NBER WORKING PAPER SERIES

VOTING WITH THEIR SANDALS:
PARTISAN RESIDENTIAL SORTING ON CLIMATE CHANGE RISK

Asaf Bernstein
Stephen B. Billings
Matthew Gustafson
Ryan Lewis

Working Paper 27989
http://www.nber.org/papers/w27989

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 2020

We are extremely grateful toward the folks at Zillow and NOAA for providing critical data. Data provided by Zillow through the Transaction and Assessment Dataset (ZTRAX). More information on accessing the data can be found at http://www.zillow.com/ztrax. The results and opinions are those of the author(s) and do not reflect the position of Zillow Group. The authors have no relevant funding or competing interests to disclose. We would like to thank seminar participants at the CU Boulder finance lunch for helpful comments. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Voting with their Sandals: Partisan Residential Sorting on Climate Change Risk
Asaf Bernstein, Stephen B. Billings, Matthew Gustafson, and Ryan Lewis
NBER Working Paper No. 27989
October 2020
JEL No. D10,D72,G1,G5,Q5,Q54,R2,R21,R23,R31

ABSTRACT

Climate change partisanship is reflected in residential choice. Comparing individual occupants at properties in the same zip code with similar elevation and proximity to the coast, registered republicans (democrats) are more (less) likely than independents to own houses exposed to sea level rise (SLR). Findings are unchanged controlling flexibly for other individual demographics and a variety of granular property characteristics, including the value of the home. This sorting is driven by differential perceptions of long-run SLR risks across the political spectrum not tolerance for current flood risk or preferences for correlated coastal amenities. Observed residential sorting manifests among owners regardless of occupancy, but not among renters. We also find no residential sorting in relation to storm surge exposure, which is a primary driver of current flood risk. Anticipatory sorting on climate change informs models of migration in the face of long-run risks and suggests households that are most likely to vote against climate friendly policies and least likely to adapt may ultimately bear the burden of climate change.

Asaf Bernstein
Leeds School of Business
University of Colorado at Boulder
Campus Box 401
Boulder, CO 80309
and NBER
asaf.bernstein@colorado.edu

Stephen B. Billings
University of Colorado
Department of Finance
Leeds School of Business
Boulder, CO 80309
stephen.billings@colorado.edu

Matthew Gustafson
Penn State University
PA 16801
mtg15@psu.edu

Ryan Lewis
Leeds School of Business
995 Regent Street
80309
Leeds School of Business
Boulder, CO
ryan.c.lewis@colorado.edu

"No challenge poses a greater threat to future generations than climate change."
President Barack Obama[1]

"I don't believe it."
President Donald Trump[2]

In a 2020 Pew survey asking registered U.S. voters about top policy priorities, climate change was the most partisan issue on a list that included immigration, gun policy, health care, terrorism, and race relations.[3] If this divide materializes in meaningful economic decisions, as opposed to reflecting mere rhetoric, the implications for both public and private investment in the face of climate change may be momentous. Of particular importance is the possibility of systematic selection of climate change exposure, akin to Tiebout (1956), along political party lines. Changes in climate cause migration away from affected areas (Hornbeck 2012; Bohra-Mishra et al. 2014). In extant models this migration serves to mitigate the costs of climate change (Desmet & Rossi-Hansberg 2014, 2015), however partisan-based sorting in expectation of future climate change may instead concentrate ownership in the voting block least likely to take private action or support government-sponsored adaptation/mitigation. Given the importance of local governments in combating climate change, such partisan-based residential sorting may exacerbate the economic costs of climate change.

We examine climate risk in the form of coastal communities exposed to sea level rise (SLR), where scientists expect many coastal homes to eventually become worthless due to SLR-induced inundation. The partisan divide on beliefs regarding SLR exposure risk mimic that of climate change more generally.[4] Moreover, properties in similar locations within coastal communities have substantial and easily observable differences in climate change exposure. As in Bernstein et al.

[1,2] 2015 State of the Union Address; 2018 interview on climate change
[3] www.pewresearch.org
[4] 67% of liberal democrats believe it is very likely climate change would cause SLR to erode shorelines, relative to only 16% of conservative republicans (Pew Survey 2016)

(2019), we exploit this variation, along with nationwide property-level data on all housing transactions in U.S. coastal communities, matched to the universe of individual voter registrations, and parcel-level SLR exposure from the NOAA to identify the extent of partisan-based residential sorting into SLR exposed properties. We find that SLR exposed homes are more (less) likely to be owned by registered Republicans (Democrats), than Independents, relative to otherwise observably equivalent unexposed properties equidistant from the beach. In particular, we find that Republicans are approximately 1.2% more likely to purchase an SLR-exposed home than Democrats. Partisan sorting is substantially larger for houses with more imminent SLR exposure, but occurs even for houses where concerns are more temporally distant, consistent with anticipatory investment changes in the face of these long-run risks.

In our baseline model, we control for zip code interacted with granular distance-to-coast x elevation interval fixed effects. This allows us to compare homes that have similar locations and amenities, but differ in SLR exposure. Several tests mitigate the possibility that our findings are driven by omitted variables that happen to correlate with both SLR exposure and political affiliation. First, our findings are similar after augmenting them with the inclusion of a broad set of observable controls for property characteristics. Moreover, specification curve analyses (Simonsohn et al. 2020) demonstrate robustness across specification and sub-sample choices. Further alleviating the concern that some valuable characteristics remain omitted, results are unchanged after including flexible controls for the actual transaction value of the home. The presence of home values for transacting properties provide a novel opportunity to control for a proxy for typically unobservable homebuyer perceived amenity value.

Three additional sets of tests indicate that the observed partisan-based sorting into SLR exposed properties is driven by differing beliefs about long-run SLR risks across the political spectrum. First, we use our detailed demographic information to show that this partisan sorting does not appear to be driven by sorting on voter age, race, income, or education. Second, we provide evidence that partisan sorting about long-run SLR-induced flooding, not just differential selection on current flood risk. Specifically, we find no evidence that political affiliation is correlated with current exposure to storm surges, a primary cause of short-term flood risks. Finally, partisan residential sorting only exists among owners, whether they occupy the property or not, but not among renters. This limits the plausibility that SLR exposed properties have attributes that systematically attract Republicans as opposed to Democrats, but is consistent with Democrats acting on concerns about long-run SLR risks with their housing ownership decisions.

These findings contribute to the growing literature on the economic effects of climate change and most directly relate to the set of studies examining how climate change affects coastal communities. These include those looking at the response of housing transaction prices or volumes, mortgage lending, municipal bonds, and insurance premia to current flood risk (Bosker 2019; Atreya and Czajkowski 2019), hurricanes (Bin & Landry 2013; Ortega & Taşpınar 2018; Ouzazd & Kahn 2020), and of course SLR (Bernstein et al. 2019; Baldauf et al. 2020; Murfin and Spiegel 2020; Keys and Mulder 2020; Painter 2020; Goldsmith-Pinkham et al. 2020). Although existing evidence that SLR exposure impacts house price supports SLR exposure as an important driver of the future trajectory of coastal economies, such price effects are neither necessary nor sufficient to predict the type of "quantity" response we document. Indeed, Forsythe et al. (1992) shows that market prices, which are set by the marginal investor, say little about the biases of the average asset owner. For example, in contrast to real estate for investment purposes, prior work has not consistently found house price effects of SLR exposure for primary residences in many coastal communities (Bernstein et al. 2019; Baldauf et al. 2020; Murfin and Spiegel 2020). Our findings suggest that isn't necessarily because climate change isn't already affecting these housing markets.

