Votes on Fire:

Did Wildfires Influence Voter Turnout in the 2020 Presidential Election?

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1 Introduction

Natural disasters increasingly feature in the lives of U.S. citizens. Events that were previously understood as rare, catastrophic anomalies, such as Hurricanes Katrina or Harvey, are no longer considered as such (CRED, EM-DAT and UNISDR 2017). An important puzzle then, is how these events influence and shape politics.

There is evidence to suggest that exposure to natural disasters in developing contexts updates citizen's prior beliefs of government capacity. When a government's response to a natural disaster is effective, affected populations turn out to vote at higher rates than non-affected populations (Fair et al., 2017). In developed contexts, exposure to natural disasters has been linked to changes in political attitudes and behaviours. We know that exposure to wildfires increases the likelihood that voters will support pro-environmental policy when voting (Hazlett and Mildenberger, 2020), and that the relationship between exposure to natural disasters and voter participation is non-linear and mediated by exposure severity. During the 2008 Mayoral

Election in New Orleans, for example, low flood severity corresponded to a decrease in voter turnout whilst the opposite was true for high flood severity (Sinclair, Hall and Alvarez, 2011). We know less, however, about what drives the heterogeneity across voter turnout outcomes amongst those exposed to natural disasters in developed contexts.

The 2020 presidential election cycle was an outlier in more ways than one. Whilst the United States experienced its first federal election in the midst of a pandemic, the west coast was ravaged by the most intense and widespread wildfires that the country had seen in years. Unprecedented wind and drought conditions lead to the burning of at least 8.2 million acres of land and the deaths of 37 people (Denton, 2020). Additionally, hundreds of thousands of people across Oregon, California and Washington State were forced to evacuate their homes.

We study how exposure to the 2020 wildfires in Washington State influenced voter turnout in the 2020 presidential election. Using Modis Active Fire Detection Data and the USDA's Wildfire Hazard Potential map, we leverage measures of exposure to severe wildfires to estimate changes in voter turnout at the precinct level. When controlling for population, we find a negative relationship between exposure to fire and voter participation. Turnout increases as distance to a burned area decreases.

This paper proceeds as follows: First, we outline our data sources and research design. Second, we detail the limitations with our study and outline our path to address them going forward. Third, we present and briefly discuss our results.

2 Research Design

2.1 The Wildfires

The 2020 wildfire season in the United States was amongst the worst in recorded history. An estimated 6.7 million acres were burned across the states of California, Washington and Oregon, causing the destruction of 16,787 structures and over 30 deaths. Whilst the overall number of fires in the continental US has declined over the last decade, the number of acres burned annually is on the rise, as fires tend to be larger and much more severe (Rattner and Newburger, 2020).

Washington State experienced three hundred separate wildfires during the 2020 wildfire season, three times the state's annual average, making 2020 the state's second most devastating wildfires season in the last two decades (Lim, 2020; Decker, 2020). An estimated $626,000$ acres of land were burned, destroying close to 200 homes (O'Sullivan, 2020). The unusually fast moving fires caused the destruction of over 80% of the structures in the southern town of Malden, and prompted the evacuation of dozens of towns nearby. Severe drought and unprecedented wind conditions caused the fires to spread far beyond areas typically considered to be high risk and into areas previously considered "too wet to burn". Around 20% of the areas burned in 2020 had not burned in over a decade (Flavelle, 2020).

