

Understanding the relationship between NSF responsiveness to climate change and public opinion

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Introduction

- NSF funds scientific research and education in US colleges and universities
- NSF is funded by taxpayer money
- Concerns about climate change and the urgency to address it have been increasing
- Is NSF putting funding towards research that is priority for the public?
- Is funding towards climate change reflective of public opinion on climate change in the US?



Research question

- Is there a positive correlation between national sentiment on climate change in the United States and NSF funding towards climate change related research?
- Hypothesis: Yes

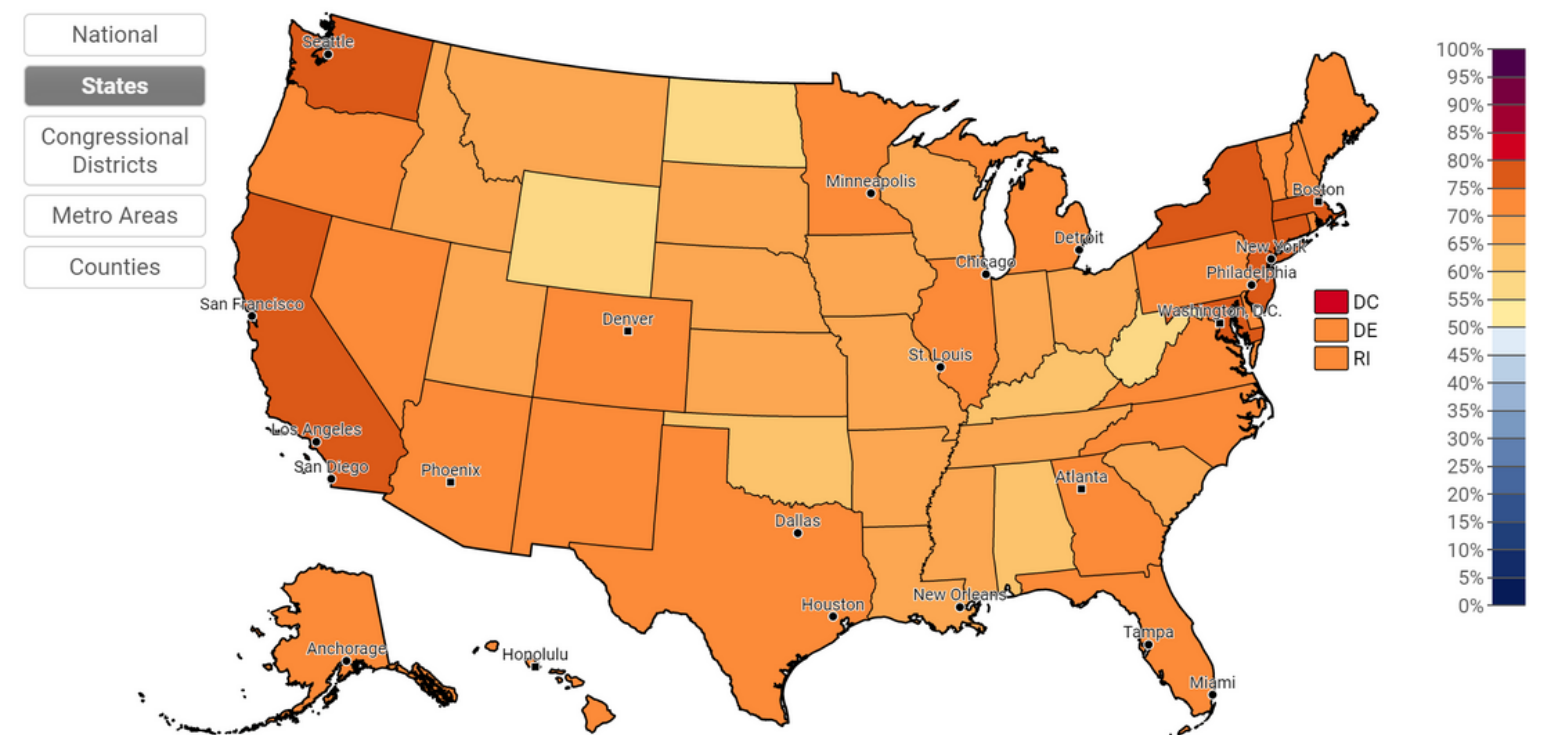
Data

Yale Climate Opinion Maps Data

- Survey of American opinions on climate change in all 50 states and DC
- Collected in 2014, 2016, 2018, 2021

Estimated % of adults who think global warming is happening (nat'l avg. 72%), 2021

Select Question: Global warming is happening
Click on map to select geography, or: Select a State



Data

Yale Climate Opinion Data

- Questions asked on beliefs, risk perception and policy support
 - Do you think that global warming is happening?
 - How worried are you about global warming?
 - How much do you support or oppose funding more research into renewable energy sources, such as solar and wind power?

Data

Yale Climate Opinion Data

- Collected CSV files from the website
- Renamed columns

	year	Statename	happening	harmUS	timing	personal	futuregen	worried	human	fundrenewables	regulate	CO2limits
0	2014	Alaska	62.000	45.000	41.000	29.000	55.000	48.000	45.000	76.000	67.000	48.000
1	2014	Alabama	56.000	45.000	40.000	31.000	53.000	46.000	43.000	73.000	69.000	53.000
2	2014	Arkansas	57.000	46.000	39.000	31.000	55.000	47.000	44.000	73.000	71.000	59.000
3	2014	Arizona	64.000	53.000	44.000	38.000	61.000	54.000	49.000	76.000	74.000	64.000
4	2014	California	70.000	59.000	48.000	42.000	70.000	62.000	55.000	79.000	79.000	72.000
...
199	2021	Virginia	74.246	66.264	61.864	47.914	72.833	67.593	59.283	79.736	73.235	69.422
200	2021	Washington	75.379	68.805	62.891	48.125	76.331	68.291	60.097	78.954	72.999	69.846
201	2021	West Virginia	56.918	50.727	45.077	32.924	57.075	49.865	42.603	70.574	62.749	47.461
202	2021	Wisconsin	69.452	62.011	55.557	42.428	70.049	61.549	55.104	77.934	72.360	64.875
203	2021	Wyoming	58.285	51.034	43.809	32.913	57.210	52.421	43.604	72.362	62.288	48.524

Data

NSF Funding Data

- NSF Award Search Tool
 - Titles or abstracts including 'climate change' in 2014, 2016, 2018, 2021

Awardee Information	
Principal Investigator First Name	<input type="text"/>
Principal Investigator Last Name	<input type="text"/>
<input type="checkbox"/> Include Co-Principal Investigator in name search	
Organization	<input type="text"/>
State	Select one
Zip Code	<input type="text"/>
Country	Select one