Rather, as is modeled theoretically by Bakkensen & Barrage (2017) and Baldauf et al. (2020), instead of altering equilibrium prices, it could be systematically altering who owns SLR-exposed homes.[5]

Evidence on systematic sorting on climate-change driven SLR risk in coastal communities is interesting in of itself, but the fact that it is on political affiliation has particular relevance. Hornbeck (2012) shows that in the decades after the Dust Bowl ravaged the U.S. plains the primary margin of stabilizing adjustment was via migration away from the area. As we noted previously though, the (de)stabilizing nature of migration could critically depend on the type of resident migration. Consistent with evidence in modern data on sorting near high risk flood zones (Bakkensen and Ma 2020), and migration following natural disasters (Boustan et al. 2012; Mahajan & Yang 2020; Spitzer et al. 2020), Hornbeck (2020) finds that Dust Bowl migrants were "negatively selected" via lower education and likely lower income. [6] An important difference in our case is that migration is responding to future expectations, which means that it affects future responses to climate change. For instance, adaptation to SLR exposure with increased flooding events appears to lead to higher uptake of flood insurance (Gallagher 2014) correlated with political affiliation (Ratnadiwakara et al. 2020). Models of the future effects of climate change migration, (e.g., Hauer 2017), though often do so based on migratory patterns and economic effects once inundation or local devastation actually occurs. As noted previously though, these projections could change substantially if the selection also occurs along partisan for in advance of actual disaster.

[5]Bakkensen and Barrage (2017) also conduct a 187-person survey in Rhode Island and find correlations between SLR exposure and beliefs consistent with what we see in our nationwide raw data.

[6] See Banzaf, Ma, Timmins (2019) for a recent summary of the environmental justice literature and the dynamics of sorting around environmental disamenities.

Beyond just the macroeconomic implications, partisan residential sorting on climate change has intriguing implications for understanding of how partisan divides are reflected in substantive actions.[7] Prior work has argued that political affiliation is a prominent driver of self-reported climate change expectations (e.g., Hamilton 2011; McCright & Dunlap 2011). Whether this divide manifests in differential behavior or is just superficial rhetoric is critically important, but unclear, especially since despite massive partisan divides now, there was no evidence of partisan gaps in stated beliefs about global warming as recently as 1998.[8] Residential real estate and SLR represent an ideal setting to assess significant responses to climate change partisanship: 1) the individual stakes are high since housing is often the largest component of personal wealth (Campbell 2006) and future flooding from SLR would make this investment worthless; 2) low discount rates make it possible that expectations of temporally distant risks could impact decisions today (Giglio et al. 2014). In fact, evidence suggests households act as if they highly value housing amenities even a century in the future, perhaps driven by bequest motives (Giglio et al. 2014). While these low discount rates make it possible that there could be partisan sorting on SLR, in the absence of empirical evidence the likelihood is unclear ex-ante. Afterall, households struggle to plan for temporally distant vital financial decisions like retirement (Chetty et al. 2014) and the impacts of climate change are not individually deterministic, so they may only generate substantial costs to the next generation.

In that respect, our findings also provide a unique contribution to the evidence on residential sorting as a mechanism people use to "vote with their feet". Banzhaf and Walsh noted in 2008 that "[g]iven the central importance of Tiebout's

[7] One example is an emerging literature on partisan divide in investor sentiment, including in-group effects on economic expectations (Mian et al. 2018) credit ratings (Kempf & Tsoutsoura 2018), and events surrounding COVID-19 (Meeuwis, Parker, Schoar and Simester 2018; Cookson, Engelberg and Mullins 2020).
[8] https://news.gallup.com

insights, there have been surprisingly few direct tests of his premise". Since then, as summarized by Banzaf et al. (2019), a number of researchers have made progress on that front, but evidence is still somewhat limited, given the prominence of Tiebout (1956). In broad terms our findings provide additional well-identified empirical evidence consistent with Tiebout sorting. In addition, though, we provide evidence of anticipatory sorting far in advance of any potential future disamenities. This may of course be specific to the salience of climate change due its high level of partisanship. Still this suggests the potential for salient (dis)amenities, even highly temporally distant, to result in significant current anticipatory Tiebout residential sorting. This could lead to even larger local general equilibrium responses than what we estimate in our partial equilibrium analyses. Theoretically, even relatively modest preferences for proximity to similar residents could cause multiplier effects where a small change in composition attracts additional akin people (Schelling 1969; Sethi & Somanathan 2004; Banzhaf & Walsh 2013). In fact, recent work has found just such effects, where politically similar people are more likely to choose geographically proximate locations (McCartney & Zhang 2020).

Therefore, taken all together we show that partisanship over temporally distant climate change risks is reflected in current residential ownership choice. This means that partisan-divides are more than just rhetoric and that voters are willing to take substantial economic actions consistent with these divides. More specifically, the climate change policy response may be impacted by the fact that the households most likely to vote against climate friendly policies and least likely to adapt to climate change related flooding are transitioning to bear the burden of SLR.

1 Data and Sample

In this section we discuss the data sources we use to obtain information on all individual level voters, properties, and SLR exposure in coastal communities.

1.1 Data Sources

We obtain property-level data from the real estate assessor and transaction datasets in the Zillow Transaction and Assessment Dataset (ZTRAX). ZTRAX is, to the best of our knowledge, the largest national real estate database with information on more than 374 million detailed public records across 2,750 U.S. counties. It also includes detailed assessor data including property characteristics, geographic information, and valuations on over 200 million parcels in over 3,100 counties.

Characteristics from the assessor files provide the exact geo-coded location of each property, which allows us to determine the property's distance from the nearest coastline point as well as its elevation. The dataset also contains information on a broad set of property information including the existence of a sea or ocean view, square footage, the number of bed/bathrooms, and build year. We also see the type of property (e.g. single-family residence, condo, town-home) as well as whether or not the unit is owner-occupied following the sale, the type of buyer, and the address of the buyer and seller.

To implement our research design, we determine the property-level exposure to SLR for all properties within our sample utilizing NOAA's publicly available SLR viewer (Marcy et al. 2011). Since tidal variation and other coastal geographic factors affect the impact of global oceanic volume increases on local SLR, we utilize the NOAA's SLR calculator to define each property's SLR exposure. The NOAA provides detailed SLR shapefiles that describe the latitude and longitudes that will be inundated following a up to 10-foot increase in average global ocean level. We utilize geographic mapping software to assess the exposure level of each property within a coastal county in the Zillow data. We find that approximately 3 million homes are exposed to SLR of between 0 (currently exposed) and 10 feet.