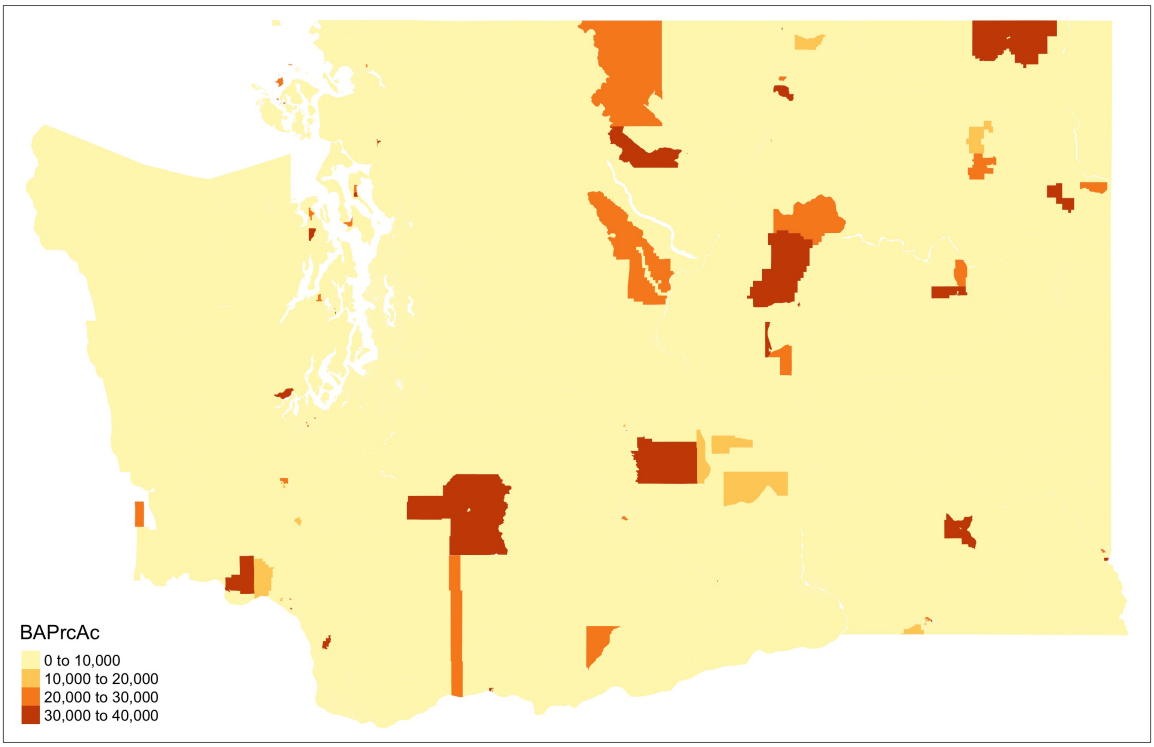
2.2 Data

We draw from Modis Active Fire Detection Data, USDA's Wildfire Hazard Potential Map and precinct level data on electoral turnout from the 2020 presidential election in the State of Washington.

Treatment Variable: Exposure to Fire

We leverage active fire data from MODIS Collection 6 NRT Hotspot / Active Fire Detections MCD14DL to estimate a) a precincts proximity to an active fire and b) percentage of area burned. Our independent variable, exposure to fire, is hence distance in kilometers, to a burned area of 5000 acres or more. This draft includes two main measures of distance to an active fire: first, we built a series of binary variables that indicate whether a precinct was within up to 40 kilometers from a fire that burned at least 5000 acres, in 5 kilometer intervals. Second, we build a continuous measure of the minimum distance to a burned area greater than 5000 acres for each precinct. Thus, it is the precincts distance to the closest burned area of 5000 acres or more.

The MODIS Burned Area Product is updated quarterly by scientists at The University of Maryland. Currently, only data spanning from January to June is available. The brunt of the wildfires happened during the third quarter of 2020. Consequently, our current estimates significantly underestimate our treatment effect.



Outcome Variable: Voter turnout in the 2020 election

Our main dependant variable is percentage turnout amongst registered voters at the precinct level during the 2020 presidential elections. We construct the variable by dividing the total number of ballots cast per precinct by the total number of registered voters. Precinct level electoral data was supplied to us by Washington State's Secretary of State. Due to data entry errors for King and Okanogan counties, we supplement official electoral results with a) official results provided by the counties' electoral offices and b) Washington State's Voter Registration Database. Our results are robust to including data from different sources for both King and Okanogan counties (see appendix).

To control for previous trends in electoral turnout, we include a control variable for turnout

in the 2016 presidential election. We construct the 2016 turnout variable by dividing the number of ballots cast by the number of registered voters as noted in the 2016 Official Precinct Totals reported by Washington State's Secretary of State.

Additionally, we create three independent variables that denote turnout amongst women, men, and registered voters younger than 30. To create these variables, we leverage Washington State's Voter Registration Database, which contains all individuals registered to vote, along with the date of when they last voted. We create a binary variable that indicates whether an individual voter cast a ballot in the 2020 presidential election, and divide the count over the total number of registered voters in each demographic group.

