When the election rains out and how bad weather excludes marginal voters from turning out

MPSA 2022

Søren Damsbo-Svendsen
sdas@ifs.ku.dk

Kasper Møller Hansen
kmh@ifs.ku.dk

Department of Political Science
University of Copenhagen

08 April 2022

When the election rains out and how bad weather excludes marginal voters from turning out

Søren Damsbo-Svendsen* and Kasper M. Hansen**

*Department of Political Science, University of Copenhagen, sdas@ifs.ku.dk
**Department of Political Science, University of Copenhagen, kmh@ifs.ku.dk, kaspermhansen.eu

March 23, 2022
Prepared for presentation at the 2022 Annual MPSA Conference

Abstract
Ostensibly random and trivial experiences of everyday life like those related to local weather can have significant political consequences. In the context of democratic elections, there is conflicting evidence about whether bad weather on Election Day depresses voter turnout by raising the cost of going to the polls. We first present a meta-analysis of the 33 studies of rainfall and electoral turnout and show that the average effect is -0.76 percentage points per centimeter of rainfall. Secondly, we present our own study, which is the first to use individual-level time series of validated turnout for a complete electorate merged with fine-grained meteorological observations. We show that poor weather does in fact reduce turnout by -0.84 percentage points per centimeter of rainfall. Importantly, marginal voters – specifically young voters except first-time voters – are up to seven times more susceptible to the negative shock caused by bad weather and also more responsive to pleasant weather (sunshine). These results suggest that bad weather can exacerbate inequalities in democratic participation by pushing low-propensity voters to abstain. The policy implication is that efforts to include marginal voters in the democratic process should be intensified at elections with poor weather and that elections even could be moved to a time of the year with more pleasant Election Day weather.

Keywords: electoral turnout, individual voter panel, weather, climate, marginal voter, cost of voting, participation.

Word count: 8,368

Previous versions of this paper were presented at the 2021 American Political Science Association (APSA) annual meeting in Seattle and the 2021 Danish Political Science Association (DPSA) annual meeting in Vejle. We thank panel participants for comments on the previous versions.

RQ: How does Election Day weather affect voters' decision to turn out for election – and for whom?

- Electoral turnout is a key indicator of health and legitimacy of democracy
- Focus on rainfall: does it reduce turnout?
- *Mechanism:* Cost of voting (and possibly mood)

When the election rains out and how bad weather excludes marginal voters from turning out

Søren Damsbo-Svendsen* and Kasper M. Hansen**

*Department of Political Science, University of Copenhagen, sdas@ifs.ku.dk
**Department of Political Science, University of Copenhagen, kmh@ifs.ku.dk, kaspermhansen.eu

March 23, 2022
Prepared for presentation at the 2022 Annual MPSA Conference

Abstract
Ostensibly random and trivial experiences of everyday life like those related to local weather can have significant political consequences. In the context of democratic elections, there is conflicting evidence about whether bad weather on Election Day depresses voter turnout by raising the cost of going to the polls. We first present a meta-analysis of the 33 studies of rainfall and electoral turnout and show that the average effect is -0.76 percentage points per centimeter of rainfall. Secondly, we present our own study, which is the first to use individual-level time series of validated turnout for a complete electorate merged with fine-grained meteorological observations. We show that poor weather does in fact reduce turnout by -0.84 percentage points per centimeter of rainfall. Importantly, marginal voters – specifically young voters except first-time voters – are up to seven times more susceptible to the negative shock caused by bad weather and also more responsive to pleasant weather (sunshine). These results suggest that bad weather can exacerbate inequalities in democratic participation by pushing low-propensity voters to abstain. The policy implication is that efforts to include marginal voters in the democratic process should be intensified at elections with poor weather and that elections even could be moved to a time of the year with more pleasant Election Day weather.

Keywords: electoral turnout, individual voter panel, weather, climate, marginal voter, cost of voting, participation.

