

Table A12 – continued...

Table A12: Overview of 34 studies on the effect of rainfall on turnout – additional information

Source	County	Election	Time frame	Design details	Effect of rain on turnout
Merrifield (1993)	United States	General election (off-year)	1982	State level turnout linked to rain in state's largest city on Election Day. Linear model with a range of state aggregated SES and institutional controls.	-2.36*** percentage points per centimeter.
Knack (1994)	United States	Presidential	1984, 1988	ANES survey combined with individual validated turnout linked to weather at county level. Logit maximum-likelihood model and linear model with a range of individual SES and institutional controls.	Insignificant: -4.79 percentage points per centimeter.
Knack (1994)	United States	House	1986	<i>See above</i>	Insignificant: 0.40 percentage points per centimeter.
Shachar & Nalebuff (1999)	United States	Presidential	1948-1988	State-level turnout linked to state weather. Linear model with a few state-aggregated SES and institutional controls, most importantly closeness of the race.	-1.37*** percentage points per centimeter.
Gatrell & Bierly (2002)	United States (Kentucky)	Presidential, gubernatorial, state legislature	1990-2000	County-level turnout linked to weather stations in the county. OLS model with election, year, and county fixed effects as indirect control for SES. Additional control for race competitiveness, urban/rural, and temperature.	Not possible to calculate due to a somewhat opaque interaction model. Claims a negative significant effect of rain on turnout.
Lakhdar & Dubois (2006)	France	Parliament (first round)	1986, 1988, 1993, 1997, 2002	County-level (departments) linked to weather stations. Linear auxiliary regressions adjusted for rain trends and average weather. Controls for unemployment and temperature at county-level. Fixed effects for county.	-1.5* percentage point per centimeter.
Gomez et al. (2007)	United States	Presidential	1948-2000	County-level turnout linked to weather stations. Linear model with a range of aggregated county SES and institutional controls. Uses relative rainfall, lagged county turnout control, and year and election dummies. Maximum-likelihood random effects linear model. Most cited study.	-0.33** percentage points per centimeter.
Horiuchi & Saito (2009)	Japan	Parliament	1990-2000	Municipal-level turnout linked to local weather stations transformed to a dummy of at least 3 mm rain on election day. Municipality and year fixed effects. Main part is an instrumental variable regression to understand policy outcomes.	Reports a negative significant dummy variable for rain.
Fraga & Hersh (2010)	United States	Presidential	1948-2000	County-level turnout linked to weather stations. Linear model with a range of aggregated county SES and institutional controls (incl. average weather). Lagged county turnout, year and election dummies. Matching applied (CEM) between control- and treatment group	-0.26** percentage points per centimeter. Stronger in uncompetitive states compared to competitive states, where is there is a slightly positive effect of rainfall.
Hansford & Gomez (2010)	United States	Presidential	1948-2000	Aggregate (county), OLS. Their focus is on weather as IV for the effect of parties' supports. We only report the first stage. 2,000 non-Southern counties in the continental	-0.40* percentage points per centimeter.

Table A12 – continued...

				US. Controls for normal weather via link to weather stations. Main variable is deviation from normal weather. Fixed effects for counties and election years are included in all models.	
Eisinga et al. (2012)	The Netherlands	Parliament	1971-2010	Municipality-level, nearest weather station to municipality, linear model with a minimum of aggregated municipal SES controls. Fixed effect for municipality, maximum likelihood hierarchical linear model	-0.41*** percentage points per centimeter.
Steinbrecher (2013)	Germany	Parliament	1994-2009	GNES survey, individual (non-validated) turnout linked to weather stations in their constituency. Logit model with few individual-level SES controls and cluster-robust standard error by election.	Insignificant. Logit model makes it not comparable.
Artés (2014)	Spain	Parliament	1986-2011	Municipality-level turnout linked to weather stations. Linear OLS model with a few aggregated municipality SES controls. Fixed effect for year. Clustered standard error by municipality.	-0.53** percentage points per centimeter.
Lo Prete & Revelli	Italy	Multiple	2001-2010	Municipality-level, instrumental variables regression study. We report the first stage only.	Significant positive effect of dummy rainfall on turnout
Persson et al. (2014)	Sweden	Parliament	1976-2010	Municipality-level turnout linked to weather stations in municipality. Linear model with a few aggregated municipality SES controls. Fixed effect for municipality. Robust standard errors.	Insignificant: -0.1 percentage points per centimeter.
Persson et al. (2014)	Sweden	Parliament	1991-2006	SNES survey, individual validated turnout linked to weather stations. Range of registry-based SES controls. Linear multi-level models with year fixed effects.	Insignificant: -0.23 percentage points per centimeter.
Persson et al. (2014)	Sweden	Parliament	2002-2010	Registry-based individual turnout (sample based on survey) linked to weather stations. Range of register based SES controls. Logit with year fixed effects and robust standard errors.	Insignificant: -0.08 percentage points per centimeter.
Sforza (2014)	Italy	Parliament	2008, 2013	Municipality-level turnout in national elections. Linked to weather stations in each municipality. OLS model with set of municipality-aggregated controls and regional fixed effects. Uses dummy for rain or not.	Impossible to calculate, but the rain dummy variable shows a negative significant effect of rain on turnout.
Arnold & Freier (2016)	Germany (North-Rhine Westphalia)	Municipalities and state	1975-2010	Municipality level, linked to weather stations to municipal, Linear model with a few aggregated municipality SES controls. Fixed effect for year and municipality. OLS with fixed effects (robust standard errors)	-1.20*** percentage points per centimeter.
Fujiwara et al. (2016)	United States	Presidential	1952-2012	County level, linked to weather stations. Linear model with a few of aggregated county SES. County and year fixed effects. Adjust for trend in rainfall on the county level over time. Clustered standard error on the state level.	-0.55 ** percentage points per centimeter.
Chen (2017)	Taiwan	Parliament	1998-2012	County-level turnout linked to weather stations in the county. Linear model with a few aggregated	-1.59** percentage points per centimeter.