To identify political affiliation, we utilize voter registration data from L2, which has information on 190 million voter records. We obtain these data for coastal states and merge it with the Zillow-SLR dataset based on physical address. For additional tests on the transaction sample, we merge the registration data based on buyer's address.

Finally, to control for other potential drivers of SLR exposure such as income, we utilize a smaller matched sample that includes data collected as part of HMDA (Home Mortgage Disclosure Act). Since HMDA does not provide transaction level identifiers, this merge requires fuzzy matching on transaction period, sales price amount, loan amount, and broad location. Approximately half of our transaction sample merges uniquely with the HMDA data.

1.2 Sample

Our primary analysis is cross-sectional, with each individual appearing once. We use the voter registration and address information in the spring 2017 L2 to define political affiliation. Property-level characteristics are from deeds records for the most recent dates, while information available only at the time of sale, such as purchase price, as well as details from HMDA, are all taken as of the most recent transaction date.

We restrict the sample to properties in coastal communities, defined as parcels within 2 miles of the coast that are located in counties where at least one property that the NOAA projects would be inundated with 10 feet of SLR. In most models, we also remove parcels that would be inundated with less than one foot of SLR.[9]

We are able to match 26.65 million observations across ZTRAX and NOAA, and approximately 16 million observations for which are able to obtain accurate distance to the coast, elevation, and political affiliation. Our sample is reduced to about 3.9 million observations in specifications where we also require detailed information on the value of the most recent transaction as well as detailed property characteristics, including square footage, the buildings age, number of bed/bath rooms, building height, assessed quality, and the presence of a garage/pool. We can also restrict ourselves even further to properties which also include a match to HMDA, leaving approximately 1.5 million observations. Throughout our analysis, we occasionally choose smaller samples in order to include these additional controls. Neither the inclusion of these additional controls, nor the smaller samples, is ever necessary for our analysis or conclusions, but useful for additional robustness checks.[10]

2 Climate Change and Reported Partisanship

In this section we provide some brief background and simple statistics on the scientific evolution of predictions about climate change/SLR risks, as well as the growing partisan divide in reported beliefs about such risks.

2.1 Scientific Evidence on Climate Change/SLR

Before examining partisan views on climate change, and in particular SLR, it is useful to understand the underlying scientific evidence on historical patterns and future projections for SLR. In Figure 1a we plot the changes in average global

[9] This restriction will not alter results much, but the exclusion of properties at SLR < 1 foot is more consistent with looking at long-term beliefs about SLR.
[10] For some analyses we employ smaller samples due to matching requirements across datasets.

mean temperatures and SLR over the 40-year period from 1970-2010. As can be seen, there is a clear upward movement in both time series, as changes in the global climate and temperature have been accompanied by rising seas.

Over the final 10 years in Figure 1a average global sea levels rose by 45.2mm or about 1.78 inches. If that was the average rate over the next 80 years, that would imply about 14 inches, or just a bit over a foot of additional SLR by 2100.[11] This is below even the low-end of most scientific projections over that period, which we depict in Figure 1b.[12] This is because scientific models expect SLR to accelerate over the coming decades. This shouldn't be terribly shocking since SLR accelerated even in the relatively small 40-year window presented in Figure 1a. In the first three decades sea levels rose on average by only about 20 mm/decade, less than half the rate in the final decade.

Improved scientific understanding of mechanisms driving these increasing rates of SLR have led to substantial increases in SLR projections, but also increased uncertainty about just how big that acceleration will be. This can be seen in Figure 1b. In the 2001 Intergovernmental Panel on Climate Change (IPCC) report, the expected SLR by the of the century was about 1 foot under a medium emissions scenario and around 1.5 feet for the high emissions scenario, with 1.5-2 feet of uncertainty within an approximate 95% confidence interval. By contrast, by 2017 the average expected SLR by the end of the century across the studies presented is 3 feet and 5 feet for the medium and high emissions scenarios respectively. In both cases these are much higher than scientific expectations in 2001. It is also worth

[11] We consider SLR projections over the next century since Giglio et al. (2014) provide evidence that due to low long-run discount rates in real estate, even losses 100 years in the future could have significant effects on current housing decisions.

[12] Following the same approach as Goldsmith-Pinkham et al. (2020) we include all studies highlighted in Garner et al. (2018) which have both medium and high emission scenarios, are semi-parametric, probabilistic, or part of the IPCC or NOAA analysis papers, include sufficient information for computation of a mean and variance of global SLR by the end of the century, and don't impose explicit constraints on projection variables or use non-standard temperature projections.

noting though that uncertainty about those projections rose substantially as well. 95% confidence intervals for 2017 projections were on average 3 feet and 3.8 feet for the medium and high emissions scenarios respectively. While the high end of the 95% confidence intervals for the three of the studies in the high emissions scenario gets up to 8 feet, the low end of that interval for three of them in the medium emissions scenario is under 2 feet[13].

This widening uncertainty in SLR projections by scientific reports could cause reasonable disagreements about the degree of climate-change-induced future SLR. In essence this would be debate about variation in estimates from studies of the type depicted in Figure 1b.

2.2 The Reported Partisan Divide on Climate Change

Political affiliation affects the way people interpret uncertain information, such as the SLR projections we present in Figure 1a. For instance, there is growing evidence that education has divergent effects on climate change beliefs by political party (McCright 2011; Hamilton 2011; McCright & Dunlap 2011), while Kahan et al. (2012) and Drummond and Fischhoff (2017) show that even experts' interpretation of new information about climate change is heavily mediated by partisan affiliation.

Figure 2 depicts the results of a 2020 Pew Research Center survey which directly examines the effect of partisanship on climate change beliefs. The survey asked U.S. adults whether they agree that a given topic should be a "top priority for President Trump and Congress." Of all 18 topics raised, "climate change" was the one least agreed with by republicans. By contrast, along with the environment,

[13] While even high-end confidence intervals for SLR projections over the next century don't exceed 8 feet, it is hard to know ex-ante whether even longer time periods could matter for current housing decisions, nor whether individual uncertainty exceeds those reported by the studies themselves. This is inevitable an empirical question and one we explore explicitly in our non-linear analysis later in the paper.

health care, and education, it was one of the most agreed upon topics by Democrats. Perhaps not surprisingly then, this meant it was the topic with the largest partisan gap, even though the other topics mentioned included “gun policy”, “immigration”, “military, and “race relations” – all considered to highly partisan topics in the U.S.

This variation in stated concerns about climate change does not simply represent differential geographic exposure. The 2018 Yale Climate Study asked participants “Do you think that global warming is happening?.” In Figure 3 we plot the % of democrats who answer yes in a county minus the % of Republicans who answer yes. Overall, only 45% of conservative Republicans report believing in global warming, relative to 95% of liberal Democrats. Not only that, there is a positive Democrat-Republican partisan gap of at least 20 percentage points in every single one of the 435 congressional district in the country!

