Supplemental Appendix to

Hierarchy and Spatial Contagion: Population in American Cities Between 1990 and 2010

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Abstract

This appendix contains materials supplemental to the manuscript, and is not intended for publication. This document contains additional technical details regarding the spatial lag hierarchical regression model, descriptive statistics for both MA and UA datasets, and results from the traditional (non-hierarchical) spatial lag regressions.

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1 List of Notation Used in the Manuscript

Table 1: List of Variable Notation

Variable	Description
Dependent Variable	
y	Urban area level dependent variable
Independent Variables	
x	Urban area level independent variables
z	Regional level independent variables
Errors	
e	Urban area level error
μ	Regional level error
α	Central place level error
u	Total error, includes time and location ($u = \alpha + \mu + e$)
Coefficients	
β	Urban area level coefficients
π	Region level coefficients
γ	Central place level coefficients
Spatial Parameters	
λ	Lag coefficient
w	Distance weight
Subscripts and Identifiers	
i, f	Urban area
j	Region
k	Central place
t	Time period
N	Total number of central places
M_k	Number of regions in central place k
M	Total number of regions, $M = \sum_{k=1}^{N} M_k$
L_{kj}	Number of urban areas in region j in central place k
L_k	Number of urban areas in central place k
L	Total number of urban areas, $L = \sum_{k=1}^{N} \sum_{j=1}^{M_k} L_{kj}$
T	Number of time periods
H	Total number of observations, $H = TL$

–continued–

Variable	Description
Subscripts and Identifiers	
p	Urban area independent variables
q	Region independent variables
P	Number of urban area level independent variables
Q	Number of regional level independent variables
Vectors	
$\mathbf{y}$	Dependent variable vector
$\mathbf{x}$	Urban area level independent variable vector
$\mathbf{z}$	Regional level independent variable vector
$\boldsymbol{\gamma}$	Intercept vector
$\boldsymbol{\beta}$	Urban area level coefficient vector
$\boldsymbol{\pi}$	Regional level coefficient vector
$\mathbf{u}$	Error vector
Matrices	
$\boldsymbol{\Omega}$	Variance-covariance matrix
$\mathbf{I}$	Identity matrix
$\mathbf{R}_\mu, \mathbf{R}_\alpha$	Indicator matrix, consists of ones and zeros that indicate inclusion in specific groups
$\mathbf{J}_\mu, \mathbf{J}_\alpha$	Block-diagonal indicator matrix
$\mathbf{X}$	Urban area level explanatory variable matrix
$\mathbf{Z}$	Regional market area explanatory variable matrix
$\mathbf{W}$	Weights matrix
$\boldsymbol{\lambda}$	Spatial lag matrix
$\mathbf{A}$	Spatial multiplier matrix
Other Parameters	
σ_e^2	Variance of the urban area level error
σ_μ^2	Variance of the region level error
σ_α^2	Variance of the central place level error
ρ_μ	Ratio of variances, $\rho_\mu = \sigma_\mu^2/\sigma_e^2$
ρ_α	Ratio of variances, $\rho_\alpha = \sigma_\alpha^2/\sigma_e^2$

2 The Gradients of the Log-Likelihood Function

As stated in the manuscript, we numerically solve the log-likelihood function for the parameter values. To do this, we provide the software with both the log-likelihood function and the analytical gradients. Here, we derive the analytical gradients that correspond to the three-level version of the Baltagi et al. (2015) model. As shown in the manuscript, the log-likelihood function is:

$$\ln \mathscr{L} = -\frac{1}{2}\Bigg[H \ln(2\pi\sigma_e^2) + \sum_{t=1}^{T}\Bigg\{\ln|I_t - \lambda_t W_t| + \sum_{k=1}^{N_t}\Bigg\{\ln\theta_{tk} + \sum_{j=1}^{M_{tk}}\Big\{\ln\theta_{tkj} + \frac{V_{tkj}}{\sigma_e^2} - \frac{\rho_\mu}{\theta_{tkj}}\frac{U_{tkj}^2}{\sigma_e^2}\Big\} - \frac{\rho_\alpha}{\theta_{tk}}\frac{U_{tk}^2}{\sigma_e^2}\Bigg\}\Bigg\}\Bigg], \tag{1}$$

