\beta\beta}^* = -\frac{1}{\sigma_v^2}\Delta X'\Omega^{-1}\Delta X, \qquad H_{\sigma_v^2\sigma_v^2}^* = -\frac{1}{\sigma_v^6}\Delta u(\theta)'\Omega^{-1}\Delta u(\theta) + \frac{n(T-1)}{2\sigma_v^4},$$

$$H_{\beta\sigma_v^2}^* = -\frac{1}{\sigma_v^4}\Delta X'\Omega^{-1}\Delta u(\theta), \qquad H_{\sigma_v^2\lambda_2}^* = -\frac{1}{\sigma_v^4}\Delta Y_{-1}'\mathbf{W}_2'\Omega^{-1}\Delta u(\theta),$$

$$H_{\beta\rho}^* = -\frac{1}{\sigma_v^2}\Delta X'\Omega^{-1}\Delta Y_{-1}, \qquad H_{\sigma_v^2\lambda_3}^* = \frac{1}{2\sigma_v^4}\Delta u(\theta)'\dot{\Omega}^{-1}\Delta u(\theta),$$

$$H_{\beta\lambda_1}^* = -\frac{1}{\sigma_v^2}\Delta X'\Omega^{-1}\mathbf{W}_1\Delta Y, \qquad H_{\rho\rho}^* = -\frac{1}{\sigma_v^2}\Delta Y_{-1}'\Omega^{-1}\Delta Y_{-1} + \text{tr}(\mathbf{C}^{-1}\mathbf{D}_{-1,\rho}),$$

$$H_{\beta\lambda_2}^* = -\frac{1}{\sigma_v^2}\Delta X'\Omega^{-1}\mathbf{W}_2\Delta Y_{-1}, \qquad H_{\rho\lambda_1}^* = -\frac{1}{\sigma_v^2}\Delta Y_{-1}'\Omega^{-1}\mathbf{W}_1\Delta Y + \text{tr}(\mathbf{C}^{-1}\mathbf{D}_{-1,\lambda_1}),$$

$$H_{\beta\lambda_3}^* = \frac{1}{\sigma_v^2}\Delta X'\dot{\Omega}^{-1}\Delta u(\theta), \qquad H_{\rho\lambda_2}^* = -\frac{1}{\sigma_v^2}\Delta Y_{-1}'\Omega^{-1}\mathbf{W}_2\Delta Y_{-1} + \text{tr}(\mathbf{C}^{-1}\mathbf{D}_{-1,\lambda_2}),$$

$$H_{\sigma_v^2\rho}^* = -\frac{1}{\sigma_v^4}\Delta Y_{-1}'\Omega^{-1}\Delta u(\theta), \qquad H_{\lambda_1\lambda_1}^* = -\frac{1}{\sigma_v^2}\Delta Y'\mathbf{W}_1'\Omega^{-1}\mathbf{W}_1\Delta Y + \text{tr}(\mathbf{C}^{-1}\mathbf{D}_{\lambda_1}\mathbf{W}_1),$$

$$H_{\sigma_v^2\lambda_1}^* = -\frac{1}{\sigma_v^4}\Delta Y'\mathbf{W}_1'\Omega^{-1}\Delta u(\theta), \qquad H_{\lambda_1\lambda_2}^* = -\frac{1}{\sigma_v^2}\Delta Y'\mathbf{W}_1'\Omega^{-1}\mathbf{W}_2\Delta Y_{-1} + \text{tr}(\mathbf{C}^{-1}\mathbf{D}_{\lambda_2}\mathbf{W}_1),$$

$$H_{\rho\lambda_3}^* = \frac{1}{\sigma_v^2}\Delta Y_{-1}'\dot{\Omega}^{-1}\Delta u(\theta), \qquad H_{\lambda_2\lambda_2}^* = -\frac{1}{\sigma_v^2}\Delta Y_{-1}'\mathbf{W}_2'\Omega^{-1}\mathbf{W}_2\Delta Y_{-1} + \text{tr}(\mathbf{C}^{-1}\mathbf{D}_{-1,\lambda_2}\mathbf{W}_2),$$

$$H_{\lambda_1\lambda_3}^* = \frac{1}{\sigma_v^2}\Delta Y'\mathbf{W}_1'\dot{\Omega}^{-1}\Delta u(\theta), \qquad H_{\lambda_3\lambda_3}^* = -\frac{1}{\sigma_v^2}\Delta u(\theta)'[C^{-1}\otimes(W_3'W_3)]\Delta u(\theta) - (T-1)\text{tr}(G_3^2),$$

$$H_{\lambda_2\lambda_3}^* = \frac{1}{\sigma_v^2}\Delta Y_{-1}'\mathbf{W}_2'\dot{\Omega}^{-1}\Delta u(\theta), \qquad H_{\lambda_1\rho}^* = -\frac{1}{\sigma_v^2}\Delta Y_{-1}'\Omega^{-1}\mathbf{W}_1\Delta Y + \text{tr}(\mathbf{C}^{-1}\mathbf{D}_\rho\mathbf{W}_1),$$

$$H_{\lambda_2\rho}^* = -\frac{1}{\sigma_v^2}\Delta Y_{-1}'\Omega^{-1}\mathbf{W}_2\Delta Y_{-1} + \text{tr}(\mathbf{C}^{-1}\mathbf{D}_{-1,\rho}\mathbf{W}_2),$$

$$H_{\lambda_2\lambda_1}^* = -\frac{1}{\sigma_v^2}\Delta Y'\mathbf{W}_1'\Omega^{-1}\mathbf{W}_2\Delta Y_{-1} + \text{tr}(\mathbf{C}^{-1}\mathbf{D}_{-1,\lambda_1}\mathbf{W}_2).$$

where the 'missing components' follow from symmetry, i.e., $H^*_{\psi\beta} = H^{*\prime}_{\beta\psi}$, $H^*_{\psi\sigma^2_v} = H^{*\prime}_{\sigma^2_v\psi}$, $H^*_{\lambda_3\rho} = H^*_{\rho\lambda_3}$, $H^*_{\lambda_3\lambda_1} = H^*_{\lambda_1\lambda_3}$, and $H^*_{\lambda_3\lambda_2} = H^*_{\lambda_2\lambda_3}$; and $\dot{\Omega}^{-1} = \frac{\partial}{\partial\lambda_3}\Omega^{-1} = -C^{-1} \otimes A_3$, $\mathbf{D}_{-1,\omega} = \frac{\partial}{\partial\omega}\mathbf{D}_{-1}$ and $\mathbf{D}_\omega = \frac{\partial}{\partial\omega}\mathbf{D}$, $\omega = \rho, \lambda_1, \lambda_2$. The exact expressions of the latter two can be easily obtained from the expressions of $\mathbf{D}(\rho, \lambda_1, \lambda_2)$ and $\mathbf{D}_{-1}(\rho, \lambda_1, \lambda_2)$ given in the main text.

Proof of Corollary 2.1: The quantities needed for evaluating the AQS function defined in (2.4) of the main text becomes: $\Pi_1 = \frac{1}{\sigma^2_{v0}}\mathbf{C}^{-1}\Delta X$, $\Pi_2 = \frac{1}{\sigma^2_{v0}}\mathbf{C}^{-1}\mathbb{B}_{-1}\Delta X\beta$, $\Pi_3 = \frac{1}{\sigma^2_{v0}}\mathbf{C}^{-1}\mathbf{W}_1\Delta X\beta$, $\Pi_4 = \frac{1}{\sigma^2_{v0}}\mathbf{C}^{-1}\mathbf{W}_2\mathbb{B}_{-1}\Delta X\beta$, $\Phi_1 = \frac{1}{2\sigma^4_{v0}}\mathbf{C}^{-1}$, $\Phi_2 = \frac{1}{\sigma^2_{v0}}\mathbf{C}^{-1}\mathbb{B}_{-1}$, $\Phi_3 = \frac{1}{\sigma^2_{v0}}\mathbf{C}^{-1}\mathbf{W}_1$, $\Phi_4 = \frac{1}{\sigma^2_{v0}}\mathbf{C}^{-1}\mathbf{W}_2\mathbb{B}_{-1}$, $\Phi_5 = \frac{1}{2\sigma^2_{v0}}[C^{-1} \otimes (W'_3 + W_3)]$, $\Psi_1 = \frac{1}{\sigma^2_{v0}}\mathbf{C}^{-1}\mathbb{R}_{-1}$, $\Psi_2 = 0$, $\Psi_3 = \frac{1}{\sigma^2_{v0}}\mathbf{C}^{-1}\mathbf{W}_2\mathbb{R}_{-1}$, $\mathbb{R}_{-1} = \text{blkdiag}(I_n, 0, \ldots, 0)$, $\mathbb{B}_{-1} = I^*_{T-1} \otimes I_n$, and I^*_{T-1} is a $(T-1) \times (T-1)$ matrix with elements 1 on the positions immediately below the diagonal elements, and zero elsewhere. Further, $\mathcal{B}_0 = 0_n$, and hence $\mathbf{D}_0 = -C \otimes I_n$ and $\mathbf{D}_{-10} = -C_{-1} \otimes I_n$, where

$$C_{-1} = \begin{pmatrix} -1 & 0 & 0 & \cdots & 0 & 0 & 0 \\ 2 & -1 & 0 & \cdots & 0 & 0 & 0 \\ -1 & 2 & -1 & \cdots & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & \cdots & 0 & 2 & -1 \end{pmatrix}_{(T-1)\times(T-1)}.$$

These show that with $\psi_0 = (\beta'_0, \sigma_{v0}, 0, 0, 0, 0)'$, all the Φ and Ψ matrices are either of the form $A \otimes I_n$ or $A \otimes W$ for some $(T-1) \times (T-1)$ matrix A and a spatial weight matrix W satisfying Assumption D. Thus, $\text{E}[S^*(\psi_0)] = 0$ even when the errors are heteroskedastic. Hence by Lemma A.5 of the main text, we have $\frac{1}{\sqrt{N}}S^*(\psi_0) \xrightarrow{D} N[0, \lim_{n\to\infty}\frac{1}{N}\Gamma^*(\psi_0)]$.

By the mean value theorem (MVT), one easily shows that $\frac{1}{\sqrt{N}}[S^*_\delta(\tilde{\psi}) - S^*_\delta(\psi_0)] = o_p(1)$, where $\tilde{\psi} = (\tilde{\beta}', \tilde{\sigma}^2_{v0}, 0, 0, 0, 0)'$ and we note that the OLS estimators $\tilde{\beta}$ and $\tilde{\sigma}^2_{v0}$ are robust against unknown heteroskedasticity $\{h_{ni}\}$. Now, since by (2.12) of the main text $S^*(\psi_0) = \sum_{i=1}^n \mathbf{g}_i$, where $\{\mathbf{g}_i, \mathcal{F}_{n,i}\}$ form a vector MD sequence, we have $\frac{1}{N}\sum_{i=1}^n[\mathbf{g}_i\mathbf{g}'_i - \text{E}(\mathbf{g}_i\mathbf{g}'_i)] = o_p(1)$ by Lemma A.6 of the main text. By MVT and the consistency of $\tilde{\beta}$ and $\tilde{\sigma}^2_{v0}$, one shows that $\frac{1}{N}\sum_{i=1}^n(\tilde{\mathbf{g}}_i\tilde{\mathbf{g}}'_i - \mathbf{g}_i\mathbf{g}'_i) = o_p(1)$ under heteroskedasticity. Finally, it is easy to show that $\text{plim}_{n\to\infty}(\tilde{\Lambda} - \Lambda) = 0$, using the simplified expression of $H^*(\psi)$ and MVT.

Proof of Lemma 2.1: Consider the AQS vector $S^*(\beta, \sigma^2_v, \rho)$ for the DPD model, and the concentrated AQS function which defines $\tilde{\rho}$ under H^{DPD}_0:

$$S^{*c}_{\text{DPD}}(\rho) = \frac{1}{\tilde{\sigma}^2_v(\rho)}\Delta\tilde{v}'(\rho)\mathbf{C}^{-1}\Delta Y_{-1} + n\left(\frac{1}{1-\rho} - \frac{1-\rho^T}{T(1-\rho)^2}\right),$$

where $\Delta\tilde{v}(\rho) = \Delta Y - \rho\Delta Y_{-1} - \Delta X\tilde{\beta}(\rho)$, $\tilde{\beta}(\rho) = (\Delta X'\mathbf{C}^{-1}\Delta X)^{-1}\Delta X'\mathbf{C}^{-1}(\Delta Y - \rho\Delta Y_{-1})$ and $\tilde{\sigma}^2_v(\rho) = \frac{1}{N}\Delta\tilde{v}'(\rho)\mathbf{C}^{-1}\Delta\tilde{v}(\rho)$.

Define $\bar{S}^*(\beta, \sigma^2_v, \rho) = \text{E}[S^*(\beta, \sigma^2_v, \rho)]$. Given ρ, $\bar{S}^*(\beta, \sigma^2_v, \rho) = 0$ is partially solved at $\bar{\beta}(\rho) = (\Delta X'\mathbf{C}^{-1}\Delta X)^{-1}\Delta X'\mathbf{C}^{-1}(\text{E}\Delta Y - \rho\text{E}\Delta Y_{-1})$ and $\bar{\sigma}^2_v(\rho) = \frac{1}{N}\text{E}[\Delta\bar{v}(\rho)'\mathbf{C}^{-1}\Delta\bar{v}(\rho)]$, where $\Delta\bar{v}(\rho) = \Delta Y - \rho\Delta Y_{-1} - \Delta X\bar{\beta}(\rho)$. Substituting $\bar{\beta}(\rho)$ and $\bar{\sigma}^2_v(\rho)$ back into $\bar{S}^*(\beta, \sigma^2_v, \rho)$

gives the population counter part of $S_{\text{DPD}}^{*c}(\rho)$ as

$$\bar{S}_{\text{DPD}}^{*c}(\rho) = \frac{1}{\bar{\sigma}_v^2(\rho)}\text{E}[\Delta\bar{v}'(\rho)\mathbf{C}^{-1}\Delta Y_{-1}] + n\left(\frac{1}{1-\rho} - \frac{1-\rho^T}{T(1-\rho)^2}\right).$$

By Theorem 5.9 of van der Vaart (1998), $\tilde{\rho}$ will be consistent if $(i)\inf_{\rho:|\rho-\rho_0|\geq\epsilon}|\bar{S}_{\text{DPD}}^{*c}(\rho)| > 0$ for every $\epsilon > 0$, and $(ii)\sup_{\rho\in\Upsilon}\frac{1}{\sqrt{N}}|S_{\text{DPD}}^{*c}(\rho) - \bar{S}_{\text{DPD}}^{*c}(\rho)| \xrightarrow{p} 0$, which are straightforward. The asymptotic normality can be proved using Lemma A.5.

Proof of Corollary 2.2: First, with $\psi_0 = (\beta_0, \sigma_{v0}^2, \rho_0, 0_3')'$ it is easy to show that $\text{E}[S^*(\psi_0)] = 0$ under the general heteroskedasticity $\{h_{ni}\}$. By Lemma A.5, one shows that $\frac{1}{\sqrt{N}}S^*(\psi_0) \xrightarrow{D} N(0, \Gamma^*(\psi_0))$. By Lemma A.6, one shows that $\frac{1}{N}\sum_{i=1}^n[\mathbf{g}_{n,i}\mathbf{g}_{n,i}' - \text{E}(\mathbf{g}_i\mathbf{g}_i')] \xrightarrow{p} 0$. By the mean value theorem, and $\sqrt{N}$ consistency and robustness of $\tilde{\beta}$, $\tilde{\sigma}_v^2$ and $\tilde{\rho}$ against unknown heteroskedasticity $\{h_{ni}\}$ as shown in Lemma 2.1, we have $\frac{1}{\sqrt{N}}[S_\lambda^*(\tilde{\psi}) - S_\lambda^*(\psi_0)] \xrightarrow{p} 0$ where $\tilde{\psi} = (\tilde{\beta}', \tilde{\sigma}_v^2, \tilde{\rho}, 0_3)'$, and $\frac{1}{N}\sum_{i=1}^n(\tilde{\mathbf{g}}_{n,i}\tilde{\mathbf{g}}_{n,i}' - \mathbf{g}_i\mathbf{g}_i') \xrightarrow{p} 0$. Finally, using the simplified expression of $H^*(\psi)$ and MVT, we show $\text{plim}_{n\to\infty}(\widetilde{\Lambda}-\Lambda) = 0$.

Proof of Theorem 2.2: The proof is similar to that of Theorem 2.1. The partial derivatives of $S^\diamond(\delta)$ required to estimate the components of $\Sigma_{\varphi\pi}^\diamond(\delta_0)$ and $\Sigma_{\varphi\varphi}^\diamond(\delta_0)$ can be obtained though numerical differentiation, as the dimensions of φ and π are very low.