In Table 1 we descriptively examine the partisan divide on climate change in our data by looking at cross-county correlations. We find that counties with more SLR exposure have a higher proportion of Republicans (and less Democrats). This is also summarized by a measure we construct, and use throughout the paper, *Pol. Conservative*, which is -100 for Republicans, 0 for Independents, and 100 for Democrats. This measure has a 95% correlation with the % of Republicans in a county, a -95% correlation with the Democrat share, and only a 5% correlation with Independents. Using this measure, we again see that more conservative counties have more SLR exposure. Despite this higher exposure, *Pol. Conservative* has -60% correlation with the % who are worried about climate change according to the 2016 Yale Climate survey, and a -55% correlation with concerns it will affect them personally. Therefore, even though Republicans are in more exposed areas they are still much less worried about climate change compared to Democrats.

To the extent these descriptive results are driven by Republicans (Democrats) who are less (more) concerned about climate change risks being more (less) willing to buy properties with SLR exposures, this would have important broader economic implications. Moreover, it would suggest partisan views on climate change are strongly held enough that people are willing to bet significant portions of their wealth on them.

In Table 2 we find that within our coastal counties, Republicans own 32% of SLR exposed properties, while Democrats own 41%, leaving Independents with the remaining 27%. This compares to an average across the whole sample of 23% Republican, 50% Democrat, and 27% Independent, suggesting Republicans are more likely to hold SLR exposed properties relative to their Independent or Democrat counterparts. SLR exposed properties are less than 1% more expensive, but are more likely to be purchased by higher income and older individuals. Exposed and unexposed properties both have approximately the same number of voters per household and are similarly distributed across ethnicity with approximately 55% of properties owned by Whites, 16% owned by Hispanics, and 13% owned by blacks.

3 Empirical Method

While the large differential between Republican and Democrat in exposure to SLR risk is suggestive of partisan-based sorting on beliefs about long-run SLR risks, a number of other explanations may be at play (as evidenced by the differences in age and income). As we explain below, we use a number of identification methods to mitigate the concern of confounding variables along three dimensions: 1) differences in amenity sets driven by coastal proximity and potentially correlated with political orientation, 2) unobserved heterogeneity in buyer and property types that is correlated with both conservative politics and SLR exposure, and 3) differences in appetite for current flood risk that is reflected in SLR exposure and may also be associated with political affiliation.

We address the first issue in a similar way as Bernstein, Gustafson, and Lewis (2019): we control for the property's zip code interacted with flexible non-linear controls for its distance to the coast and its elevation. We create flexible non-linear controls for coastal proximity and elevation by taking continuous measures of elevation and distance to the coast for each parcel and assigning them to intervals. Distance-to-the-coast is split up into intervals of 1/5th of a mile, while elevation is split into 2-meter intervals. By interacting these fixed effects with zip code, we reduce the comparison group to homes in the same neighborhood with a very similar coast-related amenity set, but potentially quite different SLR exposure. As discussed in more detail in Bernstein, Gustafson, and Lewis (2019), this design appears to eliminate coastal amenity differences between properties, while still leaving substantial variation in SLR exposure. As they note, this SLR exposure variation comes both from within interval variation in elevation and the topology of the terrain surrounding the property. Very small differences in elevation are unlikely to substantially alter amenity values on average, but might have substantial systematic effects on SLR exposure. The same is true of the topology surrounding a given property, since small inclines or structures may substantially alter the exposure to SLR without altering the amenities of the property.

Our benchmark regression is specified in Equation 1 below:

$$Exposure_i = \beta\ Pol.Conservative_i + \lambda_{zde} + \boldsymbol{X}_{ij}\phi + \varepsilon_i \qquad (1)$$

where for property *i*, *Exposure* is an indicator that takes a value of 1 if the property will experience chronic tidal flooding at the highest seasonal high tides with up to 10 feet of global average SLR. Given that scientists project that it will be at least 100 years before ten feet of SLR manifests, this measure captures any property with a chance of being inundated this century, ensuring that our control group consists of properties that will remain free of chronic flooding for the foreseeable future. λ is the set of zip, distance and elevation fixed effects discussed above. $Pol.Conservative_i$ takes a value of 100 if the voter registered at the property is Republican, 0 if they are Independent, and -100 if they are a registered Democrat.

Independents are defined to be any registered voter who is neither a Democrat nor a Republican, and so includes primarily registered unaffiliated voters, but also those registered outside the major two-party system.

We also consider variants of Equation 1 that estimate more than binary treatments, such as a version where we include dummy variables for being Republican or Democrat or both (in which case all estimates are relative to Independents as the omitted group). This allows us to see whether effects are consistent with what we would expect for not just Democrats relative to Republicans, but also each party, relative to Independents.

An important aspect of our identifying assumption is that after including our primary set of fixed effects any remaining association between SLR exposure and political affiliation is not due to correlated omitted variables related to amenities or disamenities. To help examine this we also include specifications with $\boldsymbol{X_{ij}}$, which is a set of property, i, or buyer, j, controls that varies depending on the analysis. For property characteristics these include third order polynomials of building age and lot size square footage, as well as fixed effects for the number of bedrooms, bathrooms, building height, assessed building quality, and presence of a garage or pool. For buyer demographics in the most saturated model these include fixed effects for age, race, income at origination deciles from HMDA, and estimated years of education.

A remaining concern is the possibility that there are buyer or property characteristics that we do not observe or adequately control for that are correlated with political affiliation and the choice to own an SLR exposed property. For example, if SLR exposed homes offered an unexamined set of amenities that Republicans happened to enjoy, we would show a positive β coefficient that would be unrelated to SLR risk. The concerning amenities or disamenities would be valuable ones that are observable to buyers, but not to us as the econometricians. One novel feature of our setting is that for the subset of properties with observable transactions, we typically have a variable that encompasses not just the set of characteristics in deeds records, but a measure of the full set of amenities and how they are valued by buyers – the price of the property. Therefore, for much of our analysis we consider a slightly augmented version of Equation 1:

$$Exposure_i = \beta\, Pol.Conservative_i + \lambda_{zdep} + \gamma_t + \boldsymbol{X}_{ij}\phi + \varepsilon_i \qquad (2)$$

where we restrict ourselves to only properties transacting from 2007-2017, when we have accurate prices, and include γ_t to control for any time variation in other controls and the composition of buyers by political affiliation and exposures. Critically we also now include λ_{zdep}, where the subscript p denotes a flexible non-linear control for the value of the property, based off the most recent transacted price. We implement this non-linear control, by computing common price intervals used in housing searches ($50,000 bins up to properties of $1M and $100,000 bins for properties greater than $1M), adjusted for price appreciation at a state-level to make transactions earlier and later in the sample more comparable.[14] Not only does the inclusion of these flexible price controls help alleviate concerns about unobserved correlated (dis)amenities, but a comparison between the estimated coefficients in Equations 1 and 2 provides useful information on the relevance of such unobserved factors.