Washington has a distinct analytical advantage over other states that experienced record breaking wildfires during the 2020 fire season for two main reasons. First, Washington has overwhelmingly voted for the Democratic Party in every presidential election since 1984. As such, it is unlikely to have experienced any dramatic changes in turnout and voter composition due to the unusual dynamics of the 2020 election. Second, Washington has been a mail-in voting state since 2006. All registered voters typically receive a mail-in ballot at their address during October. Consequentially, we are less likely too see endogenous shifts in voter behaviour due to changes in voting dynamics motivated by the Covid-19 pandemic.

Ex-ante fire risk

The Wildfire Hazard Potential (WHP) map is a continuous geospatial measure of wildfire risk created by USDA Forest Service's Fire Modeling Institute. It leverages data on fuel availability, weather, fire occurrence inputs, and land cover to estimate the risk of fires too big to contain. The WHP records wildfire risk at a 270m x 270m resolution. To control for ex-ante risk, we take the mean fire risk across a precincts geographic area as indicated in the WHP map.

Demographic Controls

We include two county-level demographic controls taken from the 2019 American Community Survey: (1) we include a measure for population and (2) we include a binary variable that indicated whether the county is urban or rural.

Additionally, we create two precinct-level demographic controls constructed from Washington State's Voter Registration Database: the proportion of registered voters within a precinct that are female, and the proportion of registered voters within a precinct that are under the age of 30.

COVID-19 Controls

Because COVID-19 case counts are endogenous to government disaster response, we proxy for within-county COVID-19 severity using Brodeur, Beland and Wright (2020)'s occupational risk indexes which estimate workforce COVID-19 vulnerability. The indexes, which are drawn from Occupational Information Network (O*NET) survey data, estimate risk of disease and infection by combining data on workplace proximity and exposure to disease with estimates of worker's ability to stay home. The occupational risk data at the county level, first introduced by Baccini, Brodeur and Weymouth (2020), includes four main indexes of COVID-19 occupational exposure: (1) Index of workers relatively more exposed to COVID-19, (2) Index of workers who work with proximity to co-workers, (3) Index of workers who can easily work remotely and (4) Index of essential workers. Together, they indicate variation in COVID-19 infection frequency based on within-county labor force composition and percentage of workers who are at risk.

2.3 Identification Strategy

Following Fair et al. (2017), our identification assumption is that the probability that any given precinct, having controlled for *ex-ante fire risk*, will be in proximity to a severe wildfire within a given year is random. Because wildfire onset is largely determined by exogenous events, distance to a wildfire with a burned area larger than $5000km^2$ is randomly distributed across precincts. Wildfires are amongst the natural disasters that are hardest to predict. Whilst hurricanes and tornadoes are foreshadowed by atmospheric conditions, fire onset is largely caused accidentally by humans and fire severity within a given area is governed by precipitation, exposure to lightning, wind speeds and temperature amongst other factors. Within the hundreds of fires that are started every year, only a few randomly grow. Supporting our identification assumption

that fire onset is random and not predetermined by observable characteristics, we test the correlation between mean *ex ante fire risk* per precinct as determined by the WHP map and percentage of an area within a precinct that burned. We find no evidence of a significant correlation (see appendix). Demographic, geo-spatial, and *ex-ante fire risk* controls further attenuate the concern that variation in turnout between precincts is driven by certain groups selecting into areas with distinct propensities to experience fires. As a result, we estimate how as-if-random exposure to severe wildfires during the 2020 fire season influenced the likelihood that eligible voters cast their ballot in the 2020 presidential election within precincts with equal fire propensity.

We also intend to run two placebo tests: first if our identification assumption holds, we are interested in showing that there is no relationship between exposure to fire in 2015 and voter turnout in the 2020 election. Second, we will show that Wildfire risk is not in itself a predictor of voter turnout.

Our model is estimated by equation 1:

$$y_{i,2020} = \beta_0 + \beta_1 F_i + \beta_2 y_{i,2016} + \beta D_i + \beta O_i$$

Where $y_{i,2020}$ is percentage of eligible voters who cast their ballot in 2020 in precinct i, $y_{i,2016}$ represents voter turnout for the previous two presidential elections, F_i is a measure of *ex-ante fire risk* and D_i and O_i are vectors of demographic and occupational COVID-19 controls respectively.