Table A12 – continued...

				county SES controls. Controls for normal weather in county. Fixed effect for year. OLS with fixed effects and clustered standard error by county.	
Cooperman (2017)	United States	Presidential	1948-2000	County-level turnout linked to weather stations. Linear model. Uses standardized precipitation index that takes into account the clustered and historical dependent nature of weather across countries.	Insignificant: applies a rain index.
Horiuchi & Kang (2017)	United States	Presidential	1948-2000	County-level turnout linked to weather stations in county. Logit model with a range of aggregated county SES and institutional controls. Uses relative rainfall, lagged county turnout, and year and election dummies. Seemingly unrelated regressions (SUR) guarantee that party votes shares and abstainer sums to eligible voters. Logit model with bootstrapped standard errors.	-0.44** percentage points per centimeter.
Lee & Hwang (2017)	South Korea	Parliament and municipality	1995-1999	Municipality-level turnout linked to weather stations in municipality. Linear model with a few aggregated municipality SES, seasonal, and institutional controls. OLS with robust standard errors.	-2.17* percentage points per centimeter.
Arnold (2018)	Germany (Bavaria)	Municipalities (first-past-the-post system for mayor)	1946-2009	Municipality-level turnout linked to weather stations in municipality. Linear model with a few aggregated municipality SES controls. Fixed effect for municipality. OLS with fixed effects and robust standard errors.	-1.00*** percentage points per centimeter. Insignificant in competitive races.
Stockemer & Wigginton (2018)	Canada	Parliament	2004-2015	Electoral districts linked to weather stations. OLS regression including control for a few district-level aggregated SES, average temperatures, and closeness of the race. Fixed effect for district and year.	-1.13*** percentage points per centimeter.
Kang (2019)	South Korea	Parliament	2000, 2004, 2008, 2012	Electoral district-level turnout linked to weather stations. OLS regression including fixed effects for district and year. Control for a few districts level aggregated SES and closeness of the race.	Insignificant main effect, but a negative significant dummy variable for rain is reported.
Leslie & Ari (2018)	UK	Referendum (Brexit)	2016	Aggregate constituency-level turnout linked to weather stations. OLS regression including controls for previous turnout, vote share for UKIP, labor market statistics. County fixed effects for OLS models. The reported effect (model 4) applies weights (no fixed effects) and control for sociodemographics.	-0.90** percentage points per centimeter rain.
Gavazza et al. (2019)	UK	Municipal	2006-2010	Aggregated (district/ward) turnout linked to rain from local weather stations. OLS regression with control for aggregated SES. Uses log-transformation of rainfall. Becomes insignificant with control for municipality fixed effects.	0.07** percentage points per centimeter.
Meier et al. (2019)	Switzerland	Direct democratic votes	1958-2014	Direct democratic votes on policy proposals, municipality-level, primary focus on rainfall and yes/no vote, proposal and municipality FEs	Significant negative dummy variable for rain is reported.

Table A12 – continued...

Rudolph (2019)	UK	Referendum (Brexit)	2016	Electoral district-level turnout linked to weather stations. OLS regression including controls for a few district-level aggregated SES and vote share of UKIP.	-0.59** percentage points per centimeter.
Garcia-Rodriguez & Redmond (2020)	Ireland	Parliament (lower house)	1989-2016	Constituency-level turnout linked to weather stations in county. Linear model with fixed effect for year. Rainfall weighted by constituency population. OLS interaction model with fixed effects (clustered standard error by constituency). Range of SES used as controls.	-0.51** percentage points per centimeter.
Lind (2020)	Norway	Municipal	1972-2010	Municipality-level turnout linked to weather stations in municipality. Linear model with aggregated municipality SES controls, spatiotemporal trends, and average September rainfall control. Fixed effects for municipality and year. OLS with fixed effects and clustered standard error by municipality, region, and year.	0.00339*** percentage points per centimeter.
<i>The present study</i>	Denmark	Municipal	2013-2017	Individual-level registry-based validated turnout. Pooled and two-way fixed effects panel design plus some additional controls. OLS with fixed effects and cluster-robust standard errors.	-0.95* percentage points per centimeter.

Notes: All effect sizes are expressed in centimeters. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.