Since our models include quite granular fixed effects to control for locational attributes such as elevation, zip code and distance to beach as well as property attributes and prices, it is important to confirm that there exists enough variation in SLR exposure that allows for partisan sorting after accounting for all aspects of amenities and quality difference across properties. To this end, Appendix

[14] In particular, we estimate state house price indices (normalized to 2007) by regressing time fixed effects on the transaction values for all properties in our primary sample, after including the aforementioned controls for property characteristics, state-by-state. We then take each observed housing transaction in our dataset and subtract this state house price index to put transactions within each state at different times on more comparable footing and increasing the dispersion of prices across both price intervals and time/regions.

Table 1 estimates Equations 1 and 2 without any voter attributes and increasingly granular fixed effects. This table highlights that even in our most restrictive price models, we explain at most 89% of SLR exposure. This remaining variation allows for sorting on political beliefs as well as other voter attributes.

4 Results

We begin in Section 4.1 by analyzing the relationship between SLR exposure of properties and the political affiliation of their residents. We rely on variation that remains after including the flexible set of property controls in the primary specifications outlined in Equations 1 and 2. In Section 4.2, we then provide additional evidence that observed sorting comes from partisan sorting on long-run SLR risk, not selection on other demographics, short-term flood risk, or current amenities.

4.1 Partisan Residential Sorting on SLR

In our primary analysis we estimate Equations 1 and 2 to identify the relation between political affiliation and the propensity to live in a property that is exposed to SLR. Table 3 presents our main findings. In Column 1 we regress SLR exposure on separate indicators for Republican and Democrat residents, along with zip code x distance-to-coast bin x elevation bin fixed effects. This fixed effect structure controls for the location as well as the proximity to coastal amenities. Thus, the coefficients on political affiliation is identified off of partisan variation in SLR exposure that is driven by either small (i.e., within 6-foot elevation bin) differences in elevation or topography, which can channel water towards or away from specific parcels.

In Column 1 both the Republican and Democrat indicators are statistically significant. Compared to Independents, Republicans (Democrats) are more (less) likely to live in SLR exposed properties. Column 2 is identical to Column 1 except that we aggregate political affiliation into a single measure that equals 100 for Republican, 0 for an Independent, and -100 for a Democrat. Not surprisingly, the estimated effect of this variable, 0.091, is halfway between the Republican and Democrat effects estimates in Column 1 and is highly statistically significant. We employ this aggregated measure of political affiliation for most of our subsequent analyses since it provides a more parsimonious way of capturing political leaning.

In Column 3 of Table 3 we augment the empirical specification with additional controls for property characteristics. These additional controls have little effect on the estimated relation between political affiliation and SLR exposure. Columns 4 through 6 further limit our sample to only voters in properties that have a property sale since 2007 (price sample), with Column 5 including fixed effects for the time at which the property transacted, and Column 6 further limiting the analysis to voters that can be matched to HMDA income and race data (income sample).

The additional inclusion of flexible interval-based fixed effects for housing transaction prices provides a novel opportunity to control for a direct proxy of the combined value of all housing amenities. These include anything that affects the value of the property, including the view, other benefits of proximity to the beach, costs associated with current flooding risk, etc. As shown in columns 4-6, the inclusion of price controls changes relatively little about the estimated relationship. After controlling for property characteristics and zip code x distance-to-coast bin x elevation bin x price bin fixed effects the magnitude of the coefficient increases slightly to 0.114. Scaling this coefficient by the unconditional probability of SLR exposure in our sample of 19%, suggests that Republicans are about 1.2% more likely to purchase an SLR exposed property relative to Democrats during our sample period.

In Figure 4, we switch the dependent and independent variable to examine how political affiliation changes non-linearly with categorical dummies representing intervals of SLR needed to flood the property (ex. 0-1, 1-2, 2-3 feet, etc.). Properties requiring lower levels of future SLR change to be flooded would be flooded much sooner based on climate change projections, and so we anticipate beliefs about SLR projections to be more relevant for these properties. By contrast properties requiring 9 or 10 feet of SLR to be flooded would not be likely to be underwater for significantly more than a century, so we would expect less partisan sorting. Figure 4 Panel B breaks down the effect in Panel A by splitting the political affiliation measure to separately examine the effect of being Democrat or Republican relative to Independent.[15] Here, the red and blue lines represent coefficients on Republican and Democrat indicators when regressed on these separate indicators for SLR exposure. Each point estimate reflects Republicans' or Democrats' preference for a property with the exposure denoted on the x-axis relative to a property that is not exposed to SLR of 10 feet.

Figure 4 indicates that the differential preference of Republicans for SLR exposed properties is largest for the most exposed properties. Republicans' preference for SLR exposed properties monotonically drops for properties with less than 1 foot through 3 feet of exposure. According to scientific projections, these properties are at risk of being inundated within the next 50 years. The difference between Republican and Democratic preference continues to be statistically significant for properties with between 4 and 8 feet of SLR until inundation. Upper end SLR projections would have these properties inundated within the next 100 years. Notably, Republicans and Democrats treat properties that will be inundated by 10 feet of SLR similarly to each other and similarly to unexposed properties.

In order to ensure that our specification of fixed effects and sample choice is not driving our main results, in Figure 5 and Appendix Figure 1 we provide specification curves (Simonsohn et al. 2020) for models that vary in how we specify

[15] All models in Figure 4 includes zip code x distance-to-coast bin x elevation bin fixed effects.

distance to coast fixed effects, the choice of sample, and how we incorporate price controls. In Figure 5, we provide all iterations of fixed effects and other controls for our three main data samples and compare them to our main results for all voters and those that are limited to our properties with prices. Results are consistent and show that the choice of controls generates some variation in magnitudes, but results are consistently around 0.1 and always statistically significant. Even in models with quite restrictive fixed effects (price by elevation by distance to coast by zip by year by quarter of sale bins) or distance to the coast bins of only 0.05 miles, we still find similar coefficients that are statistically significant. Appendix Figure 1 provides a specification curve for two additional samples, limiting properties to only those within 1 mile of the coast as well as including properties with SLR exposure at less than 1 feet (in essence, already exposed to SLR). This figure highlights stronger effects for the 1-mile sample, consistent with greater share of properties at 1-5ft of SLR exposure than SLR exposure in our main 2-mile sample. This evidence on residential sorting into SLR exposed properties is also consistent with Republicans actively choosing to live in SLR exposed properties more frequently than Democrats, all else equal.

4.2 Establishing a Partisan Long-Run Risk Channel

In this section we take three approaches to further establish that the observed sorting is driven by partisan beliefs about long-run SLR risks. First, we show that our findings are not driven by sorting on other correlated individual demographics. Second, we show that such sorting occurs for long-run SLR-related exposures, but not variation in current flood risks. Third, we show that this partisan sorting is about long-run risk via ownership, not current amenities by examining partisan sorting patterns for renters vs. owners of non-owner-occupied dwellings.