where

$$V_{ikj} = \sum_{i=1}^{L_{tkj}} u_{tkji}^2, \qquad \theta_{tkj} = 1 + \rho_\mu L_{tkj},$$
$$U_{tkj} = \sum_{i=1}^{L_{tkj}} u_{tkji}, \qquad \theta_{tk} = 1 + \rho_\alpha \phi_{tk},$$
$$U_{tk} = \sum_{j=1}^{M_{tk}} \frac{U_{tkj}}{\theta_{tkj}}, \qquad \phi_{tk} = \sum_{j=1}^{M_{tk}} \frac{L_{tkj}}{\theta_{tkj}},$$

and the residual is defined as:

$$\begin{aligned} u_{tkji} &= y_{tkji} - \lambda_t \sum_{k=1}^{N_t}\sum_{j=1}^{M_{tk}}\sum_{f=1}^{L_{tkj}} w_{tkjf} y_{tkjf} - \gamma_t - \mathbf{x}_{tkji}\boldsymbol{\beta} - \mathbf{z}_{tkj}\boldsymbol{\pi} \\ &= y_{tkji} - \lambda_t \tilde{y}_{tkjf} - \gamma_t - \mathbf{x}_{tkji}\boldsymbol{\beta} - \mathbf{z}_{tkj}\boldsymbol{\pi}. \end{aligned} \tag{2}$$

The analytic gradient of this log-likelihood function is:

$$\nabla \ln \mathscr{L} = \begin{pmatrix} (\frac{\partial \ln \mathscr{L}}{\partial \lambda_1}, \ldots, \frac{\partial \ln \mathscr{L}}{\partial \lambda_T})' \\ (\frac{\partial \ln \mathscr{L}}{\partial \beta_1}, \ldots, \frac{\partial \ln \mathscr{L}}{\partial \beta_P})' \\ (\frac{\partial \ln \mathscr{L}}{\partial \pi_1}, \ldots, \frac{\partial \ln \mathscr{L}}{\partial \pi_Q})' \\ \frac{\partial \ln \mathscr{L}}{\partial \sigma_e^2} \\ \frac{\partial \ln \mathscr{L}}{\partial \rho_\mu} \\ \frac{\partial \ln \mathscr{L}}{\partial \rho_\alpha} \end{pmatrix}. \tag{3}$$

Let:

$$\kappa_{p,tkj} = \sum_{i=1}^{L_{tkj}} u_{tkji} x_{p,tkji}, \qquad \psi_{tk} = \sum_{j=1}^{M_{tk}} \Big(\frac{L_{tkj}}{\theta_{tkj}}\Big)^2,$$

$$C_{p,tkj} = \sum_{i=1}^{L_{tkj}} x_{p,tkji}, \qquad V_{tk} = \sum_{j=1}^{M_{tk}} \Big(\frac{U_{tkj}}{\theta_{tkj}}\Big)^2,$$

$$C_{p,tk} = \sum_{j=1}^{M_{tk}} \frac{C_{p,tkj}}{\theta_{tkj}}, \qquad \xi_{tk} = \sum_{j=1}^{M_{tk}} \frac{U_{tkj} L_{tkj}}{\theta_{tkj}},$$

$$\Delta_{p,tkj} = \sum_{i=1}^{L_{tkj}} u_{tkji} z_{p,tkji}, \qquad \tilde{y}_{tkji} = \sum_{k=1}^{N_t} \sum_{j=1}^{M_{tk}} \sum_{f=1}^{L_{tkj}} w_{tkjf} y_{tkjf},$$

$$D_{p,tkj} = \sum_{i=1}^{L_{tkj}} z_{p,tkji}, \qquad \tilde{Y}_{tkj} = \sum_{i=1}^{L_{tkj}} \tilde{y}_{tkji},$$

$$D_{p,tk} = \sum_{j=1}^{M_{tk}} \frac{D_{p,tkj}}{\theta_{tkj}}, \qquad \tilde{Y}_{tk} = \sum_{j=1}^{M_{tk}} \frac{\tilde{Y}_{tkj}}{\theta_{tkj}},$$

$$\text{and} \qquad \Phi_{tkj} = \sum_{i=1}^{L_{tkj}} \Big(u_{tkji} \tilde{y}_{tkji}\Big).$$