3 Results

Table 1: Main result with different measure of fire exposure

	Turnout 2020					
	(1)	(2)	(3)	(4)	(5)	(6)
Fire within 0-5km	−0.002	0.001	0.010			
	(0.012)	(0.010)	(0.010)			
Distance to nearest fire				0.0002***	0.0001***	−0.0003***
				(0.00003)	(0.00002)	(0.0001)
turnout2016		0.415***	0.404***		0.414***	0.404***
		(0.022)	(0.022)		(0.022)	(0.022)
County FE			X			X
Controls	X	X		X	X	
N	6,768	6,768	6,768	6,768	6,768	6,768
R^2	0.046	0.407	0.440	0.051	0.410	0.443

*p < .1; **p < .05; ***p < .01

Table 2: Baseline Models with Demographic Controls

	Turnout 2020			
	Baseline	Baseline w Gender	Baseline w young	Baseline w age gender
	(1)	(2)	(3)	(4)
Distance to fire	0.0002***	0.0001***	0.0002***	0.0001***
	(0.00003)	(0.00003)	(0.00003)	(0.00003)
prop_under30		−0.167***		−0.342***
		(0.059)		(0.026)
prop_fem			−0.237***	−0.241***
			(0.088)	(0.069)
prop_under30:prop_fem				0.121***
				(0.012)
N	6,768	6,768	6,768	6,768
R^2	0.051	0.157	0.093	0.248

*p < .1; **p < .05; ***p < .01

Table 3: Turnout Across Demographic Groups

	Turnout 2020			
	Baseline	Female	Male	30 and under
	(1)	(2)	(3)	(4)
Distance to nearest fire	0.0002^{***}	0.0001^{***}	0.0001^{***}	-0.0001^{***}
	(0.00003)	(0.00003)	(0.00004)	(0.00004)
prop_fem		-0.520^{***}	-0.500^{***}	
		(0.129)	(0.133)	
prop_under30				-0.185^{***}
				(0.042)
N	6,733	6,733	6,733	6,733
R^2	0.056	0.202	0.152	0.230

$^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$

There is evidence to suggest that exposure to wildfires increases voter turnout. Across all binary measures of fire exposure, the relationship between exposure and voter turnout is not statistically significant. However, in models 4 and 5, the continuous measure of distance from a burned area shows that as distance from a fire decreases, voter turnout increases. Interestingly, model 6, which does not include COVID-19 controls, shows a statistically significant negative relationship between proximity to fire and voter participation. This is likely due to an omitted variable that varies across precincts but is constant in time. Probable culprits are education and income levels.