4.2.1 Addressing selection on other resident characteristics

To more directly highlight the role of partisanship as a driver of SLR exposure location patterns, we next examine the effect of our Pol. Conservative (%) measure after controlling for, age, race, income, and estimates of education levels.[16] We estimate this model in Table 4 using our sample of voters in properties that contain information on prices, homebuyer income, age and race and employ zip code x distance-to-coast bin x elevation bin x price bin fixed effects. Column 1 shows that the estimated effect of political affiliation remains similar in magnitude after controlling for measures of age, race, and household income. Age is marginally significant and positively correlated with being in a property with SLR exposure, which is consistent with older home buyers caring slightly less about long-run SLR exposure risk. Our measure of race, which negatively correlates with being Republican is noisy and small in magnitude. The small change in magnitude of our measure of partisanship highlights the strong influence of this variable even when controlling for other voter attributes that correlate with political affiliation. In the remainder of the table we use non-linear controls for these correlated characteristics. The most saturated specification in Column 5 includes zip code x distance-to-coast bin x elevation bin x Price Bin, year-quarter, age bin, race, income bin, and education years fixed effects.

The main takeaway from Table 4 is that the inclusion of other personal characteristics has little effect on the estimated relation between political affiliation and residing in SLR exposed properties. The evidence in Table 4 relates to Bakkensen and Ma (2020) who find that low income and minority residents are more likely to move into high risk flood zones. Taken together, this evidence

[16] We only have an imputed measure of education levels based on Census data that has been estimated by L2. Income is limited to our sample of mortgage-holders that can be matched to sold properties and race is a mix of actual race given on voter registration forms in some states and imputed race based on full name. We also verify race through HMDA variables for race and ethnicity. Age is measured accurately since voter registration forms all require some age verification based on birth date.

suggests that there may be differential sorting with respect to short- and long-run flood risk.[17]

Also, our finding that proxies for education don't negate the effects of partisan residential sorting on climate change is consistent with prior work based on self-reported beliefs. Existing evidence on partisanship differences in beliefs about climate change consistently suggest that education is not the primary driver of this divide (Kahan et. al 2012; Drummond & Fischhoff 2017; Bolsen & Druckman 2018) but rather "a distinctive conflict of interest: between the personal interest individuals have in forming beliefs in line with those held by others with whom they share close ties and the collective one they all share in making use of the best available science to promote common welfare" (Kahan et. al 2012). This adherence to group beliefs is quite evident in the short-run as shown by large differences in hurricane evacuation behavior along partisan lines (Long, Chen & Rohla 2020) as well as the role of politics in shared time with family during the holidays (Chen & Rohla 2018) and responses to COVID-19 (e.g. Makridis & Rothwell 2020; Green et al. 2020; Grossman et al. 2020).

4.2.2 Ruling out Short-Term Flood Risk

Our finding of alternative sorting, relative to the current flood risk literature, and evidence that our results aren't driven by house value differences are all suggestive that observed sorting is driven by long-run rather than short-run flood risk concerns. To further examine this idea in our sample, Table 5 repeats our main test (i.e., Column 5 of Table 3) including controls for *stormsurge*, which proxies

---

[17] The Bakkensen and Ma (2020) result is consistent with a larger environmental justice literature (e.g. Kahn 2000; Banzaf & Walsh 2008; Davis 2011; Bento, Freedman & Lang 2015; Lavaine 2019; Banzaf, Ma, Timmins 2019) that provides evidence of low-income and minority households sorting into areas with higher environmental disamenities like industrial sites, air quality and flooding.

for current flood risk.[18] The highly correlated relationship between SLR and storm surge does require enough variation to separately identify how both relate to partisan sorting. Appendix Figure 2 provides an illustration that storm surge is positively correlated with but does not completely explain SLR exposure. Assuming that we have the statistical power to separately identify the effect of political affiliation on SLR exposure and storm surge exposure, we expect that if the driver behind the partisan sorting into SLR exposed properties is driven by Republicans having more appetite for current flood risk in owning a property, then the coefficient on political affiliation should attenuate upon the inclusion of storm surge exposure controls.

Moving from Column 1 to Column 2 of Table 5 reveals no evidence for this as the coefficient on Pol. Conservative moves by less than 4% in magnitude, from 0.114 to 0.110. Columns 4 and 5 further support the lack of partisan-based sorting into storm surge exposed properties as the *Pol. Conservative* is almost exactly zero when expected storm surge measures are used as dependent variables. These findings strongly support the idea that the partisan sorting we observe is due to differential beliefs about long-run SLR exposure risk.

4.2.3 Owners Not Renters Exhibit Partisan SLR Sorting

Thus far we have controlled for home characteristics in a variety of ways, some of which (such as sale price) even partially address unobservable differences between exposed and unexposed properties. In our final set of tests, we further address the possibility that our findings are driven in part by unobservable

[18] NOAA conducts a series of simulation exercises using past storm data for Atlantic hurricanes and tropical storms and conducts storm surge maps to highlight current flood risk for coastal areas. In particular, they simulate 100,000 hypothetical storms. They then take the maximum possible height the water reaches at a given location across all simulations (and assuming the highest possible tide) and that is the feet of storm surge we use in our analysis. Many locations never experience any storm surge related flooding across all simulations, which we use for our extensive margin analysis.

differences between exposed and unexposed properties that differentially attract Republicans, but are not captured by our controls. Here, we separately identify the political orientation of the buyer and renter of non-owner-occupied properties and run a similar analysis.[19] If our main results capture sorting by political affiliation over some amenity from living at non-owner-occupied properties with SLR exposure, we expect conservatives to be not only more likely to own them, but also rent there.

In our prior analysis the inclusion of price controls helps adjust for (dis)amenities that alter the value of a given property overall, but what they don't necessarily let us control for completely are (dis)amenities that may not alter house values (or alter them very little), but still lead to systematic sorting along political lines. It would be somewhat surprising if there were such a feature, since even if it were valuable for only one set of buyers, but not another, we would still expect it be at least partially reflected in housing prices. That being said, while perhaps unlikely such a (dis)amenity, may still be possible.

To address this possibility, we identify $Pol.Conservative_i$ as the political orientation of the buyer of the home for non-owner-occupied properties and run a similar analysis. If unobservable amenities that appeal to conservative buyers are a play, we should find a similar effect of the occupier political orientation (either renter or owner) on SLR exposure and no effect of owner political orientation for non-owner-occupied homes. In other words, if we are picking up sorting by political affiliation over some other amenity from living at non-owner-occupied

[19] ZTRAX allows for this distinction based on tax records which provide a property and mailing address. These two addresses are the same unless the owner lives at another location. For these non-owner-occupied homes, we use L2 voting data to determine the political affiliation of the renter (current resident at the property address) and the owner (the current resident at the mailing address). Even though the number of properties that fit this definition are smaller, this model allows for us to capture a unique distinction, the renter and owner associated with the same home.

properties with SLR exposure, we would expect conservatives to be not only more likely to own them, but also live there.