Program Information	
NSF Organization	Select one
Element Code	<input type="text"/>
Reference Code	<input type="text"/>
<input type="radio"/> Any <input checked="" type="radio"/> All	
<input type="radio"/> Any <input checked="" type="radio"/> All	
HINT: The "Program" box searches both program element and program reference names and codes.	
Program	<input type="text"/>
Program Officer	<input type="text"/>

Additional Information	
Keyword	<input type="text"/>
HINT: The Keyword field searches on the title and abstract only.	
<input type="checkbox"/> Search Award Title Only	
Award Number	Select one
From	To
<input type="text"/>	<input type="text"/>
Award Amount	Select one
Award Instrument	Select one
HINT: Data prior to 1976 may be less complete.	
<input checked="" type="checkbox"/> Active Awards <input type="checkbox"/> Expired Awards	
Original Award Date	From To
Select one	<input type="text"/> <input type="text"/>
Start Date	From To
Select one	<input type="text"/> <input type="text"/>
End Date	From To
Select one	<input type="text"/> <input type="text"/>

Export up to 3,000 Awards:	CSV XML Excel Text	Email this Link Export All Results
Sort By: Relevance	Results size: 30 per page	Table List
Page 1 of 100	Displaying 1 - 30 of 3000	
A maximum of 3,000 results are displayed. If you did not find the information you are looking for, please refine your search.		
Collaborative Research: Understanding the Full Range of Amazon Drought and Impacts Award Number:1304083; Principal Investigator:Jonathan Overpeck; Co-Principal Investigator:Jianjun Yin; Organization:University of Arizona;NSF Organization:EAR Start Date:02/01/2014; Award Amount:\$433,544.00; Relevance:73.83;		
Modeled Export of Ancient, Thick Sea Ice from the Arctic, and its Role in Abrupt Climate Change Award Number:1417667; Principal Investigator:Alan Condron; Co-Principal Investigator:Raymond Bradley; Organization:University of Massachusetts Amherst;NSF Organization:OPP Start Date:09/01/2014; Award Amount:\$595,992.00; Relevance:68.61;		
Collaborative Research: Testing the Impact of Climate Change on the Greenland Ice Sheet: Combining Past Climate Records with a Coupled Climate and Ice-Sheet Model Award Number:1418074; Principal Investigator:Anders Carlson; Co-Principal Investigator:; Organization:Oregon State University;NSF Organization:OPP Start Date:09/01/2014; Award Amount:\$178,617.00; Relevance:67.45;		
CAREER: The Mesoscale Climate Dynamics of Rocky Mountain Snowpack Depletion Award Number:1349990; Principal Investigator:Justin Minder; Co-Principal Investigator:; Organization:SUNY at Albany;NSF Organization:AGS Start Date:03/01/2014; Award Amount:\$621,956.00; Relevance:67.37;		
Doctoral Dissertation Research: Montane Avian Elevational Range Shifts and Land Use Change Award Number:1434281; Principal Investigator:Stuart Pimm; Co-Principal Investigator:Natalia Ocampo Penuela; Organization:Duke University;NSF Organization:BCS Start Date:09/01/2014; Award Amount:\$12,774.00; Relevance:67.24;		
Reconciling substrate specific differences in the carbon isotope excursion marking the Paleocene-Eocene thermal maximum. Award Number:1405224; Principal Investigator:D Kelly; Co-Principal Investigator:Reinhard Kozdon, D Kelly; Organization:University of Wisconsin-Madison;NSF Organization:OCE Start Date:08/01/2014; Award Amount:\$313,679.00; Relevance:67.13;		

Data

NSF Funding Data

- Collected data for 2014, 2016, 2018, 2021

	AwardNumber	Title	NSFOrganization	Program(s)	StartDate	LastAmendmentDate	PrincipalInvestigator	State	Organization	AwardInstru
0	1304083	Collaborative Research: Understanding the Fu...	EAR	GLOBAL CHANGE	02/01/2014	07/05/2017	Jonathan Overpeck	AZ	University of Arizona	Continuing (
1	1417667	Modeled Export of Ancient, Thick Sea Ice from ...	OPP	ARCSS-Arctic System Science	09/01/2014	09/07/2018	Alan Condron	MA	University of Massachusetts Amherst	Standard (
2	1349990	CAREER: The Mesoscale Climate Dynamics of Roc...	AGS	Climate & Large-Scale Dynamics	03/01/2014	04/13/2020	Justin Minder	NY	SUNY at Albany	Standard (
3	1418074	Collaborative Research: Testing the Impact of...	OPP	ARCSS-Arctic System Science, ANS-Arctic Natura...	09/01/2014	08/18/2014	Anders Carlson	OR	Oregon State University	Standard (
4	1405224	Reconciling substrate specific differences in ...	OCE	Marine Geology and Geophysics	08/01/2014	07/06/2015	D Kelly	WI	University of Wisconsin-Madison	Standard (

Data

NSF Funding Data

- Subset and aggregate to only get state, year and total funding

	start_year	State	Funding
0	2014	AK	21278921
1	2014	AL	8717289
2	2014	AR	4822559
3	2014	AZ	31581325
4	2014	CA	163491175
...
206	2021	VT	3009169
207	2021	WA	52157584
208	2021	WI	35490091
209	2021	WV	5495792
210	2021	WY	4543177