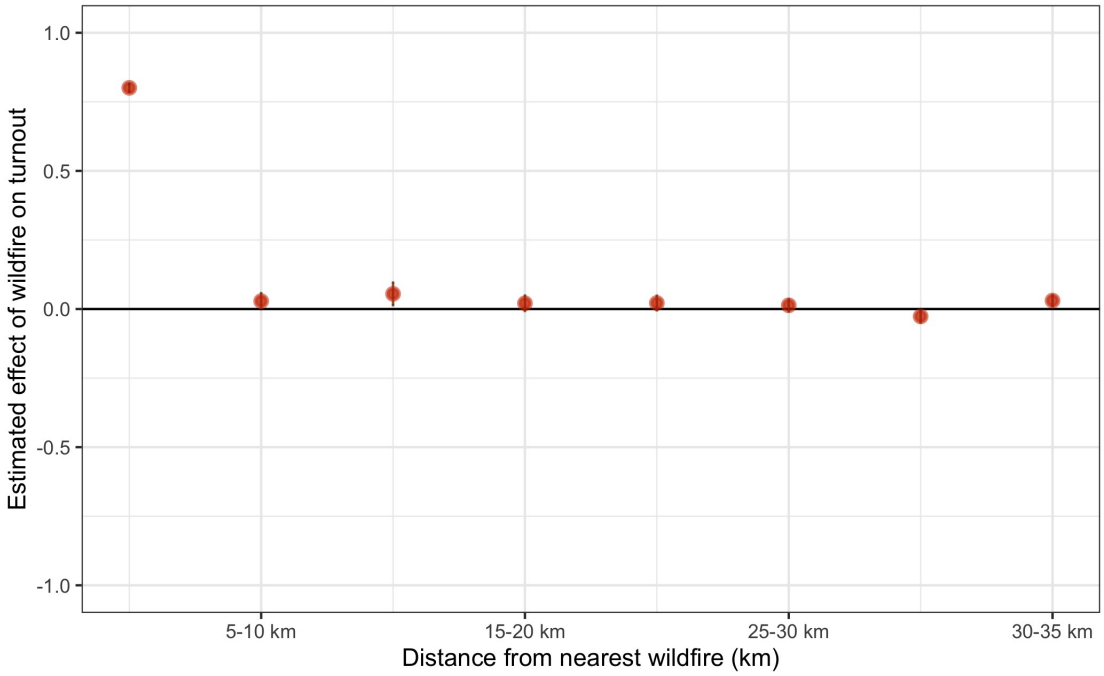


Figure 1: Estimated Effect of Wildfire Exposure on Voter Turnout, by Distance

Notes: Estimates here are based on preliminary measures of 2020 burned areas in Washington. Thus, we cannot adequately measure the median at this time. However, this Figure provides estimates compared with response at the median distance in the preliminary data (over 40km). All estimates are derived from a linear model with count fixed effects and controlling for ex ante fire vulnerability and voter turnout in 2016.

4 Looking Forward

In future versions of this paper, our plan is to project census block level demographic variables on to the 2020 precinct shapefiles. This will allow us to add precinct-level education and income controls to our baseline models.

We also plan to add a county-level control for Covid-19 case count and include updated measures of fire exposure that reflect wildfires that occurred during the third quarter of 2020.

To further analyze the robustness of our model, we plan to leverage Washington State's Individual Voter Registration Database to create a model that indicates the probability that a specific individual will vote in the future.

We also intend to try different transformations of our dependent variable to address non-normality.

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5 Appendix

Table 4: Correlation between ex ante fire risk and percentage of a precinct's area that is burned

	Burned Area (Sq m)
Wildfire Hazard Potential	1,212.155
	(1,330.625)