Word count: 8,368

Previous versions of this paper were presented at the 2021 American Political Science Association (APSA) annual meeting in Seattle and the 2021 Danish Political Science Association (DPSA) annual meeting in Vejle. We thank panel participants for comments on the previous versions.

First, we did a meta-analysis:

- Rainfall effect
- 33 studies
- Mixed designs and results
- (But) avg. rainfall effect:
  -0.76 %-points per cm

When the election rains out and how bad weather excludes marginal voters from turning out

Søren Damsbo-Svendsen* and Kasper M. Hansen**

*Department of Political Science, University of Copenhagen, sdas@ifs.ku.dk
**Department of Political Science, University of Copenhagen, kmh@ifs.ku.dk, kaspermhansen.eu

March 23, 2022
Prepared for presentation at the 2022 Annual MPSA Conference

Abstract
Ostensibly random and trivial experiences of everyday life like those related to local weather can have significant political consequences. In the context of democratic elections, there is conflicting evidence about whether bad weather on Election Day depresses voter turnout by raising the cost of going to the polls. We first present a meta-analysis of the 33 studies of rainfall and electoral turnout and show that the average effect is -0.76 percentage points per centimeter of rainfall. Secondly, we present our own study, which is the first to use individual-level time series of validated turnout for a complete electorate merged with fine-grained meteorological observations. We show that poor weather does in fact reduce turnout by -0.84 percentage points per centimeter of rainfall. Importantly, marginal voters – specifically young voters except first-time voters – are up to seven times more susceptible to the negative shock caused by bad weather and also more responsive to pleasant weather (sunshine). These results suggest that bad weather can exacerbate inequalities in democratic participation by pushing low-propensity voters to abstain. The policy implication is that efforts to include marginal voters in the democratic process should be intensified at elections with poor weather and that elections even could be moved to a time of the year with more pleasant Election Day weather.

Keywords: electoral turnout, individual voter panel, weather, climate, marginal voter, cost of voting, participation.

Word count: 8,368

Previous versions of this paper were presented at the 2021 American Political Science Association (APSA) annual meeting in Seattle and the 2021 Danish Political Science Association (DPSA) annual meeting in Vejle. We thank panel participants for comments on the previous versions.

Secondly, we did a new stand-alone study with great data:

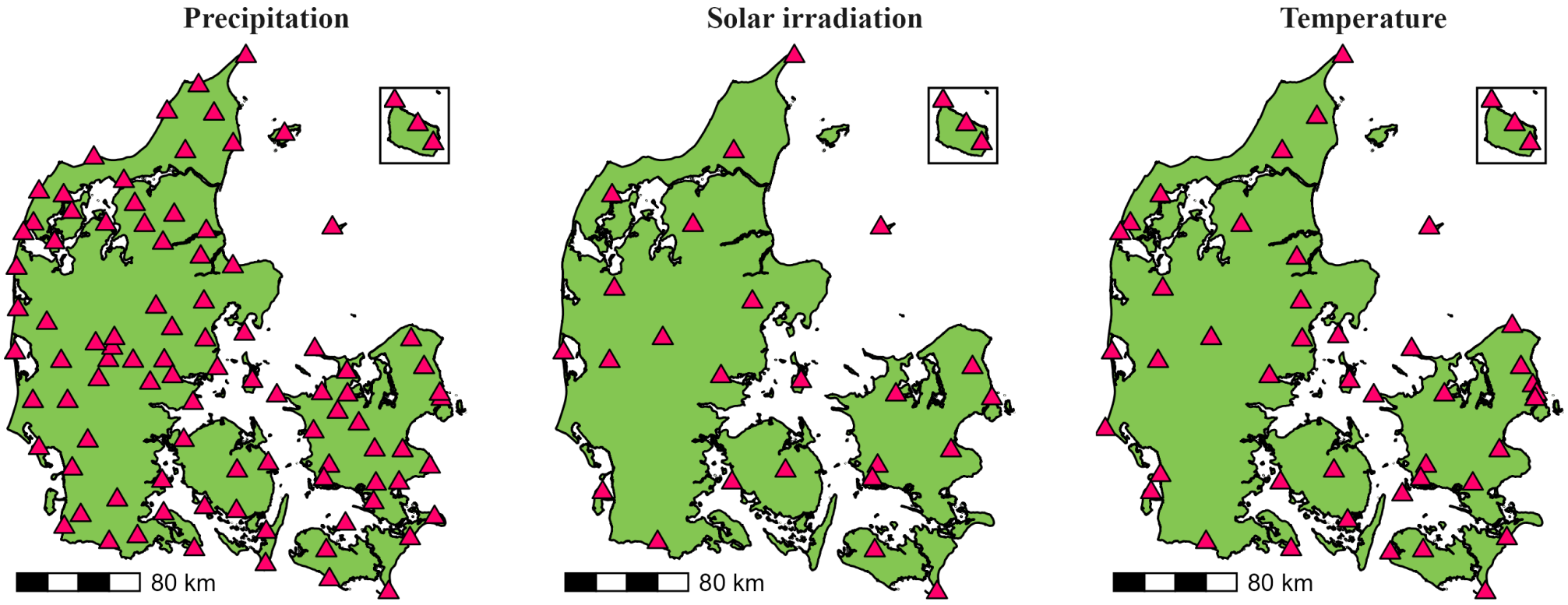
1. Revisit rainfall-turnout thesis
2. Explore other weather variables
3. Nonlinear weather effects
4. Heterogeneous weather effects