Proof of Theorem 3.1: The proof is similar to that of Theorem 2.1. The Hessian matrix $H_{\text{H}}^*(\psi) = \frac{\partial}{\partial\psi'}S_{\text{H}}^*(\psi)$ used to estimate $\Sigma_{\text{STLE}}^*(\psi_0)$ is given in Li and Yang (2020, Proof of Theorem 3.2), but the asymmetric components are missing as $H_{\text{H}}^*(\psi)$ is asymmetric, except the (β, σ_v^2) block. The full expression of $H_{\text{H}}^*(\psi)$ is given here to facilitate the applications.

$$H_{\beta\beta}^* = -\frac{1}{\sigma_v^2}\Delta X'\Omega^{-1}\Delta X, \qquad H_{\beta\sigma_v^2}^* = -\frac{1}{\sigma_v^4}\Delta X'\Omega^{-1}\Delta\mathbf{u}(\theta), \qquad H_{\beta\rho}^* = -\frac{1}{\sigma_v^2}\Delta X'\Omega^{-1}\Delta Y_{-1},$$

$$H_{\beta\lambda_1}^* = -\frac{1}{\sigma_v^2}\Delta X'\Omega^{-1}\mathbf{W}_1\Delta Y, \quad H_{\beta\lambda_2}^* = -\frac{1}{\sigma_v^2}\Delta X'\Omega^{-1}\mathbf{W}_2\Delta Y_{-1}, \quad H_{\beta\lambda_3}^* = \frac{1}{\sigma_v^2}\Delta X'\dot{\Omega}^{-1}\Delta\mathbf{u}(\theta),$$

$$H_{\sigma_v^2\lambda_3}^* = \frac{1}{2\sigma_v^4}\Delta u(\theta)'\dot{\Omega}^{-1}\Delta\mathbf{u}(\theta), \quad H_{\sigma_v^2\rho}^* = -\frac{1}{\sigma_v^4}\Delta Y_{-1}'\Omega^{-1}\Delta\mathbf{u}(\theta), \qquad H_{\sigma_v^2\lambda_1}^* = -\frac{1}{\sigma_v^4}\Delta Y'\mathbf{W}_1'\Omega^{-1}\Delta\mathbf{u}(\theta),$$

$$H_{\sigma_v^2\lambda_2}^* = -\frac{1}{\sigma_v^4}\Delta Y_{-1}'\mathbf{W}_2'\Omega^{-1}\Delta\mathbf{u}(\theta), \quad H_{\sigma_v^2\sigma_v^2}^* = -\frac{1}{\sigma_v^6}\Delta\mathbf{u}(\theta)'\Omega^{-1}\Delta\mathbf{u}(\theta) + \frac{n(T-1)}{2\sigma_v^4},$$

$$H_{\rho\rho}^* = -\frac{1}{\sigma_v^2}\Delta Y_{-1}'\Omega^{-1}\Delta Y_{-1} + \frac{1}{\sigma_v^2}[\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\rho\rho}\Delta\mathbf{u}(\theta) - \Delta Y_{-1}'(\mathbf{E}_\rho + \mathbf{E}_\rho')\Delta\mathbf{u}(\theta)],$$

$$H_{\rho\lambda_1}^* = -\frac{1}{\sigma_v^2}\Delta Y_{-1}'\Omega^{-1}\mathbf{W}_1\Delta Y + \frac{1}{\sigma_v^2}[\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\rho\lambda_1}\Delta\mathbf{u}(\theta) - \Delta Y'\mathbf{W}_1'(\mathbf{E}_\rho + \mathbf{E}_\rho')\Delta\mathbf{u}(\theta)],$$

$$H_{\rho\lambda_2}^* = -\frac{1}{\sigma_v^2}\Delta Y_{-1}'\Omega^{-1}\mathbf{W}_2\Delta Y_{-1} + \frac{1}{\sigma_v^2}[\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\rho\lambda_2}\Delta\mathbf{u}(\theta) - \Delta Y_{-1}'\mathbf{W}_2'(\mathbf{E}_\rho + \mathbf{E}_\rho')\Delta\mathbf{u}(\theta)],$$

$$H_{\rho\lambda_3}^* = \frac{1}{\sigma_v^2}\Delta Y_{-1}'\dot{\Omega}^{-1}\Delta\mathbf{u}(\theta) + \frac{1}{\sigma_v^2}\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\rho\lambda_3}\Delta\mathbf{u}(\theta),$$

$$H_{\lambda_1\lambda_1}^* = -\frac{1}{\sigma_v^2}\Delta Y'\mathbf{W}_1'\Omega^{-1}\mathbf{W}_1\Delta Y + \frac{1}{\sigma_v^2}[\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\lambda_1\lambda_1}\Delta\mathbf{u}(\theta) - \Delta Y'\mathbf{W}_1'(\mathbf{E}_{\lambda_1} + \mathbf{E}_{\lambda_1}')\Delta\mathbf{u}(\theta)],$$

$$H_{\lambda_1\lambda_2}^* = -\frac{1}{\sigma_v^2}\Delta Y'\mathbf{W}_1'\Omega^{-1}\mathbf{W}_2\Delta Y_{-1} + \frac{1}{\sigma_v^2}[\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\lambda_1\lambda_2}\Delta\mathbf{u}(\theta) - \Delta Y_{-1}'\mathbf{W}_2'(\mathbf{E}_{\lambda_1} + \mathbf{E}_{\lambda_1}')\Delta\mathbf{u}(\theta)],$$

$$H_{\lambda_1\lambda_3}^* = \frac{1}{\sigma_v^2}\Delta Y'\mathbf{W}_1'\dot{\Omega}^{-1}\Delta\mathbf{u}(\theta) + \frac{1}{\sigma_v^2}\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\lambda_1\lambda_3}\Delta\mathbf{u}(\theta),$$

$$H^*_{\lambda_2\lambda_2} = -\frac{1}{\sigma_v^2}\Delta Y'_{-1}\mathbf{W}'_2\Omega^{-1}\mathbf{W}_2\Delta Y_{-1} + \frac{1}{\sigma_v^2}[\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\lambda_2\lambda_2}\Delta\mathbf{u}(\theta) - \Delta Y'_{-1}\mathbf{W}'_2(\mathbf{E}_{\lambda_2} + \mathbf{E}'_{\lambda_2})\Delta\mathbf{u}(\theta)],$$

$$H^*_{\lambda_2\lambda_3} = \frac{1}{\sigma_v^2}\Delta Y'_{-1}\mathbf{W}'_2\dot{\Omega}^{-1}\Delta\mathbf{u}(\theta) + \frac{1}{\sigma_v^2}\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\lambda_2\lambda_3}\Delta\mathbf{u}(\theta),$$

$$H^*_{\lambda_3\lambda_3} = -\frac{1}{2\sigma_v^2}\Delta\mathbf{u}(\theta)'[C^{-1}\otimes(2W'_3W_3 + \dot{\mathbf{E}}_{\lambda_3\lambda_3})]\Delta\mathbf{u}(\theta),$$

$$H^*_{\lambda_1\rho} = -\frac{1}{\sigma_v^2}\Delta Y'_{-1}\Omega^{-1}\mathbf{W}_1\Delta Y + \frac{1}{\sigma_v^2}[\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\lambda_1\rho}\Delta\mathbf{u}(\theta) - \Delta Y'_{-1}(\mathbf{E}_{\lambda_1} + \mathbf{E}'_{\lambda_1})\Delta\mathbf{u}(\theta)],$$

$$H^*_{\lambda_2\rho} = -\frac{1}{\sigma_v^2}\Delta Y'_{-1}\Omega^{-1}\mathbf{W}_2\Delta Y_{-1} + \frac{1}{\sigma_v^2}[\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\lambda_2\rho}\Delta\mathbf{u}(\theta) - \Delta Y'_{-1}(\mathbf{E}_{\lambda_2} + \mathbf{E}'_{\lambda_2})\Delta\mathbf{u}(\theta)],$$

$$H^*_{\lambda_2\lambda_1} = -\frac{1}{\sigma_v^2}\Delta Y'\mathbf{W}'_1\Omega^{-1}\mathbf{W}_2\Delta Y_{-1} + \frac{1}{\sigma_v^2}[\Delta\mathbf{u}'(\theta)\dot{\mathbf{E}}_{\lambda_2\lambda_1}\Delta\mathbf{u}(\theta) - \Delta Y'\mathbf{W}'_1(\mathbf{E}_{\lambda_2} + \mathbf{E}'_{\lambda_2})\Delta\mathbf{u}(\theta)],$$

$$H^*_{\lambda_3\rho} = \frac{1}{2\sigma_v^2}\Delta Y'_{-1}[C^{-1}\otimes(\mathcal{A} - \mathbf{E}_{\lambda_3})]\Delta\mathbf{u}(\theta), \qquad H^*_{\lambda_3\lambda_1} = \frac{1}{\sigma_v^2}\Delta Y'\mathbf{W}'_1\dot{\Omega}^{-1}\Delta\mathbf{u}(\theta),$$

$$H^*_{\lambda_3\lambda_2} = \frac{1}{\sigma_v^2}\Delta Y'_{-1}\mathbf{W}'_2\dot{\Omega}^{-1}\Delta\mathbf{u}(\theta), \quad H^*_{\omega\beta} = H^{*\prime}_{\beta\omega} - \frac{1}{\sigma_v^2}\Delta\mathbf{u}(\theta)'\mathbf{E}_\omega X, \ \ \omega = \rho, \lambda_1, \lambda_3,$$

$$H^*_{\omega\sigma_v^2} = H^{*\prime}_{\sigma_v^2\omega} - \frac{1}{\sigma_v^4}\Delta\mathbf{u}(\theta)'\mathbf{E}_\omega\Delta\mathbf{u}(\theta), \ \ \omega = \rho, \lambda_1, \lambda_3,$$

$$H^*_{\lambda_3\beta} = -\frac{1}{\sigma_v^2}\Delta\mathbf{u}(\theta)'[C^{-1}\otimes(\mathcal{A} - \mathbf{E}_{\lambda_3})]X, \quad H^*_{\lambda_3\sigma_v^2} = -\frac{1}{2\sigma_v^4}\Delta\mathbf{u}(\theta)'[C^{-1}\otimes(\mathcal{A} - \mathbf{E}_{\lambda_3})]\Delta\mathbf{u}(\theta),$$

where $\dot{\Omega}^{-1} = \frac{\partial}{\partial\lambda_3}\Omega^{-1}$, $\dot{\mathbf{E}}_{r,v} = \frac{\partial}{\partial v}\mathbf{E}_r$, $r, v = \rho, \lambda_1, \lambda_2, \lambda_3$, and

$$\dot{\mathbf{E}}_{\rho\rho} = \Omega^{-1}\mathbf{C}^{-1}\dot{\mathbf{D}}_{-1,\rho}, \qquad \dot{\mathbf{E}}_{\rho\lambda_1} = \Omega^{-1}\mathbf{C}^{-1}\dot{\mathbf{D}}_{-1,\lambda_1}, \qquad \dot{\mathbf{E}}_{\rho\lambda_2} = \Omega^{-1}\mathbf{C}^{-1}\dot{\mathbf{D}}_{-1,\lambda_2}$$

$$\dot{\mathbf{E}}_{\rho\lambda_3} = \dot{\Omega}^{-1}\mathbf{C}^{-1}\mathbf{D}_{-1}, \qquad \dot{\mathbf{E}}_{\lambda_1\lambda_1} = \Omega^{-1}\mathbf{C}^{-1}\mathbf{W}_1\dot{\mathbf{D}}_{\lambda_1}, \qquad \dot{\mathbf{E}}_{\lambda_1\lambda_2} = \Omega^{-1}\mathbf{C}^{-1}\mathbf{W}_1\dot{\mathbf{D}}_{\lambda_2},$$

$$\dot{\mathbf{E}}_{\lambda_1\lambda_3} = \dot{\Omega}^{-1}\mathbf{C}^{-1}\mathbf{W}_1\mathbf{D}, \quad \dot{\mathbf{E}}_{\lambda_2\lambda_2} = \Omega^{-1}\mathbf{C}^{-1}\mathbf{W}_2\dot{\mathbf{D}}_{-1,\lambda_2}, \quad \dot{\mathbf{E}}_{\lambda_2\lambda_3} = \dot{\Omega}^{-1}\mathbf{C}^{-1}\mathbf{W}_2\mathbf{D}_{-1},$$

$$\dot{\mathbf{E}}_{\lambda_1\rho} = \dot{\Omega}^{-1}\mathbf{C}^{-1}\mathbf{W}_1\mathbf{D}_\rho, \quad \dot{\mathbf{E}}_{\lambda_2\rho} = \dot{\Omega}^{-1}\mathbf{C}^{-1}\mathbf{W}_2\mathbf{D}_{-1,\rho}, \qquad \dot{\mathbf{E}}_{\lambda_2\lambda_1} = \dot{\Omega}^{-1}\mathbf{C}^{-1}\mathbf{W}_2\mathbf{D}_{-1,\lambda_1},$$

$$\dot{\mathbf{E}}_{\lambda_3\lambda_3} = 2[B'_3\text{diag}(G_3^2) - W'_3\text{diag}(G_3)]\text{diag}^{-1}(B_3^{-1}) + 2B'_3\text{diag}(G_3)d_{3\lambda_3},$$

$$d_{3\lambda_3} = \frac{d}{d\lambda_3}\text{diag}^{-1}(B_3^{-1}) = -\text{diag}^{-1}(B_3^{-1})\text{diag}(B_3^{-1}W_3B_3^{-1})\text{diag}^{-1}(B_3^{-1}).$$

Monte Carlo Results: Tables 1 and 2 present the empirical sizes and the size adjusted power of the test $H_0^{\text{PD}} : \delta = 0$ with $T = 3$ and 6, respectively; Tables 3 and 4 present the empirical sizes and the size-adjusted power of the test $H_0^{\text{DPD}} : \lambda = 0$ with $T = 3$ and 6, respectively; and Table 5 presents the empirical sizes of the test $H_0^{\text{DSE}} : \lambda_1 = \lambda_2 = 0$. For the DGPs, 1 = Normal Error, 2 = Normal Mixture (standardized), and 3 = Lognormal (standardized). For the fives tests: $2 = T_{\text{M}}$, $3 = T_{\text{M}}^\dagger$ and $5 = T_{\text{M}}^\diamond$ are the three tests introduced in the main text; 1 = naive LM test, and 4 = another naive test.

Table 1: Emprical Size and Power of Tests H$_0$: δ = 0 vs H$_a$: δ = (.06, .06, .06, .06),   T = 3

(a) Rook Contiguity, CH-0

n	Test	DGP	Mean	sd	Empirical Size (H$_0$ true)			Size-Adj Power (H$_a$ true)		
					10%	5%	1%	10%	5%	1%
50	1	1	4.66	3.18	15.24	8.31	1.92	34.90	22.36	8.30
50	1	2	5.92	4.10	25.42	16.23	5.27	30.22	18.64	4.52
50	1	3	5.19	3.52	20.91	12.34	3.44	33.42	21.42	7.16
50	2	1	4.37	2.98	12.63	6.67	1.31	34.82	21.84	7.90
50	2	2	5.23	3.68	19.33	11.47	3.3	28.84	17.82	3.86
50	2	3	4.72	3.24	16.86	9.35	2.32	33.04	20.50	7.36
50	3	1	4.01	2.60	8.81	3.64	0.41	33.26	20.24	5.18
50	3	2	4.03	2.42	7.37	2.64	0.26	40.56	29.40	9.74
50	3	3	3.99	2.46	8.56	3.24	0.31	34.80	22.82	8.92
50	4	1	4.76	3.20	16.15	8.93	2.16	33.74	21.66	6.98
50	4	2	6.34	4.43	29.69	19.70	7.74	26.60	15.76	4.06
50	4	3	5.47	3.75	23.00	13.90	4.12	29.00	17.22	5.48
50	5	1	4.42	2.97	13.04	6.64	1.42	32.50	20.72	7.06
50	5	2	5.51	3.87	22.55	13.99	4.48	26.44	16.38	4.48
50	5	3	4.92	3.39	17.78	10.16	2.56	28.86	17.48	5.64
100	1	1	4.37	3.03	12.10	6.52	1.52	56.86	42.92	21.90
100	1	2	5.13	3.71	19.58	11.61	3.54	52.26	39.04	15.20
100	1	3	4.68	3.31	15.76	8.88	2.4	53.58	39.90	17.08
100	2	1	4.22	2.93	10.85	5.64	1.21	57.36	42.94	21.52
100	2	2	4.73	3.44	16.38	9.20	2.49	49.10	36.18	13.68
100	2	3	4.42	3.14	13.68	7.48	1.71	53.10	39.16	16.10
100	3	1	4.02	2.68	8.86	4.12	0.65	56.78	41.94	20.06
100	3	2	3.97	2.55	8.07	3.51	0.36	62.22	50.28	26.02
100	3	3	3.98	2.60	9.16	3.99	0.53	57.96	44.20	22.48
100	4	1	4.52	3.14	12.83	6.89	1.64	52.00	38.70	16.08
100	4	2	5.54	4.03	22.10	13.90	4.87	43.32	30.42	12.34
100	4	3	4.88	3.46	17.02	10.12	2.94	45.34	32.48	12.44
100	5	1	4.35	3.01	11.51	5.97	1.27	52.20	38.60	16.52
100	5	2	5.04	3.62	17.79	10.82	3.25	43.50	29.16	11.90
100	5	3	4.58	3.25	14.30	7.97	2.06	44.98	31.82	12.94
200	1	1	4.14	2.94	10.84	5.61	1.21	87.04	78.68	57.64
200	1	2	4.54	3.29	14.94	8.32	2.24	84.08	74.94	51.10
200	1	3	4.33	3.14	12.81	6.62	1.52	86.30	76.22	51.62
200	2	1	4.06	2.89	10.20	5.13	1.14	87.22	78.42	57.72
200	2	2	4.32	3.13	13.04	7.02	1.75	80.90	71.40	45.32
200	2	3	4.18	3.03	11.62	5.88	1.31	85.12	74.32	49.14
200	3	1	3.95	2.75	9.19	4.34	0.79	86.84	77.74	55.94
200	3	2	3.90	2.60	8.76	3.94	0.54	88.20	80.56	63.26
200	3	3	3.94	2.72	9.19	4.06	0.63	87.68	79.32	58.20
200	4	1	4.28	3.06	11.91	6.16	1.45	81.20	70.64	46.40

n	Test	DGP	Mean	sd	17.63	10.87	3.22	71.26	58.98	33.42
200	4	2	4.86	3.58	17.63	10.87	3.22	71.26	58.98	33.42
200	4	3	4.57	3.31	14.57	7.98	1.96	77.44	65.22	38.96
200	5	1	4.19	2.99	11.00	5.71	1.29	81.08	70.82	46.46
200	5	2	4.58	3.35	15.30	8.90	2.49	69.38	57.16	30.48
200	5	3	4.38	3.16	12.87	6.96	1.65	76.46	64.10	37.12
500	1	1	4.06	2.86	11.24	5.79	1.1	99.84	99.58	97.78
500	1	2	4.29	3.04	11.93	6.41	1.55	99.74	99.52	97.58
500	1	3	4.13	2.90	10.73	5.31	1.31	99.90	99.66	98.00
500	2	1	4.03	2.84	10.98	5.60	1.06	99.84	99.58	97.78
500	2	2	4.18	2.97	11.08	5.83	1.28	99.62	99.24	96.34
500	2	3	4.06	2.86	10.10	5.05	1.22	99.88	99.60	97.68
500	3	1	3.98	2.78	10.44	5.20	0.91	99.82	99.58	97.86
500	3	2	3.99	2.71	9.50	4.41	0.65	99.80	99.60	98.34
500	3	3	3.96	2.72	9.02	4.28	0.92	99.92	99.72	98.48
500	4	1	4.22	2.97	11.69	6.24	1.31	99.56	98.96	94.60
500	4	2	4.51	3.22	14.30	8.12	1.9	98.22	96.14	86.70
500	4	3	4.30	3.03	11.90	6.44	1.69	99.12	97.98	92.02
500	5	1	4.18	2.94	11.44	6.00	1.25	99.58	98.92	94.72
500	5	2	4.37	3.11	13.26	7.22	1.53	97.88	95.46	84.40
500	5	3	4.21	2.96	11.22	6.06	1.48	98.96	97.80	91.12

