Electricity Provision and Industrial Development: Evidence from India
APPENDIX - ADDITIONAL TABLES

June 2011

Table A.1: Standard Errors: Alternative Treatments

	Log Manufacturing Output (IV results)				
	All regressions use Groundwater * Year Dummies as Instruments				
Agricultural	0.027	0.027	0.027	0.027	0.028
Connections	(0.009)***	(0.009)***	(0.009)***	(0.007)***	Tests reject the null at 5%
Change in SE estimation	Autocorrelation of degree:			Bootstrap	Wild Bootstrap
	2	3	4	200 reps	1000 reps
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
State Controls	Yes	Yes	Yes	Yes	Yes
Observations	300	300	300	300	300
First Stage F-Test	36.54	31.73	29.16	79.01	not reported

Table A.2: Additional Specification Checks

	Log Manufacturing Output							Rural Manuf Workers	
								% Rural Workers	% Total Workers
Agricultural Connections	0.021 (0.009)**	0.027 (0.007)***	0.025 (0.007)***	0.034 (0.010)***	0.028 (0.007)***	0.018 (0.010)***	0.035 (0.008)**	0.002 (0.008)***	0.0009 (0.0004)**
Rural Literacy	-0.021 (1.69)**								
Neighboring States' Electrification		0.042 (0.010)***							
Other Controls/Specification	Rural Literacy	Connections in neighboring states	Cubic First Stage	Initial Literacy, Roads, Manuf Output Timetrend	No Rajasthan or AP	No Punjab or UP	No Kerala or Assam	Only observations for 2 census years	
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	210	300	300	300	260	260	260	24	24
First Stage F-Test	56.52	107.70	18.61	87.80	39.02	46.56	82.70	6.35	6.35

Table A.3: Measures of Groundwater

	Aquifer Depth		
State	>150	>100	>0
Andhra Pradesh	0.07	0.07	0.07
Assam	0.15	0.17	0.17
Bihar	0.15	0.23	0.23
Gujarat	0.2	0.25	0.27
Haryana	0.73	0.85	1
Karnataka	0	0	0.02
Kerala	0	0.12	0.29
Madhya Pradesh	0	0	0
Maharashtra	0.01	0.03	0.04
Orissa	0.05	0.05	0.05
Punjab	0.8	0.85	0.85
Rajasthan	0.01	0.21	0.28
Tamil Nadu	0.06	0.11	0.35
Uttar Pradesh	0.45	0.7	0.8
West Bengal	0.35	0.52	0.52