Columns 1 through 4 of Table 6 show that the politically driven residential sorting only exists among owners, whether they occupy the property or not, but not among renters. Specifically, we consistently find significant positive impacts for owners and quite small and imprecise effects for renters. Since we focus on the same property, the limited impacts of the political affiliation of renters as it relates to SLR suggests that amenities do not differ based on SLR exposure. Owners do have reason to care about SLR beyond correlated current amenities as it impacts future property values and rental incomes. Again, these findings are consistent with partisan-based sorting into SLR exposed properties being primarily due to difference in beliefs regarding long-run SLR across the political spectrum.

5 Conclusion

In this paper we show that climate change partisanship is reflected in residential choice. We use detailed nationwide data on all individual voters and properties in coastal communities to compare homes in the same zip code that are a similar elevation and proximity to the coast, but have differing sea level rise (SLR) exposures. After including these controls, Democratic (Republican) voters in coastal communities are less (more) likely than Independents to own properties at risk of becoming worthless because of rising sea levels caused by climate change.

These differential choices appear to reflect partisan differences in beliefs regarding the long-run effects of climate change. Results are unchanged controlling flexibly for a broad set of observable property characteristics and individual demographic information. Our findings also hold after including flexible controls for house values, suggesting sorting is not driven by differential selection on valuable amenities. Moreover, partisan-based sorting does not exist with respect to measures of immediate flood risk, and exists among the owners, but not the renters, of non-owner-occupied properties.

Our findings have important implications for academics and policymakers in climate finance, political science, real estate, urban economics, environmental economics, and geography. Our results suggest that partisan rhetoric about climate change is more than just talk; residents are "voting with their feet" for salient risks or disamenities that are forward looking. The anticipatory sorting and systematic differences in the pattern of residential movement that we document has important implications for models in environmental economics and geography projecting future migration in response to climate change. Models rarely consider the implications of shifts in residential choice decades in advance of any actual climate change-induced damage nor that this earlier shift in migrants may differ systematically based on beliefs. In fact, we find that climate change-induced residential choice is already occurring along political party lines. This may be especially important for policymakers since the growing share of those bearing the burden of future climate change, may also be those least concerned and perhaps unlikely to support adaptation/mitigation efforts.

References

Atreya, Ajita, and Jeffrey Czajkowski. 2019. "Graduated flood risks and property prices in Galveston County." *Real Estate Economics* 47(3): 807-844.

Bakkensen, Laura A., and Lint Barrage. 2017. “Flood risk belief heterogeneity and coastal home price dynamics: Going under water?” National Bureau of Economic Research Working Paper 23854.

Bakkensen, Laura A. and Lala Ma. 2020. “Sorting over flood risk and implications for policy reform.” *Journal of Environmental Economics and Management*, 104.

Bakker, A. M. R., Wong, T. E., Ruckert, K. L., & Keller, K. 2017. “Sea-level projections representing the deeply uncertain contribution of the West Antarctic ice sheet.” *Nature Scientific Reports*, 7:3880.

Baldauf, M., Garlappi, L., & Yannelis, C. 2020. “Does climate change affect real estate prices? Only if you believe in it.” *The Review of Financial Studies*, 33(3), 1256-1295.

Banzhaf, Spencer, Lala Ma, and Christopher Timmins. 2019. "Environmental justice: The economics of race, place, and pollution." *Journal of Economic Perspectives* 33(1): 185-208.

Banzhaf, H. Spencer, and Randall P. Walsh. 2013. “Segregation and Tiebout Sorting: The Link Between Place-based Investments and Neighborhood Tipping.” *Journal of Urban Economics* 74: 83–98.

Banzhaf, H. Spencer, and Randall P. Walsh. 2008. "Do people vote with their feet? An empirical test of Tiebout." *American Economic Review* 98(3): 843-863.

Bento, Antonio, Matthew Freedman, and Corey Lang. 2015. "Who benefits from environmental regulation? Evidence from the Clean Air Act Amendments." *Review of Economics and Statistics* 97(3): 610-622.

Bernstein, A., Gustafson, M. T., & Lewis, R. 2019. “Disaster on the horizon: The price effect of sea level rise.” *Journal of Financial Economics*, 134(2), 253-272.

Billings, Stephen. 2019. “Technical Summary - Merging Home Mortgage Disclosure Data to Property Records from Zillow (Ztrax) 1995-2016.” https://sites.google.com/a/colorado.edu/stephen-billings/code

Bin, Okmyung, and Craig E. Landry. 2013. "Changes in implicit flood risk premiums: Empirical evidence from the housing market." *Journal of Environmental Economics and management* 65(3): 361-376.

Bohra-Mishra, Pratikshya, Michael Oppenheimer, and Solomon M. Hsiang. 2014. "Nonlinear permanent migration response to climatic variations but minimal response to disasters." *PNAS*, 111(27): 9780–9785

Bolsen, T., & Druckman, J. N. 2018. "Do partisanship and politicization undermine the impact of a scientific consensus message about climate change?" *Group Processes & Intergroup Relations*, 21(3), 389-402.

Boustan, Leah Platt, Matthew E. Kahn, and Paul W. Rhode. 2012. "Moving to Higher Ground: Migration Responpse to Natural Disasters in the Early Twentieth Century." *American Economic Review P&P*, 102(3): 238–244.

Bosker, Maarten, Harry Garretsen, Gerard Marlet, and Clemens van Woerkens. 2019 "Nether Lands: Evidence on the price and perception of rare natural disasters." *Journal of the European Economic Association* 17(2): 413-453.

Campbell, J. Y., 2006. "Household finance." *The Journal of Finance* 61, 1553–1604.

Carleton, T. A., & Hsiang, S. M. 2016. "Social and economic impacts of climate." *Science*, *353*(6304).

Chen, M. K., & Rohla, R. 2018. "The effect of partisanship and political advertising on close family ties." *Science*, *360*(6392), 1020-1024.

Chetty, R., Friedman, J. N., Leth-Petersen, S., Nielsen, T. H., Olsen, T., 2014. "Active vs. passive decisions and crowd-out in retirement savings accounts: Evidence from denmark." Q*uarterly Journal of Economics* 129, 1141–1219

Cookson, J. A., Engelberg, J., & Mullins, W. 2020. "Does Partisanship Shape Investor Beliefs? Evidence from the COVID-19 Pandemic." *Review of Asset Pricing Studies.*

Davis, Lucas W. "The effect of power plants on local housing values and rents." *Review of Economics and Statistics* 93.4 (2011): 1391-1402.

Dell, M., Jones, B. F., & Olken, B. A. 2014. "What do we learn from the weather? The new climate-economy literature." *Journal of Economic Literature*, *52*(3), 740-98.

Desmet, K., Rossi-Hansberg, E., 2014. "Spatial development." *American Economic Review* 104 (4), 1211–1243.

Desmet, Klaus, and Esteban Rossi-Hansberg. 2015. "On the Spatial Economic Impact of Global Warming." *Journal of Urban Economics*, 88: 16–37.