Data: turnout records

Individual turnout records for 4,549,145* Danish voters age 18-80

- Validated registry data
  - → high quality
  - [handful of previous studies]
- (Almost) complete electorate
  - → huge N
  - [first study]
- Repeated measurements at 2013 and 2017 local elections
  - → voter panel
  - [first study]

Data: objective weather observations



- Voters' home coordinates matched with 166 weather stations
- Individual weather *triangulated* from three nearest weather stations

Design and models

(1) Pooled model

- Regression of turnout on *rainfall*, *sunshine*, *temperature* with municipality and election FEs
  - cross-sectional variation
  - assumption of (conditional) as-if randomness in assignment of weather

(2) Panel model

- Regression of turnout on *rainfall*, *sunshine*, *temperature* with voter and election FEs (TWFE)
  - within-unit variation over time
  - assumption of no selection into treatment from *time-varying* individual-level factors that shape where one lives
    (i.e., local weather)
  - stronger basis for causal inference, first in the literature

Results

Result I: Negative rainfall effect

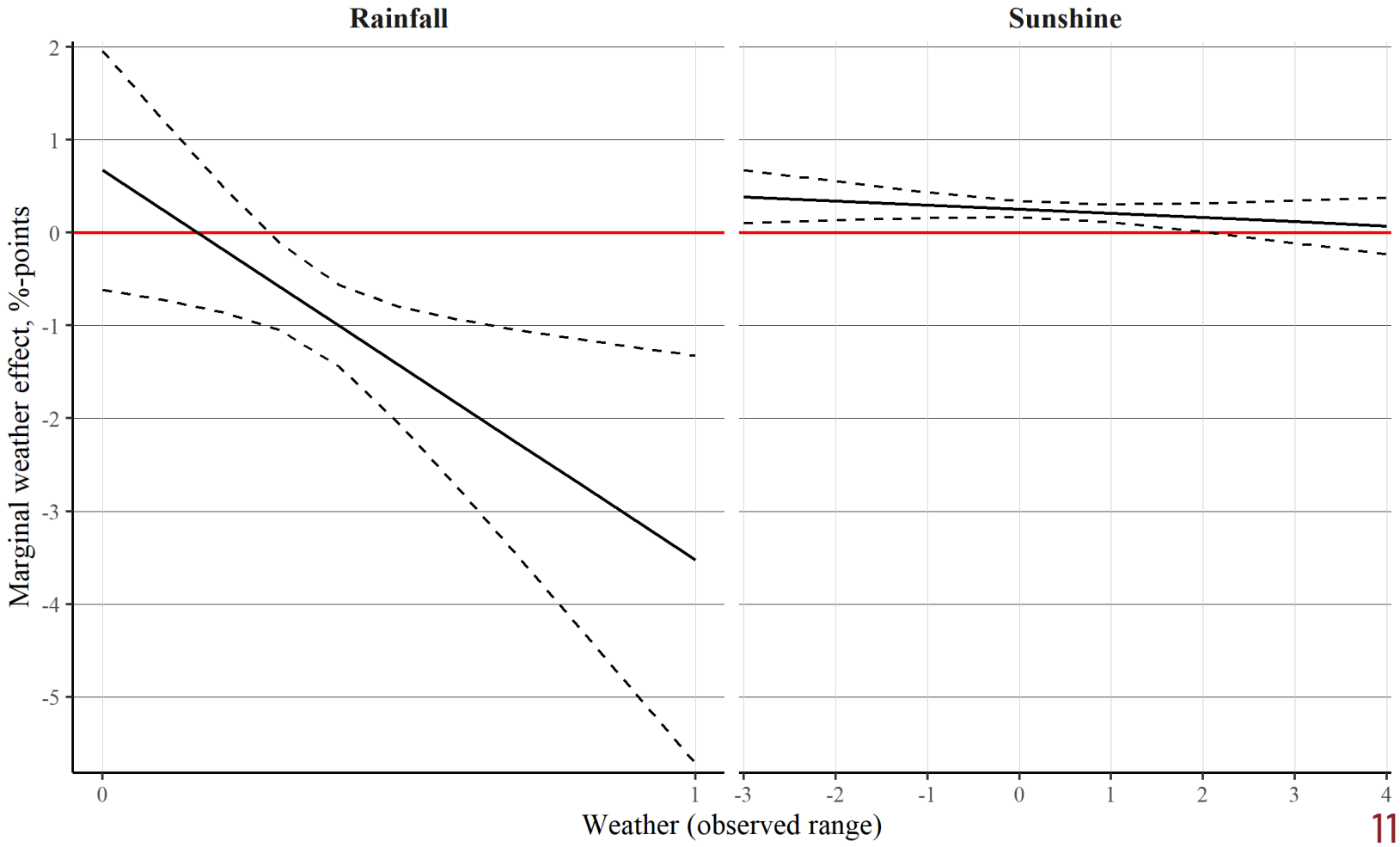
- Rainfall – "bad weather" – reduces probability of voting
- -0.84 %-points per centimeter rain, on average
- Substantial difference between panel model ↑ and pooled model

Result II: Positive sunshine effect

- Sunshine – "nice weather" – also boosts turnout
- 1.52 %-points diff. between max and min observed sunshine