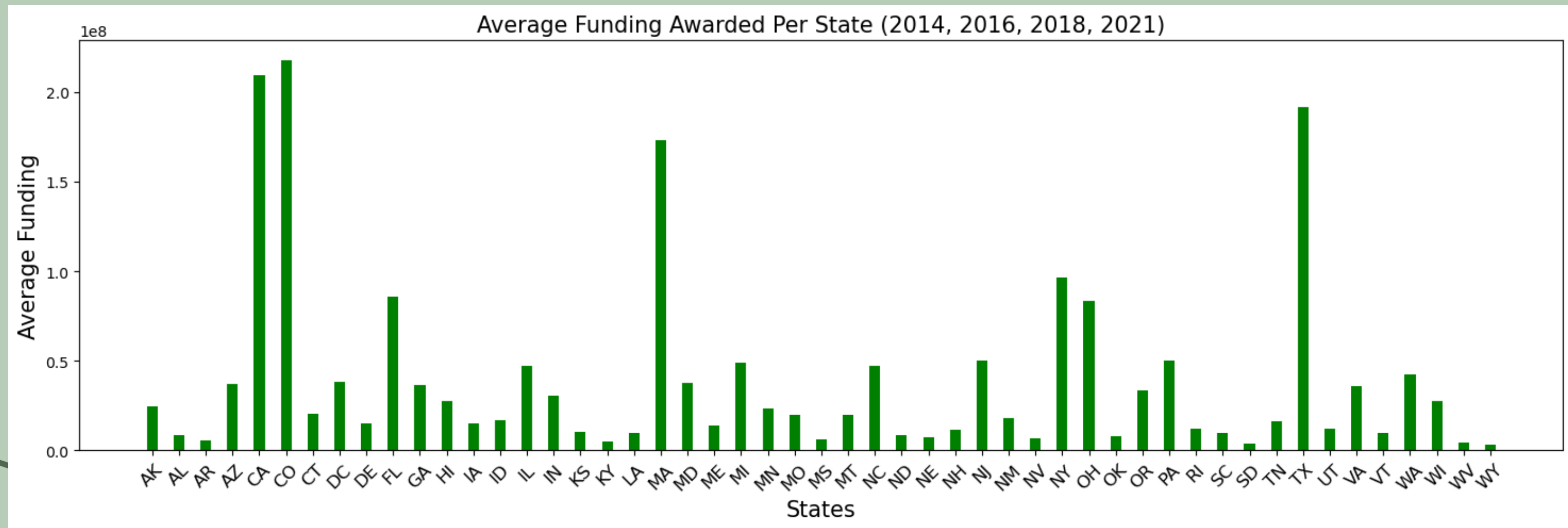
Merged data set

- Data was already clean
- No missing data
- 204 data points

	year	State	happening	harmUS	timing	personal	futuregen	worried	human	fundrenewables	regulate	CO2limits	Funding
0	2014	AK	62.000	45.000	41.000	29.000	55.000	48.000	45.000	76.000	67.000	48.000	21278921
1	2014	AL	56.000	45.000	40.000	31.000	53.000	46.000	43.000	73.000	69.000	53.000	8717289
2	2014	AR	57.000	46.000	39.000	31.000	55.000	47.000	44.000	73.000	71.000	59.000	4822559
3	2014	AZ	64.000	53.000	44.000	38.000	61.000	54.000	49.000	76.000	74.000	64.000	31581325
4	2014	CA	70.000	59.000	48.000	42.000	70.000	62.000	55.000	79.000	79.000	72.000	163491175
...
199	2021	VA	74.246	66.264	61.864	47.914	72.833	67.593	59.283	79.736	73.235	69.422	38258385
200	2021	WA	75.379	68.805	62.891	48.125	76.331	68.291	60.097	78.954	72.999	69.846	52157584
201	2021	WV	56.918	50.727	45.077	32.924	57.075	49.865	42.603	70.574	62.749	47.461	5495792
202	2021	WI	69.452	62.011	55.557	42.428	70.049	61.549	55.104	77.934	72.360	64.875	35490091
203	2021	WY	58.285	51.034	43.809	32.913	57.210	52.421	43.604	72.362	62.288	48.524	4543177