Table A.4: Time-varying Effects of Groundwater - Figures 3 to 5

	(1)	(2)	(3)	(4)	(5)	(6)
	HYV Adoption		Agricultural Connections		Log Manufacturing Output	
GW * 1961			0.006	-0.004	-0.090	-0.084
			(0.03)	(0.04)	(0.25)	(0.33)
GW * 1962			0.075	0.006	-0.060	-0.073
			(0.03)	(0.04)	(0.28)	(0.34)
GW * 1963			0.096	0.007	-0.152	-0.216
			(0.03)	(0.03)	(0.22)	(0.29)
GW * 1964			0.147	0.007	-0.020	-0.115
			(0.03)	(0.03)	(0.22)	(0.29)
GW * 1965			-0.097	0.024	0.068	-0.146
			(0.03)	(0.03)	(0.22)	(0.27)
GW * 1966	-0.051	-0.057	-0.041	0.048	0.055	-0.209
	(0.09)	(0.10)	(0.03)	(0.03)	(0.21)	(0.25)
GW * 1967	0.065	0.038	0.148	0.128	-0.053	-0.319
	(0.08)	(0.08)	(0.03)	(0.03)	(0.20)	(0.25)
GW * 1968	0.174	0.142	0.345	0.240	0.139	-0.149
	(0.08)**	(0.08)*	(0.02)	(0.03)	(0.20)	(0.25)
GW * 1969	0.219	0.198	0.531	0.377	0.174	-0.164
	(0.07)***	(0.08)**	(0.02)**	(0.03)	(0.20)	(0.26)
GW * 1970	0.225	0.199	0.707	0.454	0.125	-0.228
	(0.07)***	(0.08)**	(0.02)***	(0.03)	(0.21)	(0.25)
GW * 1971	0.273	0.243	0.748	0.434	0.252	-0.140
	(0.07)***	(0.08)***	(0.02)***	(0.03)	(0.22)	(0.26)
GW * 1972	0.324	0.292	0.826	0.502	0.326	-0.053
	(0.07)***	(0.08)***	(0.02)***	(0.03)*	(0.22)	(0.26)
GW * 1973	0.321	0.292	0.899	0.576	0.215	-0.143
	(0.07)***	(0.08)***	(0.02)***	(0.03)**	(0.22)	(0.26)
GW * 1974	0.336	0.307	0.913	0.576	0.317	-0.010
	(0.08)***	(0.08)***	(0.02)***	(0.03)**	(0.22)	(0.26)
GW * 1975	0.336	0.307	0.890	0.576	0.445	0.129
	(0.08)***	(0.08)***	(0.02)***	(0.03)**	(0.22)*	(0.27)
GW * 1976	0.407	0.379	0.882	0.615	0.263	-0.055
	(0.07)***	(0.08)***	(0.02)***	(0.03)**	(0.22)	(0.27)
GW * 1977	0.407	0.386	0.929	0.698	0.373	0.057
	(0.07)***	(0.08)***	(0.02)***	(0.03)**	(0.22)*	(0.27)
GW * 1978	0.451	0.433	0.994	0.781	0.357	0.054
	(0.07)***	(0.08)***	(0.02)***	(0.03)***	(0.22)*	(0.27)
GW * 1979	0.513	0.494	1.100	0.897	0.342	0.060
	(0.08)***	(0.08)***	(0.03)***	(0.03)***	(0.23)	(0.29)
GW * 1980	0.467	0.444	1.172	0.967	0.183	-0.070
	(0.08)***	(0.08)***	(0.03)***	(0.03)***	(0.21)	(0.26)
GW * 1981	0.471	0.452	1.207	1.006	0.386	0.157
	(0.08)***	(0.08)***	(0.03)***	(0.03)***	(0.22)*	(0.26)
GW * 1982	0.511	0.491	1.286	1.061	0.446	0.205
	(0.08)***	(0.09)***	(0.03)***	(0.04)***	(0.22)**	(0.27)
GW * 1983	0.537	0.515	1.430	1.163	0.446	0.192
	(0.08)***	(0.09)***	(0.04)***	(0.04)***	(0.22)**	(0.26)
GW * 1984	0.515	0.491	1.457	1.167	0.419	0.141
	(0.08)***	(0.11)***	(0.04)***	(0.04)***	(0.21)*	(0.26)
Education Expenditure	-0.035		-0.016		0.105	
	(0.02)		(0.007)**		(0.05)**	
Rural Population	-1.096		-2.822		-17.669	
	(0.74)		(0.20)***		(2.68)***	
Population Density	0.139		0.012		1.200	
	(0.24)		(0.05)		(0.56)**	
Total Credit	0.029		-0.005		0.019	
	(0.01)**		(0.004)		(0.04)	
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	300	300	375	375	375	375
R-squared	0.96	0.95	0.93	0.91	0.93	0.91

* significant at 10%; ** at 5%; *** at 1%. Standard errors in parentheses, robust to heteroskedasticity. "Agricultural Connections" is the number of agricultural units connected to the electricity network per 1000 people. "Log Manufacturing Output" is the log of real per capita manufacturing output. "Groundwater" is the proportion of state area covered with aquifers thicker than 150 mts. "HYV Adoption" is the proportion of cropped area with HYV seeds. "Education expenditure" and "Total Credit" are in logs. "Rural Population" is a proportion of total population. "Population Density" is population (in 1000s) per square kilometer.