Result III: Nonlinear rainfall effect

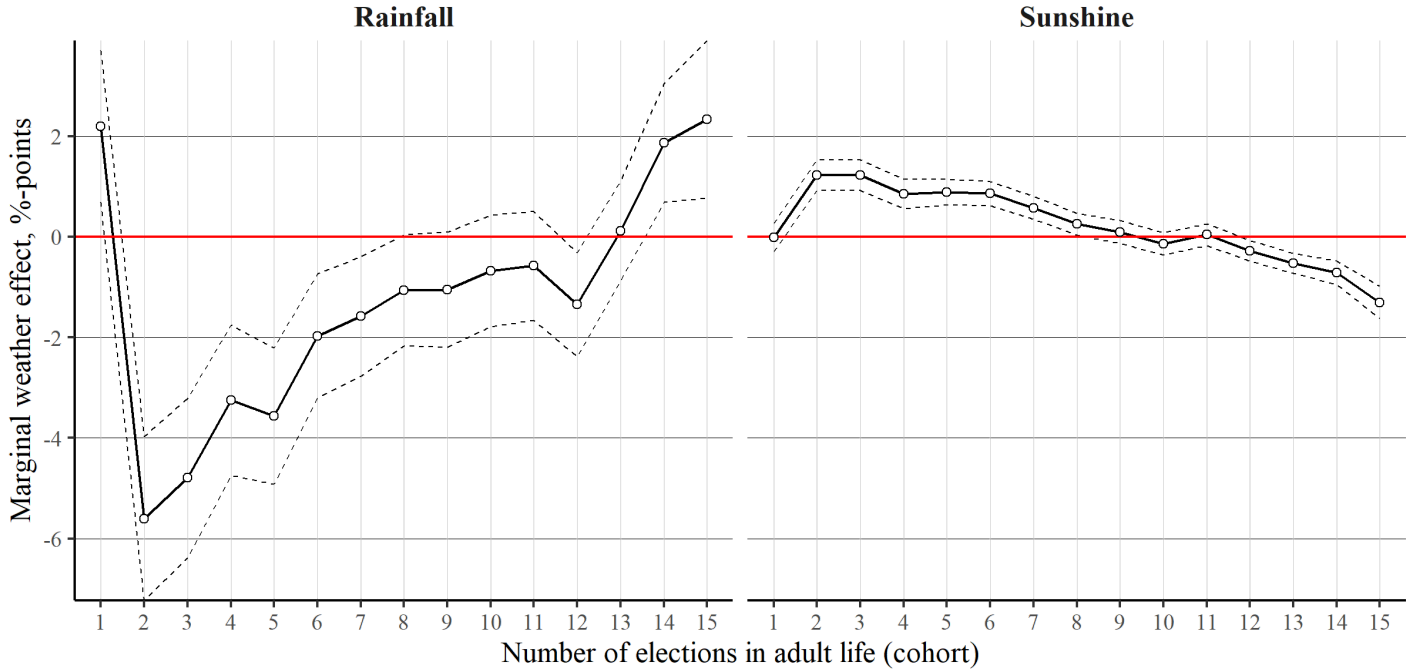
- Rainfall effect increases with more rain
- No effect at zero rain, approx. -3.5 %-points at max
- (Sunshine effect is not nonlinear)



Result IV: Stronger effects on marginal voters

- Important Q → Are marginal voter groups more susceptible?
- Potentially major issue for democratic representation
- We focus on young voters in their twenties who have
  - left their childhood home
  - not yet established a solid voting habit

Result IV: Stronger effects on marginal voters



- Young voters are influenced up to seven times more susceptible by the weather
- No effect on first-time voters in *first cohort*
- Very strong effect on *second and third cohort*

In sum

We revisit the question of how Election Day weather affects turnout with

(a) a meta-analysis of the rainfall-turnout thesis and

(b) a stand-alone study ↓

- rainfall *does* reduce turnout
  - effect comparable to avg in existing literature
  - effect is nonlinear
- sunshine also increases turnout
- marginal voters – young voters without robust turnout habit – are *much more susceptible*

Thanks for the attention

Edward Linsmier–Getty Images 2014, time.com/3554884/2014-election-weather-forecast