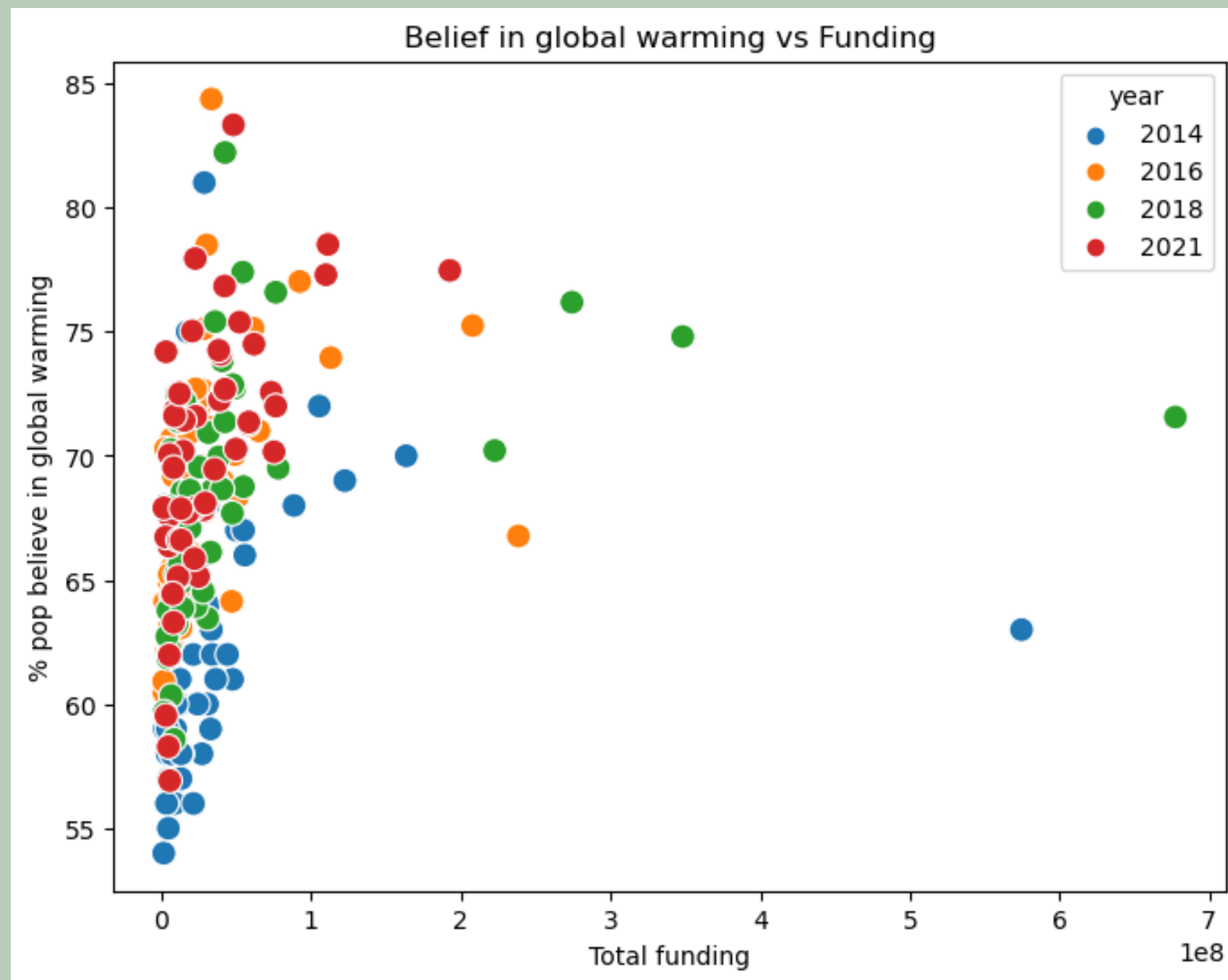
Data exploration

- Most funding goes to CA, CO, MA, TX



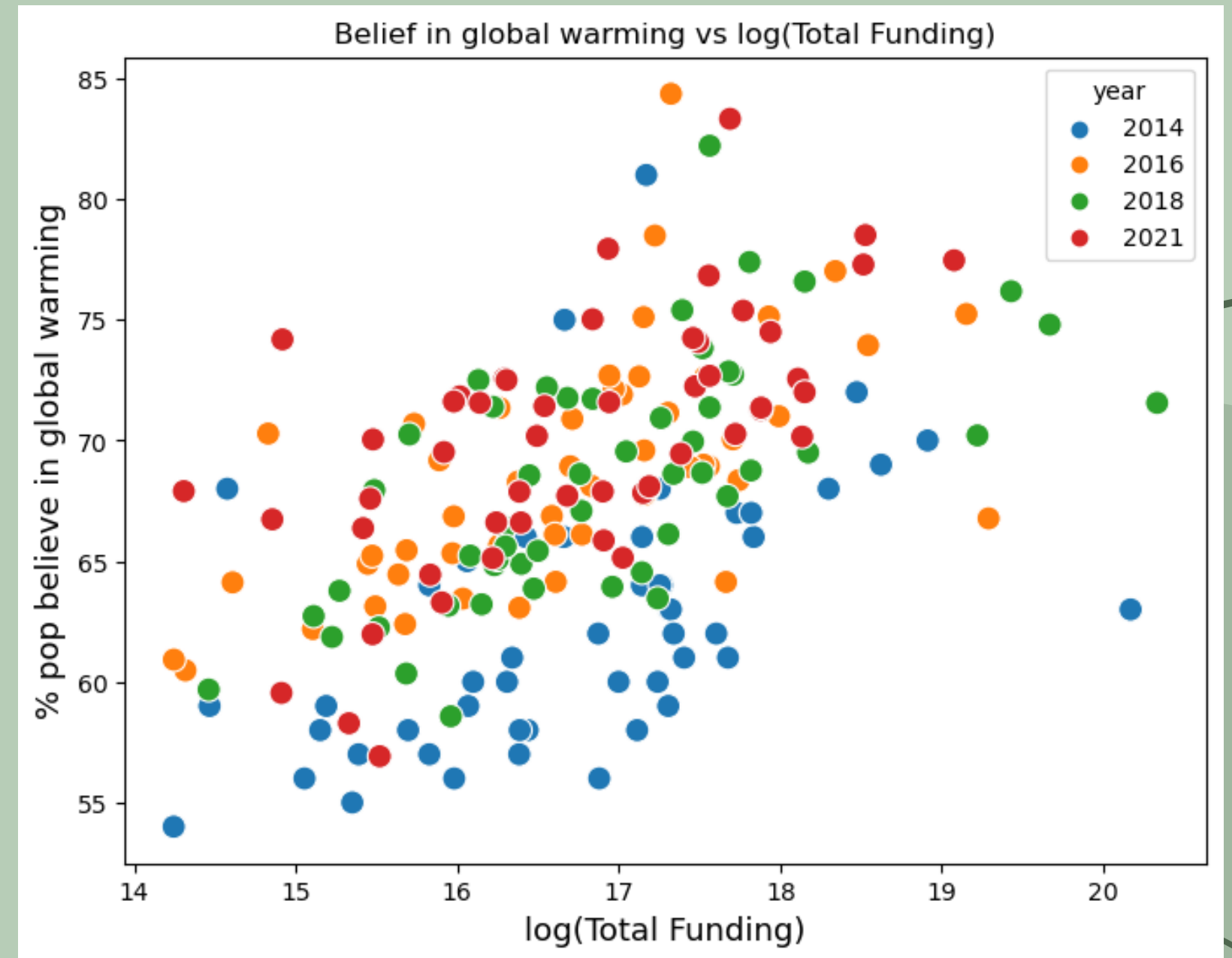
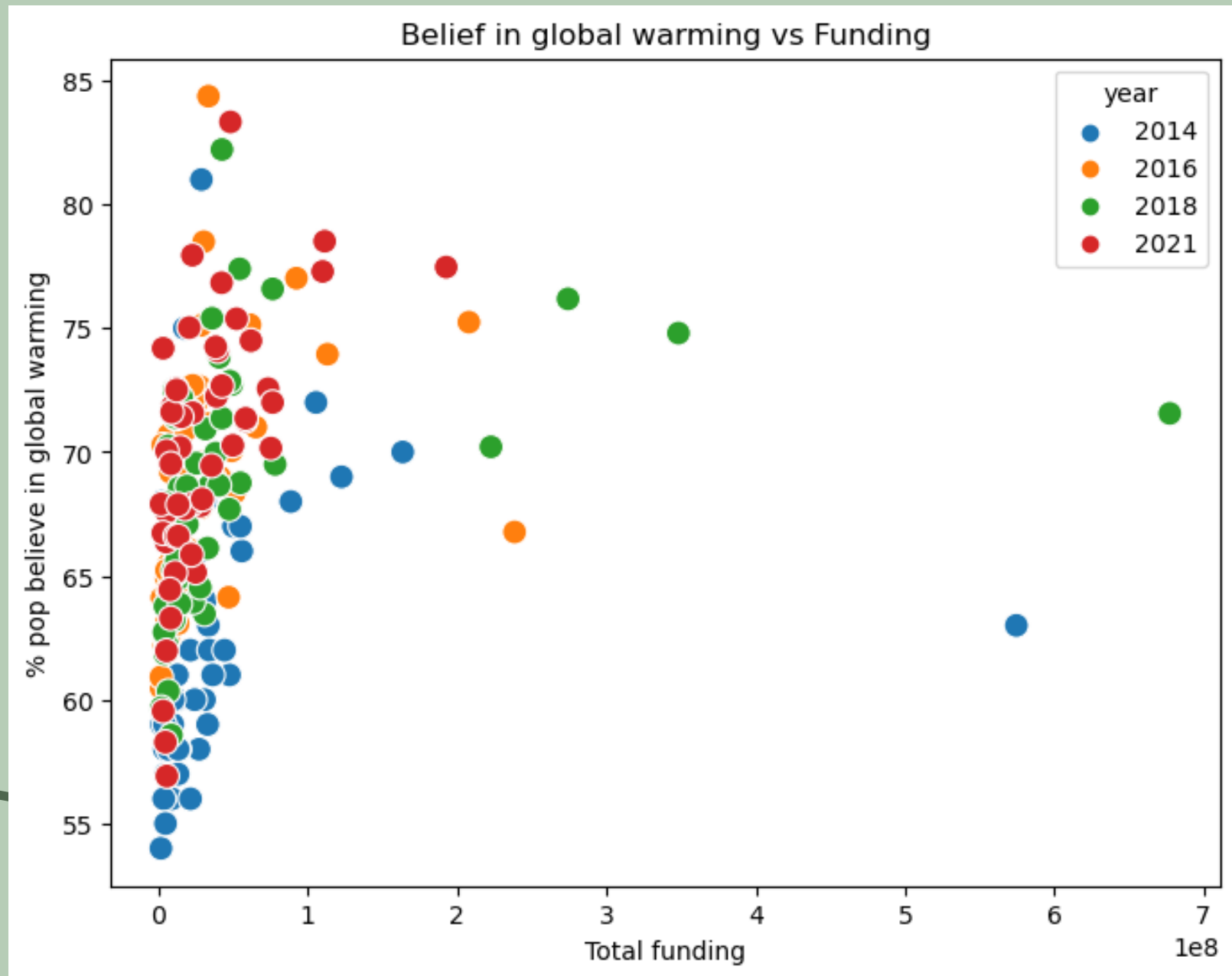
Plot response vs predictor