Table A.5: Time-varying Effects of Groundwater at the District Level - Figure 6

	(1)	(2)	(3)	(4)
	Pumpsets per capita		HYV Adoption	
GW * 1963	0.001	0.001	-0.001	0.000
	(0.001)	(0.001)	(0.015)	(0.014)
GW * 1964	0.000	0.000	-0.002	0.000
	(0.001)	(0.001)	(0.015)	(0.014)
GW * 1965	0.000	0.001	-0.004	0.000
	(0.001)	(0.001)	(0.015)	(0.014)
GW * 1966	0.001	0.001	-0.003	0.001
	(0.001)	(0.001)	(0.015)	(0.014)
GW * 1967	0.001	0.001	0.030	0.032
	(0.001)	(0.001)	(0.015)**	(0.014)**
GW * 1968	0.001	0.001	0.058	0.060
	(0.001)	(0.001)	(0.015)***	(0.014)***
GW * 1969	0.001	0.001	0.084	0.087
	(0.001)	(0.001)	(0.015)***	(0.014)***
GW * 1970	0.001	0.001	0.082	0.087
	(0.001)	(0.001)	(0.015)***	(0.014)***
GW * 1971	0.002	0.002	0.112	0.116
	(0.001)	(0.001)	(0.015)***	(0.014)***
GW * 1972	0.002	0.002	0.134	0.136
	(0.001)	(0.001)	(0.015)***	(0.014)***
GW * 1973	0.002	0.002	0.128	0.130
	(0.001)*	(0.001)*	(0.015)***	(0.014)***
GW * 1974	0.002	0.002	0.130	0.135
	(0.001)**	(0.001)**	(0.015)***	(0.014)***
GW * 1975	0.002	0.003	0.131	0.139
	(0.001)**	(0.001)**	(0.015)***	(0.014)***
GW * 1976	0.003	0.003	0.155	0.166
	(0.001)**	(0.001)**	(0.015)***	(0.014)***
GW * 1977	0.003	0.003	0.156	0.168
	(0.001)***	(0.001)***	(0.015)***	(0.014)***
GW * 1978	0.004	0.004	0.153	0.170
	(0.001)***	(0.001)***	(0.015)***	(0.014)***
GW * 1979	0.004	0.005	0.158	0.180
	(0.001)***	(0.001)***	(0.015)***	(0.014)***
GW * 1980	0.005	0.006	0.162	0.180
	(0.001)***	(0.001)***	(0.015)***	(0.014)***
GW * 1981	0.006	0.007	0.164	0.188
	(0.001)***	(0.001)***	(0.015)***	(0.014)***
GW * 1982	0.007	0.008	0.156	0.180
	(0.001)***	(0.001)***	(0.015)***	(0.014)***
GW * 1983	0.007	0.009	0.168	0.196
	(0.001)***	(0.001)***	(0.015)***	(0.014)***
GW * 1984	0.008	0.009	0.158	0.186
	(0.001)***	(0.001)***	(0.015)***	(0.014)***
Literacy	0.025		0.504	
	(0.004)***		(0.05)***	
Rural Population	-0.070		0.113	
	(0.006)***		(0.079)	
Population Density	0.001		0.027	
	(0.001)		(0.004)***	
District Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	5588	5588	5588	5588
R-squared	0.88	0.87	0.81	0.81

* significant at 10%; ** at 5%; *** at 1%. Standard errors in parentheses, robust to heteroskedasticity. Results are robust to different degrees of autocorrelation. "Groundwater" is a dummy equal to 1 if the district has aquifers thicker than 150 mts. "HYV Adoption" is the proportion of cropped area with HYV seeds. "Pumpsets per capita" is the number of powered pumpsets per district population. "Literacy" and "Rural Population" are as a proportion of total population. "Population Density" is population (in 1000s) per square kilometer.