(b) Rook Contiguity, CH-I

n	Test	DGP	Mean	sd	Empirical Size			Size-Adjusted Power		
					10%	5%	1%	10%	5%	1%
50	1	1	5.60	3.83	23.87	15.02	4.79	29.42	19.16	5.88
50	1	2	7.10	5.07	34.99	24.86	11.22	23.88	13.64	2.94
50	1	3	6.34	4.45	30.55	20.68	7.9	26.86	15.22	4.64
50	2	1	5.00	3.44	18.49	11.15	3.03	29.58	18.76	5.26
50	2	2	6.06	4.44	26.47	17.82	6.98	23.98	13.64	2.84
50	2	3	5.51	3.89	23.54	14.80	4.95	27.00	16.18	4.92
50	3	1	4.04	2.46	8.21	3.29	0.35	32.78	21.42	6.28
50	3	2	4.04	2.34	7.13	2.48	0.21	39.72	28.24	11.36
50	3	3	4.04	2.37	7.88	2.78	0.14	33.44	22.24	7.62
50	4	1	5.71	3.87	24.58	15.77	5.45	28.02	18.40	5.66
50	4	2	7.74	5.67	39.41	29.30	14.91	20.80	10.54	1.96
50	4	3	6.63	4.74	33.01	22.69	9.51	24.22	13.94	3.38
50	5	1	4.95	3.32	18.03	10.49	2.86	28.30	18.44	6.20
50	5	2	6.36	4.65	29.23	19.92	8.48	22.98	12.28	2.62
50	5	3	5.58	3.91	24.25	15.36	5.07	24.76	15.48	4.66
100	1	1	4.81	3.48	16.11	8.98	2.27	55.48	41.44	17.54
100	1	2	5.60	4.11	23.69	15.09	5.71	54.02	40.24	18.52
100	1	3	5.11	3.66	18.94	11.36	3.6	54.82	39.98	17.12
100	2	1	4.51	3.27	13.84	7.23	1.6	53.88	39.48	16.98
100	2	2	4.99	3.67	18.68	11.44	3.67	48.22	34.00	15.36

n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
100	2	3	4.66	3.36	15.46	8.91	2.5	52.62	36.98	15.78
100	3	1	4.08	2.74	9.42	3.97	0.46	59.56	47.38	22.74
100	3	2	3.93	2.49	8.08	3.55	0.31	68.72	58.70	35.76
100	3	3	3.96	2.55	8.26	3.38	0.52	65.26	52.02	29.54
100	4	1	4.94	3.54	17.03	9.91	2.61	49.92	36.44	15.08
100	4	2	6.27	4.85	28.79	19.93	8.36	42.20	28.48	7.58
100	4	3	5.42	3.97	21.62	13.44	4.76	45.68	31.98	11.06
100	5	1	4.56	3.25	13.78	7.55	1.71	49.24	35.84	15.90
100	5	2	5.35	3.96	22.36	14.13	4.91	41.46	28.50	9.78
100	5	3	4.81	3.45	16.65	9.66	2.88	44.96	30.88	13.60
200	1	1	4.46	3.17	12.79	6.99	1.6	80.72	69.80	45.70
200	1	2	5.15	3.78	18.74	11.63	3.85	80.54	67.86	37.42
200	1	3	4.67	3.44	15.29	8.96	2.6	81.46	70.04	39.88
200	2	1	4.28	3.04	11.58	6.03	1.29	80.28	69.00	45.40
200	2	2	4.74	3.50	16.01	9.34	2.79	75.48	60.50	30.18
200	2	3	4.38	3.20	13.33	7.57	2.02	79.60	67.54	37.00
200	3	1	4.01	2.70	9.43	4.45	0.63	82.76	73.48	47.38
200	3	2	4.03	2.61	9.41	4.13	0.61	86.44	78.42	55.24
200	3	3	3.90	2.56	9.60	4.24	0.62	86.30	78.10	55.30
200	4	1	4.57	3.20	14.08	7.63	1.88	75.02	64.76	39.70
200	4	2	5.62	4.37	22.78	14.57	5.49	67.74	52.72	23.54
200	4	3	5.00	3.76	17.74	10.78	3.23	73.02	58.78	27.60
200	5	1	4.34	3.02	12.55	6.58	1.45	74.96	63.64	40.20
200	5	2	5.02	3.78	18.50	11.11	3.63	65.28	51.40	24.14
200	5	3	4.60	3.38	14.99	8.55	2.29	70.80	58.02	31.48
500	1	1	4.28	2.98	11.29	5.96	1.31	99.32	98.50	94.94
500	1	2	4.53	3.25	13.72	7.83	1.85	99.20	97.76	93.12
500	1	3	4.35	3.16	12.06	6.52	1.48	99.10	98.00	91.94
500	2	1	4.20	2.93	10.73	5.63	1.19	99.26	98.44	94.78
500	2	2	4.33	3.11	12.32	6.63	1.46	98.62	96.30	89.42
500	2	3	4.21	3.05	11.26	5.96	1.23	98.74	97.42	90.46
500	3	1	4.07	2.75	9.82	4.95	0.85	99.36	98.66	95.80
500	3	2	3.98	2.69	9.30	4.35	0.68	99.58	98.86	95.06
500	3	3	3.99	2.77	9.48	4.49	0.78	99.26	98.54	94.64
500	4	1	4.44	3.13	12.21	6.71	1.38	98.28	96.20	89.06
500	4	2	4.85	3.56	15.68	9.29	2.74	95.94	92.20	74.04
500	4	3	4.61	3.38	13.78	7.80	1.9	96.60	93.08	79.60
500	5	1	4.34	3.05	11.36	6.19	1.25	98.12	95.96	88.38
500	5	2	4.56	3.30	13.77	7.73	2.08	94.74	90.78	71.24
500	5	3	4.41	3.21	12.72	6.80	1.59	95.72	91.90	77.84

(c) Group Interaction I, CH-0

					Empirical Size			Size-Adjusted Power		
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%

50	1	1	4.93	3.24	18.06	10.00	1.96	31.90	21.22	8.58
50	1	2	6.12	4.19	28.90	19.44	6.42	30.24	18.92	4.86
50	1	3	5.27	3.57	20.54	12.50	3.40	31.04	20.90	6.60
50	2	1	4.63	3.05	15.30	8.08	1.22	31.60	22.16	9.04
50	2	2	5.43	3.77	22.80	14.18	3.90	28.10	18.30	4.58
50	2	3	4.81	3.28	16.48	9.46	2.16	30.48	19.78	6.66
50	3	1	4.23	2.63	10.78	4.28	0.46	31.72	21.22	8.12
50	3	2	4.16	2.45	8.46	3.20	0.22	40.30	29.90	12.20
50	3	3	4.07	2.49	8.78	3.44	0.22	34.80	23.30	8.26
50	4	1	5.02	3.27	18.50	10.84	1.86	31.30	20.76	9.88
50	4	2	6.59	4.54	32.52	22.20	8.74	26.64	15.46	4.78
50	4	3	5.55	3.75	23.08	13.98	4.24	27.30	17.84	4.74
50	5	1	4.68	3.05	15.54	8.20	1.16	31.16	20.44	9.70
50	5	2	5.77	4.01	25.76	16.60	5.18	26.62	16.88	5.00
50	5	3	5.01	3.41	18.24	10.54	2.64	26.70	17.40	5.48
100	1	1	4.47	3.07	13.60	7.50	1.52	43.94	31.22	13.34
100	1	2	5.33	3.83	20.44	12.54	4.64	41.32	26.16	8.82
100	1	3	4.78	3.41	16.02	9.26	2.92	44.46	30.48	10.16
100	2	1	4.32	2.97	12.60	6.48	1.28	44.38	31.48	13.58
100	2	2	4.90	3.53	17.22	10.34	3.16	39.06	25.02	8.46
100	2	3	4.52	3.23	14.00	7.96	2.10	43.00	28.96	10.46
100	3	1	4.11	2.71	10.42	5.08	0.60	43.52	29.92	12.82
100	3	2	4.13	2.65	9.78	4.16	0.72	51.62	38.44	14.44
100	3	3	4.10	2.72	9.80	4.54	0.80	48.28	34.12	12.74
100	4	1	4.64	3.16	15.00	8.42	1.96	39.60	28.10	11.46
100	4	2	5.77	4.09	24.10	15.72	5.74	34.52	20.86	7.22
100	4	3	5.03	3.58	18.62	10.82	3.24	37.46	26.00	7.92
100	5	1	4.45	3.02	13.30	7.38	1.56	39.44	28.46	11.56
100	5	2	5.24	3.71	19.68	12.16	3.94	33.60	21.14	7.66
100	5	3	4.71	3.35	16.04	8.98	2.50	37.20	25.78	8.64
200	1	1	4.26	3.05	11.92	6.98	1.36	69.30	56.70	31.80
200	1	2	4.67	3.33	15.86	8.82	2.34	67.12	53.76	29.62
200	1	3	4.57	3.26	15.10	8.22	2.20	66.26	54.10	28.08
200	2	1	4.18	3.00	11.14	6.52	1.26	69.44	56.70	31.42
200	2	2	4.44	3.18	14.08	7.74	1.90	64.40	50.90	26.14
200	2	3	4.42	3.16	13.70	7.20	1.76	65.36	53.18	26.60
200	3	1	4.07	2.85	10.56	5.30	0.90	68.96	56.36	31.90
200	3	2	3.99	2.62	9.22	4.18	0.58	72.16	61.94	40.02
200	3	3	4.16	2.81	10.78	5.12	0.78	69.20	57.04	34.50
200	4	1	4.43	3.14	13.54	7.30	1.76	61.26	47.20	25.34
200	4	2	5.06	3.67	18.74	11.24	3.74	50.00	36.96	16.84
200	4	3	4.75	3.35	16.14	9.32	2.30	55.54	42.72	20.38
200	5	1	4.33	3.06	12.66	6.84	1.50	61.18	46.86	24.82
200	5	2	4.76	3.44	16.34	9.18	2.80	49.26	36.44	16.38

n	Test	DGP	Mean	sd						
200	5	3	4.56	3.22	14.60	8.14	1.96	55.24	42.54	21.24
500	1	1	4.13	2.97	10.98	5.66	1.42	98.22	96.34	85.22
500	1	2	4.39	3.18	13.42	7.50	1.66	97.22	94.18	81.70
500	1	3	4.32	3.08	12.42	6.70	1.62	97.94	95.52	84.94
500	2	1	4.10	2.95	10.78	5.58	1.32	98.24	96.40	85.24
500	2	2	4.28	3.10	12.66	6.96	1.44	96.56	92.98	78.96
500	2	3	4.26	3.03	11.98	6.40	1.62	97.86	95.08	84.28
500	3	1	4.05	2.88	10.34	4.94	1.28	98.20	96.38	84.60
500	3	2	4.07	2.82	10.38	5.16	0.80	97.76	95.74	87.26
500	3	3	4.14	2.87	10.82	5.50	1.08	98.22	96.22	87.18
500	4	1	4.22	3.04	12.12	6.44	1.56	95.02	90.96	75.12
500	4	2	4.52	3.29	14.44	7.92	2.32	85.06	76.60	56.06
500	4	3	4.44	3.18	13.94	7.64	1.76	92.44	86.78	72.32
500	5	1	4.18	3.01	11.80	6.22	1.46	95.02	90.84	74.78
500	5	2	4.39	3.18	13.30	7.16	2.00	83.16	74.48	53.64
500	5	3	4.35	3.10	13.22	7.14	1.56	91.92	86.20	71.82

(d) Group Interaction I, CH-I, T = 3

					Empirical Size (H_0 true)			Size-Adj Power (H_a true)		
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
50	1	1	4.67	3.16	15.24	8.31	1.92	24.96	15.46	4.8
50	1	2	5.82	3.95	25.42	16.23	5.27	34.78	24.94	11.24
50	1	3	5.30	3.58	20.91	12.34	3.44	28.96	19.92	7.34
50	2	1	4.37	2.96	12.63	6.67	1.31	19.4	11.52	2.96
50	2	2	5.13	3.54	19.33	11.47	3.3	27.2	18.52	6.98
50	2	3	4.82	3.30	16.86	9.35	2.32	22.42	13.94	4.64
50	3	1	4.00	2.55	8.81	3.64	0.41	9.86	3.82	0.3
50	3	2	3.98	2.38	7.37	2.64	0.26	8.18	2.96	0.16
50	3	3	4.07	2.47	8.56	3.24	0.31	8.26	3.28	0.22
50	4	1	4.77	3.21	16.15	8.93	2.16	25.96	16.7	5
50	4	2	6.29	4.38	29.69	19.70	7.74	38.92	29.04	14.88
50	4	3	5.53	3.73	23.00	13.90	4.12	32.32	22.62	8.88
50	5	1	4.42	2.98	13.04	6.64	1.42	19.44	11.92	2.9
50	5	2	5.46	3.81	22.55	13.99	4.48	29.78	21.16	9.34
50	5	3	4.98	3.37	17.78	10.16	2.56	24.26	15.1	4.94
100	1	1	4.31	3.00	12.10	6.52	1.52	18.48	11.06	3.4
100	1	2	5.12	3.64	19.58	11.61	3.54	27.64	19.34	7.22
100	1	3	4.70	3.31	15.76	8.88	2.4	23.2	14.1	5.06
100	2	1	4.16	2.90	10.85	5.64	1.21	15.7	9.12	2.46
100	2	2	4.73	3.38	16.38	9.20	2.49	22.14	14.34	4.98
100	2	3	4.45	3.15	13.68	7.48	1.71	18.52	11.1	3.5
100	3	1	3.96	2.65	8.86	4.12	0.65	10.12	4.52	0.52
100	3	2	3.98	2.52	8.07	3.51	0.36	8.86	3.74	0.32
100	3	3	4.02	2.62	9.16	3.99	0.53	9.66	4.28	0.64

100	4	1	4.42	3.06	12.83	6.89	1.64	19.6	12.02	3.72
100	4	2	5.50	3.96	22.10	13.90	4.87	32.5	22.76	10.76
100	4	3	4.86	3.45	17.02	10.12	2.94	26.52	17.58	6.98
100	5	1	4.25	2.93	11.51	5.97	1.27	15.46	9.42	2.3
100	5	2	5.00	3.59	17.79	10.82	3.25	25.44	16.3	6.18
100	5	3	4.55	3.21	14.30	7.97	2.06	20.5	13	4.3
200	1	1	4.15	2.92	10.84	5.61	1.21	15.62	8.5	2.06
200	1	2	4.60	3.27	14.94	8.32	2.24	20.48	12.56	3.74
200	1	3	4.32	3.06	12.81	6.62	1.52	17.32	9.88	2.56
200	2	1	4.07	2.86	10.20	5.13	1.14	14	7.54	1.72
200	2	2	4.38	3.11	13.04	7.02	1.75	17.08	9.88	2.64
200	2	3	4.18	2.96	11.62	5.88	1.31	14.72	8.24	2.1
200	3	1	3.97	2.71	9.19	4.34	0.79	11.08	5.34	0.76
200	3	2	3.97	2.62	8.76	3.94	0.54	9.5	3.94	0.56
200	3	3	3.94	2.66	9.19	4.06	0.63	9.86	4.56	0.9
200	4	1	4.27	2.98	11.91	6.16	1.45	16.28	9.2	2.66
200	4	2	4.93	3.59	17.63	10.87	3.22	23.36	15.5	5.82
200	4	3	4.54	3.22	14.57	7.98	1.96	18.44	11.08	3.36
200	5	1	4.18	2.91	11.00	5.71	1.29	14.1	7.78	2.14
200	5	2	4.64	3.37	15.30	8.90	2.49	19.02	11.32	3.74
200	5	3	4.36	3.08	12.87	6.96	1.65	15.78	8.94	2.38
500	1	1	4.10	2.92	11.24	5.79	1.1	11.9	6.38	1.5
500	1	2	4.26	3.02	11.93	6.41	1.55	14.34	7.8	1.72
500	1	3	4.09	2.93	10.73	5.31	1.31	12.4	6.5	1.48
500	2	1	4.07	2.90	10.98	5.60	1.06	11.44	5.94	1.42
500	2	2	4.17	2.95	11.08	5.83	1.28	12.84	6.98	1.44
500	2	3	4.03	2.89	10.10	5.05	1.22	11.32	6.04	1.2
500	3	1	4.02	2.83	10.44	5.20	0.91	10.54	5.24	1.16
500	3	2	3.97	2.69	9.50	4.41	0.65	9.12	4.18	0.6
500	3	3	3.92	2.74	9.02	4.28	0.92	9.74	4.7	0.74
500	4	1	4.21	2.98	11.69	6.24	1.31	12.84	6.92	1.72
500	4	2	4.48	3.18	14.30	8.12	1.9	17.06	10.36	3.06
500	4	3	4.27	3.07	11.90	6.44	1.69	14.8	8.08	2.04
500	5	1	4.17	2.95	11.44	6.00	1.25	12.3	6.52	1.5
500	5	2	4.35	3.08	13.26	7.22	1.53	14.84	8.66	2.42
500	5	3	4.18	3.01	11.22	6.06	1.48	13.48	7.2	1.7

(e) Group Interaction I, CH-2

| | | | | | Empirical Size | | | Size-Adjusted Power | | |
	n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
	50	1	1	5.00	3.32	18.20	10.46	2.46	32.54	20.88	7.80
	50	1	2	6.11	4.10	28.08	18.12	6.42	30.68	19.38	5.72
	50	1	3	5.49	3.68	22.42	13.38	3.92	30.60	19.38	6.02
	50	2	1	4.69	3.13	15.08	8.42	1.74	33.08	21.38	7.50

50	2	2	5.40	3.71	21.58	13.04	4.10	29.14	17.90	4.74
50	2	3	4.99	3.36	17.44	9.94	2.64	30.50	19.30	6.36
50	3	1	4.28	2.67	10.74	4.72	0.58	31.90	20.42	5.74
50	3	2	4.15	2.43	8.58	3.40	0.20	40.36	29.32	11.24
50	3	3	4.19	2.49	9.16	3.58	0.40	34.52	23.20	8.88
50	4	1	5.14	3.43	19.20	11.02	2.92	32.26	20.76	7.14
50	4	2	6.50	4.45	31.06	20.80	8.40	27.88	17.30	4.28
50	4	3	5.66	3.78	24.22	15.04	4.48	27.60	17.40	5.94
50	5	1	4.79	3.21	16.08	9.02	2.18	31.60	20.24	6.38
50	5	2	5.69	3.93	23.90	15.06	5.36	26.24	15.84	4.46
50	5	3	5.09	3.42	19.04	10.98	2.98	26.84	17.32	5.52
100	1	1	4.50	3.17	13.86	7.40	1.92	39.84	27.76	10.04
100	1	2	5.29	3.76	20.72	12.96	4.32	36.24	23.60	8.84
100	1	3	4.83	3.42	17.10	9.84	2.76	37.70	26.18	8.78
100	2	1	4.33	3.05	12.26	6.68	1.58	40.48	27.70	9.64
100	2	2	4.85	3.46	17.52	9.96	2.98	34.92	22.44	8.08
100	2	3	4.55	3.23	14.42	7.94	2.18	36.72	24.66	8.24
100	3	1	4.13	2.78	10.42	4.86	0.90	40.44	27.94	10.04
100	3	2	4.10	2.62	9.52	4.18	0.52	43.94	31.72	13.30
100	3	3	4.12	2.70	10.32	4.42	0.62	40.06	28.14	11.44
100	4	1	4.66	3.28	15.18	8.26	2.14	36.58	24.98	7.30
100	4	2	5.76	4.21	24.44	16.30	6.38	27.58	17.16	6.54
100	4	3	5.06	3.54	18.58	11.22	3.10	30.80	20.70	8.08
100	5	1	4.46	3.13	13.72	7.04	1.82	35.76	24.20	7.56
100	5	2	5.21	3.79	20.08	12.68	4.06	27.62	17.52	6.68
100	5	3	4.74	3.32	15.76	9.22	2.26	29.82	19.98	7.66
200	1	1	4.30	2.97	12.20	6.34	1.40	68.74	56.28	33.64
200	1	2	4.80	3.50	16.80	10.32	2.78	62.78	49.92	26.82
200	1	3	4.61	3.26	14.96	8.60	2.38	64.32	51.40	29.56
200	2	1	4.22	2.91	11.36	5.94	1.18	68.80	56.16	33.44
200	2	2	4.56	3.34	14.48	8.98	2.26	60.18	46.66	23.88
200	2	3	4.44	3.15	13.74	7.80	1.92	62.50	50.28	28.74
200	3	1	4.09	2.75	10.08	4.86	0.74	68.58	55.72	33.00
200	3	2	4.07	2.70	10.12	4.78	0.74	69.28	57.38	36.46
200	3	3	4.16	2.79	11.20	5.78	0.78	66.80	54.68	32.78
200	4	1	4.41	3.07	13.24	7.18	1.44	60.12	47.42	26.58
200	4	2	5.03	3.70	18.64	11.26	3.40	49.68	38.50	17.94
200	4	3	4.81	3.42	17.26	10.38	2.64	50.80	39.22	20.90
200	5	1	4.31	3.00	12.44	6.72	1.24	59.64	47.14	26.54
200	5	2	4.71	3.46	15.78	9.48	2.58	48.94	37.10	17.30
200	5	3	4.60	3.27	15.52	8.72	2.00	50.22	38.42	20.86
500	1	1	4.15	2.91	11.06	5.80	1.06	96.80	94.14	83.80
500	1	2	4.24	3.04	11.96	6.42	1.56	95.80	91.36	77.08

n	Test	DGP	Mean	sd						
500	1	3	4.23	3.03	11.76	6.16	1.72	96.88	93.72	78.48
500	2	1	4.11	2.88	10.74	5.56	1.02	96.76	94.24	83.50
500	2	2	4.14	2.97	11.34	5.82	1.40	94.62	89.36	73.20
500	2	3	4.16	2.98	11.04	5.84	1.56	96.48	93.00	76.98
500	3	1	4.07	2.82	10.26	5.06	0.86	96.84	94.28	83.52
500	3	2	3.96	2.74	9.60	4.66	0.86	96.56	92.92	81.06
500	3	3	4.06	2.83	10.04	4.96	1.24	97.12	94.76	81.48
500	4	1	4.31	3.07	12.82	6.90	1.36	91.52	85.98	68.70
500	4	2	4.52	3.30	14.62	8.32	2.36	76.44	64.94	41.94
500	4	3	4.44	3.17	13.26	7.42	2.02	88.88	80.76	59.62
500	5	1	4.27	3.04	12.58	6.68	1.30	91.54	85.50	67.94
500	5	2	4.39	3.19	13.52	7.66	1.94	74.86	62.48	39.32
500	5	3	4.35	3.10	12.68	7.02	1.74	88.02	79.56	58.14

(f) Group Interaction I, CH-3, T = 3

					Empirical Size (H_0 true)			Size-Adj Power (H_a true)		
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
50	1	1	5.64	3.85	23.87	15.02	4.79	29.2	19.42	7.28
50	1	2	7.01	4.95	34.99	24.86	11.22	42.86	32.84	17.72
50	1	3	6.41	4.43	30.55	20.68	7.9	36.2	26.08	12.02
50	2	1	5.04	3.49	18.49	11.15	3.03	23.94	14.86	4.8
50	2	2	5.98	4.33	26.47	17.82	6.98	33.68	24.62	12.16
50	2	3	5.59	3.91	23.54	14.80	4.95	28.44	19.6	8.26
50	3	1	4.06	2.46	8.21	3.29	0.35	7.74	2.64	0.18
50	3	2	4.02	2.32	7.13	2.48	0.21	6.26	1.94	0
50	3	3	4.06	2.37	7.88	2.78	0.14	7.06	2.18	0.02
50	4	1	5.78	3.95	24.58	15.77	5.45	31.84	21.56	8.64
50	4	2	7.76	5.65	39.41	29.30	14.91	49.64	39.04	22.54
50	4	3	6.71	4.71	33.01	22.69	9.51	40.64	30.04	14.76
50	5	1	5.00	3.40	18.03	10.49	2.86	26.34	16.88	5.8
50	5	2	6.36	4.62	29.23	19.92	8.48	39.92	30	15.9
50	5	3	5.67	3.98	24.25	15.36	5.07	32.94	23	10.14
100	1	1	4.73	3.32	16.11	8.98	2.27	32.82	23.54	10.78
100	1	2	5.66	4.13	23.69	15.09	5.71	45.8	35.96	20.7
100	1	3	5.07	3.66	18.94	11.36	3.6	38.98	29.02	14.98
100	2	1	4.45	3.13	13.84	7.23	1.6	22.8	14.76	5.32
100	2	2	5.06	3.70	18.68	11.44	3.67	31.5	22.62	11.42
100	2	3	4.66	3.37	15.46	8.91	2.5	26.26	18.16	7.78
100	3	1	4.03	2.62	9.42	3.97	0.46	9.64	3.78	0.1
100	3	2	4.00	2.49	8.08	3.55	0.31	7.4	2.72	0.08
100	3	3	3.95	2.54	8.26	3.38	0.52	7.9	2.84	0.2
100	4	1	4.85	3.41	17.03	9.91	2.61	37.68	27.62	13.02
100	4	2	6.31	4.83	28.79	19.93	8.36	54.74	44.84	27.32
100	4	3	5.40	3.97	21.62	13.44	4.76	45.94	36.26	20.34
100	5	1	4.49	3.13	13.78	7.55	1.71	26.88	18.24	7.14

n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
100	5	2	5.44	4.02	22.36	14.13	4.91	40.06	30.6	16.96
100	5	3	4.84	3.49	16.65	9.66	2.88	33.4	24.02	11.4
200	1	1	4.32	3.05	12.79	6.99	1.6	17.04	10.08	3.06
200	1	2	5.04	3.76	18.74	11.63	3.85	27.34	18.24	7.48
200	1	3	4.66	3.37	15.29	8.96	2.6	22.34	13.82	5.06
200	2	1	4.17	2.95	11.58	6.03	1.29	15.44	9.04	2.72
200	2	2	4.67	3.48	16.01	9.34	2.79	22.7	14.42	5.44
200	2	3	4.41	3.19	13.33	7.57	2.02	19.08	11.78	3.88
200	3	1	3.95	2.66	9.43	4.45	0.63	10.42	4.56	0.72
200	3	2	4.02	2.67	9.41	4.13	0.61	9.48	3.64	0.28
200	3	3	3.99	2.66	9.60	4.24	0.62	10.28	4.82	0.54
200	4	1	4.49	3.16	14.08	7.63	1.88	19.04	11.98	4.38
200	4	2	5.52	4.15	22.78	14.57	5.49	31.9	22.5	11
200	4	3	4.94	3.58	17.74	10.78	3.23	24.72	16.02	6.44
200	5	1	4.30	3.02	12.55	6.58	1.45	17.18	10.8	3.5
200	5	2	4.99	3.69	18.50	11.11	3.63	26.18	18	7.62
200	5	3	4.60	3.30	14.99	8.55	2.29	21.08	13.38	4.7
500	1	1	4.18	2.99	11.29	5.96	1.31	14.12	7.98	2.04
500	1	2	4.47	3.17	13.72	7.83	1.85	18.9	11.42	3.96
500	1	3	4.27	3.05	12.06	6.52	1.48	15.82	9.12	2.76
500	2	1	4.11	2.94	10.73	5.63	1.19	13.48	7.48	1.92
500	2	2	4.29	3.03	12.32	6.63	1.46	16.76	9.84	2.96
500	2	3	4.16	2.97	11.26	5.96	1.23	14.32	8.2	2.26
500	3	1	4.02	2.81	9.82	4.95	0.85	10.96	5.26	0.94
500	3	2	3.98	2.65	9.30	4.35	0.68	9.1	4.02	0.58
500	3	3	3.97	2.71	9.48	4.49	0.78	10.14	4.52	0.86
500	4	1	4.30	3.05	12.21	6.71	1.38	15.74	8.94	2.44
500	4	2	4.74	3.44	15.68	9.29	2.74	23.4	14.78	6.06
500	4	3	4.47	3.22	13.78	7.80	1.9	19.72	12.4	4.28
500	5	1	4.21	2.98	11.36	6.19	1.25	14.9	8.34	2.34
500	5	2	4.48	3.22	13.77	7.73	2.08	19.86	12.16	4.52
500	5	3	4.30	3.08	12.72	6.80	1.59	17.74	11.04	3.44

Table 2: Emprical Size and Power of Tests H_0: $\delta = 0$ vs H_a: $\delta = (.05, .05, .05, .05)$,   T = 6

(a) Rook Contiguity, CH-0

					Empirical Size			Size-Adjusted Power		
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
50	1	1	4.30	2.79	10.90	4.85	1.15	69.05	57.80	25.55
50	1	2	4.98	3.29	18.95	9.80	2.40	63.95	51.20	22.75
50	1	3	4.71	3.11	15.35	8.75	1.60	64.00	46.60	25.10
50	2	1	4.07	2.64	9.30	3.90	0.75	69.00	56.80	28.35
50	2	2	4.53	3.05	14.60	6.85	1.45	59.20	45.65	20.10
50	2	3	4.38	2.92	12.80	6.60	0.90	62.15	45.40	24.15

50	3	1	3.94	2.51	8.05	2.80	0.60	67.75	55.30	22.90
50	3	2	3.95	2.42	7.50	2.70	0.30	72.45	62.05	38.55
50	3	3	4.02	2.52	8.85	3.60	0.30	67.70	52.75	27.55
50	4	1	4.33	2.83	11.30	5.90	1.00	57.95	45.05	19.75
50	4	2	5.29	3.53	20.25	12.45	3.05	46.45	32.70	11.25
50	4	3	4.92	3.33	17.80	9.65	2.80	46.65	30.05	11.05
50	5	1	4.09	2.66	9.50	4.50	0.60	57.25	43.70	20.40
50	5	2	4.72	3.15	15.40	8.55	1.65	45.65	31.85	11.95
50	5	3	4.52	3.06	13.70	6.95	1.55	46.05	31.15	9.85
100	1	1	4.20	3.00	11.35	5.95	1.45	92.45	85.75	61.80
100	1	2	4.54	3.14	14.60	7.90	1.55	92.30	85.60	66.15
100	1	3	4.60	3.16	14.65	7.80	1.85	90.65	84.30	58.20
100	2	1	4.09	2.91	10.70	5.30	1.35	92.45	85.85	62.25
100	2	2	4.29	2.98	12.75	6.80	1.25	89.70	80.95	60.40
100	2	3	4.41	3.04	12.45	6.70	1.60	89.85	82.00	54.30
100	3	1	4.00	2.78	9.60	5.00	0.80	92.75	84.55	62.15
100	3	2	3.92	2.55	8.80	4.10	0.40	94.65	89.85	76.95
100	3	3	4.18	2.76	10.35	4.80	0.80	91.60	85.85	66.65
100	4	1	4.20	2.88	11.40	5.00	1.10	86.65	78.45	52.50
100	4	2	4.89	3.49	16.75	10.35	2.85	76.15	63.55	40.20
100	4	3	4.69	3.21	14.95	8.10	2.25	79.65	66.75	36.05
100	5	1	4.07	2.79	10.35	4.55	0.95	86.00	78.55	52.35
100	5	2	4.56	3.27	14.50	8.10	2.10	75.20	62.25	35.15
100	5	3	4.45	3.06	12.80	6.70	1.80	77.35	65.55	37.15
200	1	1	4.05	2.84	10.45	5.55	0.80	100.00	99.90	98.80
200	1	2	4.26	2.96	11.80	5.90	1.40	99.80	99.45	97.50
200	1	3	4.15	2.94	11.75	5.75	1.30	99.95	99.80	98.70
200	2	1	4.00	2.80	9.95	5.10	0.80	100.00	99.90	98.80
200	2	2	4.13	2.87	10.60	5.55	1.20	99.70	99.35	96.45
200	2	3	4.05	2.86	10.70	5.25	1.10	99.90	99.75	98.40
200	3	1	3.96	2.75	9.60	4.70	0.60	100.00	99.90	98.90
200	3	2	3.92	2.62	8.40	3.95	0.65	99.80	99.65	98.00
200	3	3	3.94	2.72	9.60	4.35	0.75	99.95	99.80	99.00
200	4	1	4.09	2.89	10.85	5.55	1.35	99.65	99.25	94.85
200	4	2	4.55	3.27	14.60	7.85	2.70	98.00	95.90	84.90
200	4	3	4.31	3.15	12.25	6.80	1.60	99.30	98.10	88.55
200	5	1	4.03	2.84	10.15	5.00	1.10	99.65	99.25	95.05
200	5	2	4.37	3.13	13.20	6.80	2.15	97.80	94.20	80.30
200	5	3	4.19	3.05	11.15	6.05	1.40	99.15	98.00	86.80
500	1	1	3.98	2.83	9.90	5.25	1.15	100.00	100.00	100.00
500	1	2	4.10	2.94	11.10	5.70	1.45	100.00	100.00	100.00
500	1	3	4.11	2.88	10.75	5.70	1.20	100.00	100.00	100.00
500	2	1	3.96	2.82	9.65	5.25	1.10	100.00	100.00	100.00

n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
500	2	2	4.05	2.90	10.50	5.50	1.30	100.00	100.00	100.00
500	2	3	4.06	2.85	10.45	5.45	1.10	100.00	100.00	100.00
500	3	1	3.94	2.79	9.40	5.15	0.90	100.00	100.00	100.00
500	3	2	3.95	2.77	9.50	5.00	1.00	100.00	100.00	100.00
500	3	3	4.01	2.78	10.10	5.00	0.80	100.00	100.00	100.00
500	4	1	3.99	2.81	10.40	5.35	0.70	100.00	100.00	100.00
500	4	2	4.19	3.06	11.50	6.00	1.85	100.00	100.00	99.95
500	4	3	4.22	2.94	11.80	5.65	1.45	100.00	100.00	100.00
500	5	1	3.96	2.79	10.20	5.20	0.70	100.00	100.00	100.00
500	5	2	4.12	3.00	11.40	5.70	1.65	100.00	100.00	99.90
500	5	3	4.16	2.90	11.15	5.30	1.30	100.00	100.00	100.00

(b) Rook Contiguity, CH-I

n	Test	DGP	Mean	sd	Empirical Size			Size-Adjusted Power		
					10%	5%	1%	10%	5%	1%
50	1	1	4.82	3.21	16.50	9.50	1.85	54.80	40.25	16.10
50	1	2	5.63	3.86	23.95	14.70	5.20	54.10	35.80	15.90
50	1	3	5.18	3.62	20.10	11.75	3.20	53.85	38.30	10.55
50	2	1	4.47	3.00	13.50	7.55	1.35	54.90	38.90	14.75
50	2	2	5.00	3.49	18.20	10.35	3.35	49.15	31.90	13.15
50	2	3	4.71	3.31	16.00	8.65	2.20	49.95	36.25	13.30
50	3	1	4.03	2.51	8.90	3.55	0.20	60.10	43.75	20.90
50	3	2	4.02	2.48	8.55	3.25	0.40	63.55	52.40	27.30
50	3	3	4.01	2.53	8.10	3.85	0.50	61.60	46.05	22.35
50	4	1	4.91	3.27	16.80	8.95	2.25	48.60	33.85	10.05
50	4	2	6.06	4.28	27.75	17.60	6.75	39.30	25.80	6.15
50	4	3	5.38	3.70	22.30	13.35	3.55	42.15	30.90	10.10
50	5	1	4.53	3.04	13.25	7.10	1.50	45.65	31.80	10.75
50	5	2	5.28	3.73	20.30	12.70	3.80	37.15	22.75	7.75
50	5	3	4.80	3.29	17.25	9.15	2.25	42.25	28.55	11.65
100	1	1	4.52	3.21	14.15	8.20	1.60	91.25	85.00	58.05
100	1	2	4.94	3.45	16.95	10.10	3.05	91.50	83.30	65.10
100	1	3	4.77	3.45	17.10	9.85	2.15	89.20	79.70	50.90
100	2	1	4.34	3.09	13.05	6.55	1.50	90.90	83.70	58.65
100	2	2	4.57	3.24	14.00	8.20	2.25	86.60	76.35	52.40
100	2	3	4.51	3.27	14.45	8.10	1.80	86.70	74.85	47.15
100	3	1	4.10	2.76	10.55	5.00	0.80	92.35	86.20	67.60
100	3	2	3.96	2.52	8.30	3.55	0.45	95.35	90.30	75.10
100	3	3	4.09	2.78	10.40	4.75	1.00	92.10	86.10	63.45
100	4	1	4.54	3.15	13.90	7.15	1.65	84.45	74.65	49.50
100	4	2	5.31	3.81	21.85	13.95	4.20	76.65	64.70	36.70
100	4	3	5.06	3.59	19.25	11.40	3.45	76.10	63.20	35.90
100	5	1	4.31	2.98	12.15	6.05	1.15	83.20	75.25	46.10
100	5	2	4.81	3.44	18.10	10.20	2.55	72.95	62.10	31.10
100	5	3	4.69	3.34	15.95	9.00	2.20	73.65	58.60	33.60

200	1	1	4.41	3.17	13.55	6.75	1.80	99.60	99.25	95.10
200	1	2	4.61	3.28	15.40	8.35	1.60	99.50	99.15	94.35
200	1	3	4.48	3.06	15.05	7.70	1.25	99.65	99.35	97.35
200	2	1	4.28	3.08	12.15	6.15	1.55	99.55	99.10	93.65
200	2	2	4.35	3.10	12.90	6.95	1.30	98.95	96.95	88.60
200	2	3	4.28	2.93	13.45	6.20	0.85	99.15	98.40	95.30
200	3	1	4.10	2.84	10.70	5.00	1.15	99.70	99.30	96.45
200	3	2	3.95	2.62	8.90	3.80	0.40	99.70	99.50	98.25
200	3	3	4.01	2.66	9.75	3.80	0.45	99.85	99.55	97.80
200	4	1	4.51	3.23	14.10	7.30	2.05	98.15	96.65	82.05
200	4	2	4.97	3.74	18.20	11.45	3.20	96.05	92.80	76.70
200	4	3	4.80	3.32	17.75	9.60	2.45	97.00	93.85	81.90
200	5	1	4.35	3.11	12.65	6.90	1.60	97.70	96.05	79.35
200	5	2	4.60	3.42	14.70	9.15	2.45	94.15	88.95	68.45
200	5	3	4.49	3.09	14.80	7.35	1.35	95.55	92.35	77.10
500	1	1	4.05	2.89	10.10	5.70	1.35	100.00	100.00	100.00
500	1	2	4.24	3.08	12.40	6.40	1.35	100.00	100.00	100.00
500	1	3	4.10	2.90	11.55	5.70	1.10	100.00	100.00	100.00
500	2	1	4.00	2.85	9.80	5.70	1.25	100.00	100.00	100.00
500	2	2	4.13	2.99	11.55	5.75	1.10	100.00	100.00	100.00
500	2	3	4.02	2.85	10.85	5.40	0.90	100.00	100.00	100.00
500	3	1	3.94	2.77	9.30	5.20	1.00	100.00	100.00	100.00
500	3	2	3.96	2.78	9.40	4.30	0.75	100.00	100.00	100.00
500	3	3	3.93	2.72	9.35	4.60	0.75	100.00	100.00	100.00
500	4	1	4.20	3.00	11.50	6.10	1.85	100.00	100.00	100.00
500	4	2	4.54	3.30	14.20	8.00	1.95	100.00	100.00	99.85
500	4	3	4.31	3.06	12.70	7.15	1.30	100.00	100.00	100.00
500	5	1	4.14	2.95	10.95	5.85	1.50	100.00	100.00	100.00
500	5	2	4.35	3.12	12.80	6.95	1.55	100.00	99.95	99.75
500	5	3	4.19	2.97	11.70	6.60	1.15	100.00	100.00	99.90

(c) Group Interaction I, CH-0

| | | | | | Empirical Size | | | Size-Adjusted Power | | |
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
50	1	1	4.44	2.98	13.55	7.35	1.20	62.95	50.05	25.95
50	1	2	5.20	3.60	19.60	12.50	3.55	60.65	46.20	17.60
50	1	3	4.74	3.19	15.90	8.45	2.10	63.95	50.25	21.95
50	2	1	4.23	2.86	12.15	6.05	0.95	63.00	49.45	26.85
50	2	2	4.74	3.32	15.40	9.50	2.35	56.60	41.90	14.25
50	2	3	4.41	2.99	13.10	6.40	1.50	62.40	48.75	20.20
50	3	1	4.07	2.67	10.45	4.75	0.55	62.05	47.40	24.70
50	3	2	4.09	2.60	9.20	4.50	0.35	72.20	56.30	29.80
50	3	3	4.03	2.57	8.95	3.85	0.35	66.75	55.50	28.55
50	4	1	4.44	2.93	13.40	7.30	1.20	55.60	42.30	20.65

50	4	2	5.42	3.74	21.35	13.60	4.55	45.85	33.05	12.25
50	4	3	4.80	3.27	16.30	9.10	2.25	50.55	38.25	15.75
50	5	1	4.21	2.78	11.60	5.50	0.80	55.90	42.50	20.40
50	5	2	4.87	3.33	16.55	10.20	2.60	43.70	30.85	11.60
50	5	3	4.42	3.02	12.50	6.75	1.40	51.85	37.05	15.15
100	1	1	4.18	2.86	11.95	5.65	0.95	80.10	71.15	44.90
100	1	2	4.71	3.33	15.55	8.95	2.50	78.55	66.20	39.75
100	1	3	4.44	3.07	14.00	6.90	1.75	76.80	67.60	37.00
100	2	1	4.07	2.78	11.00	5.15	0.85	80.15	70.05	46.85
100	2	2	4.45	3.14	13.45	7.50	1.90	74.70	63.30	34.95
100	2	3	4.26	2.94	12.00	6.00	1.20	76.25	65.85	39.35
100	3	1	3.98	2.67	9.90	4.15	0.65	79.95	70.15	43.30
100	3	2	4.05	2.64	9.25	4.35	0.60	83.25	74.70	52.55
100	3	3	4.06	2.69	9.90	4.25	0.55	78.75	69.25	44.60
100	4	1	4.27	2.97	12.00	6.10	1.65	65.15	51.35	25.75
100	4	2	4.85	3.43	15.95	9.55	2.85	55.55	39.95	15.75
100	4	3	4.64	3.27	14.55	8.25	2.25	54.85	39.00	16.25
100	5	1	4.14	2.87	10.70	5.15	1.20	64.85	51.65	25.20
100	5	2	4.51	3.15	13.50	7.85	1.85	53.70	38.55	16.50
100	5	3	4.40	3.09	12.65	7.25	1.65	54.00	37.60	16.20
200	1	1	4.20	2.95	12.00	5.90	1.25	98.00	96.50	85.95
200	1	2	4.40	3.15	13.25	7.80	1.40	97.85	95.30	85.10
200	1	3	4.15	2.90	10.75	5.80	1.30	98.60	96.30	87.20
200	2	1	4.14	2.90	11.40	5.65	1.20	98.00	96.50	85.60
200	2	2	4.26	3.05	12.25	6.80	1.15	96.95	93.85	81.50
200	2	3	4.05	2.84	10.25	5.50	1.05	98.15	95.80	85.50
200	3	1	4.10	2.84	11.20	5.05	1.10	98.10	96.60	84.45
200	3	2	4.05	2.78	10.45	4.95	0.65	98.40	96.40	89.65
200	3	3	3.92	2.68	8.65	4.40	0.70	98.90	96.95	89.65
200	4	1	4.26	3.00	11.90	6.15	1.35	92.95	86.65	68.90
200	4	2	4.53	3.16	14.80	8.10	1.60	82.80	74.80	50.25
200	4	3	4.30	3.01	12.45	6.60	1.55	87.85	79.65	54.90
200	5	1	4.19	2.95	11.35	5.80	1.25	92.85	86.65	67.75
200	5	2	4.35	3.03	13.35	6.90	1.55	80.95	72.30	45.25
200	5	3	4.16	2.90	11.15	5.65	1.25	87.25	78.75	55.10
500	1	1	4.05	2.80	10.35	5.35	0.95	100.00	100.00	99.90
500	1	2	4.18	3.06	11.60	6.50	1.40	99.90	99.85	99.65
500	1	3	4.07	2.82	10.35	4.85	1.05	100.00	99.90	99.90
500	2	1	4.03	2.78	10.25	5.15	0.85	100.00	100.00	99.90
500	2	2	4.13	3.02	11.25	6.30	1.30	99.90	99.85	99.45
500	2	3	4.02	2.79	9.85	4.70	0.95	100.00	99.90	99.90
500	3	1	4.01	2.75	10.10	4.90	0.80	100.00	100.00	99.90
500	3	2	4.02	2.88	10.35	5.50	1.00	99.95	99.90	99.80

n	Test	DGP	Mean	sd	10%	5%	1%			
500	3	3	3.97	2.72	9.20	4.30	0.70	100.00	99.90	99.90
500	4	1	4.09	2.91	11.30	5.90	1.05	99.85	99.35	97.00
500	4	2	4.26	3.05	12.45	6.90	1.45	96.55	94.05	84.45
500	4	3	4.18	3.00	11.05	6.00	1.20	99.15	97.95	93.05
500	5	1	4.07	2.89	11.05	5.85	1.05	99.80	99.30	96.70
500	5	2	4.18	3.00	11.65	6.35	1.15	96.15	92.85	82.20
500	5	3	4.13	2.96	10.55	5.50	1.00	99.10	97.90	91.90

(d) Group Interaction I, CH-2

					Empirical Size			Size-Adjusted Power		
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
50	1	1	4.38	2.86	12.20	6.30	1.35	51.25	36.05	12.85
50	1	2	5.17	3.26	19.65	10.15	2.30	49.45	34.85	15.30
50	1	3	4.76	3.11	16.55	8.95	1.55	48.10	34.60	16.15
50	2	1	4.15	2.72	10.10	4.90	0.70	50.80	35.45	11.70
50	2	2	4.69	3.01	14.65	7.75	1.35	43.35	28.85	12.05
50	2	3	4.41	2.91	13.25	6.60	0.95	46.10	32.90	14.25
50	3	1	4.05	2.60	9.30	4.15	0.55	50.45	36.50	11.85
50	3	2	4.13	2.48	9.15	3.55	0.50	56.25	43.90	22.40
50	3	3	4.11	2.60	10.10	4.05	0.30	51.80	37.90	18.65
50	4	1	4.51	2.97	14.15	7.15	1.25	38.65	24.70	8.40
50	4	2	5.61	3.67	22.75	13.65	4.10	29.45	18.10	4.45
50	4	3	4.90	3.26	17.90	9.20	2.40	31.80	20.85	5.15
50	5	1	4.24	2.81	11.45	5.60	1.00	37.95	24.00	6.80
50	5	2	5.01	3.27	17.30	9.70	2.55	27.25	16.60	4.25
50	5	3	4.47	2.96	13.75	6.60	1.35	31.15	20.25	6.45
100	1	1	4.26	2.94	12.50	6.15	0.90	74.80	65.90	42.25
100	1	2	4.71	3.28	15.35	8.50	2.40	74.70	63.25	35.85
100	1	3	4.39	3.02	13.15	6.65	1.40	76.65	63.90	40.60
100	2	1	4.14	2.85	11.85	5.55	0.80	74.60	64.75	40.45
100	2	2	4.44	3.11	13.40	7.35	2.05	72.25	57.95	30.05
100	2	3	4.21	2.91	11.45	5.75	0.90	75.55	62.85	38.80
100	3	1	4.07	2.76	10.90	5.10	0.55	74.55	64.25	40.95
100	3	2	4.08	2.66	9.55	4.30	0.55	79.05	70.35	45.95
100	3	3	4.01	2.65	8.70	3.95	0.35	78.70	68.05	43.65
100	4	1	4.30	2.96	12.40	6.95	1.00	60.50	47.10	26.45
100	4	2	4.97	3.45	18.10	10.50	2.55	48.20	34.30	16.75
100	4	3	4.63	3.25	15.20	8.35	2.15	53.50	37.90	16.35
100	5	1	4.16	2.85	11.25	6.25	0.75	59.85	46.75	25.80
100	5	2	4.64	3.23	14.75	8.30	1.90	46.05	31.70	14.50
100	5	3	4.39	3.08	13.05	7.20	1.60	51.50	36.30	15.60
200	1	1	4.12	2.78	10.95	5.20	0.75	98.30	96.15	90.10
200	1	2	4.45	3.11	14.45	7.50	1.80	97.30	95.30	81.60
200	1	3	4.11	2.86	10.75	5.20	1.00	97.80	95.65	87.75

200	2	1	4.06	2.74	10.20	4.85	0.75	98.15	96.30	89.75
200	2	2	4.30	3.00	13.20	6.45	1.45	96.25	93.35	76.35
200	2	3	4.01	2.79	9.85	5.00	0.80	97.60	95.10	85.60
200	3	1	4.01	2.69	9.80	4.40	0.60	98.30	96.30	90.00
200	3	2	4.10	2.77	10.95	4.85	0.85	97.70	96.00	87.50
200	3	3	3.91	2.66	8.55	4.30	0.55	98.25	96.35	88.45
200	4	1	4.20	2.88	12.60	5.65	0.80	90.15	85.75	69.15
200	4	2	4.61	3.26	15.85	8.35	1.85	79.85	68.95	47.05
200	4	3	4.26	3.02	12.45	5.95	1.20	85.40	77.20	56.70
200	5	1	4.13	2.83	12.05	4.95	0.80	90.20	85.75	67.75
200	5	2	4.42	3.13	13.95	7.25	1.55	78.10	65.45	44.05
200	5	3	4.14	2.93	11.40	5.30	1.00	83.80	75.35	54.85
500	1	1	3.97	2.77	9.25	4.50	0.75	100.00	100.00	100.00
500	1	2	4.27	3.06	13.35	6.85	1.45	100.00	99.95	99.80
500	1	3	4.16	2.97	11.50	7.15	1.10	99.95	99.85	99.75
500	2	1	3.94	2.75	9.15	4.45	0.75	100.00	100.00	100.00
500	2	2	4.21	3.02	12.80	6.50	1.35	99.95	99.90	99.75
500	2	3	4.12	2.95	11.25	6.75	1.00	99.95	99.80	99.70
500	3	1	3.93	2.73	9.05	4.35	0.75	100.00	100.00	100.00
500	3	2	4.11	2.89	11.50	5.60	1.05	100.00	99.95	99.85
500	3	3	4.07	2.88	10.75	6.40	0.95	100.00	99.85	99.75
500	4	1	4.07	2.88	10.35	5.55	1.15	99.75	99.55	98.20
500	4	2	4.37	3.15	13.45	7.15	1.80	97.05	93.60	81.75
500	4	3	4.18	2.99	11.70	6.65	1.55	99.05	98.05	92.55
500	5	1	4.04	2.86	10.10	5.45	1.10	99.75	99.55	98.10
500	5	2	4.28	3.07	12.60	6.70	1.65	96.30	92.50	78.65
500	5	3	4.12	2.95	11.30	6.15	1.50	99.00	97.60	90.85

Table 3: Emprical Size and Power of Tests H0: $\lambda = 0$ vs Ha: $\lambda = (.05, .05, .05)$, , T = 3, $\rho = 0.5$

(a) Rook Contiguity, CH-0

					Empirical Size			Size-Adjusted Power		
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
50	1	1	3.63	2.84	15.86	8.54	2.16	79.26	67.36	37.38
50	1	2	4.42	3.44	24.18	15.22	5.00	71.02	57.06	29.94
50	1	3	4.13	3.18	20.82	12.54	3.54	73.06	60.32	30.58
50	2	1	3.30	2.60	12.42	6.20	1.30	79.54	67.08	35.26
50	2	2	3.68	2.93	16.50	9.90	2.44	64.46	48.44	24.30
50	2	3	3.60	2.82	15.40	8.50	2.06	72.44	58.54	29.84
50	3	1	3.07	2.29	9.56	4.42	0.52	77.56	63.34	31.76
50	3	2	3.02	2.13	8.74	3.56	0.28	82.54	71.86	50.42
50	3	3	3.15	2.26	9.86	4.10	0.46	77.84	66.70	38.80
50	4	1	3.64	2.85	15.76	8.68	2.20	78.66	67.16	36.96
50	4	2	4.43	3.44	24.28	15.36	4.96	70.36	57.70	30.00
50	4	3	4.14	3.19	21.04	12.52	3.54	73.52	60.06	30.86

50	5	1	3.31	2.61	12.38	6.40	1.44	78.96	66.92	35.16
50	5	2	3.68	2.94	16.36	10.00	2.38	64.16	49.84	22.08
50	5	3	3.60	2.82	15.30	8.48	2.08	71.36	58.04	30.14
100	1	1	3.29	2.69	12.66	6.88	1.62	94.54	88.30	68.06
100	1	2	3.89	3.19	18.72	10.82	3.18	89.78	82.48	55.18
100	1	3	3.58	2.89	15.62	8.60	2.36	91.34	85.18	61.04
100	2	1	3.13	2.56	11.12	5.88	1.32	94.30	88.04	67.72
100	2	2	3.46	2.84	14.36	7.66	1.92	85.78	75.86	43.16
100	2	3	3.30	2.67	13.00	6.46	1.60	90.10	82.28	57.58
100	3	1	3.01	2.38	10.02	4.82	0.82	94.00	87.32	65.46
100	3	2	3.04	2.26	9.10	3.84	0.70	93.68	89.14	72.50
100	3	3	3.04	2.31	9.34	4.40	0.68	93.26	87.56	67.10
100	4	1	3.31	2.71	12.88	7.12	1.70	94.18	88.08	66.32
100	4	2	3.92	3.21	18.88	10.92	3.42	89.74	82.14	58.02
100	4	3	3.59	2.91	15.98	8.56	2.46	91.18	84.20	59.82
100	5	1	3.15	2.58	11.32	5.96	1.38	93.92	87.98	65.54
100	5	2	3.48	2.86	14.32	7.96	2.00	85.62	76.22	44.40
100	5	3	3.31	2.68	12.98	6.78	1.62	89.94	81.78	57.50
200	1	1	3.17	2.59	11.72	5.84	1.30	99.90	99.48	96.96
200	1	2	3.49	2.90	14.42	7.66	2.16	99.56	98.92	93.98
200	1	3	3.27	2.66	12.82	6.44	1.64	99.74	99.14	95.70
200	2	1	3.09	2.52	10.90	5.42	1.20	99.90	99.48	97.10
200	2	2	3.26	2.71	12.14	6.34	1.54	99.12	97.82	88.42
200	2	3	3.12	2.53	11.36	5.64	1.22	99.58	98.94	94.58
200	3	1	3.02	2.43	10.16	4.86	1.04	99.82	99.46	96.34
200	3	2	3.02	2.35	9.40	4.24	0.88	99.68	99.32	96.66
200	3	3	2.99	2.34	9.68	4.50	0.74	99.80	99.40	97.12
200	4	1	3.18	2.60	11.86	6.00	1.32	99.80	99.42	96.84
200	4	2	3.51	2.92	14.82	8.00	2.10	99.58	98.78	93.16
200	4	3	3.29	2.68	12.64	6.74	1.56	99.70	99.28	95.22
200	5	1	3.10	2.53	11.14	5.46	1.20	99.80	99.42	96.88
200	5	2	3.27	2.72	12.38	6.50	1.56	99.04	97.66	88.12
200	5	3	3.13	2.55	11.08	5.66	1.24	99.56	99.02	94.20
500	1	1	3.01	2.51	10.48	5.14	1.26	100.00	100.00	100.00
500	1	2	3.21	2.69	11.82	5.98	1.58	100.00	100.00	99.98
500	1	3	3.13	2.57	11.50	5.90	1.14	100.00	100.00	100.00
500	2	1	2.97	2.48	10.04	5.00	1.14	100.00	100.00	100.00
500	2	2	3.11	2.61	10.80	5.54	1.44	100.00	100.00	99.98
500	2	3	3.06	2.52	11.00	5.58	1.02	100.00	100.00	100.00
500	3	1	2.95	2.44	9.84	4.82	1.00	100.00	100.00	100.00
500	3	2	3.01	2.44	9.52	4.74	1.02	100.00	100.00	100.00
500	3	3	3.00	2.42	10.08	4.96	0.68	100.00	100.00	100.00
500	4	1	3.02	2.52	10.56	5.44	1.16	100.00	100.00	100.00

500	4	2	3.23	2.70	12.14	6.44	1.64	100.00	100.00	100.00
500	4	3	3.14	2.58	11.52	6.10	1.12	100.00	100.00	100.00
500	5	1	2.99	2.49	10.28	5.26	1.08	100.00	100.00	100.00
500	5	2	3.13	2.61	10.86	5.82	1.42	100.00	100.00	100.00
500	5	3	3.08	2.53	10.84	5.60	1.02	100.00	100.00	100.00

(b) Rook Contiguity, CH-1

					Empirical Size			Size-Adjusted Power		
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
50	1	1	4.36	3.40	22.70	14.22	4.62	68.26	53.74	27.00
50	1	2	5.39	4.29	32.78	22.66	9.40	62.94	46.68	15.42
50	1	3	4.74	3.77	26.58	17.48	6.18	65.96	48.72	19.72
50	2	1	3.74	3.00	16.56	9.80	2.60	67.86	52.94	24.86
50	2	2	4.27	3.49	21.92	13.68	4.66	56.30	39.72	14.12
50	2	3	3.91	3.15	18.82	11.44	3.44	63.60	46.88	20.98
50	3	1	3.12	2.21	9.40	3.92	0.32	74.34	60.24	32.82
50	3	2	3.10	2.08	8.60	2.90	0.14	80.36	71.98	50.06
50	3	3	3.06	2.12	8.60	3.46	0.30	78.78	66.76	40.44
50	4	1	4.38	3.42	22.94	14.26	4.86	68.20	52.94	26.58
50	4	2	5.38	4.28	32.86	22.52	9.32	63.70	47.30	16.66
50	4	3	4.75	3.76	26.70	17.48	6.36	66.60	49.62	19.62
50	5	1	3.74	3.00	16.46	9.78	2.70	67.40	51.80	24.02
50	5	2	4.25	3.48	21.66	13.36	4.76	55.50	38.96	12.90
50	5	3	3.91	3.13	18.60	11.06	3.50	64.00	46.58	21.70
100	1	1	3.66	2.95	15.78	9.10	2.34	89.74	81.34	59.62
100	1	2	4.23	3.44	21.90	13.26	4.10	88.48	80.88	52.18
100	1	3	3.94	3.26	18.54	11.24	3.58	88.54	79.06	53.34
100	2	1	3.36	2.71	13.06	7.20	1.56	88.40	79.98	57.34
100	2	2	3.63	2.96	15.96	9.24	2.20	78.62	66.98	38.48
100	2	3	3.49	2.90	14.22	8.06	2.30	84.82	73.38	44.44
100	3	1	3.11	2.34	10.16	4.80	0.66	91.64	84.58	65.10
100	3	2	3.05	2.17	9.04	3.40	0.48	93.78	89.48	74.62
100	3	3	3.07	2.29	9.68	4.10	0.58	92.12	87.28	68.92
100	4	1	3.68	2.96	16.10	9.04	2.34	89.76	80.90	58.62
100	4	2	4.26	3.48	21.66	13.64	4.46	88.56	79.96	50.42
100	4	3	3.94	3.25	18.74	11.38	3.56	88.38	78.94	54.22
100	5	1	3.38	2.72	13.28	7.12	1.52	88.64	80.06	58.16
100	5	2	3.65	2.99	15.96	9.24	2.36	79.08	67.06	36.82
100	5	3	3.50	2.89	14.38	8.30	2.30	84.88	73.46	46.70
200	1	1	3.41	2.74	13.56	7.04	1.90	99.66	99.06	94.10
200	1	2	3.71	3.03	16.84	9.68	3.00	99.18	98.26	92.68
200	1	3	3.50	2.86	14.98	8.48	1.94	99.34	98.52	93.42
200	2	1	3.25	2.61	12.02	6.18	1.42	99.60	98.80	93.44
200	2	2	3.35	2.73	13.50	6.92	1.80	97.34	93.92	79.36

n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
200	2	3	3.25	2.66	12.26	6.86	1.30	98.42	96.70	88.26
200	3	1	3.11	2.40	10.58	4.80	0.82	99.78	99.36	95.96
200	3	2	3.00	2.26	9.00	4.08	0.52	99.44	98.86	96.38
200	3	3	3.01	2.33	9.72	4.80	0.56	99.48	98.90	96.60
200	4	1	3.44	2.77	14.04	7.26	2.04	99.60	98.86	94.10
200	4	2	3.73	3.03	16.86	9.98	2.90	99.20	98.28	92.24
200	4	3	3.51	2.87	15.10	8.54	1.86	99.24	98.58	93.66
200	5	1	3.27	2.63	12.44	6.32	1.56	99.52	98.54	93.26
200	5	2	3.35	2.71	13.34	6.96	1.72	97.26	93.56	79.40
200	5	3	3.25	2.66	12.48	7.00	1.26	98.52	96.86	89.08
500	1	1	3.07	2.51	10.72	5.32	1.40	100.00	100.00	100.00
500	1	2	3.33	2.77	13.58	7.58	1.68	100.00	100.00	100.00
500	1	3	3.23	2.65	12.22	6.68	1.28	100.00	100.00	100.00
500	2	1	3.00	2.45	10.12	4.80	1.20	100.00	100.00	100.00
500	2	2	3.15	2.62	12.08	6.34	1.20	100.00	100.00	99.82
500	2	3	3.11	2.55	11.00	6.00	1.10	100.00	100.00	99.98
500	3	1	2.94	2.35	9.38	4.24	0.96	100.00	100.00	100.00
500	3	2	2.97	2.36	9.76	4.62	0.64	100.00	100.00	100.00
500	3	3	2.99	2.37	9.68	4.84	0.70	100.00	100.00	100.00
500	4	1	3.09	2.51	10.74	5.40	1.28	100.00	100.00	100.00
500	4	2	3.35	2.77	13.54	7.46	1.78	100.00	100.00	100.00
500	4	3	3.24	2.65	12.26	6.86	1.36	100.00	100.00	100.00
500	5	1	3.01	2.45	9.88	5.04	1.10	100.00	100.00	100.00
500	5	2	3.17	2.63	12.10	6.34	1.38	100.00	99.98	99.82
500	5	3	3.11	2.55	11.24	6.04	1.04	100.00	100.00	100.00

(c) Group Interaction I, CH-0

					Empirical Size			Size-Adjusted Power		
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
50	1	1	3.76	2.91	17.98	9.86	2.32	59.34	46.40	24.96
50	1	2	4.86	3.72	28.50	18.80	6.48	53.94	39.34	15.88
50	1	3	4.20	3.27	21.74	13.10	3.88	56.26	42.34	17.50
50	2	1	3.42	2.67	14.18	7.26	1.52	59.82	46.54	25.02
50	2	2	4.06	3.16	20.52	12.00	3.24	48.36	34.16	14.86
50	2	3	3.66	2.88	15.80	9.22	2.36	54.62	40.20	16.68
50	3	1	3.17	2.34	11.30	4.76	0.48	57.32	45.42	22.90
50	3	2	3.26	2.23	10.52	4.48	0.28	66.44	54.58	32.40
50	3	3	3.18	2.28	10.50	4.26	0.46	61.98	50.00	24.54
50	4	1	3.77	2.93	17.78	10.10	2.40	58.96	46.54	24.32
50	4	2	4.88	3.72	28.72	18.82	6.52	52.96	39.26	16.02
50	4	3	4.21	3.27	21.84	13.20	3.86	56.44	42.94	16.88
50	5	1	3.43	2.68	14.08	7.46	1.58	58.92	46.72	24.46
50	5	2	4.07	3.16	20.74	12.14	3.42	47.40	33.96	14.40
50	5	3	3.66	2.87	16.14	9.14	2.26	55.18	40.46	16.36

100	1	1	3.43	2.72	13.52	7.40	1.64	69.54	56.58	31.76
100	1	2	4.04	3.24	19.60	11.58	3.70	65.42	51.38	24.88
100	1	3	3.75	3.02	16.88	10.16	2.86	65.26	51.78	27.16
100	2	1	3.26	2.59	12.10	6.44	1.36	69.88	56.76	31.34
100	2	2	3.60	2.88	15.44	8.64	2.32	60.64	47.26	19.60
100	2	3	3.45	2.79	14.52	7.96	2.08	64.48	50.74	26.08
100	3	1	3.13	2.40	10.54	5.38	0.86	69.48	55.16	30.88
100	3	2	3.17	2.32	10.14	4.62	0.74	72.06	61.60	37.08
100	3	3	3.17	2.39	11.24	5.46	0.66	69.44	56.46	35.08
100	4	1	3.44	2.72	13.64	7.78	1.70	69.28	55.98	31.94
100	4	2	4.05	3.23	19.80	11.64	3.82	65.86	50.98	25.30
100	4	3	3.77	3.04	17.18	10.32	2.86	64.94	51.06	25.48
100	5	1	3.27	2.59	12.28	6.58	1.26	69.72	56.52	32.46
100	5	2	3.60	2.87	15.46	8.44	2.40	60.54	47.82	19.98
100	5	3	3.47	2.81	14.60	8.26	2.16	63.36	50.78	25.44
200	1	1	3.29	2.69	12.78	6.52	1.72	61.54	47.16	21.58
200	1	2	3.66	3.11	16.34	9.56	3.00	58.32	43.52	20.66
200	1	3	3.40	2.75	13.22	7.40	1.80	61.46	49.42	24.50
200	2	1	3.21	2.62	12.04	6.06	1.54	61.34	46.90	21.04
200	2	2	3.42	2.91	14.04	8.02	2.36	55.38	41.00	18.00
200	2	3	3.25	2.63	11.88	6.38	1.40	60.64	48.02	23.50
200	3	1	3.14	2.50	10.90	5.46	1.38	61.20	46.80	21.38
200	3	2	3.14	2.49	11.04	5.16	1.12	62.50	50.56	26.18
200	3	3	3.10	2.42	10.18	5.12	0.94	63.68	50.68	27.06
200	4	1	3.32	2.70	12.64	6.58	1.76	60.66	46.94	22.06
200	4	2	3.70	3.14	16.96	9.96	3.10	57.22	43.18	19.52
200	4	3	3.43	2.78	13.16	7.56	1.80	61.86	48.76	24.70
200	5	1	3.23	2.63	11.96	6.28	1.60	60.62	46.84	21.48
200	5	2	3.45	2.93	14.32	8.28	2.42	54.56	40.16	17.44
200	5	3	3.27	2.65	11.80	6.44	1.38	60.78	48.12	23.38
500	1	1	3.17	2.55	11.44	6.06	1.20	97.64	95.10	86.20
500	1	2	3.34	2.74	13.28	7.24	1.86	96.76	94.20	81.78
500	1	3	3.22	2.59	12.04	6.30	1.32	96.98	94.58	85.20
500	2	1	3.13	2.52	11.20	5.82	1.12	97.56	95.06	86.28
500	2	2	3.23	2.65	12.38	6.44	1.64	96.12	92.90	78.62
500	2	3	3.15	2.53	11.44	5.82	1.24	96.88	94.18	83.80
500	3	1	3.10	2.48	10.88	5.70	0.88	97.58	95.14	86.10
500	3	2	3.11	2.46	11.06	5.16	1.12	97.20	94.74	84.90
500	3	3	3.09	2.43	10.86	5.14	0.88	97.16	94.96	86.20
500	4	1	3.18	2.56	11.64	5.96	1.22	97.54	94.86	86.54
500	4	2	3.36	2.75	13.30	7.20	1.88	96.60	93.78	80.88
500	4	3	3.23	2.60	12.42	6.48	1.30	96.94	94.06	84.48
500	5	1	3.14	2.53	11.32	5.84	1.10	97.58	94.84	86.46
500	5	2	3.24	2.66	12.52	6.50	1.66	96.00	92.78	78.62

n	Test	DGP	Mean	sd						
500	5	3	3.16	2.54	11.54	6.00	1.18	96.74	93.76	83.22

(d) Group Interaction I, CH-1

					Empirical Size			Size-Adjusted Power		
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
50	1	1	3.90	2.96	19.06	11.14	2.26	58.80	46.90	22.34
50	1	2	4.75	3.67	27.16	17.34	6.00	56.44	41.92	15.94
50	1	3	4.24	3.33	22.38	14.02	4.40	57.48	41.58	18.42
50	2	1	3.54	2.70	15.30	8.16	1.54	59.18	47.28	24.16
50	2	2	3.97	3.12	18.96	11.00	3.14	51.02	35.48	13.20
50	2	3	3.69	2.92	17.28	9.24	2.30	55.06	41.18	17.44
50	3	1	3.29	2.38	12.04	5.40	0.60	57.58	44.86	20.52
50	3	2	3.19	2.16	9.82	3.62	0.30	67.60	56.32	36.08
50	3	3	3.20	2.29	10.78	4.58	0.38	63.64	51.16	26.60
50	4	1	3.91	2.96	19.20	10.92	2.28	58.96	46.40	21.78
50	4	2	4.77	3.67	27.48	17.16	6.14	55.94	41.50	16.04
50	4	3	4.24	3.33	22.62	14.06	4.28	57.56	42.14	17.18
50	5	1	3.55	2.70	15.22	8.20	1.52	59.16	46.48	23.78
50	5	2	3.98	3.11	18.96	10.98	2.98	50.60	35.48	13.24
50	5	3	3.68	2.91	16.86	9.42	2.42	55.38	40.52	17.80
100	1	1	3.46	2.74	14.24	7.74	1.72	72.82	59.88	34.06
100	1	2	4.04	3.30	20.26	11.76	3.84	69.18	54.16	29.78
100	1	3	3.77	3.05	17.26	10.60	3.06	69.48	55.66	26.66
100	2	1	3.28	2.60	12.46	6.46	1.36	72.48	59.06	33.26
100	2	2	3.60	2.96	16.00	8.84	2.50	63.32	47.32	22.80
100	2	3	3.48	2.83	14.46	8.34	2.12	66.66	52.52	25.72
100	3	1	3.18	2.45	11.26	5.40	0.86	73.64	60.84	35.66
100	3	2	3.17	2.36	10.24	4.82	0.78	76.66	66.86	43.26
100	3	3	3.24	2.49	11.74	5.90	0.96	73.62	61.54	36.66
100	4	1	3.47	2.75	14.48	7.88	1.78	72.74	59.62	33.58
100	4	2	4.06	3.31	20.56	12.16	3.92	69.20	54.58	28.84
100	4	3	3.80	3.06	17.70	10.62	3.02	68.82	56.52	27.06
100	5	1	3.29	2.60	12.68	6.52	1.26	72.22	59.16	33.06
100	5	2	3.62	2.97	16.18	8.98	2.48	62.62	46.90	22.12
100	5	3	3.50	2.83	14.90	8.36	2.14	66.56	52.34	25.54
200	1	1	3.29	2.66	12.60	6.72	1.56	62.78	49.00	25.92
200	1	2	3.61	2.91	15.54	8.44	2.24	63.78	49.34	26.26
200	1	3	3.43	2.80	14.34	7.66	1.96	63.08	49.76	27.90
200	2	1	3.21	2.59	11.62	6.02	1.38	62.48	48.70	26.00
200	2	2	3.38	2.74	13.02	6.74	1.78	60.30	46.80	23.62
200	2	3	3.28	2.69	12.58	6.94	1.60	62.38	49.02	26.40
200	3	1	3.14	2.49	10.92	5.62	0.98	62.70	48.88	27.46
200	3	2	3.11	2.35	9.78	4.74	0.84	67.56	55.86	33.86
200	3	3	3.14	2.47	10.80	5.44	0.96	64.60	52.74	30.48

n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
200	4	1	3.33	2.69	13.10	6.78	1.68	62.30	47.82	26.16
200	4	2	3.65	2.96	15.98	8.82	2.48	62.76	49.82	26.68
200	4	3	3.46	2.82	14.60	7.96	2.08	62.32	50.26	27.02
200	5	1	3.24	2.62	12.28	6.26	1.52	61.98	47.82	25.92
200	5	2	3.40	2.77	13.68	7.22	1.72	60.42	46.54	23.64
200	5	3	3.30	2.70	13.16	7.18	1.76	61.72	48.68	24.90
500	1	1	3.18	2.59	11.98	6.12	1.42	96.82	93.80	82.42
500	1	2	3.28	2.68	12.66	6.54	1.60	96.16	93.36	81.70
500	1	3	3.26	2.71	12.52	7.00	1.60	96.36	93.24	81.10
500	2	1	3.14	2.55	11.68	5.84	1.34	96.82	93.88	82.16
500	2	2	3.17	2.59	11.68	5.78	1.38	95.60	91.78	78.30
500	2	3	3.18	2.65	11.96	6.40	1.48	96.12	92.74	80.22
500	3	1	3.11	2.50	11.36	5.50	1.20	96.86	93.92	81.86
500	3	2	3.05	2.41	9.88	4.78	1.02	96.68	94.08	83.72
500	3	3	3.11	2.53	11.18	5.66	1.22	96.60	93.52	82.28
500	4	1	3.19	2.60	12.26	6.12	1.34	96.82	93.82	82.60
500	4	2	3.29	2.68	12.86	6.60	1.60	96.24	93.30	81.18
500	4	3	3.27	2.72	12.58	7.16	1.56	96.32	92.74	81.00
500	5	1	3.15	2.57	11.86	5.90	1.30	96.82	93.82	82.74
500	5	2	3.18	2.59	11.80	5.90	1.46	95.46	92.22	77.70
500	5	3	3.20	2.65	12.04	6.60	1.46	96.18	92.54	80.12

Table 4: Emprical Size and Power of Tests H0: $\lambda = 0$ vs Ha: $\lambda = (.03, .03, .03)$, T = 6, $\rho = 0.5$

(a) Group Interaction I, CH-0

					Empirical Size			Size-Adjusted Power		
n	Test	DGP	Mean	sd	10%	5%	1%	10%	5%	1%
50	1	1	3.38	2.60	13.15	7.40	1.30	89.95	82.45	61.25
50	1	2	3.92	3.02	19.50	10.95	2.60	87.10	78.05	52.45
50	1	3	3.81	2.95	17.45	10.00	2.35	85.05	73.35	49.75
50	2	1	3.13	2.42	10.95	5.55	0.85	90.35	82.10	59.25
50	2	2	3.43	2.68	14.65	7.95	1.40	79.70	68.75	42.25
50	2	3	3.44	2.70	13.55	7.15	1.75	83.85	71.50	43.75
50	3	1	3.04	2.31	9.95	4.80	0.45	89.40	81.40	56.60
50	3	2	3.03	2.20	9.15	3.20	0.35	91.45	85.70	65.15
50	3	3	3.21	2.38	10.90	5.35	0.65	88.00	77.85	57.40
50	4	1	3.40	2.62	13.50	7.50	1.50	88.85	82.10	59.20
50	4	2	3.91	3.01	19.80	11.20	2.60	86.35	78.65	50.45
50	4	3	3.82	2.96	17.85	10.20	2.35	85.05	73.35	50.05
50	5	1	3.14	2.44	11.30	5.60	1.00	89.30	81.70	56.95
50	5	2	3.42	2.67	14.35	7.50	1.40	79.00	69.30	39.55
50	5	3	3.45	2.69	13.90	7.60	1.70	83.05	71.60	45.15
100	1	1	3.30	2.63	13.25	6.55	1.40	94.25	88.60	68.75
100	1	2	3.63	2.85	15.60	8.55	1.90	93.75	87.30	67.45

100	1	3	3.44	2.74	14.45	6.65	1.65	95.65	91.45	67.10
100	2	1	3.16	2.52	11.60	5.70	1.25	94.10	88.80	69.00
100	2	2	3.36	2.65	13.15	6.90	1.65	90.60	83.75	57.00
100	2	3	3.25	2.59	12.45	5.60	1.50	95.00	89.85	63.20
100	3	1	3.12	2.45	11.05	5.30	1.10	93.90	88.70	69.20
100	3	2	3.13	2.36	10.20	4.80	0.90	95.00	90.75	76.20
100	3	3	3.12	2.43	10.30	4.35	0.90	96.00	93.75	73.75
100	4	1	3.31	2.64	13.60	6.80	1.50	93.75	88.00	70.05
100	4	2	3.64	2.86	15.95	8.85	2.15	93.60	87.20	69.35
100	4	3	3.43	2.72	13.80	6.50	1.75	95.55	91.50	68.95
100	5	1	3.17	2.53	11.80	5.70	1.20	93.70	88.45	70.65
100	5	2	3.36	2.65	13.15	6.75	1.50	91.10	82.80	58.40
100	5	3	3.23	2.58	11.90	5.40	1.50	94.85	90.55	65.15
200	1	1	3.17	2.61	11.40	6.40	1.75	99.55	98.55	94.15
200	1	2	3.40	2.74	13.45	7.35	1.85	99.30	98.55	93.60
200	1	3	3.17	2.72	10.90	6.30	1.95	99.45	98.20	90.60
200	2	1	3.10	2.56	10.65	6.00	1.45	99.50	98.60	94.20
200	2	2	3.25	2.63	12.35	6.45	1.35	99.00	97.70	90.60
200	2	3	3.07	2.63	10.10	5.40	1.75	99.45	97.95	89.20
200	3	1	3.08	2.51	10.60	5.30	1.40	99.55	98.55	94.35
200	3	2	3.12	2.43	10.70	5.25	0.45	99.35	98.90	95.70
200	3	3	2.99	2.49	9.00	4.85	1.40	99.50	98.70	93.10
200	4	1	3.19	2.63	11.50	6.10	1.70	99.50	98.30	93.65
200	4	2	3.41	2.75	14.05	7.45	1.70	99.35	98.55	93.80
200	4	3	3.17	2.73	11.00	6.50	1.95	99.55	98.30	90.55
200	5	1	3.12	2.58	10.95	5.70	1.55	99.60	98.30	93.60
200	5	2	3.26	2.64	12.65	6.45	1.35	99.10	97.40	90.35
200	5	3	3.06	2.63	9.75	5.60	1.75	99.40	98.25	88.80
500	1	1	3.13	2.57	11.35	6.05	1.50	100.00	99.95	99.00
500	1	2	3.23	2.65	12.30	6.50	1.40	100.00	99.90	98.60
500	1	3	3.10	2.54	11.10	5.50	0.95	99.95	99.95	99.55
500	2	1	3.11	2.55	11.05	5.85	1.40	100.00	99.95	99.00
500	2	2	3.17	2.61	11.60	6.30	1.25	100.00	99.85	98.00
500	2	3	3.06	2.50	10.55	5.15	0.90	99.95	99.95	99.50
500	3	1	3.09	2.52	10.80	5.75	1.45	100.00	99.95	99.00
500	3	2	3.12	2.52	10.95	5.35	1.20	100.00	99.95	98.75
500	3	3	3.03	2.46	10.20	4.70	0.80	99.95	99.95	99.65
500	4	1	3.15	2.59	11.70	6.00	1.60	100.00	99.90	99.00
500	4	2	3.24	2.66	12.20	6.40	1.45	100.00	99.75	98.40
500	4	3	3.10	2.54	10.85	5.15	1.15	100.00	99.95	99.30
500	5	1	3.13	2.56	11.25	5.80	1.55	100.00	99.90	98.95
500	5	2	3.18	2.62	11.55	6.10	1.40	100.00	99.70	97.55
500	5	3	3.06	2.50	10.30	4.90	0.95	100.00	99.95	99.10

(b) Group Interaction I, CH-1

n	Test	DGP	Mean	sd	Empirical Size 10%	5%	1%	Size-Adjusted Power 10%	5%	1%
50	1	1	3.37	2.58	13.30	7.35	1.15	88.10	80.15	60.70
50	1	2	3.90	3.00	19.25	11.05	2.70	83.05	73.35	51.55
50	1	3	3.92	3.02	19.10	10.95	2.65	82.50	72.40	47.15
50	2	1	3.12	2.40	10.85	5.60	0.75	88.50	80.50	59.90
50	2	2	3.39	2.65	13.80	7.75	1.20	78.10	65.40	42.05
50	2	3	3.52	2.71	15.15	8.15	1.45	79.40	69.15	46.05
50	3	1	3.03	2.28	10.10	4.50	0.40	87.55	78.90	54.00
50	3	2	2.97	2.12	8.20	3.60	0.00	88.65	82.55	70.50
50	3	3	3.26	2.37	11.50	5.45	0.70	84.80	75.65	54.35
50	4	1	3.39	2.59	13.95	7.05	1.20	87.90	79.75	58.65
50	4	2	3.92	3.02	19.15	11.65	2.80	82.60	73.40	49.80
50	4	3	3.92	3.01	19.00	10.35	2.60	83.20	72.95	47.60
50	5	1	3.12	2.41	11.05	5.60	0.80	87.90	80.45	58.90
50	5	2	3.40	2.66	14.10	7.85	1.30	76.75	63.70	38.30
50	5	3	3.52	2.71	14.80	7.85	1.35	80.85	70.10	46.95
100	1	1	3.21	2.52	11.95	6.45	1.00	97.00	93.55	82.15
100	1	2	3.70	3.07	17.00	9.65	2.70	94.65	88.50	68.45
100	1	3	3.48	2.77	14.55	7.05	1.80	96.30	93.70	75.40
100	2	1	3.08	2.42	10.95	5.70	0.65	97.05	93.20	81.80
100	2	2	3.41	2.81	13.85	8.10	2.00	91.30	81.65	56.35
100	2	3	3.28	2.62	12.05	5.85	1.25	95.80	91.25	69.90
100	3	1	3.05	2.36	10.60	5.25	0.55	97.15	93.90	83.30
100	3	2	3.16	2.46	11.55	5.70	0.75	96.00	92.85	83.20
100	3	3	3.16	2.42	10.50	4.55	0.75	96.85	94.50	79.95
100	4	1	3.21	2.53	12.20	6.50	1.00	97.05	93.05	82.65
100	4	2	3.73	3.09	16.95	10.00	3.10	94.70	88.15	69.80
100	4	3	3.49	2.79	14.20	7.25	2.05	96.20	93.90	73.30
100	5	1	3.08	2.42	10.75	5.65	0.70	96.90	92.80	81.95
100	5	2	3.43	2.82	14.00	7.90	2.15	90.65	81.80	57.70
100	5	3	3.28	2.63	12.25	5.70	1.45	95.85	92.00	68.50
200	1	1	3.13	2.52	10.00	5.70	1.30	99.60	98.85	94.80
200	1	2	3.21	2.61	13.00	6.00	1.45	99.20	98.45	94.90
200	1	3	3.19	2.63	11.15	6.20	1.45	99.60	98.80	94.20
200	2	1	3.07	2.47	9.15	5.40	1.10	99.60	98.85	94.60
200	2	2	3.07	2.51	11.50	5.15	1.00	98.85	97.90	91.90
200	2	3	3.09	2.55	10.25	5.55	1.25	99.40	98.60	93.40
200	3	1	3.04	2.42	9.00	5.15	0.85	99.60	98.90	95.20
200	3	2	2.95	2.33	9.75	4.25	0.65	99.30	98.70	96.40
200	3	3	3.02	2.45	9.60	5.20	1.00	99.65	98.90	95.10
200	4	1	3.13	2.51	9.70	5.65	1.35	99.60	99.00	94.00
200	4	2	3.22	2.62	12.55	6.70	1.55	99.20	98.65	94.20

200	4	3	3.20	2.63	11.60	6.30	1.35	99.65	98.70	94.25
200	5	1	3.07	2.46	9.35	5.15	1.30	99.60	99.05	93.95
200	5	2	3.08	2.51	11.35	5.70	1.10	98.95	97.80	90.10
200	5	3	3.09	2.54	10.50	5.70	1.20	99.45	98.40	93.15
500	1	1	3.02	2.47	10.10	5.25	0.95	100.00	99.95	99.25
500	1	2	3.15	2.48	12.15	6.15	0.95	100.00	99.95	99.50
500	1	3	3.16	2.56	11.45	5.80	1.25	99.95	99.90	99.15
500	2	1	2.99	2.45	9.85	5.00	0.95	100.00	99.95	99.25
500	2	2	3.09	2.42	11.65	5.55	0.85	100.00	99.90	99.05
500	2	3	3.12	2.52	11.15	5.50	1.15	99.95	99.90	99.05
500	3	1	2.98	2.43	9.95	4.85	0.85	100.00	99.95	99.25
500	3	2	3.04	2.34	10.90	4.65	0.35	100.00	99.95	99.75
500	3	3	3.09	2.48	10.75	5.10	1.15	99.95	99.95	99.20
500	4	1	3.02	2.49	10.20	5.45	1.05	100.00	99.90	99.10
500	4	2	3.16	2.49	11.85	6.10	0.90	100.00	99.90	99.45
500	4	3	3.18	2.54	11.25	6.00	1.25	99.95	99.85	98.90
500	5	1	2.99	2.47	9.95	5.25	1.00	100.00	99.90	99.10
500	5	2	3.10	2.43	11.45	5.45	0.65	99.95	99.85	99.10
500	5	3	3.14	2.50	10.80	5.55	1.20	99.95	99.90	98.80

Table 5: Emprical Size of Tests H0: $\lambda_1 = \lambda_2 = 0$ vs Ha: λ = (.03, .03, .03)

			(a) Queen, (ρ, λ_3) = (-.5, .9), T = 3, CH-0				
n	Test	DGP	Mean	sd	10%	5%	1%
50	1	1	2.49	2.40	16.14	9.16	1.94
50	1	2	3.09	2.97	22.88	13.86	5.14
50	1	3	2.69	2.63	18.42	11.20	3.08
50	2	1	2.16	2.09	12.24	6.00	1.18
50	2	2	2.40	2.36	14.34	7.92	2.20
50	2	3	2.20	2.16	12.54	6.56	1.30
50	3	1	2.02	1.86	10.14	4.30	0.58
50	3	2	1.99	1.75	8.40	3.26	0.48
50	3	3	1.97	1.79	8.90	3.88	0.46
50	4	1	2.61	2.47	17.16	9.80	2.58
50	4	2	3.61	3.47	28.76	19.62	7.86
50	4	3	3.03	2.95	22.50	13.76	4.66
50	5	1	2.18	2.08	11.34	6.00	1.32
50	5	2	2.54	2.49	16.78	9.66	2.66
50	5	3	2.34	2.32	13.98	7.46	1.94
100	1	1	2.21	2.19	12.36	7.00	1.48
100	1	2	2.69	2.73	17.58	10.72	3.32
100	1	3	2.42	2.39	15.42	8.36	2.00
100	2	1	2.05	2.03	10.42	5.26	1.06
100	2	2	2.28	2.34	13.36	7.22	2.00

100	2	3	2.16	2.14	11.88	5.94	1.06
100	3	1	1.98	1.90	9.48	4.60	0.72
100	3	2	2.04	1.90	9.50	4.74	0.68
100	3	3	2.01	1.87	9.76	4.44	0.56
100	4	1	2.35	2.30	13.28	7.28	2.00
100	4	2	2.93	2.96	20.84	13.16	4.46
100	4	3	2.63	2.55	16.54	9.62	2.96
100	5	1	2.09	2.02	10.34	5.30	1.04
100	5	2	2.31	2.34	13.94	7.78	1.90
100	5	3	2.22	2.15	11.68	6.16	1.48
200	1	1	2.09	2.07	10.94	5.22	1.22
200	1	2	2.36	2.35	14.02	7.88	1.78
200	1	3	2.26	2.28	13.06	7.22	1.86
200	2	1	2.00	1.98	10.16	4.74	1.08
200	2	2	2.13	2.13	11.68	5.60	1.32
200	2	3	2.10	2.12	11.16	6.08	1.46
200	3	1	1.96	1.91	9.50	4.28	0.92
200	3	2	1.99	1.90	9.30	4.38	0.76
200	3	3	2.02	1.96	10.12	5.02	0.88
200	4	1	2.30	2.27	12.68	7.02	1.86
200	4	2	2.71	2.65	19.04	11.06	3.16
200	4	3	2.45	2.49	15.68	8.94	2.28
200	5	1	2.14	2.12	11.06	6.06	1.34
200	5	2	2.24	2.20	12.94	6.76	1.52
200	5	3	2.17	2.20	12.22	6.56	1.60

(b) Queen, (ρ, λ_3) = (.5, -.9), T = 3, CH-0

n	Test	DGP	Mean	sd	10%	5%	1%
50	1	1	2.40	2.39	15.00	8.46	2.14
50	1	2	3.13	3.07	23.62	14.66	4.96
50	1	3	2.68	2.68	17.94	10.72	3.32
50	2	1	2.09	2.08	11.26	5.58	1.24
50	2	2	2.44	2.41	15.30	8.38	2.40
50	2	3	2.21	2.23	12.18	6.64	1.42
50	3	1	1.98	1.87	9.68	4.12	0.74
50	3	2	2.02	1.77	9.24	3.90	0.34
50	3	3	2.01	1.88	9.78	4.52	0.56
50	4	1	2.46	2.44	15.48	9.00	2.24
50	4	2	3.32	3.23	25.00	16.38	6.06
50	4	3	2.72	2.71	18.72	11.22	3.42
50	5	1	2.10	2.06	10.80	5.86	1.04
50	5	2	2.44	2.37	15.40	8.20	2.20
50	5	3	2.18	2.16	12.32	6.64	1.32
100	1	1	2.22	2.23	13.08	6.62	1.46

100	1	2	2.59	2.59	17.38	10.40	2.92
100	1	3	2.36	2.34	13.86	7.60	2.00
100	2	1	2.06	2.06	11.34	5.48	1.06
100	2	2	2.21	2.22	12.88	7.14	1.60
100	2	3	2.10	2.08	10.82	5.60	1.10
100	3	1	2.00	1.94	10.04	4.82	0.80
100	3	2	1.97	1.83	9.42	4.26	0.40
100	3	3	1.96	1.84	8.90	3.98	0.72
100	4	1	2.24	2.25	12.78	7.52	1.52
100	4	2	2.76	2.79	19.28	12.26	3.62
100	4	3	2.48	2.48	15.58	9.18	2.40
100	5	1	2.06	2.05	10.80	5.72	1.02
100	5	2	2.24	2.29	13.22	7.38	1.66
100	5	3	2.16	2.15	12.06	6.10	1.42
200	1	1	2.08	2.05	10.76	5.48	1.16
200	1	2	2.34	2.34	13.84	8.28	1.84
200	1	3	2.25	2.23	12.48	6.98	1.58
200	2	1	1.99	1.96	9.62	4.90	0.92
200	2	2	2.11	2.11	11.54	6.22	1.22
200	2	3	2.10	2.08	10.84	5.68	1.18
200	3	1	1.96	1.91	9.18	4.48	0.68
200	3	2	1.98	1.88	10.06	4.62	0.64
200	3	3	2.02	1.92	9.72	4.72	0.84
200	4	1	2.12	2.08	11.24	5.60	1.14
200	4	2	2.43	2.44	15.30	9.18	2.48
200	4	3	2.34	2.31	13.74	7.60	1.82
200	5	1	2.02	1.97	10.16	4.88	0.84
200	5	2	2.13	2.15	11.90	6.56	1.50
200	5	3	2.14	2.10	11.64	5.96	1.08

(c) Queen, (ρ, λ_3) = (-.9, .9), T = 3, CH-0

n	Test	DGP	Mean	sd	10%	5%	1%
50	1	1	2.62	2.44	17.46	10.32	2.38
50	1	2	3.46	3.15	27.64	17.86	6.06
50	1	3	2.97	2.78	21.80	13.06	4.02
50	2	1	2.17	1.98	12.32	5.38	0.80
50	2	2	2.54	2.33	16.32	8.58	2.02
50	2	3	2.33	2.15	13.74	6.90	1.34
50	3	1	2.03	1.79	9.50	3.66	0.42
50	3	2	2.04	1.66	8.38	3.10	0.16
50	3	3	2.03	1.73	8.96	3.56	0.20
50	4	1	2.58	2.39	17.28	9.82	1.92
50	4	2	3.26	3.06	25.14	15.88	5.36
50	4	3	2.94	2.79	21.14	13.02	4.08
50	5	1	2.06	1.87	10.18	4.38	0.62

50	5	2	2.25	2.13	12.66	6.70	1.12
50	5	3	2.18	2.07	11.96	5.80	1.14
100	1	1	2.32	2.21	13.32	7.14	1.36
100	1	2	3.11	3.00	23.28	14.80	4.54
100	1	3	2.63	2.51	17.82	10.16	2.52
100	2	1	2.09	1.96	10.42	5.02	0.70
100	2	2	2.51	2.39	16.40	9.14	2.02
100	2	3	2.25	2.13	13.22	6.98	0.96
100	3	1	2.01	1.83	9.28	4.12	0.42
100	3	2	2.14	1.86	10.96	4.56	0.44
100	3	3	2.06	1.84	10.16	4.44	0.38
100	4	1	2.27	2.12	12.68	6.44	1.32
100	4	2	2.73	2.58	18.14	10.30	2.90
100	4	3	2.51	2.39	16.00	8.68	2.04
100	5	1	2.00	1.83	9.02	4.12	0.50
100	5	2	2.16	2.02	10.90	5.32	1.06
100	5	3	2.09	1.95	10.54	4.84	0.76
200	1	1	2.12	2.05	11.40	5.56	1.22
200	1	2	2.59	2.47	17.54	9.54	2.36
200	1	3	2.35	2.27	14.18	7.92	1.62
200	2	1	2.01	1.94	9.94	4.64	0.80
200	2	2	2.26	2.17	13.16	6.76	1.46
200	2	3	2.15	2.07	11.80	6.08	0.98
200	3	1	1.97	1.87	9.36	4.22	0.64
200	3	2	2.07	1.88	10.28	4.54	0.62
200	3	3	2.05	1.89	10.44	4.78	0.58
200	4	1	2.11	2.01	11.40	5.50	0.72
200	4	2	2.40	2.26	15.06	7.58	1.62
200	4	3	2.30	2.24	13.86	7.02	1.42
200	5	1	1.98	1.88	9.88	4.70	0.42
200	5	2	2.08	1.96	10.38	5.40	0.70
200	5	3	2.08	2.03	11.06	5.18	1.00

(d) Queen, (ρ, λ_3) = (-.5, .9), T = 3, CH-1

n	Test	DGP	Mean	sd	10%	5%	1%
50	1	1	2.91	2.82	20.68	12.68	4.10
50	1	2	3.61	3.64	28.18	19.74	8.22
50	1	3	3.25	3.29	24.30	15.98	6.22
50	2	1	2.35	2.31	14.02	7.58	1.98
50	2	2	2.62	2.71	17.56	10.78	3.28
50	2	3	2.47	2.55	15.46	9.20	2.74
50	3	1	2.05	1.83	9.44	4.12	0.50
50	3	2	2.01	1.74	9.34	3.40	0.28
50	3	3	2.01	1.82	8.70	3.96	0.64

n	Test	DGP	Mean	sd	10%	5%	1%
50	4	1	3.12	2.99	22.84	14.02	5.22
50	4	2	4.06	4.12	31.86	22.24	10.62
50	4	3	3.67	3.63	28.50	19.66	8.12
50	5	1	2.41	2.32	14.24	8.04	1.94
50	5	2	2.70	2.82	18.14	11.06	3.80
50	5	3	2.61	2.62	16.88	10.36	2.96
100	1	1	2.44	2.39	15.30	8.58	2.10
100	1	2	3.01	3.09	21.36	13.26	4.44
100	1	3	2.65	2.71	17.62	10.60	3.20
100	2	1	2.14	2.11	11.88	5.90	1.26
100	2	2	2.43	2.54	14.60	8.32	2.48
100	2	3	2.25	2.33	13.32	7.12	2.00
100	3	1	2.02	1.89	9.94	4.64	0.64
100	3	2	2.05	1.87	9.88	4.70	0.66
100	3	3	2.02	1.91	10.38	4.38	0.92
100	4	1	2.60	2.55	17.40	10.20	2.82
100	4	2	3.41	3.40	26.02	17.22	6.76
100	4	3	2.88	2.85	19.80	13.06	4.08
100	5	1	2.18	2.12	12.06	6.52	1.36
100	5	2	2.52	2.59	15.82	8.94	2.84
100	5	3	2.29	2.27	13.74	7.64	1.78
200	1	1	2.26	2.26	13.10	6.86	1.70
200	1	2	2.57	2.61	16.44	9.98	2.76
200	1	3	2.38	2.34	15.04	8.52	1.70
200	2	1	2.07	2.08	10.78	5.40	1.08
200	2	2	2.21	2.27	12.66	7.24	1.70
200	2	3	2.12	2.09	12.08	6.02	0.96
200	3	1	1.98	1.90	9.50	4.44	0.64
200	3	2	1.97	1.87	9.24	4.36	0.68
200	3	3	1.97	1.84	9.80	4.30	0.44
200	4	1	2.44	2.42	15.54	8.74	2.26
200	4	2	3.12	3.20	22.32	14.38	5.70
200	4	3	2.75	2.78	19.18	11.56	3.44
200	5	1	2.16	2.14	12.12	6.40	1.32
200	5	2	2.36	2.41	13.74	7.78	2.02
200	5	3	2.27	2.29	13.20	7.30	1.68

(e) Queen, (ρ, λ_3) = (.5, -.9), T = 3, CH-1

n	Test	DGP	Mean	sd	10%	5%	1%
50	1	1	2.93	2.89	21.04	12.92	4.36
50	1	2	3.83	3.89	29.90	20.86	9.22
50	1	3	3.25	3.24	24.38	16.10	5.88
50	2	1	2.38	2.36	14.12	8.18	2.12
50	2	2	2.83	2.93	19.92	12.14	4.40

n	Test	DGP	Mean	sd	10%	5%	1%
50	2	3	2.49	2.50	16.24	9.62	2.72
50	3	1	2.04	1.84	9.74	4.28	0.42
50	3	2	2.07	1.79	9.46	3.80	0.50
50	3	3	2.03	1.80	9.50	4.04	0.48
50	4	1	3.03	3.03	22.20	14.06	4.78
50	4	2	4.07	4.13	32.18	23.24	10.62
50	4	3	3.27	3.25	24.34	16.06	6.44
50	5	1	2.38	2.34	14.74	7.88	2.16
50	5	2	2.84	2.90	20.34	12.32	4.28
50	5	3	2.43	2.41	15.16	8.74	2.14
100	1	1	2.46	2.40	15.38	8.86	2.24
100	1	2	3.01	2.98	21.78	13.76	4.60
100	1	3	2.70	2.65	17.88	10.52	3.28
100	2	1	2.17	2.12	11.78	6.54	1.28
100	2	2	2.39	2.37	14.90	8.42	2.04
100	2	3	2.25	2.21	12.82	6.86	1.68
100	3	1	2.03	1.89	10.20	4.78	0.64
100	3	2	2.04	1.83	9.76	3.96	0.54
100	3	3	2.03	1.86	9.70	4.46	0.64
100	4	1	2.50	2.43	15.98	9.48	2.42
100	4	2	3.23	3.23	24.20	15.70	5.52
100	4	3	2.84	2.81	19.62	12.08	3.62
100	5	1	2.17	2.11	12.34	6.38	1.34
100	5	2	2.42	2.39	15.08	8.00	2.12
100	5	3	2.30	2.27	13.48	6.86	1.74
200	1	1	2.24	2.24	12.28	6.86	1.82
200	1	2	2.51	2.48	15.58	8.84	2.54
200	1	3	2.40	2.41	14.26	8.30	2.20
200	2	1	2.09	2.09	10.38	5.62	1.32
200	2	2	2.18	2.17	11.94	6.26	1.46
200	2	3	2.16	2.17	11.86	6.28	1.46
200	3	1	2.01	1.94	9.52	4.78	0.94
200	3	2	1.98	1.84	8.84	3.82	0.58
200	3	3	2.02	1.92	9.80	4.66	0.76
200	4	1	2.28	2.26	12.78	7.24	1.88
200	4	2	2.66	2.63	18.10	10.36	3.00
200	4	3	2.49	2.50	15.82	9.36	2.54
200	5	1	2.11	2.09	10.86	5.80	1.36
200	5	2	2.24	2.23	13.00	6.56	1.58
200	5	3	2.18	2.19	12.42	6.56	1.56

(f) Group I, CH-3, (ρ, λ_3) = (.5, .3)

n	Test	DGP	Mean	sd	10%	5%	1%
50	1	1	3.33	3.34	24.24	16.14	6.44

50	1	2	4.17	4.12	33.12	23.96	11.48
50	1	3	3.70	3.72	28.86	20.22	8.26
50	2	1	2.23	2.28	11.54	6.06	1.88
50	2	2	2.53	2.53	15.76	8.78	2.60
50	2	3	2.35	2.40	13.38	7.48	2.16
50	3	1	1.88	1.62	6.52	2.98	0.30
50	3	2	1.89	1.55	6.30	2.28	0.10
50	3	3	1.86	1.58	6.32	2.26	0.22
50	4	1	3.61	3.48	28.10	19.06	7.92
50	4	2	4.49	4.33	36.62	26.78	13.02
50	4	3	3.93	3.91	31.26	21.72	9.28
50	5	1	2.46	2.41	14.46	8.30	2.18
50	5	2	2.70	2.70	17.90	10.60	3.18
50	5	3	2.51	2.52	15.82	8.94	2.34
100	1	1	4.31	4.38	33.78	24.86	12.02
100	1	2	5.48	5.52	43.32	33.08	18.44
100	1	3	4.77	4.88	38.00	28.66	14.28
100	2	1	2.46	2.50	15.12	9.08	2.48
100	2	2	2.90	3.12	19.60	12.30	4.52
100	2	3	2.63	2.78	17.24	11.00	3.56
100	3	1	2.16	1.99	11.32	5.80	0.76
100	3	2	2.13	1.85	10.84	4.50	0.46
100	3	3	2.17	1.99	11.38	5.82	0.78
100	4	1	3.97	4.00	31.12	21.14	10.04
100	4	2	5.09	5.08	40.72	30.50	16.20
100	4	3	4.33	4.38	34.40	24.80	12.06
100	5	1	2.32	2.34	12.76	7.52	1.88
100	5	2	2.62	2.75	16.16	9.66	3.22
100	5	3	2.37	2.42	13.82	7.66	2.00
200	1	1	2.57	2.64	16.30	9.90	2.98
200	1	2	3.08	3.22	21.92	14.56	5.34
200	1	3	2.92	3.01	20.46	13.18	4.20
200	2	1	2.07	2.04	10.50	5.30	1.12
200	2	2	2.25	2.32	12.84	7.08	1.70
200	2	3	2.20	2.19	11.88	6.24	1.50
200	3	1	1.93	1.80	8.38	3.86	0.56
200	3	2	1.92	1.74	7.90	3.20	0.48
200	3	3	1.95	1.76	8.56	3.30	0.40
200	4	1	2.64	2.62	16.90	9.98	3.08
200	4	2	3.24	3.33	24.22	16.20	6.06
200	4	3	3.14	3.12	22.84	14.58	5.10
200	5	1	2.16	2.06	10.68	5.40	1.16
200	5	2	2.36	2.36	14.30	7.92	2.00
200	5	3	2.34	2.25	12.80	6.56	1.80

n	Test	DGP	Mean	sd	10%	5%	1%
500	1	1	2.35	2.43	13.62	7.96	2.22
500	1	2	2.52	2.68	16.16	9.52	2.78
500	1	3	2.47	2.63	15.46	8.60	2.54
500	2	1	2.10	2.18	11.12	6.32	1.40
500	2	2	2.09	2.24	11.44	6.34	1.52
500	2	3	2.13	2.28	11.68	6.24	1.78
500	3	1	2.02	2.03	10.36	5.48	0.92
500	3	2	1.89	1.86	8.90	3.98	0.58
500	3	3	1.99	1.99	9.96	4.70	0.92
500	4	1	2.41	2.43	14.64	8.56	2.38
500	4	2	2.70	2.77	18.34	10.86	3.46
500	4	3	2.50	2.60	15.30	8.70	2.68
500	5	1	2.12	2.08	11.22	5.76	1.20
500	5	2	2.19	2.21	12.10	6.44	1.50
500	5	3	2.09	2.10	10.40	5.28	1.28

(g) Group-II, CH-1, $(\rho, \lambda_3) = (.5, .3)$

n	Test	DGP	Mean	sd	10%	5%	1%
50	1	1	3.12	2.97	22.76	14.82	4.46
50	1	2	3.85	3.83	30.12	21.06	9.04
50	1	3	3.47	3.23	27.60	18.64	6.18
50	2	1	2.32	2.12	13.02	6.74	1.20
50	2	2	2.62	2.53	16.90	9.60	2.70
50	2	3	2.45	2.25	15.18	7.82	1.58
50	3	1	2.12	1.83	9.82	4.30	0.62
50	3	2	2.07	1.73	9.06	3.40	0.34
50	3	3	2.09	1.75	9.00	3.76	0.32
50	4	1	3.14	2.97	23.82	14.78	5.10
50	4	2	3.84	3.76	30.16	21.10	8.86
50	4	3	3.47	3.23	27.36	18.22	6.72
50	5	1	2.29	2.05	12.78	6.26	0.88
50	5	2	2.54	2.43	15.64	8.58	2.42
50	5	3	2.37	2.15	13.46	7.02	1.36
100	1	1	2.42	2.39	15.16	8.46	2.00
100	1	2	2.98	3.03	20.54	13.34	4.90
100	1	3	2.60	2.60	17.08	9.84	2.98
100	2	1	2.04	1.96	10.20	4.80	0.82
100	2	2	2.32	2.32	13.88	7.76	2.02
100	2	3	2.09	2.04	11.00	5.48	1.08
100	3	1	1.92	1.77	8.58	3.48	0.42
100	3	2	1.99	1.78	8.90	3.80	0.44
100	3	3	1.91	1.74	8.26	3.56	0.42
100	4	1	2.53	2.46	16.22	8.96	2.24
100	4	2	3.07	3.10	22.00	13.58	4.76

100	4	3	2.69	2.64	17.84	10.60	2.98
100	5	1	2.10	1.99	10.62	5.20	1.10
100	5	2	2.32	2.29	13.08	6.92	1.74
100	5	3	2.13	2.04	11.42	5.32	1.14
200	1	1	2.19	2.23	12.30	6.86	1.58
200	1	2	2.48	2.52	15.48	8.72	2.54
200	1	3	2.29	2.32	13.28	7.34	1.92
200	2	1	2.01	2.01	9.98	5.32	1.04
200	2	2	2.12	2.13	11.28	5.86	1.30
200	2	3	2.04	2.03	10.46	5.14	1.14
200	3	1	1.95	1.91	9.16	4.60	0.82
200	3	2	1.95	1.84	9.02	3.96	0.60
200	3	3	1.93	1.84	9.04	3.88	0.62
200	4	1	2.26	2.28	12.50	7.00	1.88
200	4	2	2.55	2.60	16.16	9.22	2.76
200	4	3	2.36	2.35	14.32	7.76	2.16
200	5	1	2.06	2.04	10.46	5.44	1.20
200	5	2	2.16	2.18	11.22	5.86	1.56
200	5	3	2.07	2.05	11.16	5.46	1.14
500	1	1	1.99	1.97	9.72	4.92	0.94
500	1	2	2.17	2.19	11.92	6.38	1.42
500	1	3	2.07	2.06	11.06	5.34	1.16
500	2	1	1.89	1.86	8.80	4.16	0.58
500	2	2	1.97	1.99	9.76	4.82	0.96
500	2	3	1.92	1.90	9.36	4.32	0.84
500	3	1	1.86	1.81	8.44	3.88	0.46
500	3	2	1.89	1.83	8.62	4.10	0.58
500	3	3	1.86	1.79	8.28	3.54	0.50
500	4	1	2.13	2.08	11.92	5.66	1.12
500	4	2	2.33	2.31	14.00	7.42	2.04
500	4	3	2.23	2.22	12.84	6.72	1.76
500	5	1	2.01	1.96	10.44	4.62	0.84
500	5	2	2.07	2.04	10.76	5.38	0.96
500	5	3	2.03	2.02	10.44	5.18	1.12

(h) Group-II, CH-2, $(\rho, \lambda_3) = (.5, .3)$

n	Test	DGP	Mean	sd	10%	5%	1%
50	1	1	2.91	2.75	20.12	12.04	3.76
50	1	2	3.54	3.34	27.80	18.68	6.82
50	1	3	3.17	3.08	23.50	15.34	5.66
50	2	1	2.33	2.12	12.92	6.44	1.28
50	2	2	2.57	2.41	16.12	9.06	2.28
50	2	3	2.41	2.29	14.52	8.32	1.82
50	3	1	2.22	1.94	11.70	5.06	0.82

50	3	2	2.14	1.80	9.84	4.14	0.44
50	3	3	2.16	1.92	11.44	5.50	0.56
50	4	1	2.85	2.67	19.26	11.52	3.64
50	4	2	3.48	3.27	27.14	18.02	6.32
50	4	3	3.12	3.00	22.96	14.60	4.88
50	5	1	2.17	1.95	10.40	5.18	0.96
50	5	2	2.38	2.23	13.76	7.00	1.64
50	5	3	2.23	2.09	12.30	6.32	1.32
100	1	1	2.57	2.53	16.72	9.54	2.64
100	1	2	3.06	3.02	22.02	13.96	4.90
100	1	3	2.62	2.63	17.42	10.42	2.94
100	2	1	2.26	2.18	12.66	6.76	1.44
100	2	2	2.48	2.44	15.12	8.70	2.36
100	2	3	2.22	2.18	12.40	6.26	1.32
100	3	1	2.20	2.08	11.86	5.90	1.18
100	3	2	2.21	2.00	11.60	5.66	0.86
100	3	3	2.10	1.98	10.60	4.94	0.86
100	4	1	2.48	2.47	15.58	8.92	2.62
100	4	2	2.88	2.88	19.92	12.50	3.92
100	4	3	2.52	2.51	15.74	9.58	2.54
100	5	1	2.12	2.04	11.06	5.82	1.18
100	5	2	2.24	2.19	12.32	6.48	1.54
100	5	3	2.06	2.01	10.42	5.32	1.06
200	1	1	2.37	2.30	13.94	7.68	1.78
200	1	2	2.62	2.61	17.22	10.30	3.04
200	1	3	2.47	2.47	15.42	9.08	2.42
200	2	1	2.20	2.11	11.86	6.30	1.24
200	2	2	2.30	2.27	13.72	7.40	1.80
200	2	3	2.21	2.18	12.48	6.86	1.42
200	3	1	2.17	2.07	11.40	5.98	1.16
200	3	2	2.15	2.00	11.28	5.54	0.98
200	3	3	2.15	2.09	11.60	6.12	1.20
200	4	1	2.21	2.14	12.38	6.60	1.36
200	4	2	2.49	2.42	15.90	8.72	2.28
200	4	3	2.38	2.37	14.36	8.08	2.40
200	5	1	2.02	1.93	10.10	4.88	0.68
200	5	2	2.12	2.06	10.92	5.54	1.06
200	5	3	2.07	2.04	10.72	5.30	1.16
500	1	1	2.42	2.37	14.32	8.10	2.10
500	1	2	2.53	2.56	15.38	8.94	2.88
500	1	3	2.44	2.39	15.02	8.60	2.16
500	2	1	2.31	2.26	13.02	7.24	1.80
500	2	2	2.35	2.36	13.22	7.46	2.20

500	2	3	2.30	2.24	13.54	7.16	1.48
500	3	1	2.30	2.24	12.92	7.10	1.76
500	3	2	2.27	2.22	12.48	6.66	1.78
500	3	3	2.26	2.17	13.04	6.76	1.34
500	4	1	2.12	2.10	11.50	5.88	1.24
500	4	2	2.26	2.28	13.10	7.58	1.62
500	4	3	2.19	2.14	11.98	6.76	1.40
500	5	1	2.01	1.99	10.12	4.72	1.00
500	5	2	2.02	2.02	10.52	5.44	0.86
500	5	3	2.00	1.95	9.66	5.22	0.90

(i) Group-II, CH-3, $(\rho, \lambda_3) = (.5, .3)$

n	Test	DGP	Mean	sd	10%	5%	1%
50	1	1	5.93	5.51	46.64	37.58	22.54
50	1	2	7.51	6.88	56.02	46.96	30.26
50	1	3	6.56	5.92	51.64	41.66	25.44
50	2	1	3.05	3.26	21.82	14.70	5.70
50	2	2	3.63	3.92	26.92	18.62	8.60
50	2	3	3.15	3.36	22.66	15.02	5.94
50	3	1	2.30	2.01	13.42	6.22	0.68
50	3	2	2.16	1.74	9.46	3.90	0.26
50	3	3	2.18	1.85	11.10	4.74	0.44
50	4	1	5.50	5.01	45.04	35.08	19.90
50	4	2	6.57	6.04	51.98	41.90	25.16
50	4	3	6.01	5.36	48.98	39.00	22.16
50	5	1	2.76	2.71	18.92	11.40	3.24
50	5	2	3.13	3.26	22.56	14.38	5.36
50	5	3	2.88	2.96	19.64	11.86	4.22
100	1	1	3.64	3.95	26.60	18.36	8.90
100	1	2	4.86	5.39	36.62	27.96	15.14
100	1	3	4.26	4.78	32.12	23.90	12.30
100	2	1	2.64	2.89	16.88	11.10	4.02
100	2	2	3.09	3.60	21.88	14.62	5.92
100	2	3	2.88	3.22	20.18	13.46	5.26
100	3	1	2.19	2.06	11.64	6.48	0.98
100	3	2	2.09	1.82	9.76	4.28	0.42
100	3	3	2.15	1.99	12.28	5.30	0.80
100	4	1	3.53	3.73	26.28	18.14	7.74
100	4	2	4.70	5.00	36.20	27.04	14.52
100	4	3	4.05	4.31	30.50	22.08	10.50
100	5	1	2.53	2.59	16.30	9.50	2.74
100	5	2	2.85	3.01	19.24	12.18	4.26
100	5	3	2.62	2.73	16.90	10.14	3.36
200	1	1	3.53	3.40	27.94	18.72	7.12

200	1	2	4.28	4.28	33.92	24.20	12.08
200	1	3	3.83	3.74	30.80	21.08	8.78
200	2	1	2.72	2.61	18.68	10.84	3.06
200	2	2	2.93	2.97	20.62	13.12	4.42
200	2	3	2.79	2.71	19.30	11.62	3.40
200	3	1	2.63	2.45	17.96	10.08	2.24
200	3	2	2.51	2.27	15.92	8.64	1.60
200	3	3	2.57	2.36	16.42	9.10	1.76
200	4	1	2.67	2.61	17.92	10.64	3.04
200	4	2	3.26	3.34	23.60	15.42	6.30
200	4	3	2.84	2.89	19.50	11.80	3.80
200	5	1	2.17	2.10	11.68	6.04	1.24
200	5	2	2.28	2.34	13.12	7.38	1.90
200	5	3	2.16	2.17	11.44	6.20	1.60
500	1	1	4.14	3.78	34.48	23.94	9.86
500	1	2	4.49	4.02	38.24	27.56	11.66
500	1	3	4.38	3.91	36.48	25.66	11.68
500	2	1	3.54	3.26	27.78	18.32	6.76
500	2	2	3.55	3.18	28.76	17.96	5.84
500	2	3	3.60	3.26	28.10	19.00	7.02
500	3	1	3.50	3.17	27.52	17.86	6.54
500	3	2	3.28	2.75	25.94	15.12	3.86
500	3	3	3.44	2.98	26.74	17.58	5.52
500	4	1	2.28	2.37	13.42	7.40	2.08
500	4	2	2.62	2.65	17.18	9.96	3.14
500	4	3	2.46	2.49	15.64	8.94	2.28
500	5	1	2.05	2.12	10.72	5.42	1.52
500	5	2	2.11	2.12	11.50	5.96	1.40
500	5	3	2.09	2.12	11.46	5.68	1.14