- Response: % population that believes in global warming
- Predictor: Total Funding



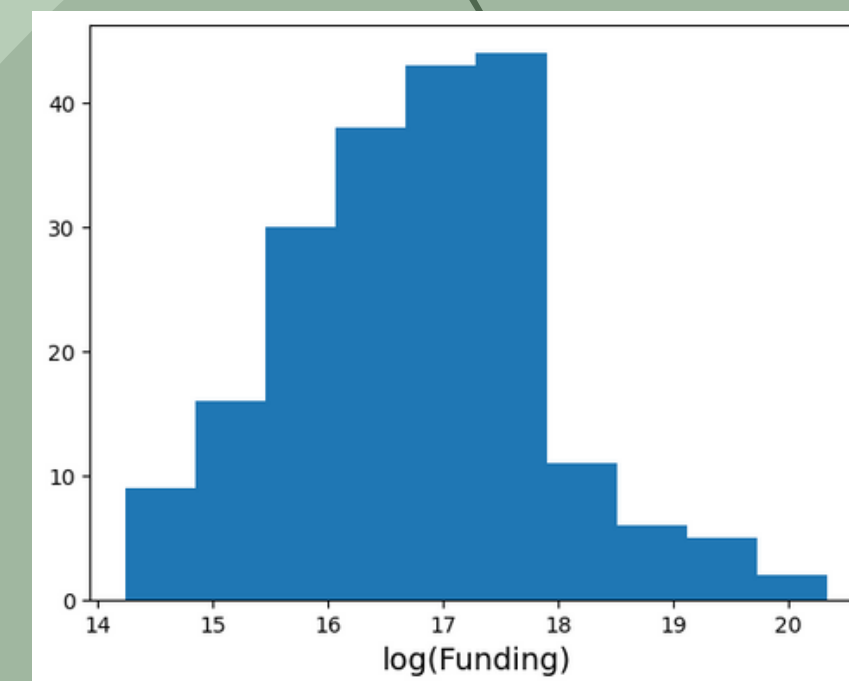
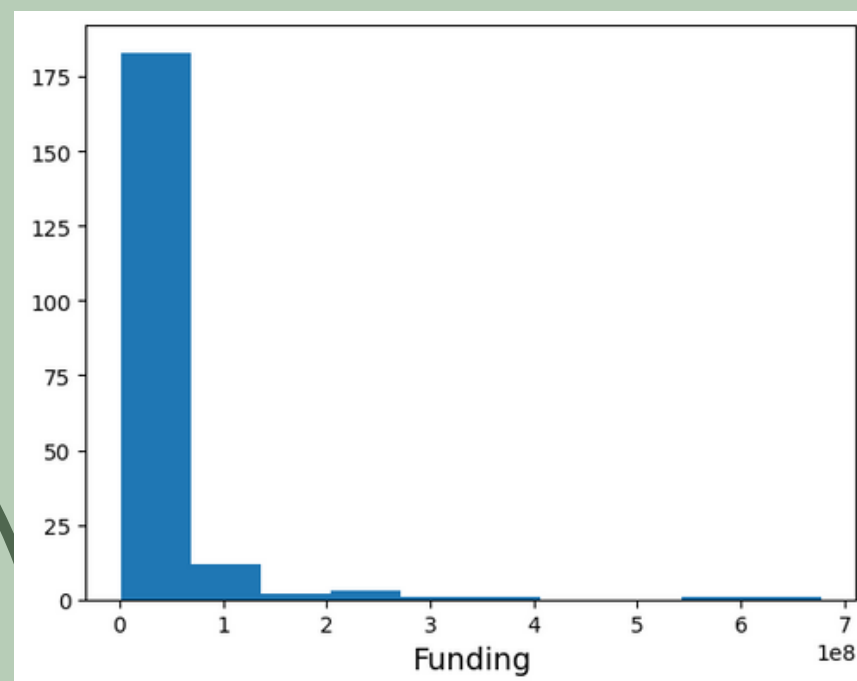
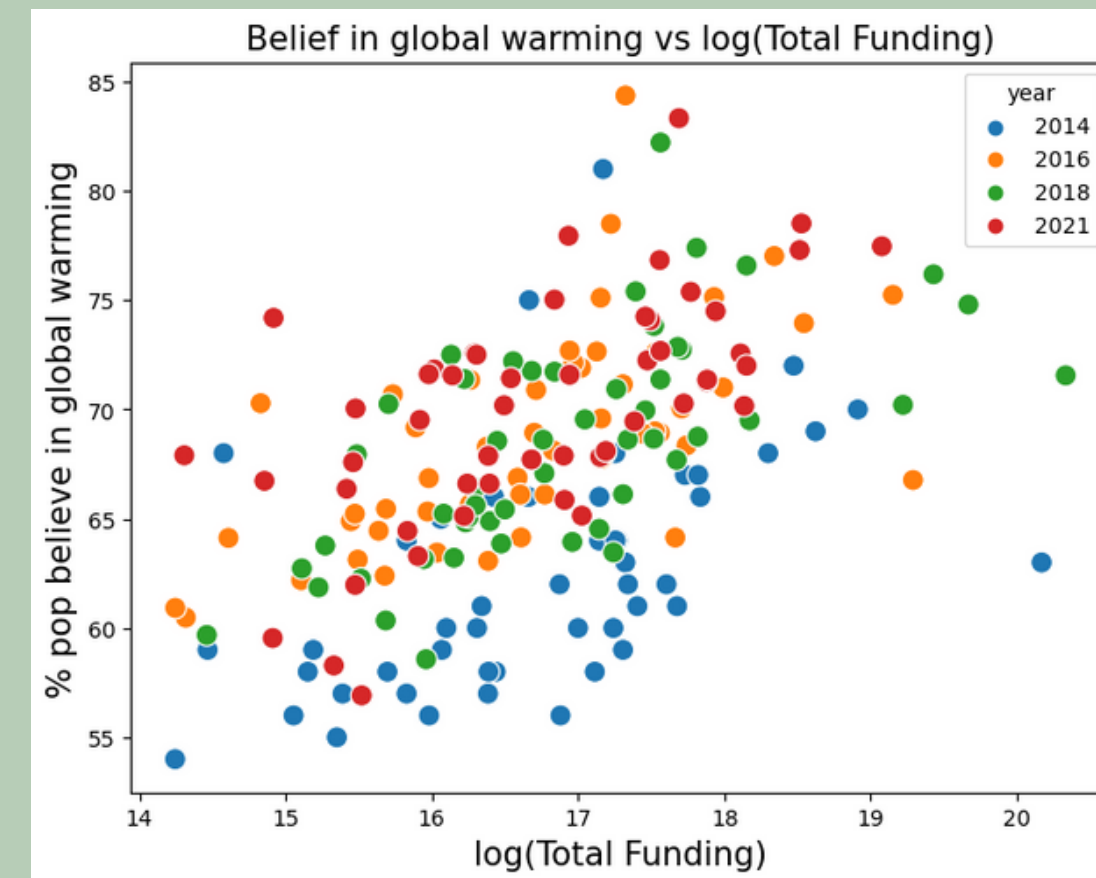
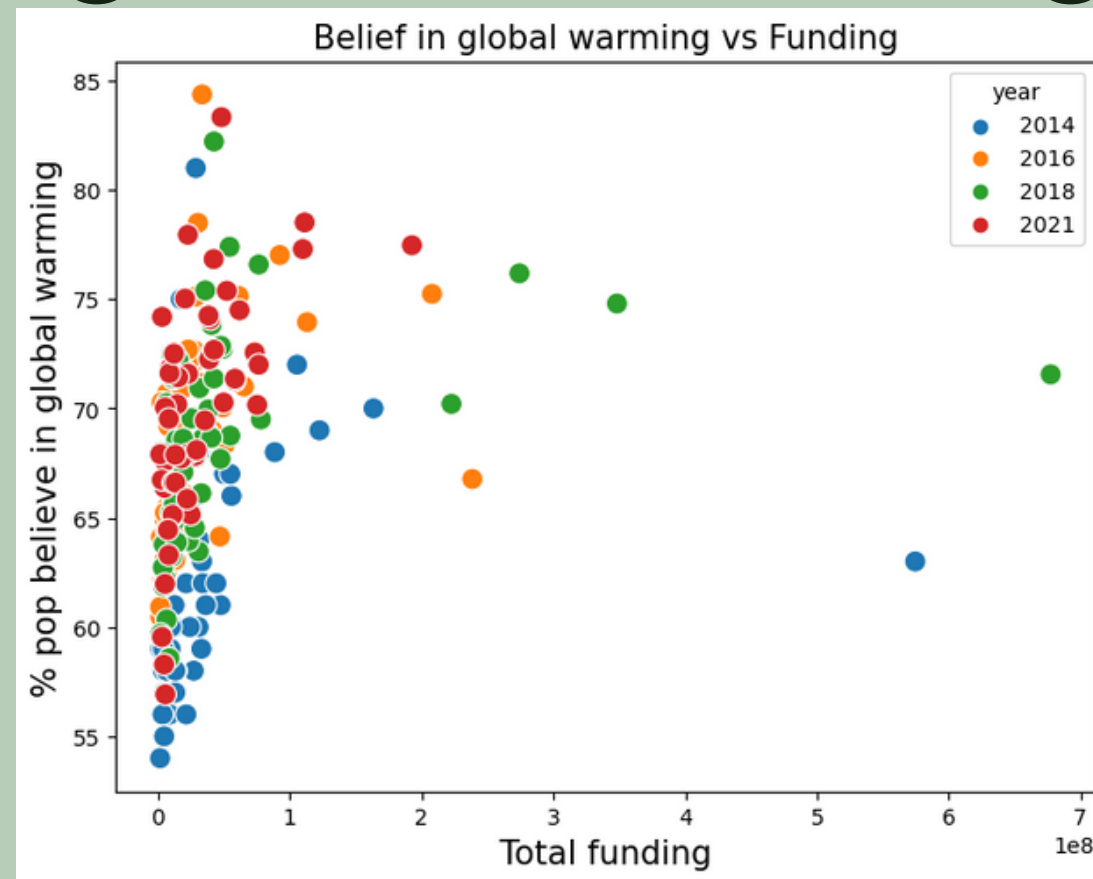
Data transformation