Table A.6: Full First Stage - Table 5

	(1)	(2)	(3)	(4)	(5)	(6)
			Log Manufacturing Output			
			IV using Groundwater * Time Trend			
Agricultural Connections	0.020	0.020	0.021	0.020	0.024	0.034
	(0.007)***	(0.007)***	(0.008)***	(0.007)***	(0.008)***	(0.010)***
Full First Stage						
			Agricultural Connections			
Groundwater * Time Trend	0.703	0.665	0.707	0.715	0.709	0.652
	(0.088)***	(0.083)***	(0.080)***	(0.078)***	(0.078)***	(0.089)***
Education Expenditure	-2.513	-1.936	-1.596	-1.600	-1.125	-0.542
	(0.855)***	(0.795)**	(0.781)**	(0.666)**	(0.669)*	(0.563)
Rural Population	-186.5	-113.2	-94.57	-92.19	-69.46	-127.3
	(21.82)***	(32.27)***	(30.81)***	(29.80)***	(27.89)**	(27.94)***
Population Density	-17.60	-39.99	-46.92	-58.14	-61.35	-55.89
	(5.841)***	(9.110)***	(9.016)***	(8.530)***	(7.578)***	(8.777)***
Total Credit	-0.287	-0.653	-0.603	5.972	4.786	6.437
	(0.408)	(0.394)*	(0.397)	(1.310)***	(1.265)***	(1.373)***
Development Expenditure	2.102	2.057	1.988	1.848	1.972	1.413
	(0.849)**	(0.771)***	(0.738)***	(0.669)***	(0.641)***	(0.565)**
Literacy		52.71	50.36	54.64	61.15	34.51
		(12.61)***	(12.24)***	(10.36)***	(9.579)***	(9.666)***
Mean HH Rural Expenditure			4.637	4.132	3.491	2.676
			(1.127)***	(1.025)***	(0.113)	(1.041)**
Non Agricultural Rural Credit				-7.346	-6.562	-6.541
				(1.414)***	(1.339)***	(1.330)***
Labor Regulation					-0.439	-0.533
					(0.245)*	(0.212)**
Vote Share Congress Party					-0.027	0.002
					(0.009)***	(0.007)
Chief Minister Congress Party					-1.257	-0.932
					(0.436)***	(0.336)***
Chief Minister Hard Left Party					-1.602	-0.669
					(0.525)***	(0.485)
Chief Minister Janata Party					-1.115	-0.775
					(0.493)**	(0.389)*
Initial Income Time-Trend						0.130
						(0.038)***
Initial Literacy Time-Trend						0.126
						(0.293)
Initial Roads Time-Trend						0.745
						(0.133)***
First Stage F-Test	62.60	64.87	77.08	83.05	41.41	87.70
R-square	0.95	0.95	0.95	0.95	0.96	0.98

* significant at 10%; ** at 5%; *** at 1%. Standard errors in parentheses, robust to heteroskedasticity. "Agricultural Connections" is the number of agricultural units connected to the electricity network per 1000 people. "Log Manufacturing Output" is the log of real per capita manufacturing output. "Groundwater" is the proportion of state area covered with aquifers thicker than 150 mts. "Education Expenditure", "Total Credit", "Development Expenditure", "Non Agricultural Rural Credit" are in logs, per capita. "Rural population" and "Literacy" are shares of total population and "Population Density" is population (in 1000s) per square kilometer. "Labor Regulation" is taken from Besley and Burgess (2004). All "Chief Minister" variables are dummies equal to 1 if the chief minister belongs to the parties mentioned. All "Initial" variables are measured in 1965. "Roads" is surfaced state roads (in kms) indexed by population density. F-test: Staiger and Stocks (1997) rule of thumb is that instruments are weak if the first-stage F is less than 10, the Stock-Yogo Weak ID test critical value for 2SLS bias being less than 10% of OLS bias is 16.38. All data are for 1965-1984.

Table A.7: First Stage - Table 7: Industry Composition

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Log Manufacturing Output				
				IV using Groundwater * Time Trend				
	Registered Sector	Unregistered Sector	High Electricity	Low Electricity	Food Sector	No Food	High Water Use	Low Water Use
Agricultural Connections	0.052	0.001	0.212	0.125	0.093	0.141	0.088	0.136
	(0.015)***	(0.014)	(0.069)***	(0.037)***	(0.031)***	(0.046)***	(0.048)*	(0.038)***
First Stage				Agricultural Connections				
Groundwater	0.735	0.735	0.745	0.745	0.745	0.745	0.745	0.745
* Time Trend	(0.101)***	(0.101)***	(0.157)***	(0.157)***	(0.157)***	(0.157)***	(0.157)***	(0.157)***
Education Expenditure	-0.841	-0.841	0.241	0.241	0.241	0.241	0.241	0.241
	(0.993)	(0.993)	(0.638)	(0.638)	(0.638)	(0.638)	(0.638)	(0.638)
Rural Population	-214.1	-214.1	-154.9	-154.9	-154.9	-154.9	-154.9	-154.9
	(19.78)***	(19.78)***	(20.45)***	(20.45)***	(20.45)***	(20.45)***	(20.45)***	(20.45)***
Population Density	-15.28	-15.28	-35.18	-35.18	-35.18	-35.18	-35.18	-35.18
	(5.943)**	(5.943)**	(9.055)***	(9.055)***	(9.055)***	(9.055)***	(9.055)***	(9.055)***
Total Credit	-0.356	-0.356	-0.293	-0.293	-0.293	-0.293	-0.293	-0.293
	(0.430)	(0.430)	(0.573)	(0.573)	(0.573)	(0.573)	(0.573)	(0.573)
First Stage F-Test	79.01	79.01	22.52	22.52	22.52	22.52	22.52	22.52
R-square	0.95	0.95	0.98	0.98	0.98	0.98	0.98	0.98

* significant at 10%; ** at 5%; *** at 1%. Standard errors in parentheses, robust to heteroskedasticity. Results are robust to different degrees of autocorrelation. All regressions include state and year fixed effects. "Agricultural Connections" is the number of agricultural units connected to the electricity network per 1000 people. "Groundwater" is the proportion of state area covered with aquifers thicker than 150 mts. "Registered sector" includes factories with more than 10 workers and power or more than 20 workers without power. "Electricity Use" and "Water Use" are high if the input use is above median for all Indian industries and low otherwise. Controls are as in Table 3. For columns (3)-(8) the coefficient of "Groundwater * Time Trend" in the First Stage is 0.745, with a standard error of 0.157. Stock-Yogo Weak ID test critical value for 2SLS bias being less than 10% of OLS bias is 16.38. Data is 1965-1984 for columns (1) and (2) and 1973-84 for all other columns.

Table A.8: First Stage - Table 8: Mechanisms: small sector, factories and wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Value Added		Factories	Fixed Capital		Manufacturing Wage	
	All	Small Sector		All	Small Sector	Real	Nominal
			IV using Groundwater * Time Trend				
Agricultural Connections	0.045	0.016	0.005	0.214	0.062	0.001	0.002
	(0.016)***	(0.007)**	(0.002)**	(0.046)***	(0.006)***	(0.001)	(0.009)
First Stage			Agricultural Connections				
Groundwater	0.735	0.559	0.764	0.620	0.659	0.735	0.735
* Time Trend	(0.101)***	(0.098)***	(0.078)***	(0.121)***	(0.158)***	(0.101)***	(0.101)***
Education Expenditure	-0.841	-1.269	-0.862	-2.740	-1.486	-0.841	-0.841
	(0.993)	(0.797)	(0.966)	(0.608)***	(0.747)**	(0.993)	(0.993)
Rural Population	-214.1	-165.9	-223.9	-209.4	-164.8	-214.1	-214.1
	(19.78)***	(20.41)***	(20.45)***	(21.60)***	(18.64)***	(19.78)***	(19.78)***
Population Density	-15.28	-14.05	-12.06	-11.06	-23.29	-15.28	-15.28
	(5.943)**	(8.595)*	(5.960)**	(5.945)*	(7.187)***	(5.943)**	(5.943)**
Total Credit	-0.356	-0.055	-0.344	-0.701	-0.454	-0.356	-0.356
	(0.430)	(0.509)	(0.438)	(0.462)	(0.542)	(0.430)	(0.430)
First Stage F-Test	79.01	32.49	47.75	26.33	17.41	79.01	79.01
R-square	0.95	0.97	0.95	0.95	0.96	0.95	0.95

* significant at 10%; ** at 5%; *** at 1%. Standard errors in parentheses, robust to heteroskedasticity. Results are robust to different degrees of autocorrelation. All regressions include state and year fixed effects. "Agricultural Connections" is the number of agricultural units connected to the electricity network per 1000 people. "Groundwater" is the proportion of state area covered with aquifers thicker than 150 mts. "Fixed Capital" and "Value Added" are per capita for the manufacturing sector. All outcome variables are in real terms and per capita. "Small sector" are factories in the 'registered sector' with less than 50 workers using power or more than 50 and less than 100 workers without power. "Wages" are log of wages for workers in the manufacturing sector. In all cases, the coefficient of "Groundwater * Time Trend" in the First Stage is significant at the 0.1% level.