AJAE Appendix for "An Empirical Exploration of the Population-Environment Nexus in India"

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Note: The material contained herein is supplementary to the article named in the title and published in the American Journal of Agricultural Economics (AJAE)"

Appendix A: Complete Regression Results

Table A1. Rural Natural Population Growth Rate (G_R) Regressions

	(1) OLS	(2) GMM	(3) GMM	(4) OLS	(5) GMM	(6) GMM
Environmental Variables:						
ΔNDVI	-0.657*	-3.731**	-3.208***			
	(0.068)	(0.010)	(0.009)			
NDVI	-0.209	-0.277	-0.238			
	(0.197)	(0.220)	(0.250)			
LagΔNDVI	0.485	0.158	0.157			
	(0.271)	(0.791)	(0.781)			
Δz-NDVI				-7.591	-51.432**	-35.703**
				(0.201)	(0.015)	(0.015)
z-NDVI				1.142	-9.759	-5.968
				(0.674)	(0.111)	(0.209)
LagΔz-NDVI				3.132***	2.526*	2.563*
				(0.009)	(0.094)	(0.070)
NSA	-0.434	3.453	4.447	5.907	18.578	17.786
	(0.965)	(0.815)	(0.745)	(0.540)	(0.172)	(0.141)
Rain Dev(+)	-0.008	-0.007	-0.008	-0.011	-0.012	-0.010
	(0.328)	(0.544)	(0.438)	(0.151)	(0.184)	(0.224)
Rain Dev(-)	-0.010	-0.020	-0.020	-0.008	-0.009	-0.010
	(0.371)	(0.130)	(0.121)	(0.445)	(0.441)	(0.339)
(R)ural Variables:						
Popn dens(R)	-0.034***	-0.022	-0.023	-0.032***	-0.028**	-0.031***
	(0.001)	(0.211)	(0.139)	(0.001)	(0.030)	(0.010)
Death Rate(R)	6.583***	7.393***	7.225***	6.825***	8.444***	7.774***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inf Death(R)	0.034	0.033	0.032	-0.033	-0.123	-0.090
	(0.766)	(0.803)	(0.801)	(0.773)	(0.402)	(0.485)
AHS(R)	22.843***	20.285***	20.865***	22.197***	18.289***	20.118***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cons exp(R)	-0.062***	-0.069***	-0.071***	-0.063***	-0.076***	-0.076***
	(0.000)	(0.002)	(0.001)	(0.000)	(0.002)	(0.000)
Fem lit(R)	15.793***	16.380*	17.900**	14.601**	18.034**	16.776**
	(0.007)	(0.067)	(0.030)	(0.013)	(0.014)	(0.013)
Male lit(R)	16.013***	16.159*	17.834**	15.208**	19.058**	17.633**
	(0.010)	(0.090)	(0.043)	(0.015)	(0.015)	(0.014)
Tot lit(R)	-30.802**	-31.609*	-34.789**	-28.912**	-36.270**	-33.528**
	(0.011)	(0.086)	(0.041)	(0.017)	(0.017)	(0.016)
Sex ratio(R)	-0.242***	-0.276*	-0.295**	-0.234**	-0.342***	-0.298**
	(0.008)	(0.051)	(0.026)	(0.012)	(0.009)	(0.012)
Fem work(R)	-0.280*	-0.231	-0.280	-0.315**	-0.131	-0.195
	(0.077)	(0.280)	(0.136)	(0.046)	(0.461)	(0.226)
Tribals(R)	0.161	-0.051	0.018	0.158	0.110	0.147
	(0.311)	(0.780)	(0.905)	(0.310)	(0.495)	(0.311)
Muslims(R)	0.473*	0.148	0.168	0.416	0.390	0.351
	(0.086)	(0.621)	(0.558)	(0.126)	(0.180)	(0.180)
Life exp(R)	3.923***	2.800**	3.134***	4.319***	4.205***	4.425***
	(0.000)	(0.029)	(0.006)	(0.000)	(0.000)	(0.000)

Table A1.Rural Natural Population Growth Rate (G_R) Regressions (contd…)

	(1)	(2)	(3)	(4)	(5)	(6)

	OLS	GMM	GMM	OLS	GMM	GMM
Urban Variables:						
Urban popn	-0.047	-0.122	-0.092	-0.078	-0.152	-0.114
	(0.672)	(0.378)	(0.475)	(0.480)	(0.263)	(0.356)
Popn dens(U)	-0.000	0.001	0.001	-0.000	-0.000	-0.000
	(0.796)	(0.331)	(0.385)	(0.719)	(0.733)	(0.730)
Death Rate(U)	2.361***	3.340***	3.356***	1.855***	2.234**	2.278***
	(0.001)	(0.000)	(0.000)	(0.008)	(0.012)	(0.004)
Inf Death(U)	0.052	-0.099	-0.083	0.063	-0.135	-0.093
	(0.616)	(0.416)	(0.473)	(0.546)	(0.431)	(0.532)
AHS(U)	-9.326*	-10.911*	-10.637**	-9.803**	-13.729**	-13.603**
	(0.063)	(0.051)	(0.046)	(0.048)	(0.020)	(0.013)
Cons exp(U)	0.014	0.018	0.016	0.013	0.019*	0.014
	(0.157)	(0.148)	(0.179)	(0.164)	(0.088)	(0.160)
Fem lit(U)	15.820**	11.205	9.662	15.991*	-6.538	0.462
	(0.042)	(0.325)	(0.363)	(0.058)	(0.671)	(0.971)
Male lit(U)	17.371**	12.469	10.768	17.756*	-6.675	1.026
	(0.050)	(0.335)	(0.373)	(0.063)	(0.690)	(0.941)
Tot lit(U)	-34.075**	-24.507	-21.266	-34.412*	12.584	-2.156
	(0.039)	(0.310)	(0.346)	(0.054)	(0.695)	(0.935)
Sex ratio(U)	-0.188**	-0.170	-0.151	-0.180**	0.050	-0.027
	(0.021)	(0.144)	(0.159)	(0.040)	(0.748)	(0.827)
Fem work(U)	-0.598	-0.834	-0.693	-0.229	0.057	-0.048
	(0.201)	(0.187)	(0.220)	(0.626)	(0.918)	(0.926)
Tribals(U)	-0.346	-0.275	-0.398	-0.205	-0.187	-0.275
	(0.540)	(0.633)	(0.471)	(0.713)	(0.743)	(0.608)
Muslims(U)	-0.307	0.033	-0.024	-0.153	0.097	0.009
	(0.181)	(0.912)	(0.929)	(0.508)	(0.745)	(0.972)
Life exp(U)	-3.344***	-2.380**	-2.645***	-3.732***	-3.583***	-3.772***
	(0.000)	(0.035)	(0.009)	(0.000)	(0.000)	(0.000)
Constant	406.597***	468.483***	454.252***	342.572***	263.284**	285.551***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.011)	(0.003)
Observations	178	178	178	178	178	178
R-squared	0.741			0.748		
Hansen J statistic			1.307			3.091
			(0.5201)			(0.2132)
Pagan-Hall statistic		15.774	19.918		14.742	19.096
		(0.9951)	(0.9809)		(0.9974)	(0.9868)

Notes:
i. * significant at 10%; ** significant at 5%; *** significant at 1%; p values in parentheses

ii. Model (2) and (5) use Rainfall as instrument for ΔNDVI and Δz-NDVI respectively, while model (3) and (6) use Rainfall, Elevation and Temperature as instruments.

Table A2. Urban Natural Population Growth Rate (G_U) Regressions

	(1) OLS	(2) GMM	(3) GMM	(4) OLS	(5) GMM	(6) GMM
Environmental Variables:						
ΔNDVI	-0.008	5.923**	4.243*			
	(0.992)	(0.050)	(0.075)			
NDVI	-0.483	-0.352	-0.464			
	(0.156)	(0.430)	(0.231)			
LagΔNDVI	1.427	2.058*	2.008*			
	(0.124)	(0.094)	(0.068)			
Δz-NDVI				-0.043	94.350*	69.801**
				(0.997)	(0.051)	(0.035)
z-NDVI				-3.821	19.650	13.871
				(0.511)	(0.106)	(0.125)
Lag Δz-NDVI				0.607	1.912	1.567
				(0.812)	(0.516)	(0.571)
NSA	-39.255*	-46.753	-59.147**	-25.497	-52.779*	-50.537*
	(0.063)	(0.148)	(0.034)	(0.219)	(0.084)	(0.074)
Rain Dev(+)	0.054***	0.052**	0.054**	0.049***	0.050**	0.051**
	(0.002)	(0.042)	(0.017)	(0.004)	(0.020)	(0.014)
Rain Dev(-)	-0.066***	-0.045*	-0.048**	-0.072***	-0.069***	-0.071***
	(0.004)	(0.085)	(0.049)	(0.002)	(0.009)	(0.004)
Urban Variables:						
Urban popn	-1.428***	-1.283***	-1.337***	-1.405***	-1.245***	-1.294***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Popn dens(U)	0.001	-0.001	-0.001	0.001	0.001	0.001
	(0.506)	(0.561)	(0.641)	(0.446)	(0.414)	(0.462)
Death Rate(U)	10.845***	8.958***	9.083***	10.940***	10.125***	10.363***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inf Death(U)	-1.133***	-0.841***	-0.910***	-1.101***	-0.673*	-0.788***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.054)	(0.006)
AHS(U)	-30.810***	-27.752***	-29.928***	-30.053***	-21.601*	-23.478**
	(0.004)	(0.005)	(0.001)	(0.005)	(0.063)	(0.024)
Cons exp(U)	0.002	-0.007	-0.009	-0.001	-0.014	-0.014
	(0.908)	(0.795)	(0.720)	(0.945)	(0.572)	(0.562)
Fem lit(U)	28.972*	37.874*	37.447*	30.883*	79.389**	65.259**
	(0.075)	(0.090)	(0.056)	(0.088)	(0.021)	(0.017)
Male lit(U)	30.067	39.522	39.265*	32.775	85.377**	70.033**
	(0.105)	(0.116)	(0.074)	(0.109)	(0.023)	(0.019)
Tot lit(U)	-58.515*	-76.971	-76.060*	-62.835	-164.019**	-134.476**
	(0.091)	(0.103)	(0.065)	(0.101)	(0.022)	(0.018)
Sex ratio(U)	-0.235	-0.270	-0.287	-0.256	-0.749**	-0.607**
	(0.166)	(0.227)	(0.136)	(0.172)	(0.032)	(0.028)
Fem work(U)	-2.926***	-2.470**	-2.714***	-2.816***	-3.432***	-3.251***
	(0.003)	(0.034)	(0.008)	(0.006)	(0.002)	(0.002)
Tribals(U)	-1.779	-1.916	-1.888	-1.657	-1.697	-1.647
	(0.135)	(0.171)	(0.149)	(0.168)	(0.131)	(0.133)
Muslims(U)	1.155**	0.500	0.936*	1.269**	0.731	0.936*
	(0.017)	(0.468)	(0.087)	(0.011)	(0.244)	(0.084)
Life exp(U)	0.259	-1.601	-0.885	-0.224	-0.543	-0.696
	(0.889)	(0.509)	(0.681)	(0.902)	(0.786)	(0.718)

Table A2. Urban Natural Population Growth Rate (G_U) Regressions (contd…)