$^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$

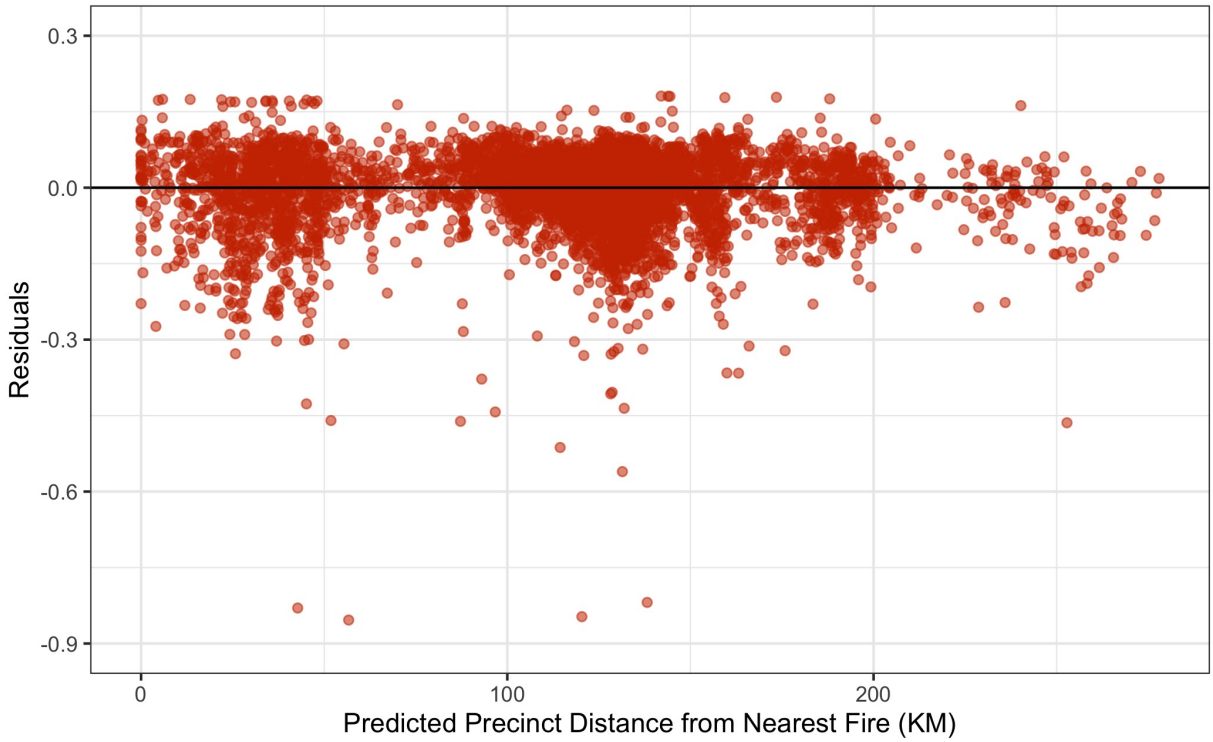

Figure 2: Residuals from Estimated Effect of Wildfire Exposure on Voter Turnout

Notes:

Table 5: Assessing different specifications of the baseline model

	Turnout 2020								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Distance to fire	0.0001	0.0001	0.0001	0.0001***	0.0002***	0.0001***	0.0001***	−0.0003***	−0.0003***
	(0.00002)	(0.00002)	(0.00003)	(0.00002)	(0.00003)	(0.00002)	(0.00003)	(0.00002)	(0.00002)
crit_work			−0.027		0.102***		0.069*		
			(0.038)		(0.039)		(0.038)		
remindex			0.066		0.185***		0.104***		
			(0.015)		(0.015)		(0.021)		
proximity			−0.014		−0.068**		0.024		
			(0.028)		(0.028)		(0.037)		
exposure			−0.015		−0.139***		−0.085**		
			(0.028		(0.028)		(0.033)		
pop				0.000	−0.00000		−0.000***		
							(0.000)		
urban				−0.009	−0.017		−0.005		
							(0.005)		
County FE								X	X
Covid Controls			X		X		X		
Trend Controls						X	X		
Urban Controls				X	X		X		
Clusters		X	X	X	X	X	X	X	
N	6,768	6,768	6,768	6,768	6,768	6,768	6,768	6,768	6,768
R^2	0.010	0.010	0.040	0.031	0.051	0.401	0.410	0.443	0.443