- $\log(\text{Total Funding})$



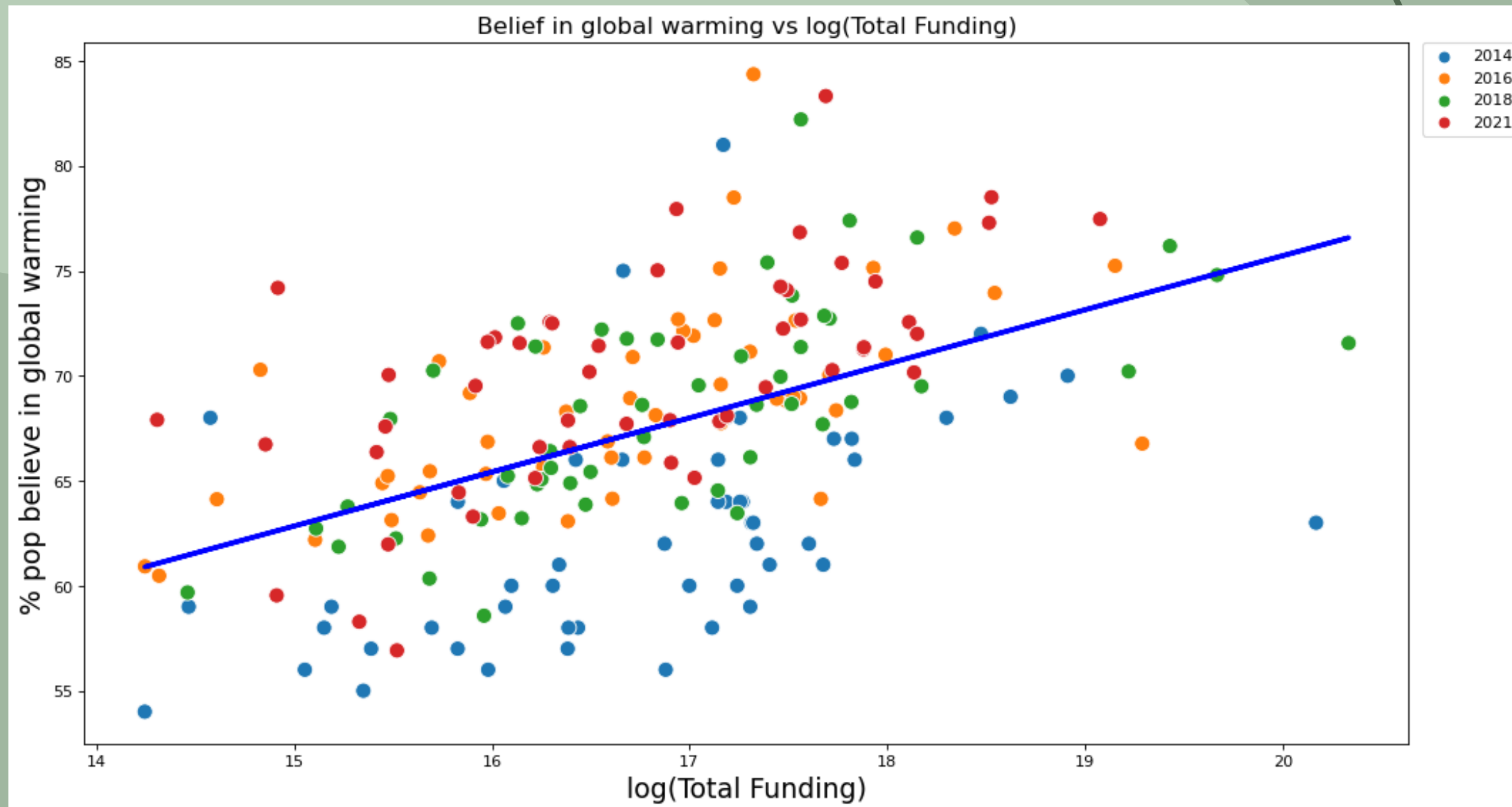
Data transformation

- $\log(\text{Total Funding})$



Simple Linear Regression

- Response: % population that believes in global warming
- Predictor: $\log(\text{Total Funding})$



Simple Linear Regression

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=====
                        OLS Regression Results
=====
Dep. Variable:          happening      R-squared:                0.268
Model:                  OLS           Adj. R-squared:           0.263
Method:                 Least Squares  F-statistic:              58.82
Date:                  Tue, 08 Nov 2022  Prob (F-statistic):      1.55e-12
Time:                  17:22:34         Log-Likelihood:           -492.95