	(1) OLS	(2) GMM	(3) GMM	(4) OLS	(5) GMM	(6) GMM
(R)ural Variables:						
Popn dens(R)	-0.021	-0.044	-0.036	-0.021	-0.030	-0.031
	(0.309)	(0.315)	(0.343)	(0.305)	(0.355)	(0.292)
Death Rate(R)	-5.858***	-7.420***	-7.072***	-6.342***	-9.828***	-8.941***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Inf Death(R)	0.172	0.174	0.114	0.160	0.353	0.286
	(0.474)	(0.546)	(0.679)	(0.517)	(0.181)	(0.243)
AHS(R)	7.641	12.577	10.365	6.337	14.751*	12.615
	(0.374)	(0.146)	(0.176)	(0.460)	(0.082)	(0.100)
Cons exp(R)	-0.059*	-0.045	-0.050	-0.059	-0.030	-0.035
	(0.100)	(0.302)	(0.218)	(0.103)	(0.523)	(0.414)
Fem lit(R)	-24.192**	-25.324*	-26.402**	-23.637*	-31.029**	-27.991**
	(0.047)	(0.075)	(0.030)	(0.061)	(0.022)	(0.019)
Male lit(R)	-22.808*	-23.091	-24.353*	-22.048*	-30.339**	-26.960**
	(0.078)	(0.127)	(0.060)	(0.098)	(0.035)	(0.032)
Tot lit(R)	48.578*	50.135*	52.517**	47.217*	63.059**	56.648**
	(0.054)	(0.088)	(0.037)	(0.069)	(0.025)	(0.021)
Sex ratio(R)	0.239	0.305	0.286	0.227	0.459**	0.377**
	(0.209)	(0.138)	(0.107)	(0.250)	(0.043)	(0.038)
Fem work(R)	0.107	0.012	0.028	0.072	-0.324	-0.269
	(0.746)	(0.976)	(0.935)	(0.831)	(0.357)	(0.408)
Tribals(R)	0.210	0.618	0.456	0.276	0.381	0.352
	(0.527)	(0.108)	(0.186)	(0.410)	(0.243)	(0.268)
Muslims(R)	-0.106	0.522	0.038	-0.234	-0.177	-0.342
	(0.854)	(0.556)	(0.961)	(0.687)	(0.840)	(0.677)
Life exp(R)	-0.109	2.057	1.257	0.391	0.637	0.810
	(0.958)	(0.434)	(0.589)	(0.848)	(0.771)	(0.701)
Constant	177.629	58.243	133.228	100.877	271.589	234.374
	(0.336)	(0.791)	(0.505)	(0.576)	(0.192)	(0.236)
Observations	178	178	178	178	178	178
R-squared	0.740			0.736		
Hansen J statistic			3.074			1.010
			(0.2150)			(0.6036)
Pagan-Hall statistic		14.717	22.339		23.547	32.378
		(0.9975)	(0.9521)		(0.8876)	(0.5953)

Notes:
i. * significant at 10%; ** significant at 5%; *** significant at 1%; p values in parentheses

ii. Model (2) and (5) use Rainfall as instrument for ΔNDVI and Δz-NDVI respectively, while model (3) and (6) use Rainfall, Elevation and Temperature as instruments.

Table A3.Rural Net In-migration Rate (M_R) Regressions

	(1) OLS	(2) GMM	(3) GMM	(4) OLS	(5) GMM	(6) GMM
Environmental Variables:						
ΔNDVI	-0.340	-2.309	-1.812			
	(0.578)	(0.155)	(0.195)			
NDVI	0.506*	0.462	0.638**			
	(0.068)	(0.193)	(0.039)			
LagΔNDVI	-0.960	-1.169	-1.003			
	(0.201)	(0.108)	(0.145)			
Δz-NDVI				-22.257**	-50.904*	-38.734*
				(0.030)	(0.056)	(0.070)
z-NDVI				-6.614	-13.737	-10.432
				(0.158)	(0.124)	(0.191)
LagΔz-NDVI				-2.441	-2.837	-2.815
				(0.234)	(0.167)	(0.165)
NSA	2.563	5.054	14.593	-0.528	7.752	6.037
	(0.880)	(0.827)	(0.490)	(0.975)	(0.695)	(0.758)
Rain Dev(+)	-0.017	-0.017	-0.017	-0.009	-0.010	-0.011
	(0.218)	(0.258)	(0.228)	(0.499)	(0.464)	(0.405)
Rain Dev(-)	0.038**	0.031	0.030	0.037**	0.036*	0.036*
	(0.041)	(0.166)	(0.169)	(0.042)	(0.095)	(0.093)
Rural Variables:						
Popn dens	0.033*	0.040*	0.037*	0.033**	0.036*	0.034*
	(0.054)	(0.076)	(0.082)	(0.048)	(0.073)	(0.075)
Death Rate	-8.079***	-7.560***	-7.420***	-7.390***	-6.332***	-6.591***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inf Death(R)	-0.144	-0.145	-0.186	-0.136	-0.194	-0.172
	(0.458)	(0.435)	(0.304)	(0.492)	(0.325)	(0.371)
AHS(R)	-23.355***	-24.994***	-25.558***	-25.197***	-27.751***	-27.214***
	(0.001)	(0.004)	(0.003)	(0.000)	(0.002)	(0.002)
Cons exp(R)	0.041	0.036	0.028	0.036	0.027	0.031
	(0.159)	(0.214)	(0.322)	(0.219)	(0.341)	(0.259)
Fem lit(R)	-12.768	-12.392	-14.281	-13.859	-11.616	-11.690
	(0.195)	(0.249)	(0.158)	(0.169)	(0.249)	(0.230)
Male lit(R)	-13.875	-13.781	-15.507	-15.192	-12.676	-12.830
	(0.185)	(0.230)	(0.154)	(0.155)	(0.245)	(0.225)
Tot lit(R)	24.907	24.390	28.165	27.446	22.638	22.886
	(0.221)	(0.273)	(0.180)	(0.186)	(0.281)	(0.260)
Sex ratio(R)	0.217	0.195	0.226	0.210	0.140	0.167
	(0.160)	(0.282)	(0.192)	(0.184)	(0.431)	(0.329)
Fem work(R)	-0.255	-0.223	-0.249	-0.042	0.078	0.007
	(0.342)	(0.395)	(0.316)	(0.876)	(0.787)	(0.978)
Tribals(R)	-0.937***	-1.072***	-0.965***	-0.882***	-0.914***	-0.895***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Muslims(R)	-0.826*	-1.034**	-1.045**	-0.698	-0.715	-0.711
	(0.078)	(0.038)	(0.028)	(0.136)	(0.142)	(0.126)
Life exp(R)	-5.431***	-6.150***	-6.159***	-5.912***	-5.986***	-5.956***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)

Table A3.Rural Net In-migration Rate (M_R) Regressions (contd…)

	(1) OLS	(2) GMM	(3) GMM	(4) OLS	(5) GMM	(6) GMM
Urban Variables:						
Urban popn	-0.397**	-0.445**	-0.420**	-0.454**	-0.503***	-0.447**
	(0.037)	(0.017)	(0.021)	(0.018)	(0.010)	(0.014)
Popn dens(U)	-0.000	0.000	0.000	-0.000	-0.000	-0.001
	(0.815)	(0.757)	(0.998)	(0.607)	(0.510)	(0.431)
Death Rate(U)	-5.092***	-4.465***	-4.317***	-4.952***	-4.704***	-4.690***
	(0.000)	(0.007)	(0.007)	(0.000)	(0.002)	(0.001)
Inf Death(U)	0.194	0.097	0.046	0.115	-0.015	0.025
	(0.273)	(0.674)	(0.837)	(0.524)	(0.948)	(0.911)
AHS(U)	25.122***	24.106**	20.729*	22.663***	20.098*	21.004*
	(0.004)	(0.040)	(0.064)	(0.008)	(0.083)	(0.066)
Cons exp(U)	-0.019	-0.016	-0.016	-0.014	-0.010	-0.014
	(0.241)	(0.314)	(0.302)	(0.394)	(0.539)	(0.339)
Fem lit(U)	-17.780	-20.737	-22.348	-28.326*	-43.047**	-39.516**
	(0.177)	(0.175)	(0.133)	(0.051)	(0.025)	(0.029)
Male lit(U)	-19.570	-22.710	-24.011	-31.732*	-47.696**	-43.831**
	(0.192)	(0.189)	(0.155)	(0.053)	(0.025)	(0.030)
Tot lit(U)	40.018	46.147	48.837	62.352**	93.061**	85.615**
	(0.153)	(0.154)	(0.123)	(0.043)	(0.022)	(0.025)
Sex ratio(U)	0.228*	0.240	0.256*	0.340**	0.490**	0.449**
	(0.098)	(0.120)	(0.086)	(0.025)	(0.011)	(0.013)
Fem work(U)	1.247	1.096	1.058	1.133	1.320*	1.137
	(0.118)	(0.136)	(0.147)	(0.162)	(0.079)	(0.105)
Tribals(U)	2.716***	2.761**	2.775**	2.412**	2.424**	2.454**
	(0.005)	(0.017)	(0.013)	(0.013)	(0.020)	(0.017)
Muslims(U)	0.574	0.791*	0.859**	0.501	0.664	0.597
	(0.142)	(0.065)	(0.033)	(0.208)	(0.109)	(0.125)
Life exp(U)	4.494***	5.112***	5.167***	4.986***	5.083***	5.072***
	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Constant	-496.765***	-457.119**	-519.005***	-466.196***	-518.006***	-509.972***
	(0.001)	(0.014)	(0.003)	(0.002)	(0.003)	(0.003)
Observations	178	178	178	178	178	178
R-squared	0.629			0.631		
Hansen J statistic			1.664			0.926
			(0.4351)			(0.6293)
Pagan-Hall statistic		27.387	31.775		24.392	24.007
		(0.7425)	(0.6246)		(0.8610)	(0.9195)

Notes:
i. * significant at 10%; ** significant at 5%; *** significant at 1%; p values in parentheses

ii. Model (2) and (5) use Rainfall as instrument for ΔNDVI and Δz-NDVI respectively, while model (3) and (6) use Rainfall, Elevation and Temperature as instruments.

Table A4.Urban Net In-migration Rate (M_U) Regressions

	(1) OLS	(2) GMM	(3) GMM	(4) OLS	(5) GMM	(6) GMM
Environmental Variables:						
ΔNDVI	0.823	3.961	6.015			
	(0.527)	(0.382)	(0.134)			
NDVI	-0.299	-0.230	-0.233			
	(0.612)	(0.662)	(0.672)			
LagΔNDVI	-1.874	-1.540	-1.555			
	(0.242)	(0.265)	(0.259)			
Δz-NDVI				-0.558	83.120	68.058
				(0.980)	(0.229)	(0.201)
z-NDVI				4.600	25.407	22.415
				(0.647)	(0.132)	(0.115)
LagΔz-NDVI				3.168	4.325	4.323
				(0.473)	(0.351)	(0.345)
NSA	-20.536	-24.503	-18.538	-30.670	-54.856	-46.783
	(0.573)	(0.509)	(0.619)	(0.392)	(0.199)	(0.253)
Rain Dev(+)	-0.016	-0.017	-0.026	-0.014	-0.012	-0.012
	(0.589)	(0.594)	(0.416)	(0.644)	(0.686)	(0.684)
Rain Dev(-)	-0.030	-0.019	-0.001	-0.019	-0.017	-0.011
	(0.446)	(0.681)	(0.989)	(0.619)	(0.680)	(0.779)
Urban Variables:						
Urban popn	1.219***	1.296***	1.303***	1.149***	1.290***	1.266***
	(0.003)	(0.000)	(0.000)	(0.005)	(0.001)	(0.001)
Popn dens(U)	-0.001	-0.001	-0.002	-0.000	-0.000	-0.000
	(0.739)	(0.359)	(0.228)	(0.808)	(0.687)	(0.715)
Death Rate(U)	-0.291	-1.289	-4.833	-0.498	-1.221	-1.964
	(0.908)	(0.827)	(0.337)	(0.846)	(0.806)	(0.645)
Inf Death(U)	0.824**	0.978**	1.149***	0.730*	1.109**	1.087**
	(0.030)	(0.025)	(0.005)	(0.061)	(0.026)	(0.014)
AHS(U)	34.792*	36.410**	32.542*	32.273*	39.765**	37.108**
	(0.056)	(0.032)	(0.052)	(0.079)	(0.029)	(0.037)
Cons exp(U)	0.009	0.005	0.007	0.017	0.006	0.011
	(0.787)	(0.897)	(0.856)	(0.635)	(0.886)	(0.772)
Fem lit(U)	-47.430*	-42.720	-34.633	-45.544	-2.543	-5.889
	(0.092)	(0.141)	(0.229)	(0.145)	(0.955)	(0.881)
Male lit(U)	-55.780*	-50.778	-41.590	-54.130	-7.498	-10.386
	(0.082)	(0.132)	(0.213)	(0.125)	(0.881)	(0.813)
Tot lit(U)	99.637*	89.872	72.958	95.935	6.235	12.652
	(0.096)	(0.147)	(0.236)	(0.147)	(0.948)	(0.879)
Sex ratio(U)	0.396	0.377	0.315	0.375	-0.062	-0.029
	(0.178)	(0.206)	(0.296)	(0.246)	(0.893)	(0.942)
Fem work(U)	2.023	2.264	2.367	2.152	1.607	1.635
	(0.234)	(0.125)	(0.114)	(0.217)	(0.335)	(0.311)
Tribals(U)	-0.321	-0.394	0.361	-0.260	-0.295	0.129
	(0.876)	(0.845)	(0.848)	(0.900)	(0.886)	(0.945)
Muslims(U)	-1.619*	-1.966**	-1.822**	-1.422*	-1.899**	-1.641*
	(0.053)	(0.024)	(0.025)	(0.098)	(0.044)	(0.058)
Life exp(U)	-2.018	-3.003	-3.440	-1.229	-1.512	-1.111
	(0.528)	(0.374)	(0.301)	(0.696)	(0.620)	(0.709)