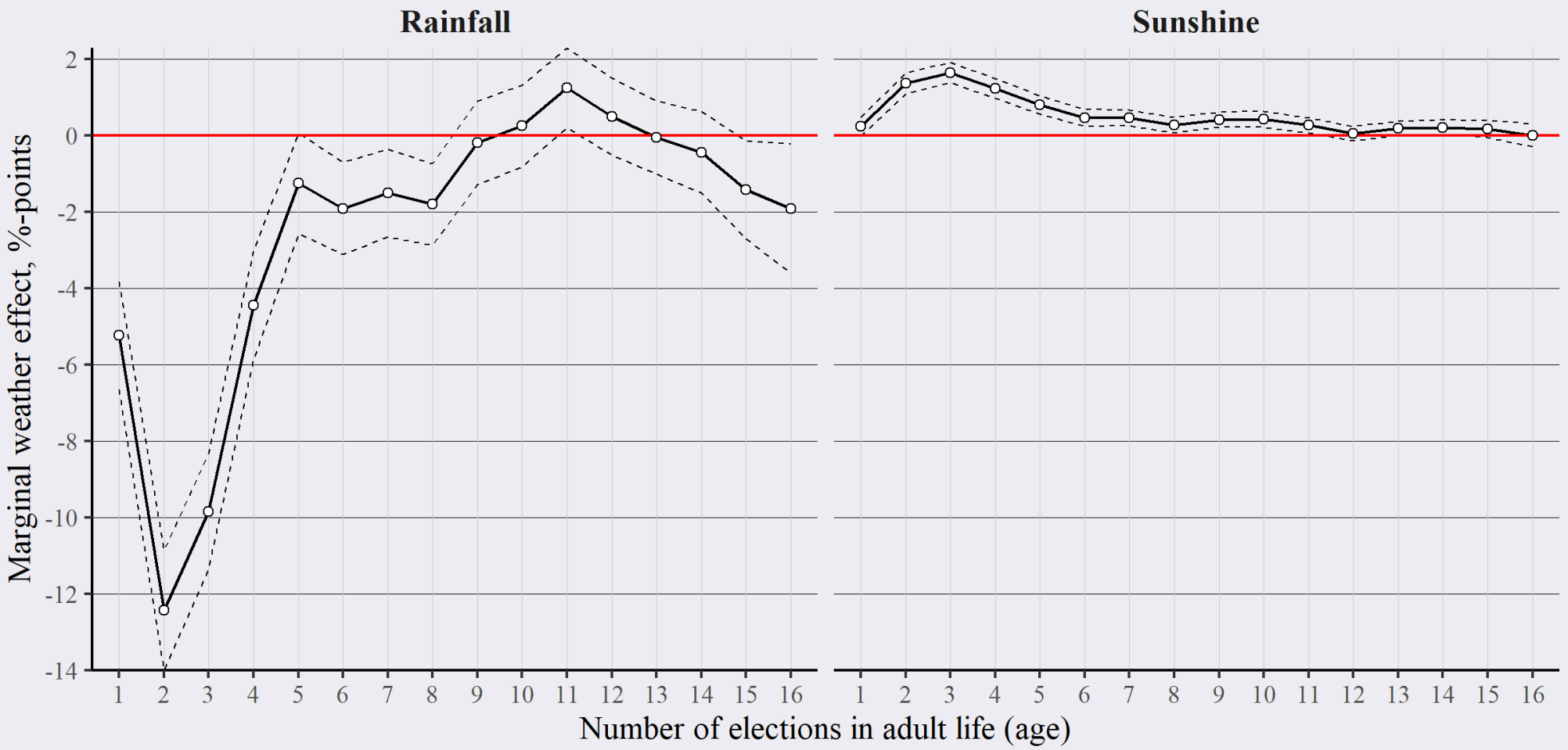

Rainfall
Sunshine
Marginal weather effect, %-points
2
0
-2
-4
-6
-8
-10
-12
-14
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Number of elections in adult life (age)

Table 3: Voting and Election Day Weather

	Pooled model	Panel model
	Voting on Election Day	
	(1) OLS	(2) TWFE
Rainfall (cm)	-0.0225***	-0.0084***
	(0.0030)	(0.0021)
Sunshine (W/m^2 normalized)	0.0045***	0.0028***
	(0.0006)	(0.0004)
Temperature (Celsius)	0.0005	0.0017***
	(0.0004)	(0.0003)
Municipality FEs	+	
Voter FEs		+
Election FEs	+	+
Additional controls	+	+
N observations	7,855,649	7,855,649
N unique voters	4,549,145	4,549,145

Note: Additional controls include age, age^2, age^3, ln(population), close-to-coast dummy, non-western immigrant population share, closeness of the election, and gender (only in the pooled model). Cluster-robust SEs at level of residential addresses in parentheses. ***p<0.001; **p<0.01; *p<0.05.

Table 1: Meta-analysis of 33 studies of the effect of rainfall on voter turnout

Source	Country	Election(s)	Study level	Rainfall-turnout effect (%-points per cm)
Merrifield (1993)	US	General (1982)	Aggregate (state)	-2.36***
Knack (1994), I	US	Presidential (1984-1988)	Individual (survey, validated turnout)	No effect
Knack (1994), II	US	House (1986)	Individual (survey, validated turnout)	No effect
Shachar & Nalebuff (1999), I	US	Presidential (1948-1988)	Aggregate (state)	-1.37***
Shachar & Nalebuff (1999), II	US	Presidential (1948-1988)	Aggregate (state)	-3.17***
Gatrell & Bierly (2002)	US (Kentucky)	Presidential, state, gubernatorial (1990-2000)	Aggregate (county)	IC (negative effect)
Lakhdar & Dubois (2006)	France	Parliamentary (1986-2002)	Aggregate (département)	-1.50*
Gomez et al. (2007)	US	Presidential (1948-2000)	Aggregate (county)	-0.33**
Fraga & Hersh (2010)	US	Presidential (1948-2000)	Aggregate (county)	-0.26**
Hansford & Gomez (2010)	US	Presidential (1948-2000)	Aggregate (county)	-0.40**
Eisinga et al. (2012)	The Netherlands	Parliamentary (1971-2010)	Aggregate (municipality)	-0.41***
Steinbrecher (2013)	Germany	Parliamentary (1994-2009)	Individual (survey)	No effect
Artés (2014)	Spain	Parliamentary (1986-2011)	Aggregate (municipality)	-0.53**
Lo Prete & Revelli (2014)	Italy	Multiple (2001-2010)	Aggregate (city)	IC (positive effect of rainfall dummy)
Persson et al. (2014), I	Sweden	Parliamentary (1976-2010)	Aggregate (municipality)	No effect
Persson et al. (2014), II	Sweden	Parliamentary (1991-2006)	Individual (survey, validated turnout)	No effect
Persson et al. (2014), III	Sweden	Parliamentary (2002-2010)	Individual (survey, validated turnout)	No effect
Sforza (2014)	Italy	Parliamentary (2008-2013)	Aggregate (municipality)	IC (negative effect of rainfall dummy)
Arnold & Freier (2016)	Germany (North-Rhine Westphalia)	Municipal and state (1975-2010)	Aggregate (municipality)	-1.20***
Fujiwara et al. (2016)	US	Presidential (1952-2012)	Aggregate (county)	-0.55**
Chen (2017)	Taiwan	Parliamentary (1998-2012)	Aggregate (county)	-1.59**
Cooperman (2017)	US	Presidential (1948-2000)	Aggregate (county)	No effect
Lee & Hwang (2017)	South Korea	Parliamentary and municipal (1995-1999)	Aggregate (municipality)	-2.17*
Arnold (2018)	Germany (Bavaria)	Municipal (1946-2009)	Aggregate (municipality)	-1.00***
Horiuchi & Kang (2018)	US	Presidential (1948-2000)	Aggregate (county)	-0.44**
Stockemer & Wigginton (2018)	Canada	Parliamentary (2004-2015)	Aggregate (districts)	-1.13***
Leslie & Arı (2018)	UK	Referendum (2016)	Aggregate (constituency)	-0.9**
Kang (2019)	South Korea	Parliamentary (2000-2012)	Aggregate (districts)	IC (negative effect of rainfall dummy)
Meier et al. (2019)	Switzerland	Direct democratic votes (1958-2014)	Aggregate (municipality)	IC (negative effect of heavy rain dummy)
Rudolph (2019)	UK	Brexit referendum (2016)	Aggregate (districts)	-0.59**
Garcia-Rodriguez & Redmond (2020)	Ireland	Parliamentary (1989-2016)	Aggregate (constituency)	-0.51**
Lind (2020)	Norway	Municipal (1972-2010)	Aggregate (municipality)	0.003***
The present study	Denmark	Municipal (2013-2017)	Individual (registry, validated turnout)	-0.84***
			Average	-0.76
			Median	-0.52
			Range	[-3.17, 0.003]
			N	33 (28)