No. Observations:      163             AIC:                     989.9
Df Residuals:          161             BIC:                     996.1
Df Model:               1
Covariance Type:       nonrobust
=====

```

	coef	std err	t	P> t	[0.025	0.975]
const	24.2208	5.640	4.295	0.000	13.083	35.358
log_funding	2.5749	0.336	7.669	0.000	1.912	3.238

```

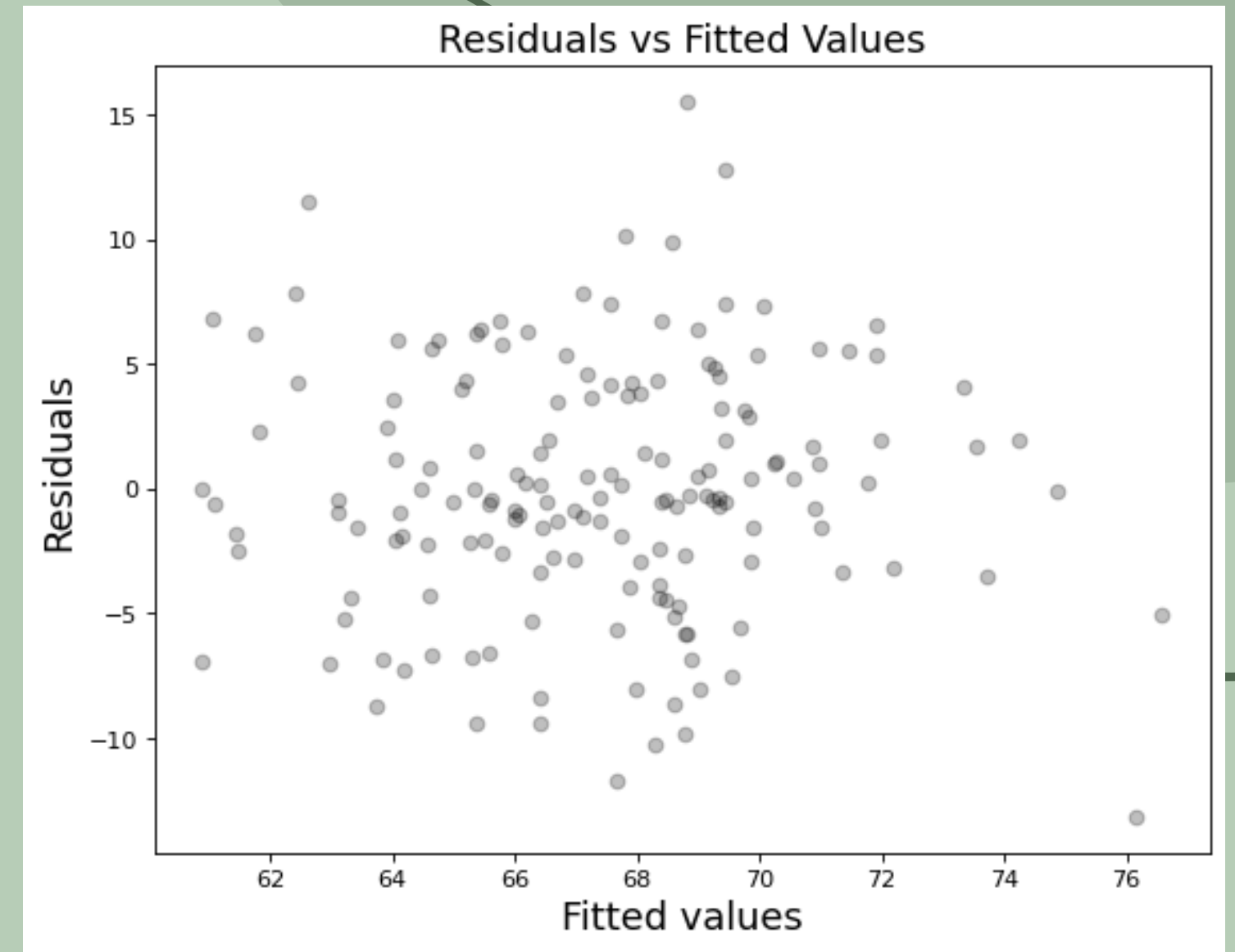
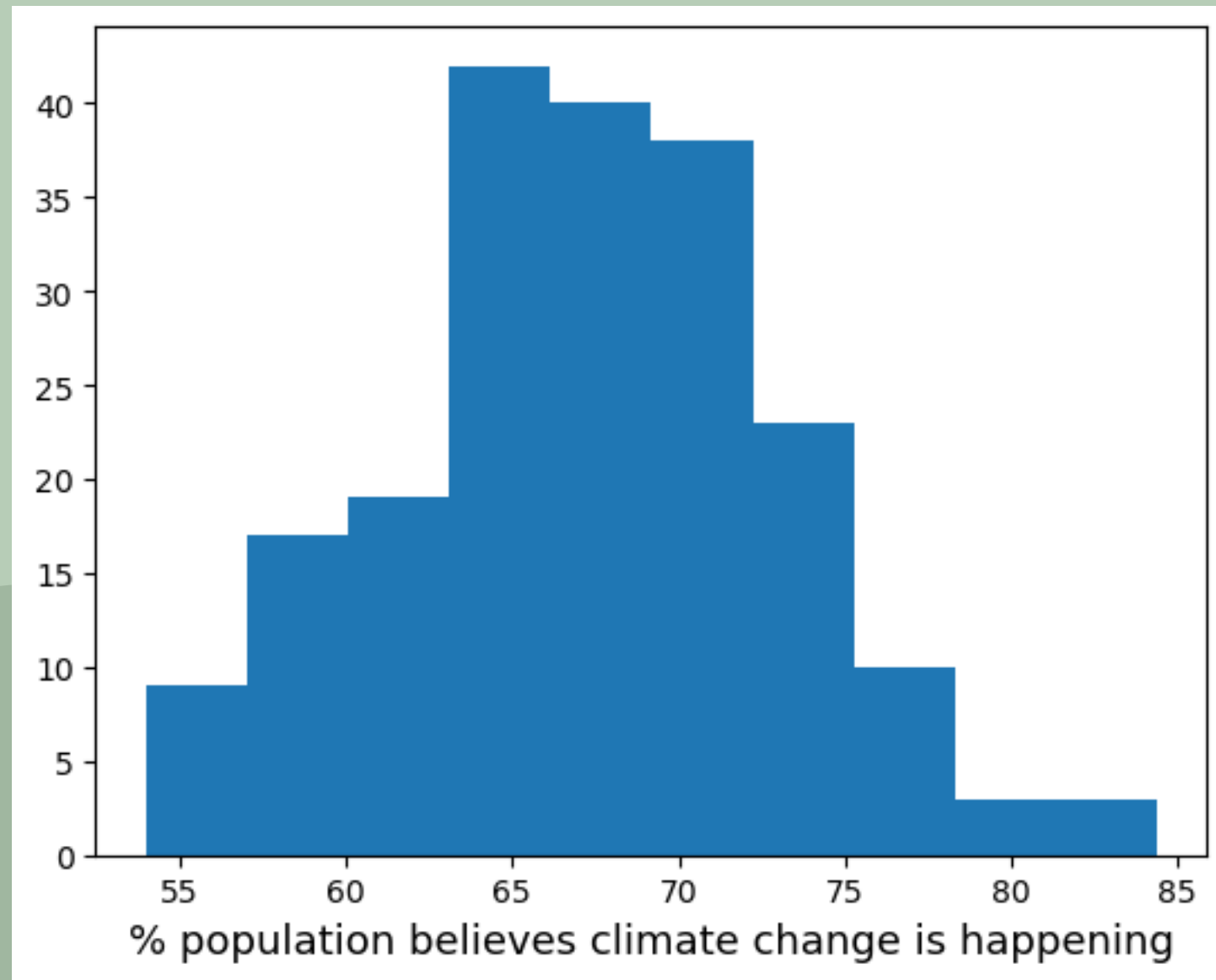
=====
Omnibus:                0.408      Durbin-Watson:           1.871
Prob(Omnibus):          0.816      Jarque-Bera (JB):         0.185
Skew:                   0.064      Prob(JB):                 0.912
Kurtosis:               3.104      Cond. No.                  242.
=====