*p < .1; **p < .05; ***p < .01

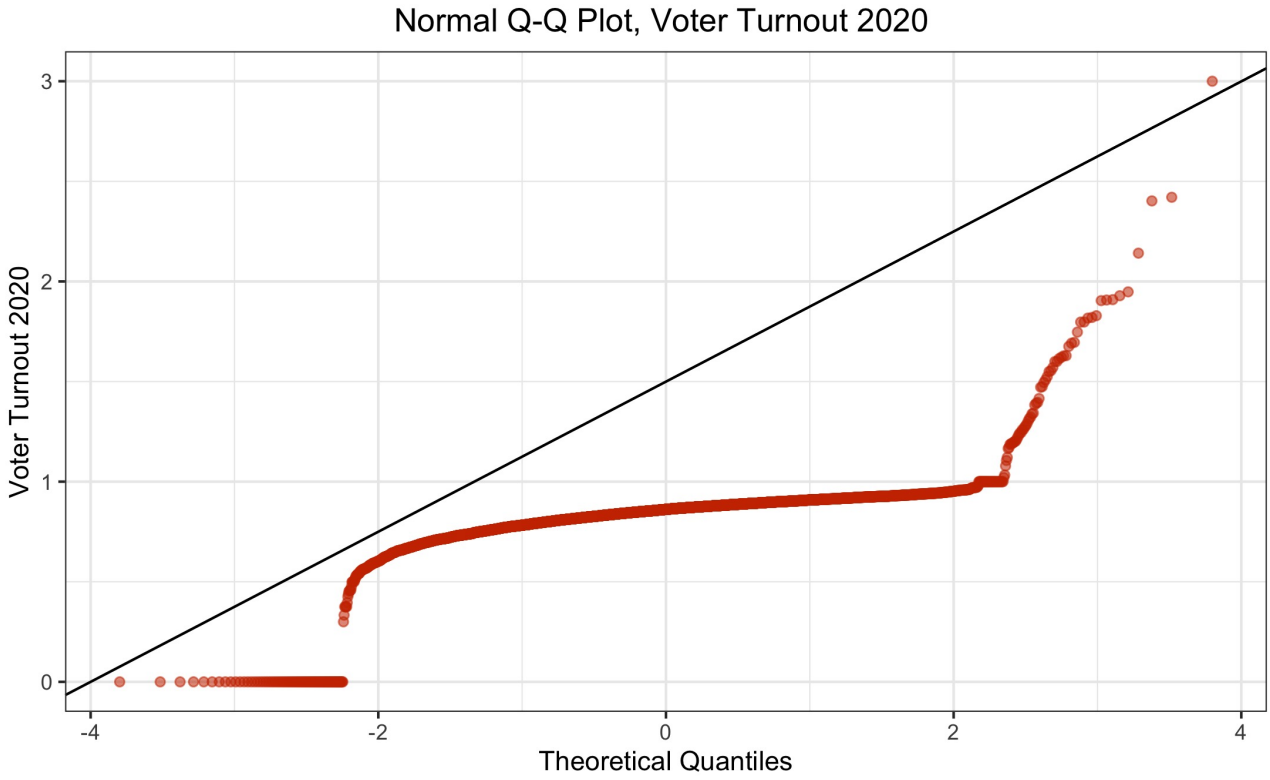

Figure 3: QQ Plot of Voter Turnout in 2020

Notes:

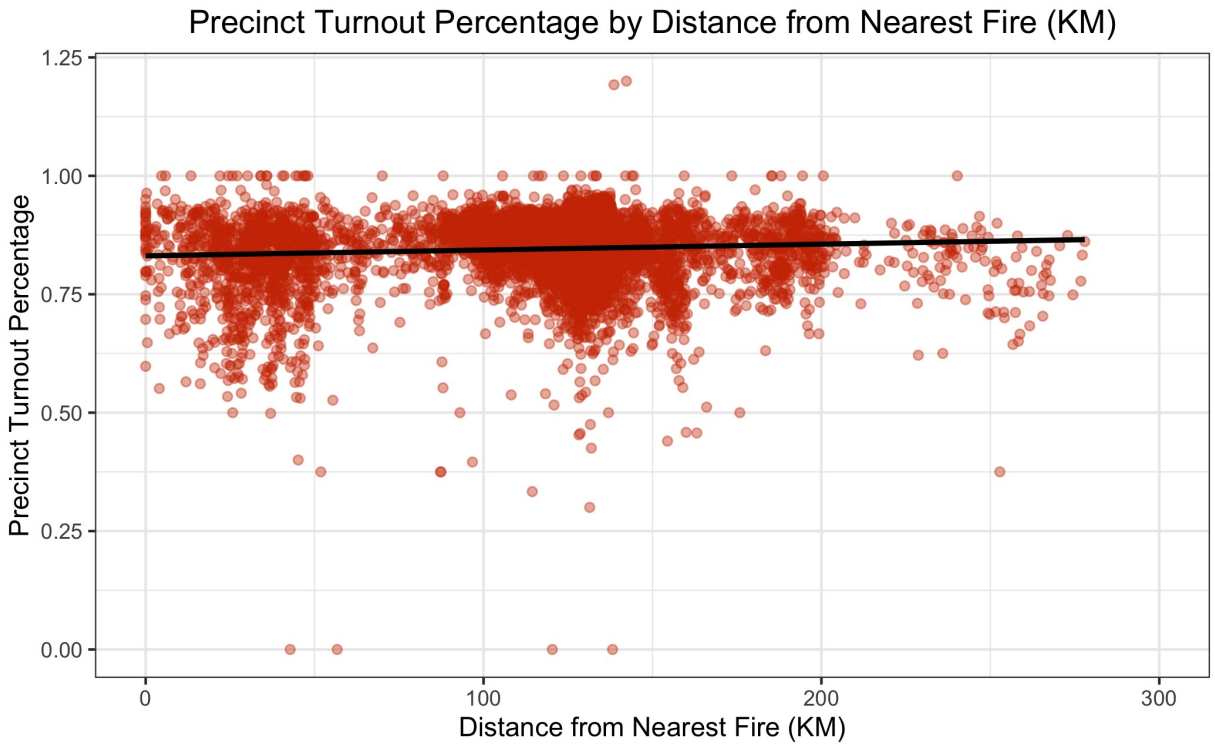

Figure 4: Effect of Wildfire on Voter Turnout by Distance, km

Notes: