PNAS
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Supplementary Information for

Attendance Trends Threaten Future Operations of America's State Park Systems

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This PDF file includes:

www.pnas.org/cgi/doi/10.1073/pnas.1902314116

Table S1. Comparison of stochastic frontier models fit using different specifications

	A. True Random Effects (Exponential Inefficiency Distribution) (1)				B. True Random Effects (Half-normal Inefficiency Distribution) (1)				C. True Fixed Effects (2)				D. Maximum Likelihood Random-effects Time-varying Inefficiency Effects (3)				E. Maximum Likelihood Random-effects Time-varying Efficiency Decay (4)				F. ML Random-effects Flexible Time-varying Efficiency (5)			
		95% C. I.				95% C. I.				95% C. I.				95% C. I.				95% C. I.				95% C. I.		
Variable	Coef.	S. E.	L. B.	U. B.	Coef.	S. E.	L. B.	U. B.	Coef.	S. E.	L. B.	U. B.	Coef.	S. E.	L. B.	U. B.	Coef.	S. E.	L. B.	U. B.	Coef.	S. E.	L. B.	U. B.
ln Attendance (visitor-hours) / acre	**0.250**	0.015	0.221	0.279	**0.244**	0.017	0.211	0.276	**0.255**	0.012	0.231	0.279	**0.233**	0.012	0.210	0.255	**0.229**	0.011	0.207	0.251	**0.230**	0.011	0.207	0.252
ln Capital expenditures / acre [b]	**0.027**	0.004	0.019	0.035	**0.029**	0.004	0.021	0.038	**0.070**	0.004	0.063	0.077	**0.045**	0.006	0.034	0.057	**0.045**	0.006	0.033	0.057	**0.044**	0.006	0.033	0.056
ln Revenue / acre [b]	**0.064**	0.008	0.049	0.079	**0.051**	0.007	0.037	0.065	**0.157**	0.007	0.144	0.170	**0.135**	0.010	0.116	0.153	**0.146**	0.010	0.127	0.165	**0.147**	0.010	0.127	0.166
ln Labor (person-hours) / acre [c]	**0.425**	0.016	0.394	0.455	**0.385**	0.019	0.348	0.422	**0.502**	0.013	0.476	0.528	**0.464**	0.016	0.432	0.496	**0.452**	0.016	0.421	0.483	**0.452**	0.016	0.421	0.483
Precipitation (cm / year)	-2.5e^{-4}	3.7e^{-4}	-0.001	0.000	-0.001	4.8e^{-04}	-0.002	3.4e^{-04}	**0.001**	3.2e^{-04}	2.1e^{-04}	0.001	-3.6e^{-04}	2.5e^{-04}	-0.001	1.3e^{-04}	-1.1e^{-04}	2.4e^{-04}	-0.001	3.6e^{-04}	-1.1e^{-04}	2.4e^{-04}	-0.001	3.6e^{-04}
Average temperature (°C)	**0.003**	1.7e^{-3}	0.001	0.006	**0.004**	0.002	0.001	0.007	**0.032**	0.002	0.029	0.035	**0.024**	0.002	0.021	0.028	**0.024**	0.002	0.021	0.027	**0.024**	0.002	0.021	0.027
Constant	**3.097**	0.069	2.961	3.232	**3.512**	0.091	3.335	3.690					**2.473**	0.055	2.365	2.581	**2.252**	0.052	2.150	2.353	**2.253**	0.052	2.151	2.355
Parameter																								
U^{σ} constant	**-3.401**	0.092	-3.582	-3.220	**-0.944**	0.042	-1.027	-0.861	**-8.630**	0.056	-8.741	-8.520	**3.176**	0.058	3.062	3.289	—	—	—	—	—	—	—	—
V^{σ} constant	**-3.485**	0.059	-3.601	-3.369	**-4.087**	0.118	-4.318	-3.856	-3.431	—	—	—	**-2.433**	0.048	-2.527	-2.339	—	—	—	—	—	—	—	—
M^{σ} constant	—	—	—	—	—	—	—	—	—	—	—	—	**-110.771**	—	—	—	—	—	—	—	—	—	—	—
$ln\sigma^2$	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**6.536**	0.804	4.960	8.112	—	—	—	—
$ilgt\gamma$	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**8.743**	0.805	7.165	10.321	—	—	—	—
μ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	-985.225	782.922	-2519.724	549.274	—	—	—	—
η	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**-2.190**	0.167	-2.517	-1.862	—	—	—	—
b	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**5.558**	—	—	—
c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**-0.166**	1.8e^{-04}	-0.167	-0.166
θ constant	**0.319**	0.023	0.274	0.363	**0.280**	0.016	0.249	0.310	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
σ_U	**0.183**	0.008	0.167	0.200	**0.624**	0.013	0.598	0.650	**0.013**	3.8e^{-04}	0.013	0.014	**4.893**	0.141	4.624	5.178	—	—	—	—	**2.636**	0.269	2.042	3.119
σ_V	**0.175**	0.005	0.165	0.186	**0.130**	0.008	0.115	0.145	0.180	—	—	—	**0.296**	0.007	0.283	0.310	—	—	—	—	**0.333**	0.006	0.321	0.344
λ	**1.043**	0.012	1.020	1.066	**4.816**	0.017	4.782	4.849	0.074	—	—	—	**16.517**	0.144	16.234	16.799	—	—	—	—	**7.918**	0.269	7.391	8.445
σ^2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	689.664	554.550	142.626	3334.860	—	—	—	—
γ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.000	0.000	0.999	1.000	—	—	—	—
σ_U^2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	689.554	554.550	-397.344	1776.452	**6.949**	1.418	4.170	9.727
σ_V^2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.110	0.004	0.103	0.117	**0.111**	0.004	0.103	0.118
Summary Statistic																								
Wald χ^2 (6)	3040.64				2098.85				7352.56				13883.16				15202.76				15066.42			
Log simulated-likelihood	-127.19				-766.51				-59960.00				-680.34				-583.63				-634.67			
Number of pseudo-random draws used in each model	250				250				—				—				—				—			

Bold values are significant at the 0.05 level; N = 1,700 (50 states × 34 years).

Table S2. Deviation of coefficient estimates generated by the true random effects model (with an exponential inefficiency distribution) from estimates generated by other specifications (Table S1)

Variable	Min.	Max.
ln Attendance (visitor-hours) / acre	0.9 %	1.0 %
ln Capital expenditures / acre [b]	1.1 %	2.6 %
ln Revenue / acre [b]	0.8 %	2.5 %
ln Labor (person-hours) / acre [c]	0.9 %	1.2 %
Precipitation (cm / year)	-3.3 %	2.4 %
Average temperature (°C)	1.2 %	9.7 %

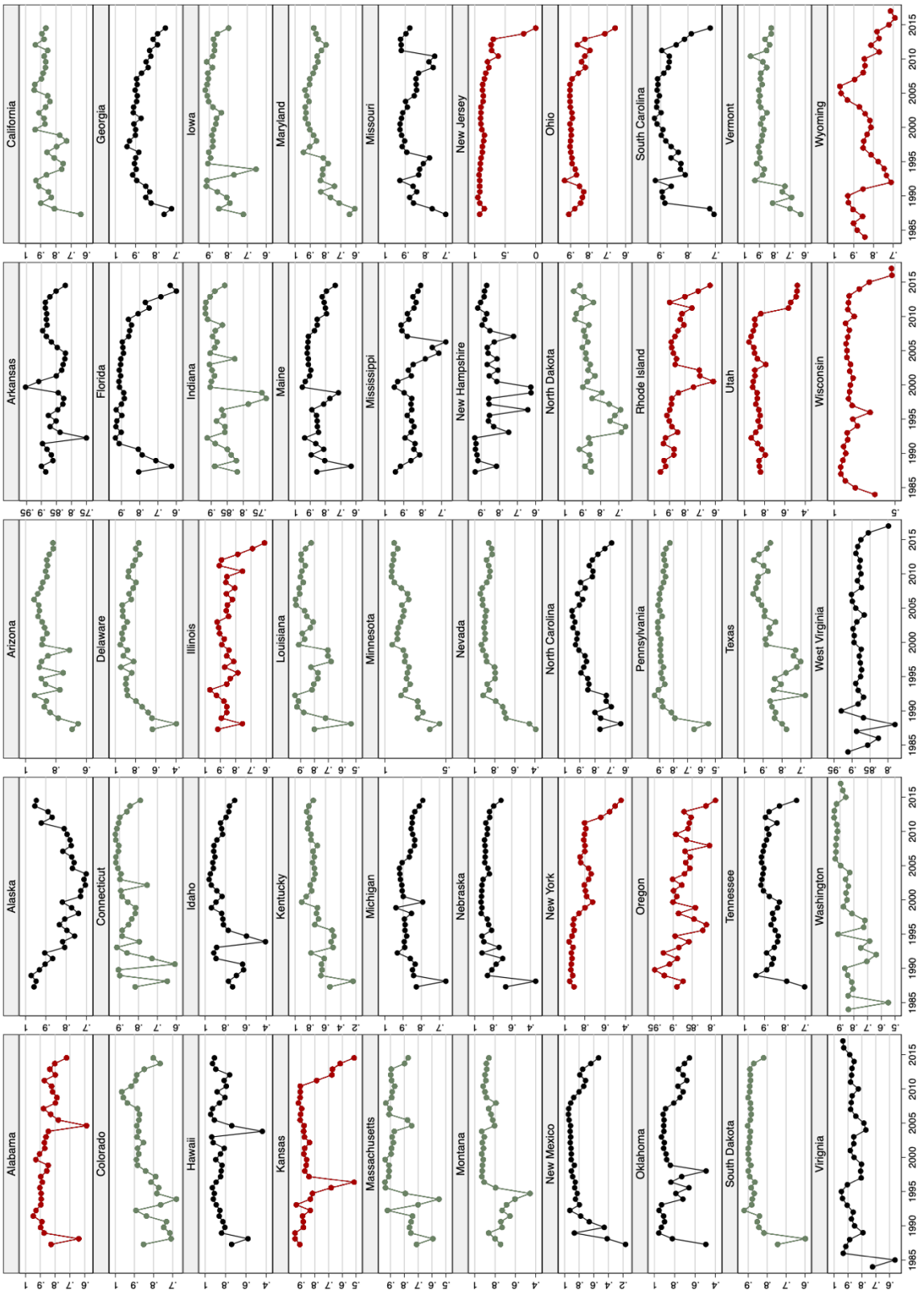

Fig. S1. Estimated cost efficiencies by state (1984-2017). Cost efficiencies range from 1.0 to 0.0, where 1.0 indicates a more cost-efficient state park and constant returns to scale. Dark red estimates indicate states whose estimated cost efficiencies are *negatively* and significantly correlated with time. Green estimates indicate states whose estimated cost efficiencies are *positively* and significantly correlated with time.

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