Table A4. Urban Net In-migration Rate (M_U) Regressions (contd…)

	(1) OLS	(2) GMM	(3) GMM	(4) OLS	(5) GMM	(6) GMM
Rural Variables:						
Popn dens(R)	0.069*	0.057	0.041	0.075**	0.068	0.063
	(0.056)	(0.155)	(0.283)	(0.038)	(0.105)	(0.109)
Death Rate(R)	7.614**	6.787*	7.453*	8.818***	5.728	6.554
	(0.019)	(0.087)	(0.058)	(0.009)	(0.216)	(0.141)
Inf Death(R)	0.248	0.249	0.177	0.190	0.361	0.268
	(0.550)	(0.567)	(0.685)	(0.655)	(0.472)	(0.572)
AHS(R)	-8.684	-6.072	-5.528	-6.113	1.346	-1.274
	(0.559)	(0.668)	(0.700)	(0.680)	(0.929)	(0.929)
Cons exp(R)	0.139**	0.146**	0.152**	0.130**	0.156**	0.146**
	(0.026)	(0.021)	(0.017)	(0.037)	(0.020)	(0.022)
Fem lit(R)	41.401**	40.802	35.154	38.389*	31.836	28.112
	(0.050)	(0.100)	(0.162)	(0.078)	(0.186)	(0.218)
Male lit(R)	45.526**	45.377*	39.154	42.605*	35.254	30.952
	(0.042)	(0.091)	(0.145)	(0.065)	(0.179)	(0.212)
Tot lit(R)	-88.009**	-87.185*	-75.283	-82.167*	-68.122	-60.096
	(0.044)	(0.092)	(0.148)	(0.067)	(0.177)	(0.209)
Sex ratio(R)	-0.506	-0.471	-0.389	-0.465	-0.259	-0.237
	(0.125)	(0.198)	(0.299)	(0.173)	(0.482)	(0.494)
Fem work(R)	1.031*	0.981	0.766	0.961*	0.610	0.695
	(0.073)	(0.145)	(0.241)	(0.099)	(0.425)	(0.300)
Tribals(R)	0.534	0.750	0.703	0.275	0.367	0.270
	(0.354)	(0.130)	(0.152)	(0.635)	(0.457)	(0.562)
Muslims(R)	0.054	0.386	0.426	-0.122	-0.072	-0.142
	(0.957)	(0.648)	(0.616)	(0.903)	(0.934)	(0.868)
Life exp(R)	2.184	3.330	3.793	1.288	1.506	1.112
	(0.542)	(0.374)	(0.302)	(0.714)	(0.660)	(0.741)
Constant	158.735	95.568	78.348	109.567	260.903	219.956
	(0.619)	(0.754)	(0.797)	(0.725)	(0.408)	(0.459)
Observations	178	178	178	178	178	178
R-squared	0.478			0.472		
Hansen J statistic			1.273			0.649
			(0.5292)			(0.7228)
Pagan-Hall statistic		20.648	22.156		22.082	23.174
		(0.9537)	(0.9550)		(0.9258)	(0.9372)

Notes:
i. * significant at 10%; ** significant at 5%; *** significant at 1%; p values in parentheses

ii. Model (2) and (5) use Rainfall as instrument for ΔNDVI and Δz-NDVI respectively, while model (3) and (6) use Rainfall, Elevation and Temperature as instruments.

Table A5.Vegetation Change (ΔE) Regressions

	ΔNDVI		Δz-NDVI			
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	GMM	OLS	GMM	GMM	GMM
Environmental Variables:						
NDVI	0.017	0.022				
	(0.643)	(0.675)				
LagΔNDVI	-0.099	-0.174				
	(0.306)	(0.245)				
z-NDVI			-0.233***	-0.217**	-0.236***	-0.230***
			(0.000)	(0.015)	(0.000)	(0.000)
LagΔz-NDVI			-0.007	0.032	0.002	0.007
			(0.658)	(0.576)	(0.931)	(0.777)
Rainfall	0.019***	0.003	0.001***	-0.001	0.001	0.000
	(0.000)	(0.837)	(0.000)	(0.749)	(0.404)	(0.534)
NSA	2.135	0.106	0.266**	-0.230	0.149	0.072
	(0.337)	(0.980)	(0.038)	(0.672)	(0.428)	(0.701)
Rain Dev(+)	-0.003	-0.004	-0.000	-0.000	-0.000	-0.000
	(0.176)	(0.153)	(0.125)	(0.483)	(0.240)	(0.288)
Rain Dev(-)	0.001	0.000	0.000	0.000	0.000	0.000
	(0.749)	(0.882)	(0.217)	(0.958)	(0.462)	(0.609)
Endogenous Demographic Variables:						
G_R	-0.018	-0.174	-0.003***	-0.026	-0.009*	-0.012**
	(0.215)	(0.271)	(0.002)	(0.184)	(0.079)	(0.024)
G_U	0.000	-0.021	-0.001**	-0.007	-0.002	-0.003*
	(1.000)	(0.624)	(0.049)	(0.232)	(0.188)	(0.071)
Rural Socio-economic Variables:						
Popn dens(R)	0.002	0.004	0.000	0.000	0.000	0.000
	(0.340)	(0.295)	(0.706)	(0.351)	(0.357)	(0.264)
Fem lit(R)	0.175	1.071	0.049	0.123	0.038	0.067
	(0.890)	(0.606)	(0.521)	(0.564)	(0.676)	(0.484)
Male lit(R)	-0.039	0.918	0.056	0.150	0.047	0.079
	(0.977)	(0.684)	(0.490)	(0.515)	(0.627)	(0.434)
Tot lit(R)	-0.162	-2.123	-0.106	-0.287	-0.089	-0.151
	(0.951)	(0.628)	(0.501)	(0.520)	(0.635)	(0.440)
Cons exp(R)	-0.004	-0.004	-0.000**	-0.000	-0.000	-0.000
	(0.251)	(0.483)	(0.044)	(0.683)	(0.153)	(0.241)
Sex ratio(R)	-0.013	-0.019	-0.002*	-0.002	-0.002	-0.002
	(0.498)	(0.510)	(0.085)	(0.467)	(0.262)	(0.216)
Fem work(R)	0.005	-0.057	0.005***	0.000	0.004	0.003
	(0.880)	(0.387)	(0.010)	(0.974)	(0.204)	(0.326)
Tribals(R)	-0.085**	-0.176*	-0.002	-0.014	-0.005	-0.007*
	(0.016)	(0.074)	(0.397)	(0.227)	(0.155)	(0.083)
Muslims(R)	-0.072	-0.146	0.002	-0.010	-0.002	-0.004
	(0.239)	(0.177)	(0.663)	(0.456)	(0.657)	(0.551)
Life exp(R)	-0.374**	-0.461	-0.004	-0.030	-0.015	-0.016
	(0.046)	(0.104)	(0.730)	(0.409)	(0.339)	(0.348)
AHS(R)	-0.579	-0.645	-0.101**	-0.103	-0.049	
	(0.508)	(0.586)	(0.050)	(0.450)	(0.399)	

Table A5.Vegetation Change (ΔE) Regressions (contd…)

	ΔNDVI		Δz-NDVI			
	(1) OLS	(2) GMM	(3) OLS	(4) GMM	(5) GMM	(6) GMM
Urban Socio-economic Variables:						
Urban popn	-0.032	-0.102	-0.003*	-0.016	-0.007*	-0.008**
	(0.203)	(0.243)	(0.051)	(0.172)	(0.059)	(0.020)
Popn dens(U)	0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.155)	(0.374)	(0.213)	(0.457)	(0.300)	(0.386)
Fem lit(U)	-0.260	-2.039	-0.432***	-0.555*	-0.434***	-0.438***
	(0.873)	(0.451)	(0.000)	(0.051)	(0.000)	(0.001)
Male lit(U)	-0.121	-2.308	-0.468***	-0.663*	-0.481***	-0.492***
	(0.948)	(0.478)	(0.000)	(0.054)	(0.001)	(0.002)
Tot lit(U)	0.485	4.600	0.905***	1.236**	0.924***	0.940***
	(0.889)	(0.444)	(0.000)	(0.050)	(0.000)	(0.001)
Cons exp(U)	0.001	0.001	0.000	0.000	0.000	0.000
	(0.584)	(0.846)	(0.395)	(0.734)	(0.595)	(0.649)
Sex ratio(U)	-0.007	0.016	0.004***	0.006**	0.005***	0.005***
	(0.687)	(0.611)	(0.000)	(0.049)	(0.000)	(0.001)
Muslims(U)	0.079	0.125	0.002	0.009	0.006	0.007
	(0.110)	(0.103)	(0.419)	(0.359)	(0.128)	(0.141)
Fem work(U)	-0.035	0.030	0.007	0.017	0.009	0.011
	(0.737)	(0.847)	(0.262)	(0.355)	(0.263)	(0.187)
Tribals(U)	0.139	0.402	0.009	0.041	0.016	0.019
	(0.279)	(0.182)	(0.262)	(0.225)	(0.147)	(0.113)
Life exp(U)	0.320*	0.369	0.004	0.023	0.012	0.013
	(0.058)	(0.131)	(0.665)	(0.442)	(0.349)	(0.382)
AHS(U)	0.634	2.422	0.029	0.303		
	(0.563)	(0.325)	(0.659)	(0.293)		
Constant	18.078	6.128	-2.001*	-2.514	-2.081	-1.886
	(0.347)	(0.824)	(0.068)	(0.413)	(0.139)	(0.231)
Observations	178	178	178	178	178	178
R-squared	0.375		0.773			
Hansen J statistic					0.046	2.299
					(0.8017)	(0.3169)
Pagan-Hall statistic		48.729		0.024	0.160	3.006
		(0.0382)		(1.0000)	(1.0000)	(1.0000)
F Test for equality of G_R and G_U		0.173 (1.0000)		1.75 (0.1875)	3.02 (0.0844)	4.41 (0.0374)
F Test for the validity of constraints		0.00 (0.9971)		0.00 (0.9984)	0.03 (0.9693)	0.33 (0.7200)

Notes:

i. * significant at 10%; ** significant at 5%; *** significant at 1%; p values in parentheses

ii. Model (2) and (4) use Death rate(R,U) and Inf Death(R,U) as instruments for G_R, G_U, M_R and M_U; model (5) uses the instruments Death rate(R,U), Inf Death(R,U), AHS(U) and model (6) uses the instruments Death rate(R,U), Inf Death(R,U), AHS(U,R).

First Stage Regressions:

Table A6. ΔNDVI with rainfall as instrument

Number of obs = 178

ΔNDVI	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NDVI	.0256442	.043555	0.59	0.557	-.0604456	.111734
LagΔNDVI	-.0837381	.098329	-0.85	0.396	-.2780928	.1106165
NSA	2.467401	2.515624	0.98	0.328	-2.504919	7.43972
Cons exp(R)	-.0034026	.0036847	-0.92	0.357	-.0106856	.0038804
Cons exp(U)	.0011683	.0019079	0.61	0.541	-.0026027	.0049394
Urban popn	-.0130436	.0216765	-0.60	0.548	-.0558887	.0298016
Popn dens(R)	.002019	.0037279	0.54	0.589	-.0053494	.0093874
Death Rate(R)	.2274624	.1563767	1.45	0.148	-.0816278	.5365526
Fem lit(R)	.668513	1.642318	0.41	0.685	-2.577651	3.914677
Male lit(R)	.470313	1.686447	0.28	0.781	-2.863077	3.803703
Tot lit(R)	-1.176863	3.319791	-0.35	0.723	-7.73868	5.384954
Sex ratio(R)	-.0208824	.0251544	-0.83	0.408	-.070602	.0288372
Fem work(R)	-.0029368	.0426408	-0.07	0.945	-.0872196	.0813459
Tribals(R)	-.0679855	.0296556	-2.29	0.023	-.1266021	-.0093688
Inf Death(R)	-.0104512	.0195755	-0.53	0.594	-.0491437	.0282412
AHS(R)	-.3529387	.7707042	-0.46	0.648	-1.876293	1.170416
Muslims(R)	-.0749938	.0509683	-1.47	0.143	-.1757365	.0257489
Life exp(R)	-.2451635	.2250457	-1.09	0.278	-.6899832	.1996563
Popn dens(U)	.0001784	.0001365	1.31	0.193	-.0000913	.0004482
Death Rate(U)	.2933038	.1772755	1.65	0.100	-.0570945	.6437021
Fem lit(U)	-1.121284	2.010285	-0.56	0.578	-5.094764	2.852195
Male lit(U)	-.9934073	2.272179	-0.44	0.663	-5.484539	3.497724
Tot lit(U)	2.170884	4.250153	0.51	0.610	-6.229863	10.57163
Sex ratio(U)	-.0001687	.0214165	-0.01	0.994	-.0425	.0421626
Fem work(U)	-.0285988	.1221424	-0.23	0.815	-.2700223	.2128248
Tribals(U)	.0884506	.0968095	0.91	0.362	-.1029006	.2798018
Inf Death(U)	-.0360325	.0162691	-2.21	0.028	-.0681896	-.0038754
AHS(U)	.2300262	.8396939	0.27	0.785	-1.429692	1.889744
Muslims(U)	.0821111	.0441412	1.86	0.065	-.0051373	.1693596
Life exp(U)	.2000028	.2072643	0.96	0.336	-.2096706	.6096762
Rain Dev(+)	-.0024265	.0025393	-0.96	0.341	-.0074456	.0025926
Rain Dev(-)	-.0005737	.0021139	-0.27	0.786	-.0047518	.0036045
Rainfall	.0203446	.0065436	3.11	0.002	.0074107	.0332785
Constant	18.13619	19.5375	0.93	0.355	-20.48114	56.75353

Table A7. ΔNDVI with rainfall, elevation and temperature as instruments

Number of obs = 178

ΔNDVI	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NDVI	.0219073	.0450332	0.49	0.627	-.0671147	.1109294
LagΔNDVI	-.2041967	.0979029	-2.09	0.039	-.3977322	-.0106612
NSA	2.553264	2.536426	1.01	0.316	-2.460771	7.567299
Cons exp(R)	-.0039756	.003767	-1.06	0.293	-.0114222	.0034711
Cons exp(U)	.0013545	.0017945	0.75	0.452	-.0021929	.0049018
Urban popn	-.0078059	.0210491	-0.37	0.711	-.049416	.0338041
Popn dens(R)	.0017691	.0036633	0.48	0.630	-.0054725	.0090108
Death Rate(R)	.0914552	.1747556	0.52	0.602	-.2540037	.436914
Fem lit(R)	.4122927	1.59318	0.26	0.796	-2.737124	3.561709
Male lit(R)	.2044239	1.63824	0.12	0.901	-3.034067	3.442915
Tot lit(R)	-.6514616	3.222326	-0.20	0.840	-7.021392	5.718468
Sex ratio(R)	-.010766	.0241283	-0.45	0.656	-.058463	.036931
Fem work(R)	-.0201895	.0433461	-0.47	0.642	-.1058765	.0654974
Tribals(R)	-.0578608	.0276747	-2.09	0.038	-.1125686	-.0031531
Inf Death(R)	-.0037927	.0193095	-0.20	0.845	-.041964	.0343785
AHS(R)	-.2627524	.7795612	-0.34	0.737	-1.803798	1.278293
Muslims(R)	-.0714192	.0495135	-1.44	0.151	-.1692981	.0264597
Life exp(R)	-.2250454	.2266228	-0.99	0.322	-.6730359	.2229451
Popn dens(U)	.0002053	.000129	1.59	0.114	-.0000497	.0004604
Death Rate(U)	.3292107	.1799513	1.83	0.069	-.026519	.6849404
Fem lit(U)	-1.277706	1.992951	-0.64	0.522	-5.217394	2.661982
Male lit(U)	-1.18311	2.255163	-0.52	0.601	-5.641141	3.274922
Tot lit(U)	2.503837	4.213266	0.59	0.553	-5.824993	10.83267
Sex ratio(U)	.0002269	.0214031	0.01	0.992	-.042083	.0425368
Fem work(U)	-.0853433	.137657	-0.62	0.536	-.3574651	.1867785
Tribals(U)	.0619883	.0942253	0.66	0.512	-.1242773	.2482539
Inf Death(U)	-.0353325	.0161727	-2.18	0.031	-.0673029	-.0033621
AHS(U)	.6194717	.8649434	0.72	0.475	-1.090358	2.329301
Muslims(U)	.0442931	.0434967	1.02	0.310	-.0416917	.1302779
Life exp(U)	.1861112	.2093647	0.89	0.376	-.2277633	.5999857
Rain Dev(+)	-.00167	.0024639	-0.68	0.499	-.0065406	.0032007
Rain Dev(-)	-.0004844	.0021513	-0.23	0.822	-.0047371	.0037683
Rainfall	.0180478	.0064101	2.82	0.006	.0053762	.0307193
Elevation	.0057615	.0026232	2.20	0.030	.0005759	.0109471
Temperature	1.158037	.5710606	2.03	0.044	.0291585	2.286916
Constant	-23.54433	21.48752	-1.10	0.275	-66.0211	18.93244

Table A8.Δz-NDVI with rainfall as instrument

Number of obs = 178

Δz-NDVI	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
z-NDVI	-.2089235	.0441633	-4.73	0.000	-.2962156	-.1216314
lagΔz-NDVI	-.001754	.0150953	-0.12	0.908	-.0315909	.0280829
NSA	.3464649	.1509678	2.29	0.023	.0480658	.6448641
Cons exp(R)	-.000355	.0002333	-1.52	0.130	-.0008163	.0001062
Cons exp(U)	.000111	.0001058	1.05	0.296	-.0000982	.0003202
Urban popn	-.0012186	.0012989	-0.94	0.350	-.0037861	.0013489
Popn dens(R)	-.0000132	.0001328	-0.10	0.921	-.0002756	.0002492
Death Rate(R)	.0361136	.0102407	3.53	0.001	.0158721	.0563552
Fem lit(R)	.1057439	.0693433	1.52	0.129	-.0313184	.2428061
Male lit(R)	.1117479	.0721483	1.55	0.124	-.0308586	.2543544
Tot lit(R)	-.2205082	.1422547	-1.55	0.123	-.5016852	.0606689
Sex ratio(R)	-.0030621	.0010146	-3.02	0.003	-.0050674	-.0010567
Fem work(R)	.003005	.0016822	1.79	0.076	-.0003199	.00633
Tribals(R)	-.0012126	.0018946	-0.64	0.523	-.0049574	.0025322
Inf Death(R)	-.0028525	.0013735	-2.08	0.040	-.0055675	-.0001376
AHS(R)	-.0649851	.0386889	-1.68	0.095	-.1414566	.0114865
Muslims(R)	.0016202	.0038376	0.42	0.674	-.0059651	.0092055
Life exp(R)	.0052341	.0095738	0.55	0.585	-.0136893	.0241574
Popn dens(U)	-3.82e-06	5.24e-06	-0.73	0.467	-.0000142	6.54e-06
Death Rate(U)	.00502	.0091453	0.55	0.584	-.0130564	.0230964
Fem lit(U)	-.4939638	.1230491	-4.01	0.000	-.7371796	-.2507481
Male lit(U)	-.5247348	.132858	-3.95	0.000	-.7873386	-.2621311
Tot lit(U)	1.022522	.2559572	3.99	0.000	.5166035	1.528441
Sex ratio(U)	.0049029	.0012053	4.07	0.000	.0025205	.0072853
Fem work(U)	.0104963	.0067641	1.55	0.123	-.0028735	.023866
Tribals(U)	.0049867	.0059839	0.83	0.406	-.0068408	.0168143
Inf Death(U)	-.003669	.0015258	-2.40	0.017	-.0066848	-.0006532
AHS(U)	-.0413526	.0669195	-0.62	0.538	-.1736239	.0909187
Muslims(U)	.0042763	.0031693	1.35	0.179	-.001988	.0105407
Life exp(U)	-.0041667	.0084885	-0.49	0.624	-.020945	.0126115
Rain Dev(+)	-.0001892	.0000986	-1.92	0.057	-.0003841	5.67e-06
Rain Dev(-)	.0001551	.0001442	1.08	0.284	-.00013	.0004402
Rainfall	.0012806	.0003688	3.47	0.001	.0005518	.0020095
Constant	-1.449195	.9800239	-1.48	0.141	-3.386285	.4878962

Table A9. Δz-NDVI with rainfall, elevation and temperature as instruments

Number of obs = 178

Δz-NDVI	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
z-NDVI	-.2101889	.0446606	-4.71	0.000	-.2984745	-.1219032
lagΔz-NDVI	.0005632	.0149882	0.04	0.970	-.0290656	.030192
NSA	.3128717	.1568495	1.99	0.048	.0028098	.6229336
Cons exp(R)	-.0004598	.0002345	-1.96	0.052	-.0009233	3.78e-06
Cons exp(U)	.0001379	.0001029	1.34	0.182	-.0000655	.0003413
Urban popn	-.0009589	.0012292	-0.78	0.437	-.0033888	.0014709
Popn dens(R)	3.03e-06	.0001383	0.02	0.983	-.0002704	.0002765
Death Rate(R)	.0298646	.0096306	3.10	0.002	.0108267	.0489025
Fem lit(R)	.0698608	.0680065	1.03	0.306	-.0645751	.2042967
Male lit(R)	.0750342	.0703241	1.07	0.288	-.0639833	.2140517
Tot lit(R)	-.1471156	.1390327	-1.06	0.292	-.4219569	.1277258
Sex ratio(R)	-.0021341	.0009636	-2.21	0.028	-.004039	-.0002293
Fem work(R)	.0016052	.0018308	0.88	0.382	-.002014	.0052243
Tribals(R)	-.0008102	.0017961	-0.45	0.653	-.0043607	.0027404
Inf Death(R)	-.0025454	.001339	-1.90	0.059	-.0051923	.0001016
AHS(R)	-.0538329	.0390425	-1.38	0.170	-.1310127	.0233468
Muslims(R)	.001762	.0037338	0.47	0.638	-.005619	.009143
Life exp(R)	.0048319	.0094899	0.51	0.611	-.0139279	.0235917
Popn dens(U)	-2.31e-06	4.70e-06	-0.49	0.624	-.0000116	6.98e-06
Death Rate(U)	.0063536	.0090535	0.70	0.484	-.0115435	.0242508
Fem lit(U)	-.4831166	.1231359	-3.92	0.000	-.726533	-.2397002
Male lit(U)	-.5170381	.1325094	-3.90	0.000	-.7789841	-.2550921
Tot lit(U)	1.001011	.255774	3.91	0.000	.4953937	1.506627
Sex ratio(U)	.0047731	.0011907	4.01	0.000	.0024193	.0071268
Fem work(U)	.0065242	.0074629	0.87	0.383	-.0082285	.0212769
Tribals(U)	.0026865	.0058799	0.46	0.648	-.0089369	.0143099
Inf Death(U)	-.0037278	.0014857	-2.51	0.013	-.0066648	-.0007907
AHS(U)	-.0282586	.0690681	-0.41	0.683	-.1647932	.1082759
Muslims(U)	.0016168	.0032006	0.51	0.614	-.0047101	.0079436
Life exp(U)	-.0033196	.008497	-0.39	0.697	-.0201165	.0134774
Rain Dev(+)	-.0001061	.0001005	-1.06	0.293	-.0003047	.0000926
Rain Dev(-)	.0001536	.0001444	1.06	0.289	-.0001318	.000439
Rainfall	.0011249	.0003737	3.01	0.003	.000386	.0018637
Elevation	.0003922	.0001314	2.99	0.003	.0001325	.0006518
Temperature	.0635467	.0314756	2.02	0.045	.0013253	.125768
Constant	-3.846642	1.415665	-2.72	0.007	-6.645143	-1.048141

Table A10. Rural Natural Population Growth Rate for NDVI model

Number of obs = 178

G_R	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NDVI	-.3728174	.1714742	-2.17	0.031	-.711749	-.0338858
LagΔNDVI	.4706017	.45951	1.02	0.307	-.4376543	1.378858
Rainfall	-.0759031	.0201702	-3.76	0.000	-.115771	-.0360351
NSA	-5.752381	10.21672	-0.56	0.574	-25.9465	14.44174
Popn dens(R)	-.0292012	.0119233	-2.45	0.016	-.0527684	-.0056339
Popn dens(U)	-.0000326	.000425	-0.08	0.939	-.0008726	.0008073
Fem lit(R)	13.88611	5.809331	2.39	0.018	2.403528	25.36869
Male lit(R)	14.40455	6.232652	2.31	0.022	2.085246	26.72386
Tot lit(R)	-27.21832	12.0623	-2.26	0.026	-51.06035	-3.376284
Fem lit(U)	15.3883	7.747223	1.99	0.049	.0753335	30.70127
Male lit(U)	16.17551	8.737016	1.85	0.066	-1.09386	33.44488
Tot lit(U)	-32.60657	16.41423	-1.99	0.049	-65.05051	-.1626163
Urban popn	-.0734187	.115732	-0.63	0.527	-.3021716	.1553342
Cons exp(R)	-.056258	.0176065	-3.20	0.002	-.0910585	-.0214575
Cons exp(U)	.0138339	.009614	1.44	0.152	-.005169	.0328367
Sex ratio(R)	-.1984634	.1025304	-1.94	0.055	-.4011226	.0041957
Fem work(R)	-.2197022	.14623	-1.50	0.135	-.5087368	.0693323
Tribals(R)	.2030526	.1091902	1.86	0.065	-.01277	.4188751
Life exp(R)	3.714859	.9204899	4.04	0.000	1.895442	5.534277
Life exp(U)	-3.126137	.8028357	-3.89	0.000	-4.713002	-1.539272
Rain Dev(+)	.0019353	.0085834	0.23	0.822	-.0150304	.018901
Rain Dev(-)	-.0182746	.011633	-1.57	0.118	-.0412681	.0047189
Muslims(R)	.4275815	.243593	1.76	0.081	-.0538983	.9090613
Sex ratio(U)	-.169273	.0765399	-2.21	0.029	-.3205598	-.0179862
Muslims(U)	-.2737182	.2221201	-1.23	0.220	-.7127552	.1653188
Fem work(U)	-.7275197	.4703226	-1.55	0.124	-1.657148	.2021082
Tribals(U)	-.6048651	.534004	-1.13	0.259	-1.660364	.450634
AHS(R)	21.60141	3.527875	6.12	0.000	14.6283	28.57452
AHS(U)	-11.76945	4.867277	-2.42	0.017	-21.38999	-2.148911
Death Rate(R)	6.544695	.7632342	8.57	0.000	5.036105	8.053285
Death Rate(U)	2.245345	.7015889	3.20	0.002	.8586017	3.632088
Inf Death(R)	.0717699	.1096527	0.65	0.514	-.1449669	.2885066
Inf Death(U)	.0354364	.0900651	0.39	0.695	-.1425841	.2134569
Constant	400.8194	94.36272	4.25	0.000	214.3044	587.3344

Table A11.Urban Natural Population Growth Rate for NDVI model

Number of obs = 178

G_U	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NDVI	-.2002415	.3210288	-0.62	0.534	-.834779	.4342961
LagΔNDVI	1.561763	.9181251	1.70	0.091	-.2529798	3.376507
Rainfall	.1204993	.0457359	2.63	0.009	.0300988	.2108998
NSA	-32.13879	23.49694	-1.37	0.174	-78.58226	14.30468
Popn dens(R)	-.0320551	.0283845	-1.13	0.261	-.0881592	.024049
Popn dens(U)	.0003022	.0008232	0.37	0.714	-.001325	.0019293
Fem lit(R)	-21.36486	9.735645	-2.19	0.030	-40.60809	-2.121626
Male lit(R)	-20.30542	10.27793	-1.98	0.050	-40.62052	.0096718
Tot lit(R)	43.16485	20.11676	2.15	0.034	3.402563	82.92714
Fem lit(U)	31.23319	15.08757	2.07	0.040	1.411475	61.0549
Male lit(U)	33.63823	17.13096	1.96	0.052	-.2223943	67.49886
Tot lit(U)	-64.11419	31.96927	-2.01	0.047	-127.3038	-.9245419
Urban popn	-1.359829	.2499307	-5.44	0.000	-1.853836	-.865822
Cons exp(R)	-.0653204	.0369691	-1.77	0.079	-.1383926	.0077518
Cons exp(U)	.0003899	.022522	0.02	0.986	-.0441264	.0449063
Sex ratio(R)	.1812964	.1508313	1.20	0.231	-.1168331	.4794258
Fem work(R)	-.0053104	.2877801	-0.02	0.985	-.5741293	.5635085
Tribals(R)	.2153237	.3235904	0.67	0.507	-.424277	.8549245
Life exp(R)	.6047681	1.888574	0.32	0.749	-3.12814	4.337677
Life exp(U)	-.4167311	1.759104	-0.24	0.813	-3.893731	3.060269
Rain Dev(+)	.0376523	.0193072	1.95	0.053	-.0005097	.0758144
Rain Dev(-)	-.0482867	.021457	-2.25	0.026	-.0906981	-.0058754
Muslims(R)	.0780374	.6986755	0.11	0.911	-1.302947	1.459022
Sex ratio(U)	-.2711839	.151709	-1.79	0.076	-.5710481	.0286804
Muslims(U)	.9862269	.4703336	2.10	0.038	.0565772	1.915877
Fem work(U)	-2.639888	.8812509	-3.00	0.003	-4.381746	-.8980293
Tribals(U)	-1.392429	1.192106	-1.17	0.245	-3.748717	.9638591
AHS(R)	10.48636	6.81374	1.54	0.126	-2.981513	23.95422
AHS(U)	-26.38962	8.582849	-3.07	0.003	-43.35426	-9.424976
Death Rate(R)	-6.073253	1.675732	-3.62	0.000	-9.385463	-2.761043
Death Rate(U)	10.69513	1.324691	8.07	0.000	8.076777	13.31348
Inf Death(R)	.1119462	.2614936	0.43	0.669	-.4049156	.628808
Inf Death(U)	-1.054374	.1865214	-5.65	0.000	-1.423047	-.6857001
Constant	165.6625	183.0932	0.90	0.367	-196.235	527.5599

Table A12. Rural Net In-migration Rate for NDVI model

Number of obs = 178

M_R	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NDVI	.4028521	.350249	1.15	0.252	-.2894413	1.095146
LagΔNDVI	-.9759887	.654089	-1.49	0.138	-2.268845	.3168672
Rainfall	-.0469768	.0308033	-1.53	0.129	-.1078618	.0139081
NSA	-.6438715	22.39842	-0.03	0.977	-44.91604	43.6283
Popn dens(R)	.0355238	.0195579	1.82	0.071	-.0031339	.0741814
Popn dens(U)	-.0001269	.0007208	-0.18	0.861	-.0015516	.0012979
Fem lit(R)	-13.93554	10.29753	-1.35	0.178	-34.28938	6.418296
Male lit(R)	-14.86681	11.10342	-1.34	0.183	-36.81356	7.079937
Tot lit(R)	27.10774	21.47089	1.26	0.209	-15.33108	69.54657
Fem lit(U)	-18.14749	14.9404	-1.21	0.226	-47.67833	11.38334
Male lit(U)	-20.41651	16.99097	-1.20	0.231	-54.00045	13.16743
Tot lit(U)	41.1348	31.7608	1.30	0.197	-21.64281	103.9124
Urban popn	-.4148515	.1779847	-2.33	0.021	-.7666516	-.0630513
Cons exp(R)	.0441186	.0292033	1.51	0.133	-.0136039	.1018412
Cons exp(U)	-.0189241	.0154463	-1.23	0.223	-.0494549	.0116067
Sex ratio(R)	.2432021	.1744346	1.39	0.165	-.1015809	.5879851
Fem work(R)	-.2165874	.2430802	-0.89	0.374	-.6970537	.2638789
Tribals(R)	-.9151216	.2475814	-3.70	0.000	-1.404485	-.4257584
Life exp(R)	-5.583965	1.623058	-3.44	0.001	-8.792061	-2.37587
Life exp(U)	4.650256	1.405712	3.31	0.001	1.87176	7.428751
Rain Dev(+)	-.0109018	.014554	-0.75	0.455	-.0396688	.0178652
Rain Dev(-)	.0321744	.0220049	1.46	0.146	-.01132	.0756687
Muslims(R)	-.8610492	.4243654	-2.03	0.044	-1.699839	-.0222591
Sex ratio(U)	.2401438	.1479946	1.62	0.107	-.0523786	.5326661
Muslims(U)	.6018529	.3703855	1.62	0.106	-.1302419	1.333948
Fem work(U)	1.162072	.7286629	1.59	0.113	-.2781849	2.602329
Tribals(U)	2.556791	1.067789	2.39	0.018	.4462261	4.667355
AHS(R)	-24.17908	8.062169	-3.00	0.003	-40.11457	-8.243601
AHS(U)	23.57533	11.5866	2.03	0.044	.6735498	46.47711
Death Rate(R)	-8.08498	1.509198	-5.36	0.000	-11.06802	-5.101937
Death Rate(U)	-5.142149	1.458289	-3.53	0.001	-8.024565	-2.259732
Inf Death(R)	-.1208632	.1800725	-0.67	0.503	-.4767901	.2350636
Inf Death(U)	.1805467	.2199484	0.82	0.413	-.2541979	.6152913
Constant	-498.9959	176.7607	-2.82	0.005	-848.3767	-149.6151

