

Appendix to:
The Economic Impacts of Climate Change:
Evidence from Agricultural Profits and Random Fluctuations in Weather*

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Additional Tables

Appendix Table 1: Deviations of Growing Season Degree-Days and Precipitation From Normals

<u>A. Removed Year Effects</u>								
		<u>Proportion of Counties with Degree Days Below/Above Average (Degrees):</u>						
Degree Days	±200	±400	±600	±800	±1000	±1200	±1400	±1600
1987	0.477	0.231	0.122	0.069	0.045	0.024	0.015	0.006
1992	0.531	0.302	0.203	0.123	0.049	0.023	0.008	0.004
1997	0.426	0.173	0.084	0.046	0.027	0.012	0.008	0.003
2002	0.572	0.340	0.256	0.187	0.099	0.042	0.019	0.010
		<u>Proportion of Counties with Precipitations Below/Above Average (Inches):</u>						
Total Precipitation	±0.5	±1.0	±1.5	±2.0	±2.5	±3.0	±3.5	±4.0
1987	0.856	0.715	0.572	0.455	0.345	0.255	0.189	0.148
1992	0.828	0.653	0.506	0.391	0.310	0.239	0.178	0.121
1997	0.849	0.697	0.552	0.420	0.314	0.230	0.163	0.119
2002	0.845	0.702	0.561	0.450	0.351	0.281	0.217	0.161
<u>B. Removed State*Year Effects</u>								
		<u>Proportion of Counties with Degree Days Below/Above Average (Degrees):</u>						
Degree Days	±200	±400	±600	±800	±1000	±1200	±1400	±1600
1987	0.458	0.206	0.112	0.068	0.043	0.024	0.011	0.005
1992	0.512	0.279	0.175	0.103	0.049	0.019	0.009	0.004
1997	0.388	0.147	0.076	0.044	0.023	0.011	0.005	0.002
2002	0.559	0.348	0.239	0.156	0.082	0.034	0.016	0.008
		<u>Proportion of Counties with Precipitations Below/Above Average (Inches):</u>						
Total Precipitation	±0.5	±1.0	±1.5	±2.0	±2.5	±3.0	±3.5	±4.0
1987	0.814	0.635	0.482	0.363	0.263	0.187	0.130	0.092
1992	0.810	0.626	0.468	0.347	0.244	0.173	0.123	0.085
1997	0.805	0.607	0.464	0.331	0.237	0.164	0.111	0.080
2002	0.793	0.624	0.482	0.371	0.276	0.201	0.149	0.104

Note: All statistics are weighted by acres of farmland. Panel A reports on the magnitude of the deviations between counties' yearly weather realizations and their long run averages after subtracting the deviation between the national average weather realization and the national long run average. The entries report the fraction of counties with deviations at least as large as the one reported in the column heading. For example, consider the 2002 degree-days row, it indicates that 57%, 19%, and 2% of counties had deviations larger than 200, 800, and 1,400 degree days, respectively. Panel B repeats this exercise after subtracting the deviation between a states' yearly weather realization and the states' long run average (rather than the national deviation).

Appendix Table 2: Sample Means by Quartiles of Temperature Normals

Quartile	January Temperature Normals					April Temperature Normals				
	1	2	3	4	F-Stat	1	2	3	4	F-Stat
<u>Farmland values (\$1/ac):</u>										
Value of Land/Bldg	1,196.9	1,518.2	1,403.3	1,889.5	20.7	1,040.5	1,733.5	1,802.0	1,570.1	52.6
<u>Soil Characteristics:</u>										
K Factor	0.30	0.33	0.33	0.28	39.3	0.30	0.32	0.33	0.29	23.9
Slope Length	247.9	235.2	210.4	316.0	6.9	266.5	234.2	278.3	225.1	4.0
Fraction Flood-Prone	0.10	0.14	0.19	0.19	14.3	0.11	0.13	0.20	0.18	12.4
Fraction Sand	0.04	0.02	0.02	0.16	31.5	0.03	0.04	0.02	0.16	29.5
Fraction Clay	0.21	0.16	0.20	0.36	28.5	0.19	0.19	0.22	0.34	15.4
Fraction Irrigated	0.03	0.07	0.06	0.09	12.8	0.04	0.07	0.08	0.06	6.7
Permeability	2.24	1.92	2.05	3.51	20.0	2.13	2.12	2.04	3.55	17.6
Moisture Capacity	0.18	0.19	0.17	0.14	145.0	0.18	0.19	0.17	0.14	88.5
Wetlands	0.07	0.04	0.04	0.11	43.3	0.07	0.03	0.04	0.12	55.7
Salinity	0.05	0.02	0.01	0.03	12.1	0.05	0.02	0.02	0.02	14.4
<u>Socioeconomic and Locational Attributes:</u>										
Pop Density	33.0	65.4	50.5	95.1	17.9	28.1	67.8	84.8	72.4	27.4
Per Capita Income	16,573	16,755	15,136	15,280	15.4	16,432	16,648	16,193	14,525	20.8

Quartile	July Temperature Normals					October Temperature Normals				
	1	2	3	4	F-Stat	1	2	3	4	F-Stat
<u>Farmland values (\$1/ac):</u>										
Value of Land/Bldg	1,120.0	1,775.6	1,606.9	1,506.0	26.0	1,018.5	1,816.8	1,653.9	1,728.5	60.3
<u>Soil Characteristics:</u>										
K Factor	0.32	0.30	0.32	0.30	13.8	0.31	0.31	0.33	0.29	20.2
Slope Length	280.5	245.5	255.6	218.9	5.0	270.5	218.0	230.5	275.0	9.8
Fraction Flood-Prone	0.12	0.13	0.17	0.19	7.1	0.11	0.14	0.17	0.20	12.3
Fraction Sand	0.03	0.05	0.03	0.14	23.9	0.03	0.04	0.03	0.15	24.1
Fraction Clay	0.18	0.21	0.21	0.33	16.1	0.18	0.20	0.20	0.35	22.8
Fraction Irrigated	0.05	0.06	0.07	0.06	3.4	0.04	0.06	0.06	0.08	6.0
Permeability	2.05	2.34	2.04	3.28	15.8	2.14	2.09	2.11	3.43	15.2
Moisture Capacity	0.17	0.18	0.18	0.15	63.6	0.18	0.19	0.17	0.14	81.4
Wetlands	0.06	0.05	0.05	0.10	23.4	0.07	0.04	0.04	0.11	41.4
Salinity	0.05	0.04	0.01	0.02	13.7	0.05	0.01	0.01	0.02	16.8
<u>Socioeconomic and Locational Attributes:</u>										
Pop Density	30.2	84.3	59.4	67.6	21.3	21.0	83.5	62.5	92.2	50.2
Per Capita Income	16,583	16,483	16,118	14,741	17.8	16,319	16,813	15,989	14,857	12.7

Notes: All dollar figures in 2002 constant dollars. The entries report the results of weighted regressions where the dependent variable is noted in the row headings and the weight is the square root of the acres of farmland. The entries are the parameter estimates from dummy variables for quartiles of the relevant climate normal, so they report the mean of each variable by quartile. Climate normals are defined as the 1970-2000 average of temperature and precipitation, by county. The F-statistics are from tests of equality of the means across the quartiles. The regressions are fit with data from the 1978, 1982, 1987, 1992, 1997, and 2002 Censuses, so they adjust for year fixed effects to account for national differences across years. The variance-covariance matrix allows for a county-specific variance component. See the text for further details.

Appendix Table 3: Sample Means by Quartiles of Precipitation Normals

Quartile	January Precipitation Normals					April Precipitation Normals				
	1	2	3	4	F-Stat	1	2	3	4	F-Stat
<u>Farmland values (\$1/ac):</u>										
Value of Land/Bldg	914.3	1,708.4	2,366.4	2,228.5	217.2	1,026.7	1,717.3	2,335.8	1,962.7	148.9
<u>Soil Characteristics:</u>										
K Factor	0.30	0.32	0.32	0.29	15.0	0.31	0.29	0.31	0.35	90.7
Slope Length	261.3	258.4	244.9	209.6	3.2	312.0	195.9	189.4	164.7	46.1
Fraction Flood-Prone	0.12	0.15	0.19	0.22	12.6	0.13	0.12	0.13	0.27	35.1
Fraction Sand	0.03	0.06	0.06	0.18	29.3	0.05	0.11	0.07	0.02	42.5
Fraction Clay	0.26	0.21	0.18	0.19	6.3	0.23	0.27	0.20	0.16	11.8
Fraction Irrigated	0.05	0.05	0.08	0.08	4.5	0.08	0.05	0.02	0.05	40.1
Permeability	2.13	2.28	2.59	3.65	18.9	2.32	2.99	2.52	1.75	28.3
Moisture Capacity	0.18	0.18	0.16	0.15	50.3	0.17	0.17	0.18	0.18	19.8
Wetlands	0.04	0.06	0.08	0.17	73.2	0.04	0.09	0.09	0.10	49.8
Salinity	0.04	0.02	0.01	0.01	25.7	0.05	0.01	0.00	0.00	45.7
<u>Socioeconomic and Locational Attributes:</u>										
Pop Density	13.4	80.8	139.2	101.2	94.9	24.9	72.3	138.2	85.5	62.1
Per Capita Income	16,087	16,236	16,364	14,976	8.0	15,963	16,670	16,940	14,340	64.9

Quartile	July Precipitation Normals					October Precipitation Normals				
	1	2	3	4	F-Stat	1	2	3	4	F-Stat
<u>Farmland values (\$1/ac):</u>										
Value of Land/Bldg	1,115.4	1,402.6	2,233.6	2,166.2	139.5	1,030.7	1,994.9	1,957.2	1,926.8	110.7
<u>Soil Characteristics:</u>										
K Factor	0.32	0.30	0.32	0.25	38.6	0.31	0.29	0.30	0.33	25.2
Slope Length	325.6	194.2	185.6	161.4	53.9	309.6	210.5	181.3	169.1	44.3
Fraction Flood-Prone	0.16	0.14	0.16	0.12	3.9	0.14	0.08	0.16	0.24	52.5
Fraction Sand	0.03	0.04	0.03	0.28	45.3	0.03	0.11	0.11	0.04	26.3
Fraction Clay	0.29	0.17	0.21	0.10	35.2	0.22	0.25	0.15	0.29	14.6
Fraction Irrigated	0.07	0.06	0.02	0.04	18.7	0.08	0.02	0.02	0.05	29.0
Permeability	1.93	2.36	1.89	5.23	49.6	2.14	2.89	3.03	2.15	12.6
Moisture Capacity	0.16	0.19	0.19	0.15	122.7	0.17	0.18	0.16	0.16	12.6
Wetlands	0.03	0.07	0.10	0.17	143.7	0.04	0.09	0.10	0.11	80.5
Salinity	0.05	0.02	0.00	0.00	46.7	0.05	0.01	0.01	0.01	35.1
<u>Socioeconomic and Locational Attributes:</u>										
Pop Density	33.6	51.0	117.0	104.8	47.3	21.2	97.0	99.9	102.6	67.8
Per Capita Income	15,835	16,391	16,665	15,260	11.0	16,299	16,300	15,415	15,370	8.1

Notes: All dollar figures in 2002 constant dollars. The entries report the results of weighted regressions where the dependent variable is noted in the row headings and the weight is the square root of the acres of farmland. The entries are the parameter estimates from dummy variables for quartiles of the relevant climate normal, so they report the mean of each variable by quartile. Climate normals are defined as the 1970-2000 average of temperature and precipitation, by county. The F-statistics are from tests of equality of the means across the quartiles. The regressions are fit with data from the 1978, 1982, 1987, 1992, 1997, and 2002 Censuses, so they adjust for year fixed effects to account for national differences across years. The variance-covariance matrix allows for a county-specific variance component. See the text for further details.

Appendix Table 4: Fixed-Effects Estimates of Agricultural Profit Models and Hypothesis Tests

	(1)	(2)	(3)	(4)
<u>Non-irrigated counties:</u>				
Growing Season Degree-Days	-0.00295560 (0.00215640)	-0.00293180 (0.00216900)	0.00236230 (0.00201700)	0.00292280 (0.00200150)
Growing Season Degree-Days Squared	0.00000020 (0.00000033)	0.00000018 (0.00000033)	-0.00000015 (0.00000031)	-0.00000023 (0.00000031)
Growing Season Total Precipitation	-0.46070710 (0.41975300)	-0.45038850 (0.42017730)	0.01624210 (0.46391920)	0.03287530 (0.47133400)
Growing Season Total Precipitation Squared	0.00243360 (0.00975000)	0.00230540 (0.00973340)	0.00360220 (0.01084080)	0.00331670 (0.01095420)
<u>Irrigated counties:</u>				
Growing Season Degree-Days	-0.01159260 (0.00877660)	-0.01169860 (0.00879800)	-0.00366090 (0.00801680)	-0.00368220 (0.00800660)
Growing Season Degree-Days Squared	0.00000123 (0.00000141)	0.00000125 (0.00000142)	0.00000020 (0.00000129)	0.00000019 (0.00000129)
Growing Season Total Precipitation	0.63382370 (1.29355200)	0.77529660 (1.30510900)	1.75161400 (1.31468900)	1.84390400 (1.32800800)
Growing Season Total Precipitation Squared	0.00074260 (0.03620790)	-0.00378570 (0.03658910)	-0.01862300 (0.03677150)	-0.02049190 (0.03718890)
<u>P-Values from Tests of Equality of Marginal Effects by Irrigation Status:</u>				
Degree Days	0.165	0.173	0.054	0.047
Total Precip	0.012	0.012	0.009	0.007
<u>P-Values from Tests that Listed Variables are Jointly Equal to Zero:</u>				
Soil Characteristics:	---	0.162	---	0.542
County Fixed Effects	0.001	0.001	0.001	0.001
Year Fixed Effects	0.001	0.001	---	---
State by Year Fixed Effects	---	---	0.001	0.001
Soil Controls	No	Yes	No	Yes
County Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	No	No
State*Year Fixed Effects	No	No	Yes	Yes

Notes: All dollar figures in 2002 constant dollars. The entries in the first panel are the result of the estimation of version of equation (4) for agricultural profits that model the growing season degree-days and total precipitation with quadratics. The second and third panels report p-values from F-tests that subsets of the variables are jointly equal to zero. The controls are listed in the row headings at the bottom of the table. See the text for further details.