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Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly

Simple Linear Regression

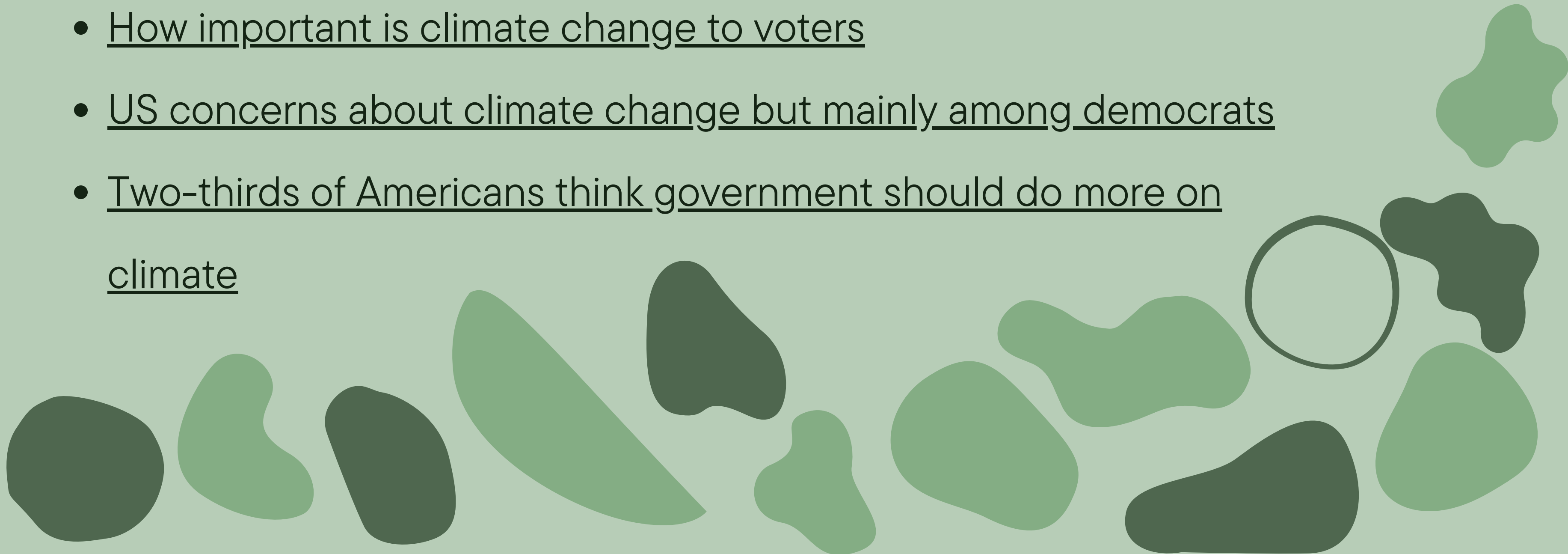


Future steps

- Climate change is very politicized. I want to see if political leaning by state can be added as feature
 - Climate in the American Mind study by Yale Climate Lab has data by political views
- Look at the data on a more granular level
 - By county and political leaning

References

- Yale Climate Opinion Lab
- NSF Award Search
- How important is climate change to voters
- US concerns about climate change but mainly among democrats
- Two-thirds of Americans think government should do more on
climate





Questions?