Table A13. Urban Net In-migration Rate for NDVI model

Number of obs = 178

M_U	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NDVI	-.1280111	.5067709	-0.25	0.801	-1.129682	.8736597
LagΔNDVI	-1.871707	1.342774	-1.39	0.165	-4.5258	.7823853
Rainfall	.0805914	.0896304	0.90	0.370	-.0965699	.2577527
NSA	-14.72899	37.21498	-0.40	0.693	-88.28719	58.82922
Popn dens(R)	.0648405	.0393194	1.65	0.101	-.0128773	.1425583
Popn dens(U)	-.0007048	.0011068	-0.64	0.525	-.0028924	.0014829
Fem lit(R)	43.4502	23.12245	1.88	0.062	-2.253053	89.15345
Male lit(R)	47.23991	25.36237	1.86	0.065	-2.890721	97.37054
Tot lit(R)	-91.84737	48.56963	-1.89	0.061	-187.8489	4.15415
Fem lit(U)	-47.16129	27.93942	-1.69	0.094	-102.3856	8.063066
Male lit(U)	-54.7128	32.75397	-1.67	0.097	-119.4535	10.02787
Tot lit(U)	98.47109	59.99545	1.64	0.103	-20.11443	217.0566
Urban popn	1.24409	.3176765	3.92	0.000	.616179	1.872002
Cons exp(R)	.1324284	.061395	2.16	0.033	.0110765	.2537803
Cons exp(U)	.009363	.0341938	0.27	0.785	-.0582235	.0769496
Sex ratio(R)	-.5535595	.3388907	-1.63	0.105	-1.223402	.1162834
Fem work(R)	.9690741	.652378	1.49	0.140	-.3204001	2.258548
Tribals(R)	.4803052	.4535651	1.06	0.291	-.4162003	1.376811
Life exp(R)	2.358709	3.242434	0.73	0.468	-4.050205	8.767623
Life exp(U)	-2.210299	2.913415	-0.76	0.449	-7.968882	3.548285
Rain Dev(+)	-.0263575	.0353333	-0.75	0.457	-.0961963	.0434814
Rain Dev(-)	-.0211663	.0446462	-0.47	0.636	-.109413	.0670803
Muslims(R)	.0888457	.7779521	0.11	0.909	-1.448835	1.626526
Sex ratio(U)	.3765889	.2889555	1.30	0.195	-.1945534	.9477313
Muslims(U)	-1.640333	.8195342	-2.00	0.047	-3.260204	-.0204624
Fem work(U)	2.150659	1.414062	1.52	0.130	-.6443407	4.94566
Tribals(U)	-.0433982	2.072557	-0.02	0.983	-4.139963	4.053166
AHS(R)	-7.470581	13.54621	-0.55	0.582	-34.24569	19.30453
AHS(U)	37.3215	16.80588	2.22	0.028	4.103411	70.53959
Death Rate(R)	7.687994	3.943238	1.95	0.053	-.1061118	15.4821
Death Rate(U)	-.1274418	4.890098	-0.03	0.979	-9.793088	9.538205
Inf Death(R)	.2078093	.4277641	0.49	0.628	-.6376985	1.053317
Inf Death(U)	.8355714	.3431192	2.44	0.016	.1573705	1.513772
Constant	167.4109	313.5976	0.53	0.594	-452.4383	787.2601

Table A14. Rural Natural Population Growth Rate for z-NDVI model

Number of obs = 178

G_R	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
z-NDVI	.9858994	2.536817	0.39	0.698	-4.02831	6.000109
lagΔz-NDVI	2.616387	1.298596	2.01	0.046	.0496141	5.18316
Rainfall	-.0658659	.0192956	-3.41	0.001	-.1040051	-.0277266
NSA	.7587687	9.496818	0.08	0.936	-18.01241	19.52994
Popn dens(R)	-.0277585	.0110504	-2.51	0.013	-.0496003	-.0059166
Popn dens(U)	.0000255	.0004059	0.06	0.950	-.0007769	.0008279
Fem lit(R)	12.59588	5.781556	2.18	0.031	1.168205	24.02356
Male lit(R)	13.31106	6.163933	2.16	0.032	1.127581	25.49453
Tot lit(R)	-24.92917	11.96675	-2.08	0.039	-48.58234	-1.275988
Fem lit(U)	18.86758	7.780122	2.43	0.017	3.489587	34.24558
Male lit(U)	20.31281	8.739292	2.32	0.022	3.038945	37.58668
Tot lit(U)	-40.00677	16.42408	-2.44	0.016	-72.47019	-7.543342
Urban popn	-.0892731	.1175114	-0.76	0.449	-.3215432	.1429971
Cons exp(R)	-.0579249	.0175068	-3.31	0.001	-.0925285	-.0233214
Cons exp(U)	.0131321	.0090873	1.45	0.151	-.0048296	.0310937
Sex ratio(R)	-.1842565	.101495	-1.82	0.072	-.384869	.016356
Fem work(R)	-.2858281	.1463278	-1.95	0.053	-.5750561	.0033998
Tribals(R)	.1721404	.1159196	1.48	0.140	-.0569835	.4012643
Life exp(R)	3.935724	.8966745	4.39	0.000	2.16338	5.708069
Life exp(U)	-3.368982	.7750014	-4.35	0.000	-4.90083	-1.837133
Rain Dev(+)	-.0022449	.0082775	-0.27	0.787	-.0186059	.0141162
Rain Dev(-)	-.0169955	.0105002	-1.62	0.108	-.0377499	.003759
Muslims(R)	.3067062	.2440116	1.26	0.211	-.1756009	.7890134
Sex ratio(U)	-.2026239	.0763914	-2.65	0.009	-.3536173	-.0516306
Muslims(U)	-.1229696	.2122788	-0.58	0.563	-.5425546	.2966154
Fem work(U)	-.4825178	.4930664	-0.98	0.329	-1.457101	.4920649
Tribals(U)	-.4431887	.4856002	-0.91	0.363	-1.403014	.5166366
AHS(R)	21.63174	3.526639	6.13	0.000	14.66108	28.60241
AHS(U)	-11.60181	4.8674	-2.38	0.018	-21.22259	-1.981026
Death Rate(R)	6.586843	.75644	8.71	0.000	5.091682	8.082003
Death Rate(U)	1.975718	.7062734	2.80	0.006	.579716	3.371721
Inf Death(R)	.0241124	.1141056	0.21	0.833	-.2014259	.2496506
Inf Death(U)	.0532545	.0966681	0.55	0.583	-.1378172	.2443262
Constant	337.8187	87.714	3.85	0.000	164.4454	511.192

Table A15. Urban Natural Population Growth Rate for z-NDVI model

Number of obs = 178

G_U	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
z-NDVI	-.0623269	4.795611	-0.01	0.990	-9.541211	9.416558
lagΔz-NDVI	1.746576	2.509271	0.70	0.488	-3.213187	6.706338
Rainfall	.1208284	.0458172	2.64	0.009	.0302672	.2113896
NSA	-20.09039	21.87891	-0.92	0.360	-63.3357	23.15492
Popn dens(R)	-.0308112	.0272735	-1.13	0.260	-.0847194	.0230969
Popn dens(U)	.0004421	.0008609	0.51	0.608	-.0012596	.0021437
Fem lit(R)	-21.05234	9.928027	-2.12	0.036	-40.67583	-1.428847
Male lit(R)	-19.79614	10.46975	-1.89	0.061	-40.49039	.8981184
Tot lit(R)	42.2541	20.47646	2.06	0.041	1.78084	82.72736
Fem lit(U)	32.78359	15.25912	2.15	0.033	2.622792	62.94438
Male lit(U)	35.8685	17.33199	2.07	0.040	1.610531	70.12648
Tot lit(U)	-67.54479	32.29617	-2.09	0.038	-131.3806	-3.708985
Urban popn	-1.360341	.2561591	-5.31	0.000	-1.866659	-.8540232
Cons exp(R)	-.0630851	.0377146	-1.67	0.097	-.1376309	.0114606
Cons exp(U)	-.0032617	.0224239	-0.15	0.885	-.0475842	.0410607
Sex ratio(R)	.1702993	.1498654	1.14	0.258	-.125921	.4665196
Fem work(R)	-.0401671	.2849519	-0.14	0.888	-.6033959	.5230616
Tribals(R)	.2662039	.3474371	0.77	0.445	-.4205315	.9529394
Life exp(R)	1.130534	1.969344	0.57	0.567	-2.762022	5.02309
Life exp(U)	-.936592	1.823828	-0.51	0.608	-4.541525	2.668341
Rain Dev(+)	.0324253	.0185899	1.74	0.083	-.0043189	.0691695
Rain Dev(-)	-.0546105	.0216154	-2.53	0.013	-.097335	-.011886
Muslims(R)	-.0244574	.7410636	-0.03	0.974	-1.489225	1.44031
Sex ratio(U)	-.2865618	.1531716	-1.87	0.063	-.589317	.0161934
Muslims(U)	1.134959	.4917069	2.31	0.022	.1630637	2.106855
Fem work(U)	-2.441486	.8590872	-2.84	0.005	-4.139536	-.7434353
Tribals(U)	-1.226429	1.157873	-1.06	0.291	-3.515051	1.062194
AHS(R)	8.619336	6.663067	1.29	0.198	-4.550715	21.78939
AHS(U)	-25.50227	8.36583	-3.05	0.003	-42.03796	-8.96658
Death Rate(R)	-6.420937	1.639917	-3.92	0.000	-9.662356	-3.179518
Death Rate(U)	10.59878	1.429464	7.41	0.000	7.773338	13.42423
Inf Death(R)	.0833665	.2583865	0.32	0.747	-.4273538	.5940867
Inf Death(U)	-1.019143	.1862698	-5.47	0.000	-1.387319	-.6509665
Constant	134.8573	166.8253	0.81	0.420	-194.8854	464.6001

Table A16. Rural Net In-migration Rate for z-NDVI model

Number of obs = 178

M_R	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
z-NDVI	-3.102176	5.805299	-0.53	0.594	-14.57679	8.372434
lagΔz-NDVI	-2.747637	2.049826	-1.34	0.182	-6.799272	1.303998
Rainfall	-.06519	.0340763	-1.91	0.058	-.1325444	.0021644
NSA	-9.884507	20.32315	-0.49	0.627	-50.05474	30.28573
Popn dens(R)	.036345	.0188473	1.93	0.056	-.000908	.073598
Popn dens(U)	-.0002457	.0006752	-0.36	0.716	-.0015802	.0010888
Fem lit(R)	-16.99837	9.933042	-1.71	0.089	-36.63178	2.635029
Male lit(R)	-18.36446	10.77401	-1.70	0.090	-39.66009	2.931179
Tot lit(R)	33.86242	20.72172	1.63	0.104	-7.095624	74.82045
Fem lit(U)	-17.90267	16.16345	-1.11	0.270	-49.85095	14.04561
Male lit(U)	-20.9852	18.13267	-1.16	0.249	-56.82578	14.85538
Tot lit(U)	41.01042	34.10869	1.20	0.231	-26.40797	108.4288
Urban popn	-.4405752	.1829714	-2.41	0.017	-.8022319	-.0789185
Cons exp(R)	.0447047	.0282796	1.58	0.116	-.011192	.1006014
Cons exp(U)	-.0156819	.0148606	-1.06	0.293	-.0450551	.0136913
Sex ratio(R)	.2955338	.1701244	1.74	0.084	-.04073	.6317975
Fem work(R)	-.0751612	.2518408	-0.30	0.766	-.5729434	.4226211
Tribals(R)	-.8520275	.2355049	-3.62	0.000	-1.317521	-.3865343
Life exp(R)	-6.252731	1.700454	-3.68	0.000	-9.613805	-2.891656
Life exp(U)	5.295069	1.470382	3.60	0.000	2.388749	8.201389
Rain Dev(+)	.0000467	.014912	0.00	0.998	-.029428	.0295213
Rain Dev(-)	.028128	.0221218	1.27	0.206	-.0155974	.0718535
Muslims(R)	-.797454	.4203623	-1.90	0.060	-1.628332	.0334236
Sex ratio(U)	.2400608	.1591526	1.51	0.134	-.0745163	.5546378
Muslims(U)	.4466549	.3726075	1.20	0.233	-.2898318	1.183142
Fem work(U)	.7858088	.788659	1.00	0.321	-.7730349	2.344652
Tribals(U)	2.169798	1.043662	2.08	0.039	.1069228	4.232674
AHS(R)	-24.44259	8.123018	-3.01	0.003	-40.49834	-8.386831
AHS(U)	22.20343	11.27854	1.97	0.051	-.0894555	44.49632
Death Rate(R)	-8.169859	1.537454	-5.31	0.000	-11.20875	-5.130966
Death Rate(U)	-4.959912	1.422192	-3.49	0.001	-7.770982	-2.148842
Inf Death(R)	-.0489826	.1890057	-0.26	0.796	-.4225665	.3246013
Inf Death(U)	.1717308	.2302881	0.75	0.457	-.283451	.6269126
Constant	-444.2356	159.5464	-2.78	0.006	-759.591	-128.8803

Table A17. Urban Net In-migration Rate for z-NDVI model

Number of obs = 178

M_U	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
z-NDVI	8.04076	7.989061	1.01	0.316	-7.750219	23.83174
lagΔz-NDVI	4.178805	4.378507	0.95	0.341	-4.475643	12.83325
Rainfall	.1064476	.090647	1.17	0.242	-.0727229	.2856182
NSA	-26.0573	35.09219	-0.74	0.459	-95.41965	43.30505
Popn dens(R)	.0670834	.0410858	1.63	0.105	-.0141257	.1482925
Popn dens(U)	-.0007905	.0011426	-0.69	0.490	-.003049	.001468
Fem lit(R)	40.6255	22.59688	1.80	0.074	-4.038923	85.28992
Male lit(R)	44.54282	24.71357	1.80	0.074	-4.305406	93.39104
Tot lit(R)	-86.45099	47.44307	-1.82	0.070	-180.2258	7.323813
Fem lit(U)	-43.60196	28.67882	-1.52	0.131	-100.2878	13.08387
Male lit(U)	-51.11437	33.40058	-1.53	0.128	-117.1331	14.90438
Tot lit(U)	91.22764	61.51085	1.48	0.140	-30.35318	212.8085
Urban popn	1.189029	.333686	3.56	0.000	.5294734	1.848584
Cons exp(R)	.1268004	.0609633	2.08	0.039	.0063018	.2472989
Cons exp(U)	.0148139	.035197	0.42	0.674	-.0547556	.0843834
Sex ratio(R)	-.5139699	.3284098	-1.57	0.120	-1.163097	.1351567
Fem work(R)	.8599345	.6486954	1.33	0.187	-.4222607	2.14213
Tribals(R)	.2666852	.4713962	0.57	0.572	-.6650648	1.198435
Life exp(R)	1.940563	3.362548	0.58	0.565	-4.705766	8.586892
Life exp(U)	-1.85822	2.994981	-0.62	0.536	-7.778024	4.061585
Rain Dev(+)	-.0281211	.0360622	-0.78	0.437	-.0994006	.0431585
Rain Dev(-)	-.0043276	.0446873	-0.10	0.923	-.0926553	.0840002
Muslims(R)	.0627544	.8285986	0.08	0.940	-1.575033	1.700542
Sex ratio(U)	.3455878	.2975929	1.16	0.247	-.242627	.9338025
Muslims(U)	-1.543569	.8318975	-1.86	0.066	-3.187877	.1007388
Fem work(U)	2.479151	1.463516	1.69	0.092	-.4135975	5.3719
Tribals(U)	.1197563	2.044576	0.06	0.953	-3.921501	4.161013
AHS(R)	-4.055895	13.29178	-0.31	0.761	-30.32809	22.2163
AHS(U)	36.32814	16.87007	2.15	0.033	2.983187	69.67309
Death Rate(R)	8.729612	3.90731	2.23	0.027	1.00652	16.4527
Death Rate(U)	-.803246	4.638621	-0.17	0.863	-9.971828	8.365336
Inf Death(R)	.1238731	.4232108	0.29	0.770	-.7126348	.9603809
Inf Death(U)	.8045211	.3315696	2.43	0.016	.1491489	1.459893
Constant	140.4454	285.8296	0.49	0.624	-424.5182	705.409

Appendix B. An Illustrative Conceptual Model: Derivations and Proofs

Here we develop a simple conceptual model to illustrate many of the economic forces that we discuss in Section 3. The model necessarily abstracts from much (including private ownership, endogenous property rights, dynamics, etc.), but captures several key attributes of the environment-population nexus in developing countries such as India. In particular, we assume (i) a model of rural household decision-making in which household production is central, (ii) urban household decision-making in which children are consumption goods, and (iii) a model of open access rural environmental (e.g., forest) resources that are inputs in rural household production, the source of marketed surplus to the urban sector, and have amenity value to urban households. Child-bearing and migration are modeled in a two-period framework wherein first period decisions (on children and migration) affect second period labor allocations in resource extraction. Our model builds generally on the household production literature (e.g., Renkow, 1990; Renkow, et al., 2004; Singh, Squire and Strauss, 1986; Innes, 1993).

Rural Households. In period 2, a representative rural household obtains utility from environmental (forest) products X_c, other (numeraire) goods Z, and leisure L,

(A1) $$U^R(X_c,L) + Z,$$

where U^R is increasing concave with $U^R_{21} \geq 0$ (subscripts denoting partial derivatives with respect to the ith argument). The number of children (c_R) and labor that migrates to the urban sector (m) are chosen in period 1. Migrant labor earns an exogenous net wage in the urban sector in period 2, w. Children c_R are available for production of forest products X in period 2, but also involve costs (measured in units of the numeraire) in periods 1 and 2, $\beta_1 c_R$ and $\beta_2 c_R$, respectively ($\beta_1+\beta_2<1$). Children also consume environmental/forest goods in the amount $v_R c_R$ in period 2. Forest goods are produced according to the function,

(A2) $X=X(E,L=l+c_R-m)$,

where l=total adult labor allocated to production and migration, E=initial state of the environment/forest in period 2, and X is increasing concave with $\partial^2 X/\partial L\partial E=X_{12}\geq 0$ (labor and environment are complements) and $X_L>v_R$ (children are net contributors to household production). Out of production, the household markets X_m of forest products to the urban sector at (endogenous) price P. Consumption of X_c is:

(A3) $X_c = X() - X_m - v_R c_R$.

Period 2 leisure satisfies the identity, $L=\underline{L}-l$, where $\underline{L}$ is total available adult labor. Hence, in period 2, rural households solve the problem:

(A4) $U^{R*}(E,c_R,m,P) = \max_{l,Xm} U^R(X(E,l-m+c_R)-X_m- v_R c_R, \underline{L}-l) + PX_m + wm - \beta_2 c_R$,

which yields $l^*(E,c_R,m,P)$ and $X^*_m(E,c_R,m,P)$. Normalizing β_1 to account for intertemporal discounting, c_R and m are chosen to

(A5) $\max_{cR,m} U^{R0} = U^{R*}() - \beta_1 c_R$.

Environmental Change. Period 2 environmental change depends on both the initial state of the environment E (the autonomous component) and the extraction X (the endogenous component):

(A6) $\Delta E = f(E,X)$, where $\partial f/\partial X < 0$.

The autonomous effect can have any sign. For example, autonomous growth in either a decimated landscape or a dense mature forest can be negligible, but in a weakened landscape (with new trees, for example), can be large.

Urban Households. In period 2, a representative urban household obtains utility from the environmental amenity (E), children (c_U), forest products (X_U), and other (numeraire) goods (Z) according to

(A7) $U^U(E,c_U,X_U) + Z,$

where U^U is increasing concave with $U^U_{23} \geq 0$ and $U^R_{12} \geq 0$. Children c_U are chosen in period 1 and bear numeraire costs $\gamma_1 c_U$ and $\gamma_2 c_U$ in periods 1 and 2, as well as consuming $v_U c_U$ in forest products in period 2. With exogenous urban household income of Y, the period 2 household choice problem is

(A8) $U^{U*}(E,c_U,P) = \max_{Xd} U^U(E,c_U,X_d - v_U c_U) + Y - \gamma_2 c_U - PX_d,$

which yields $X^*_d(E,c_U,P)$. Children are chosen to

(A9) $\max_{cU} U^{U*}(E,c_U,P) - \gamma_1 c_U.$

Market Equilibrium. The market price for forest goods equates supply and demand:

(A10) $P(E,c_R,c_U,m)$: $X^*_m(E,c_R,m,P) = X^*_d(E,c_U,P).$

Demographic Effects on Environmental Change. Differentiating (A6) with respect to c_R and m:

(A11a) $d\Delta E/dc_R = (\partial f/\partial X)(\partial X/\partial L)[(dl^*/dc_R)+1]$

$$\overset{s}{=} -[(dl^*/dc_R)+1] = -[1+(\partial l^*/\partial c_R)+(\partial l^*/\partial P)(dP/dc_R)],$$

(A11b) $d\Delta E/dm = (\partial f/\partial X)(\partial X/\partial L)[(dl^*/dm)-1]$

$$\overset{s}{=} [1-(dl^*/dm)] = 1-(\partial l^*/\partial m)-(\partial l^*/\partial P)(dP/dm)],$$

where the sign equalities are due to $\partial f/\partial X<0$ and $\partial X/\partial L>0$.

Proposition 1. (a) $d\Delta E/dc_R <0$. Higher rural birth rates promote environmental decline. (b) $d\Delta E/dm <0$. Greater rural out-migration yields environmental improvement.

Proof. (a) Suppose not. Then $[(dl^*/dc_R)+1] \leq 0$. Hence, if $dX^*_m/dc_R>0$, then $dP/dc_R<0$ (by (A10)),

(A12) $dU_1^R/dc_R = U_{11}^R \{(\partial X/\partial L)[(dl^*/dc_R)+1] - (dX_m^*/dc_R)\} - U_{12}^R (dl^*/dc_R) > 0,$

and, hence, $d\{-U_1^R+P\}/dc_R < 0$ (using $U_{11}^R<0$, $U_{12}^R \geq 0$, and $dl^*/dc_R \leq 0$), contradicting the preservation of the first order condition for X_m in problem (A4). Therefore, we must have $dX_m^*/dc_R \leq 0$ and, therefore, $dP/dc_R \geq 0$; with $\partial l^*/\partial P>0$ (from differentiation of the first order conditions (FOC) for (A4)), it now suffices to show that $[1+(\partial l^*/\partial c_R)] > 0$, implying the contradiction that $[(dl^*/dc_R)+1] >0$. Totally differentiating the two FOC for (A4), appealing to second order conditions (SOC), and rewriting, we have

(A13) $$1+(\partial l^*/\partial c_R) \overset{s}{=} U_{11}^R U_{22}^R - (U_{12}^R)^2 > 0,$$

where the inequality follows from concavity of U^R.

(b) Suppose not. Then $[(dl^*/dm)-1] \geq 0$. Hence, if $dX_m^*/dm<0$, then $dP/dm>0$ (by (A10)),

$$dU_1^R/dm = U_{11}^R \{(\partial X/\partial L)[(dl^*/dm)-1] - (dX_m^*/dm)\} - U_{12}^R (dl^*/dm) < 0,$$

and, hence, $d\{-U_1^R+P\}/dm > 0$, contradicting the preservation of the FOC for X_m in (A4). Therefore, we must have $dX_m^*/dm \geq 0$ and, therefore, $dP/dm \leq 0$; with $\partial l^*/\partial P>0$, it now suffices to show that $[(\partial l^*/\partial m)-1] < 0$, implying the contradiction that $[(dl^*/dm)-1] <0$. Totally differentiating the two FOC for (A4), appealing to SOC, and rewriting, we have

$$(\partial l^*/\partial m)-1 \overset{s}{=} -\{U_{11}^R U_{22}^R - (U_{12}^R)^2\} < 0,$$

where the inequality follows from concavity of U^R. QED.

Next, differentiating (A6) with respect to c_U:

(A14) $$d\Delta E/dc_U = (\partial f/\partial X)(\partial X/\partial L)(\partial l^*/\partial P)(\partial P/\partial c_U).$$

Proposition 2. $d\Delta E/dc_U < 0$. Higher urban birth rates promote environmental decline.

Proof. With $\partial f/\partial X<0$, $\partial X/\partial L>0$, and $\partial l^*/\partial P>0$ (from problem (A4)), it suffices to show that $\partial P/\partial c_U>0$. Differentiating:

$$\partial P/\partial c_U = (\partial X_d^*/\partial c_U)/[(dX_m^*/dP)-(dX_d^*/dP)] \overset{s}{=} \partial X_d^*/\partial c_U = [U_{32}^U - U_{33}^U v_U]/(-U_{33}^U) > 0,$$

where the inequality follows from $U_{33}^U<0$ and $U_{32}^U \geq 0$. QED.

Intuitively, more rural births translate into more extractive labor that increases exploitation of the open access resource. More urban births raises demand for the products of the environmental resource, thus elevating the price of the products, which in turn increases incentives for exploitation of the forest resource in order to sell the resulting products. Propositions 1-2 provide a formal statement of Hypotheses 1-2 in the text.

Effects of Environmental Change on Demographic Decisions. We are interested in the effects of first period environmental change on three choices: c_U, c_R, and m. Because $E=E_0+\Delta E_0$, these comparative static effects can be deduced from the derivatives,

(A15a) $$dc_U^* = (\partial c_U^*/\partial E) + (\partial c_U^*/\partial P)(dP/dE),$$

(A15b) $$dc_R^* = (\partial c_R^*/\partial E) + (\partial c_R^*/\partial P)(dP/dE),$$

(A15c) $$dm^* = (\partial m^*/\partial E) + (\partial m^*/\partial P)(dP/dE).$$

We note that even this simple model becomes rather exceptionally complex at this juncture. To develop potential (illustrative) outcomes with maximum simplicity, we will thus assume here that $U_{31}^U = U_{12}^R = X_{LL} = 0$. We begin by examining the partial derivative effects in (A15).

Lemma 1. Assume $U_{31}^U = U_{12}^R = X_{LL} = 0$. Then (1) $\partial c_R^*/\partial E>0$ and $\partial c_R^*/\partial P>0$; (2) $\partial m^*/\partial E<0$ and $\partial m^*/\partial P<0$; (3) $\partial c_U^*/\partial E \geq 0$ and $\partial c_U^*/\partial P<0$; and (4) $\partial P/\partial E<0$, $\partial P/\partial c_R<0$, $\partial P/\partial m>0$, and $\partial P/\partial c_U>0$.

Intuitively, a better environment increases the marginal product of rural child labor in resource extraction, yielding greater demand for children by rural households. Similarly, a higher resource price raises the marginal benefit of child labor in resource extraction. Likewise, a better environment and higher resource price raise the cost of migration in foregone resource extraction activity. Complementarity between children and the rural environmental amenity in urban household consumption imply a non-negative relationship between the environment and urban child demand. On the other hand, a higher price for environmental/forest goods raises the costs of supporting urban children, thus reducing net incentives for child-bearing in the urban sector. A better rural environment, greater supply of rural child labor, or reduced out-migration of rural labor, all raise net marketed surplus of the environmental good, thus depressing its market price. Conversely, a greater number of urban children increases the urban demand for the resource-related good, thus raising its market price.

Proof. Let us start with rural household decisions, noting first that

$$\text{(A16)} \qquad U^{R*}_{cm} = U^{R}_{11}\,(X_L - v_R)\,\{X_L[(\partial l^*/\partial m)-1] - (\partial X^*_m/\partial m)\} = 0,$$

where the equality follows from differentiating the FOC for problem (A4) and substituting in the brackets. Hence, from problem (A5) (and associated SOC), we have

$$\text{(A17a)} \qquad \partial c^*_R/\partial E = (1/H_R)\,[-U^{R*}_{cE}\;U^{R*}_{mm}] \overset{s}{=} U^{R*}_{cE},$$

$$\text{(A17b)} \qquad \partial m^*/\partial E = (1/H_R)\,[-U^{R*}_{mE}\;U^{R*}_{cc}] \overset{s}{=} U^{R*}_{mE},$$

$$\text{(A17c)} \qquad \partial c^*_R/\partial P = (1/H_R)\,[-U^{R*}_{cP}\;U^{R*}_{mm}] \overset{s}{=} U^{R*}_{cP},$$

$$\text{(A17d)} \qquad \partial m^*/\partial P = (1/H_R)\,[-U^{R*}_{mP}\;U^{R*}_{cc}] \overset{s}{=} U^{R*}_{mP},$$

where $H_R>0$ is the determinant of the Hessian for problem (A5).

Differentiating the FOC for (A4), it can be shown (given our assumptions) that

(A18a) $X_E + (\partial l^*/\partial E)X_L - (\partial X^*_m/\partial E) = 0,$

(A18b) $(\partial l^*/\partial P)X_L - (\partial X^*_m/\partial P) = (1/U^R_{11}) < 0.$

Using these relationships, we have

(A19) $U^{R*}_{mE} = -U^R_1 X_{LE} < 0$, $U^{R*}_{cE} = U^R_1 X_{LE} > 0$, $U^{R*}_{mP} = -X_L < 0$, $U^{R*}_{cP} = (X_L - v_R) > 0.$

Substituting (A19) into (A17) gives results (1)-(2).

Similarly, totally differentiating the FOC for problems (A8) and (A9) (for choices of X_d and c_U) and appealing to SOC gives:

(A20a) $\partial c^*_U/\partial E = (1/H_U)[-U^U_{21} U^U_{33}] \overset{s}{=} U^U_{21} \geq 0,$

(A20a) $\partial c^*_U/\partial P = (1/H_U)[U^U_{33} v_U - U^U_{23}] \overset{s}{=} U^U_{33} v_U - U^U_{23} < 0,$

where $H_U>0$ is the determinant of the joint Hessian for (A8)-(A9). (A20) implies (3).

Finally, from (A11), we have:

(A21) $\partial P/\partial c_R = (1/\Delta)[-(\partial X^*_m/\partial c_R)]$, $\partial P/\partial m = (1/\Delta)[-(\partial X^*_m/\partial m)]$,

$\partial P/\partial c_U = (1/\Delta)(\partial X^*_d/\partial c_U)$, $\partial P/\partial E = (1/\Delta)[(\partial X^*_d/\partial E) - (\partial X^*_m/\partial E)]$

where $\Delta=[(\partial X^*_d/\partial P) - (\partial X^*_m/\partial P)] > 0$. Further, differentiating the FOC for (A4), we have

(A22) $\partial X^*_m/\partial c_R = (X_L - v_R) > 0$, $\partial X^*_m/\partial m = -X_L < 0$, $\partial X^*_m/\partial E = X_E - [U^R_1 X_{LE} X_L/U^R_{22}] > 0.$

Finally, differentiating the FOC for (A8)-(A9):

(A23) $\partial X^*_d/\partial c_U = v_U - (U^U_{23}/U^U_{33}) > 0$, $\partial X^*_d/\partial E = 0$ (with $U^U_{31}=0$).

Substituting (A22) and (A23) into (A21 implies (4). QED.

To characterize the effect of environmental change on market resource price, dP/dE, note that households take the price as parametric in all decisions. However, the equilibrium price accounts for impacts of all decisions. Hence, we have the total derivative:

(A24) $dP/dE = \partial P/\partial E + (\partial P/\partial c_R)(dc_R^*/dE) + (\partial P/\partial m)(dm^*/dE) + (\partial P/\partial c_U)(dc_U^*/dE)$.

Substituting (A15) into (A24) and solving gives

(A25) $dP/dE = (1/A)\{\partial P/\partial E+(\partial P/\partial c_R)(\partial c_R^*/\partial E)+(\partial P/\partial m)(\partial m^*/\partial E)+(\partial P/\partial c_U)(\partial c_U^*/\partial E)\}$,

where $A = 1 - \{(\partial P/\partial c_R)(\partial c_R^*/\partial P) + (\partial P/\partial m)(\partial m^*/\partial P) + (\partial P/\partial c_U)(\partial c_U^*/\partial P)\} > 0$, with the inequality due to Lemma 1. Note that the first three (bracketed) right-hand terms in (A25) are negative and the last term is positive. These first three terms correspond to the following effects: A better environment directly lowers the resource price by spurring greater marketed supply and indirectly lowers it by prompting elevated levels of both rural child labor and rural adult labor (due to reduced incentives for migration) that in turn depress the market price by raising marketed surplus of the environmental good. Opposing these effects is the impact of a better environment in stimulating the demand for urban children (as complements in consumption) which in turn elevates the market price by raising urban demand for the environmental good. Provided the last effect is sufficiently small relative to the former three (as we expect), we have

Lemma 2. Provided ($\partial c_U^*/\partial E$ is sufficiently small (because U_{21}^U is sufficiently small),

$dP/dE<0$.

Returning to the original derivatives of interest, equation (A15), we can see that we have an unambiguous positive sign for the effect of environmental change on urban child-bearing c_U, provided $dP/dE<0$. For the rural household decisions, however, direct and indirect (price) effects on rural child demand and migration are opposing. In practice, of course, either effect may dominate. However, if price effects dominate (as they will if the marginal labor productivity impact of environmental change, X_{LE}, is sufficiently small), then we have:

Proposition 3. Assume that $dP/dE<0$. Then: (a) $dc_U^*/dE>0$. Urban child demand rises with environmental improvement. (b) Provided $|dP/dE|>U_1^R X_{LE}/(X_L-v_R)$, $dc_R^*/dE<0$ and $dm^*/dE>0$. Rural child demand and rural in-migration both fall with environmental improvement.

Proposition 3 provides a formal counterpart to Hypotheses 3-5 in the text.

Effects of Environmental "Scarcity" on Environmental Change. Recall, from (A7), that there are two components of environmental change, the "autonomous" effect and the endogenous component due to the resource extraction activities of rural households. We will focus here on the endogenous component only, namely, whether a higher level of initial environmental quality (E) leads to an increase in exploitation (higher X), and conversely, whether a poorer initial environment leads to less exploitation. Formally,

(26) $dX/dE = \partial X/\partial E + (\partial X/\partial l)(dl^*/dE)$, $dl^*/dE = \partial l^*/\partial E + (\partial l^*/\partial P)(\partial P/\partial E)$.

(Note that here we control for demographic decisions and, hence, only need be concerned with direct effects of E on the second period equilibrium P, $\partial P/\partial E$.) Evaluating (26), we have:

Proposition 4. $dX/dE>0$. Environmental scarcity leads to less endogenous environmental degradation.

Proof. Suppose not, $dX/dE\leq 0$. Then because X is an increasing function, we must have $dl^*/dE<0$. With $dX/dE\leq 0$ and $dl/dE<0$, following the logic of the proof of Lemma 1, if $\partial X_m^*/\partial E>0$ (and hence, $\partial P/\partial E<0$), then $dU_1^R/dE>0$ and, hence,

$d(-U_1^R+P)/dE<0$, contradicting the preservation of the FOC for X_m in (A4). Therefore, we must have $\partial X_m^*/\partial E\leq 0$ and therefore, $\partial P/\partial E\geq 0$. With $\partial l^*/\partial P>0$ (from the FOC for (A4)) and $\partial P/\partial E\geq 0$,

we will have a contradiction ($dl^*/dE>0$) if $\partial l^*/\partial E>0$. Furthermore, differentiating the FOC for (A4) gives: $\partial l^*/\partial E \overset{s}{=} - U_{11}^R \; U_1^R \; X_{LE} > 0$. QED.