Then the gradients are:

$$\frac{\partial \ln \mathscr{L}}{\partial \lambda_t} = \frac{1}{2} \mathrm{tr}\Big[(I_t - \lambda_t W_t)^{-1} W_t\Big] + \frac{1}{\sigma_e^2} \sum_{k=1}^{N_t} \left\{ \sum_{j=1}^{M_{tk}} \left\{ \Phi_{tkj} - \frac{\rho_\mu}{\theta_{tkj}} \tilde{Y}_{tkj} U_{tkj} \right\} - \frac{\rho_\alpha}{\theta_{tk}} \tilde{Y}_{tk} U_{tk} \right\} \quad \forall t = 1, \ldots, T, \tag{4}$$

$$\frac{\partial \ln \mathscr{L}}{\partial \beta_p} = \frac{1}{\sigma_e^2} \sum_{t=1}^{T} \sum_{k=1}^{N_t} \left\{ \sum_{j=1}^{M_{tk}} \left\{ \kappa_{p,tkj} - \frac{\rho_\mu}{\theta_{tkj}} C_{p,tkj} U_{tkj} \right\} - \frac{\rho_\alpha}{\theta_{tk}} C_{p,tk} U_{tk} \right\} \quad \forall p = 1, \ldots, P, \tag{5}$$

$$\frac{\partial \ln \mathscr{L}}{\partial \pi_q} = \frac{1}{\sigma_e^2} \sum_{t=1}^{T} \sum_{k=1}^{N_t} \left\{ \sum_{j=1}^{M_{tk}} \left\{ \Delta_{p,tkj} - \frac{\rho_\mu}{\theta_{tkj}} D_{p,tkj} U_{tkj} \right\} - \frac{\rho_\alpha}{\theta_{tk}} D_{p,tk} U_{tk} \right\} \quad \forall q = 1, \ldots, Q, \tag{6}$$

$$\frac{\partial \ln \mathscr{L}}{\partial \sigma_e^2} = -\frac{1}{2\sigma_e^2} \left[H - \frac{1}{\sigma_e^2} \sum_{t=1}^{T} \sum_{k=1}^{N_t} \left\{ \sum_{j=1}^{M_{tk}} \left\{ V_{tkj} - \frac{\rho_\mu}{\theta_{tkj}} U_{tkj}^2 \right\} - \frac{\rho_\alpha}{\theta_{tk}} U_{tk}^2 \right\} \right], \tag{7}$$

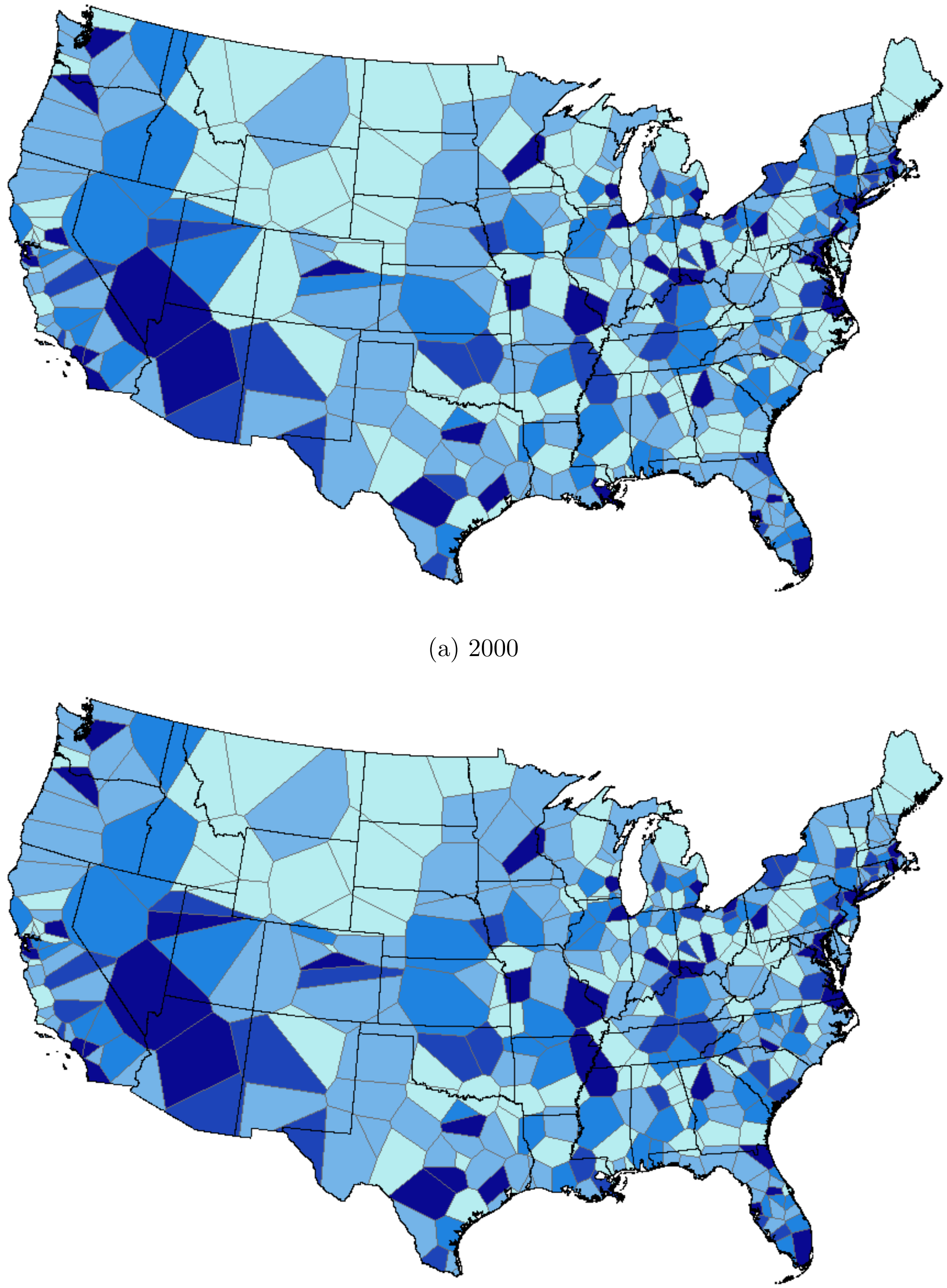
$$\frac{\partial \ln \mathscr{L}}{\partial \rho_\mu} = \frac{1}{2} \sum_{t=1}^{T} \sum_{k=1}^{N_t} \left\{ \frac{V_{tk}}{\sigma_e^2} - \phi_{tk} + \frac{\rho_\alpha}{\theta_{tk}} \left[\frac{U_{tk}}{\sigma_e^2} \left(\frac{\rho_\alpha}{\theta_{tk}} U_{tk} \psi_{tk} - 2\xi_{tk} \right) + \psi_{tk} \right] \right\}, \tag{8}$$

and

$$\frac{\partial \ln \mathscr{L}}{\partial \rho_\alpha} = \frac{1}{2} \sum_{t=1}^{T} \sum_{k=1}^{N_t} \frac{1}{\theta_{tk}} \left\{ \frac{U_{tk}^2}{\sigma_e^2 \theta_{tk}} - \phi_{tk} \right\}. \tag{9}$$

3 Additional Descriptive Statistics

In this section we report additional descriptive statistics of the MA and UA datasets. The first are maps that show the distribution of population throughout the United States, and the second set are tables that show additional breakdowns of the data by central place market area.



(a) 2000

(b) 2010

Figure 1: Population of Metropolitan Areas, 2000 and 2010. Maps of the population of metropolitan areas in the MA data. The lightest blue indicates the smallest metropolitan areas with between 50,000 and 99,999 inhabitants. The color deepens for each subsequent category (100,000-249,999; 250,000-499,999; 500,000-999,999) until the darkest, most populous metropolitan areas of one million inhabitants or more. Categories were chosen at cutoffs from the literature (e.g. Partridge et al. (2008)) and in practice (e.g. USDA-ERS Urban-Rural Continuum Codes).

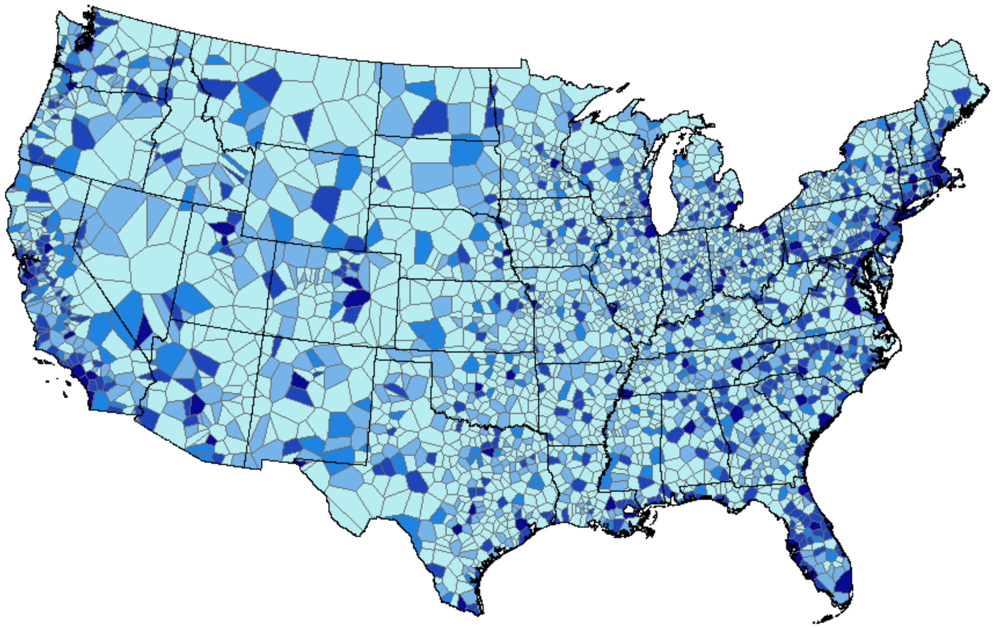


Figure 2: Population of Urban Areas, 2010. Maps of the population of urban areas in the UA data. The lightest blue indicates the smallest urban areas with a population between 2,500 inhabitants and 9,999 inhabitants. The color deepens for each subsequent category (10,000-24,999; 25,000-49,999; 50,000-499,999) until the darkest and most populous urban areas of 500,000 inhabitants or more. These groupings were chosen at typical cutoffs in practice and definition. The US Census Bureau defines 10,000 inhabitants as the minimum population of a Micropolitan Statistical Area. A minimum population of 25,000 was necessary for a city to be included in the US Census Bureau's *County and City Data Book*, as well as for a city to qualify for the USDA's rural housing program. Finally, the minimum population for a Metropolitan Statistical Area is 50,000 residents. These thresholds were also used in creating the USDA's Economic Research Service's Frontier and Remote Area Codes (US Department of Agriculture, Economic Research Service, 2015).

Table 2: Number of Metropolitan and Urban Areas by Central Place Market Area and Tier

(a) MA dataset

CP Market Area	Number of MAs
Atlanta, GA	
High Tier	1
Middle Tier	6
Low Tier	54
Chicago, IL–IN	
High Tier	1
Middle Tier	10
Low Tier	75
Denver–Aurora, CO	
High Tier	1
Middle Tier	1
Low Tier	20
Houston, TX	
High Tier	1
Middle Tier	5
Low Tier	41
Los Angeles–Long Beach–Santa Ana, CA	
High Tier	1
Middle Tier	2
Low Tier	40
Miami, FL	
High Tier	1
Middle Tier	1
Low Tier	20
New York–Newark, NY–NJ–CT	
High Tier	1
Middle Tier	4
Low Tier	38
Seattle, WA	
High Tier	1
Middle Tier	1
Low Tier	11
Washington, DC–VA–MD	
High Tier	1
Middle Tier	4
Low Tier	25

(b) UA dataset

CP Market Area	Number of UAs
Atlanta, GA	
High Tier	1
Middle Tier	6
Low Tier	493
Chicago, IL–IN	
High Tier	1
Middle Tier	10
Low Tier	988
Denver–Aurora, CO	
High Tier	1
Middle Tier	1
Low Tier	193
Houston, TX	
High Tier	1
Middle Tier	5
Low Tier	488
Los Angeles–Long Beach–Santa Ana, CA	
High Tier	1
Middle Tier	2
Low Tier	268
Miami, FL	
High Tier	1
Middle Tier	1
Low Tier	72
New York–Newark, NY–NJ–CT	
High Tier	1
Middle Tier	4
Low Tier	235
Seattle, WA	
High Tier	1
Middle Tier	1
Low Tier	143
Washington, DC–VA–MD	
High Tier	1
Middle Tier	4
Low Tier	251

Table 3: Descriptive Statistics for Metropolitan Areas by Central Place Market Area, 1990–2010[a]

Variables	Atlanta	Chicago	Denver	Houston	Los Angeles
Total Pop 1990	203,351.400	372,977.900	221,030.100	325,263.400	690,365.400
Total Pop 2000	276,421.500	426,201.100	289,808.200	413,869.600	828,672.300
Total Pop 2010	338,370.300	452,772.000	348,947.400	498,927.000	930,161.500
Avg Temp (° C)	16.473	9.846	9.624	18.939	16.726
Temp Discomfort	17.439	25.034	22.449	16.807	13.311
Dist to GL/Ocean (km)	259.362	231.346	1,010.268	315.154	108.169
Ruggedness (category)	2.377	1.674	1.909	1.383	1.558
Elev Diff (m)	138.082	88.826	378.727	73.170	362.837
Dist to Middle or High Tier (km)	152.743	141.952	300.012	214.823	181.080
Centrality Index (2000)	12.995	12.888	13.887	13.206	13.662

	Miami	New York	Seattle	Washington, DC
Total Pop 1990	443,542.900	802,524.700	360,922.500	467,170.000
Total Pop 2000	583,936.200	917,549.000	472,162.200	521,807.400
Total Pop 2010	695,976.900	955,948.500	543,325.200	561,048.300
Avg Temp (° C)	22.176	9.727	10.690	12.192
Temp Discomfort	12.988	23.596	16.690	20.980
Dist to GL/Ocean (km)	23.707	61.225	140.794	98.818
Ruggedness (category)	1.091	2.349	1.615	3.100
Elev Diff (m)	32.182	234.070	328.769	205.933
Dist to Middle or High Tier (km)	170.801	109.591	214.722	116.184
Centrality Index (2000)	14.025	13.230	14.268	12.411

Data Sources: NHGIS/US Census Bureau, PRISM Climate Group, USGS LCS, NOAA GLOBE Project, NETS, Authors' Estimates
[a] MA data includes Census-defined urban areas with a population greater than 50,000 residents in 1990 and non-population variables are created using land area from 2000. Central place areas contain all metropolitan areas closest to central place nodes by network distance. This table contains means for each central place market area.

Table 4: Descriptive Statistics for Urban Areas by Central Place Market Area, 2000–2010[a]

Variables	Atlanta	Chicago	Denver	Houston	Los Angeles
Total Pop 2000	43,261.570	45,382.570	41,194.370	48,379.590	144,606.300
Total Pop 2010	51,971.450	48,203.160	49,930.610	57,587.990	164,488.500
Avg Temp (° C)	16.305	9.973	8.722	18.044	16.063
Temp Discomfort	20.589	27.456	25.807	20.435	18.441
Dist to GL/Ocean (km)	308.796	313.434	951.037	401.430	194.504
Ruggedness (category)	2.328	1.831	2.421	1.520	2.277
Elev Diff (m)	71.886	46.354	171.092	40.330	190.970
Dist to Middle or High Tier (km)	176.480	176.958	394.182	231.001	247.918
Centrality Index (2000)	7.331	7.162	7.938	7.126	8.067

	Miami	New York	Seattle	Washington, DC
Total Pop 2000	185,355.200	174,467.900	54,022.930	72,791.610
Total Pop 2010	222,618.400	181,935.000	62,559.830	78,737.930
Avg Temp (° C)	21.927	8.652	10.329	11.701
Temp Discomfort	16.247	27.091	19.240	23.831
Dist to GL/Ocean (km)	40.866	90.261	175.452	102.508
Ruggedness (category)	1.095	2.821	2.221	2.758
Elev Diff (m)	21.635	153.450	145.455	104.723
Dist to Middle or High Tier (km)	190.651	163.066	277.030	144.620
Centrality Index (2000)	9.104	7.993	8.310	7.002

Data Sources: NHGIS/US Census Bureau, PRISM Climate Group, USGS LCS, NOAA GLOBE Project, NETS, Authors' Estimates

[a] UA data includes Census-defined urban areas that exist in both 2000 and 2010 and non-population variables are created using land area from 2000. Central place areas contain all urban areas closest to central place nodes by network distance. This table contains means for each central place market area.

4 Spatial Lag Regression Estimates

The following tables report parameter and marginal effect estimates from a traditional spatial lag model that assumes a non-hierarchical data structure. These models are estimated using the 'splm' and 'spdep' packages in `R`.

Table 5: Metropolitan Area Spatial Lag Regression Results

Dependent variable:	*Model 1*		*Model 2*	
$\ln(Pop_t)$	Coefficient	Std. Error	Coefficient	Std. Error
Constant	1.072***	(0.283)	1.459***	(0.267)
Urban Area Level:				
$\ln(Pop_{t-1})$	0.945***	(0.010)	0.951***	(0.010)
Centrality Index[b]	0.038***	(0.007)	0.033***	(0.007)
Dist to GL/Ocean (100km)	0.003	(0.003)	0.001	(0.003)
Elev Diff (100m)	0.001	(0.004)		
Land Surface Forms				
Flat Plains			base	base
Smooth Plains			0.007	(0.016)
Irregular Plains			0.004	(0.015)
Hills			0.018	(0.049)
Foothills			−0.101**	(0.049)
Low Mountains			−0.186**	(0.093)
Avg Temp (° C)	0.007***	(0.002)		
Temp Discomfort[c]			−0.003	(0.002)
Time Period	−0.145***	(0.018)	−0.143***	(0.019)
Regional Market Area Level:				
Real Agg Income ($100B)[d]	0.011*	(0.006)	0.013*	(0.007)
Mfg Emp Share	−0.367	(0.290)	−0.822***	(0.295)
Svc Emp Share	−0.136	(0.347)	−0.413	(0.351)
Rural Land Proportion	−0.406***	(0.147)	−0.355**	(0.154)
λ	−0.020	(0.020)	−0.025	(0.020)
σ^2	0.030	(0.054)	0.032	(0.053)
Observations	734		734	

Table 6: Metropolitan Area Spatial Lag Marginal Effects

Dependent variable:	*Model 1*			*Model 2*		
$\ln(Pop_t)$	Direct Effect	Indirect Effect	Total Effect	Direct Effect	Indirect Effect	Total Effect
Urban Area Level:						
$\ln(Pop_{t-1})$	0.945***	−0.019	0.926***	0.951***	−0.023	0.928***
Centrality Index	0.038***	−0.001	0.037***	0.033***	−0.001	0.032***
Dist to GL/Ocean	0.003	−0.0001	0.003	0.001	−0.00002	0.001
Elev Diff	0.001	−0.00002	0.001			
Land Surface Forms						
Flat Plains				base	base	base
Smooth Plains				0.007	−0.0002	0.007
Irregular Plains				0.004	−0.0001	0.004
Hills				0.018	−0.0004	0.017
Foothills				−0.101**	0.002	−0.099**
Low Mountains				−0.186**	0.004	−0.181**
Avg Temp	0.007***	−0.0001	0.007***			
Temp Discomfort				−0.003	0.0001	−0.003
Time Period	−0.145***	0.003	−0.142***	−0.143***	0.003	−0.139***
Regional Market Area Level:						
Real Agg Income	0.011*	−0.0002	0.011	0.013*	−0.0003	0.013*
Mfg Emp Share	−0.367	0.007	−0.360	−0.822***	0.020	−0.803***
Svc Emp Share	−0.136	0.003	−0.134	−0.413	0.010	−0.403
Rural Land Proportion	−0.406***	0.008	−0.398***	−0.355**	0.009	−0.347**

Table 7: Urban Area Spatial Lag Regression Results

Dependent variable:	*Model 1*		*Model 2*	
ln(Pop2010)	Coefficient	Std. Error	Coefficient	Std. Error
Constant	-1.048^{***}	(0.247)	-1.048^{***}	(0.236)
Urban Area Level:				
ln(Pop 2000)	0.990^{***}	(0.006)	0.985^{***}	(0.006)
Centrality Index (4-dig)[b]	0.010^{***}	(0.003)	0.011^{***}	(0.003)
Dist to GL/Ocean (100km)	0.006^{***}	(0.002)	0.004^{**}	(0.002)
Elev Diff (100m)	-0.016^{***}	(0.004)		
Land Surface Forms				
Flat Plains			base	base
Smooth Plains			0.016^{*}	(0.009)
Irregular Plains			-0.005	(0.009)
Escarpments			-0.068	(0.068)
Hills			0.006	(0.025)
Foothills			-0.032	(0.024)
Low Mountains			-0.035	(0.031)
Avg Temp (° C)	-0.002^{*}	(0.001)		
Temp Discomfort[c]			0.004^{***}	(0.001)
Regional Market Area Level:				
Real Agg Income ($100B)[d]	0.004	(0.004)	0.005	(0.004)
Mfg Emp Share	-0.830^{***}	(0.182)	-1.076^{***}	(0.188)
Svc Emp Share	-0.667^{***}	(0.239)	-0.922^{***}	(0.245)
Rural Land Proportion	0.056	(0.081)	0.087	(0.083)
λ	0.157^{***}	(0.014)	0.178^{***}	(0.015)
σ^2	0.036		0.036	
Observations	3,174		3,174	

Table 8: Urban Area Spatial Lag Marginal Effects

Dependent variable:	*Model 1*			*Model 2*		
ln(Pop2010)	Direct Effect	Indirect Effect	Total Effect	Direct Effect	Indirect Effect	Total Effect
Urban Area Level:						
ln(Pop 2000)	0.991***	0.204***	1.195***	0.985***	0.213***	1.199***
Centrality Index	0.010***	0.002***	0.012***	0.011***	0.002***	0.013***
Dist to GL/Ocean	0.006***	0.001***	0.007***	0.004**	0.001**	0.004**
Elev Diff	−0.016***	−0.003***	−0.019***			
Land Surface Forms						
Flat Plains				base	base	base
Smooth Plains				0.016*	0.003*	0.019*
Irregular Plains				−0.005	−0.001	−0.005
Escarpments				−0.068	−0.015	−0.082
Hills				0.006	0.001	0.007
Foothills				−0.032	−0.007	−0.039
Low Mountains				−0.035	−0.008	−0.042
Avg Temp	−0.002*	−0.0004*	−0.002*			
Temp Discomfort				0.004***	0.001***	0.005***
Regional Market Area Level:						
Real Agg Income	0.004	0.001	0.005	0.0005	0.001	0.006
Mfg Emp Share	−0.831***	−0.171***	−1.002***	−1.077***	−0.233***	−1.310***
Svc Emp Share	−0.667***	−0.137***	−1.804***	−0.922***	−0.200***	−1.122***
Rural Land Proportion	0.056	0.011	0.067	0.087	0.019	0.106

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