Drummond, C., & Fischhoff, B. 2017. "Individuals with greater science literacy and education have more polarized beliefs on controversial science topics." *Proceedings of the National Academy of Sciences*, *114*(36), 9587-9592.

Edlund, L., & Pande, R. 2002. “Why have women become left-wing? The political gender gap and the decline in marriage.” *Quarterly Journal of Economics*, 117(3), 917-961.

Forsythe, R., Nelson, F., Neumann, G. R., & Wright, J. 1992. “Anatomy of an experimental political stock market.” *American Economic Review*, 1142-1161.

Gallagher, Justin. 2014. "Learning about an infrequent event: evidence from flood insurance take-up in the United States." *American Economic Journal: Applied Economics* 206-233.

Garner, Andra J., Jeremy L. Weiss, Adam Parris, Robert E. Kopp, Radley M. Horton, Jonathan T. Overpeck, and Benjamin P. Horton. 2018. “Evolution of 21st century sea level rise projections.” *Earth’s Future* 6, 1603–1615.

Giglio, S., Maggiori, M., Stroebel, J., 2014. “Very long-run discount rates.” *Quarterly Journal of Economics* 130: 1–53.

Giglio, S., Maggiori, M., Rao, K., Stroebel, J., Weber, A., 2018. “Climate change and Long-Run Discount Rates: Evidence from Real Estate.” Working Paper.

Green, Jon, Jared Edgerton, Daniel Naftel, Kelsey Shoub, Skyler J. Cranmer. 2020. “Elusive consensus: Polarization in elite communication on the COVID-19 pandemic.” *Science Advances* 6(28).

Grossman, Guy, Soojong Kim, Jonah M. Rexer, and Harsha Thirumurthy. 2020. “Political partisanship influences behavioral responses to governors’ recommendations for COVID-19 prevention in the United States”. *PNAS*. 117 (39) 24144-24153.

Hamilton, Lawrence C. 2011. “Education, Politics, and Opinions about Climate Change: Evidence for Interaction Effects.” *Climatic Change.*

Hauer, M.E., 2017. “Migration Induced by Sea Level Rise could Reshape the U.S. Population Landscape.” *Nature Climate Change*, 7:321-325.

Hornbeck, R. 2012. “The enduring impact of the American Dust Bowl: Short-and long-run adjustments to environmental catastrophe.” *American Economic Review*, 102(4), 1477-1507.

Hornbeck, Richard 2020. “Dust Bowl Migrants: Identifying an Archetype.” Working paper.

Hsiang, S. M., Burke, M., & Miguel, E. 2013. “Quantifying the influence of climate on human conflict.” *Science*, 341(6151).

Kahan, D. M., Peters, E., Wittlin, M., Slovic, P., Ouellette, L. L., Braman, D., & Mandel, G. 2012. “The polarizing impact of science literacy and numeracy on perceived climate change risks.” *Nature climate change*, *2*(10):732-735.

Kahn, Matthew E. 2000. "Smog reduction's impact on California county growth." *Journal of Regional science* 40(3): 565-582.

Kempf, E., & Tsoutsoura, M. 2018. "Partisan professionals: Evidence from credit rating analysts" National Bureau of Economic Research Working Paper 25292.

Keys, Benjamin and Philip Mulder. 2020. "Neglected No More: Housing Markets, Mortgage Lending, and Sea Level Rise." National Bureau of Economic Research Working Paper 27930.

Kopp, R. E., DeConto, R. M., Bader, D. A., Hay, C. C., Horton, R. M., Kulp, S., et al. 2017. "Evolving understanding of Antarctic ice-sheet physics and ambiguity in probabilistic sea-level projections." *Earth's Future*, 5(12):1217–1233.

Lavaine, Emmanuelle. 2019. "Environmental risk and differentiated housing values: Evidence from the north of France." *Journal of Housing Economics* 44: 74-87.

Le Bars, D., Drijfhout, S., & de Vries, H. 2017. "A high-end sea level rise probabilistic projection including rapid Antarctic ice sheet mass loss." *Environmental Research Letters*, 12(4).

Long, E. F., Chen, M. Lavaine K., & Rohla, R. 2020. "Political storms: Emergent partisan skepticism of hurricane risks." *Science Advances*, 6(37).

Mahajan, Parag, and Dean Yang. 2020. "Taken by Storm: Hurricanes, Migrant Networks, and US Immigration." *American Economic Journal: Applied Economics*, 12(2): 250–277.

Makridis, Christos and Jonathan Rothwell. 2020. "The Real Cost of Political Polarization: Evidence from the COVID-19 Pandemic." Working Paper.

Marcy, D., Herold, N., Waters, K., Brooks, W., Hadley, B., Pendleton, M., Schmid, K., Sutherland, M., Dragonov, K., McCombs, J., Ryan, S., 2011. "New mapping tool and techniques for visualizing sea level rise and coastal flooding impacts." In Proceedings of the 2011 Solutions to Coastal Disasters Conference, Anchorage, Alaska 474–490.

McCartney, W Ben, and Calvin Zhang. 2020. "'Sort Selling': Political Affiliation and Households' Real Estate Decisions". Working Paper.

McCright, A. M. 2011. "Political orientation moderates Americans' beliefs and concern about climate change." *Climatic Change,* 104(2), 243-253.

McCright, A. M., & Dunlap, R. E. 2011. "The politicization of climate change and polarization in the American public's views of global warming, 2001–2010." *The Sociological Quarterly*, *52*(2), 155-194.

Meeuwis, M., Parker, J. A., Schoar, A., & Simester, D. I. 2018. “Belief disagreement and portfolio choice”. National Bureau of Economic Research Working Paper 25108.

Mian, A. R., Sufi, A., & Khoshkhou, N. 2018. “Partisan bias, economic expectations, and household spending.” Working Paper.

Murfin, Justin, and Matthew Spiegel. 2020. "Is the risk of sea level rise capitalized in residential real estate?" *The Review of Financial Studies* 33(3): 1217-1255.

Nauels, A., Meinshausen, M., Mengel, M., Lorbacher, K., & Wigley, T. M. L. 2017. “Synthesizing long-term sea level rise projections—The MAGICC sea level model v2.0.” *Geoscientific Model Development*, 10, 2495–2524.

Ortega, Francesc, and Süleyman Taṣpınar. 2018. "Rising sea levels and sinking property values: Hurricane Sandy and New York’s housing market." *Journal of Urban Economics* 106: 81-100.

Ouazad, A., & Kahn, M. E. 2019. “Mortgage finance in the face of rising climate risk” National Bureau of Economic Research Working Paper 26322.

Ratnadiwakara, Dimuthu and Venugopal, Buvaneshwaran. 2019. “Climate Risk Perceptions and Demand for Flood Insurance”. Working Paper.

Sethi, Rajiv, and Rohini Somanathan. 2004. “Inequality and Segregation.” *Journal of Political Economy* 112(6): 1296–1321.

Simonsohn, Uri, Joseph P. Simmons, and Leif D. Nelson. 2020. “Specification curve analysis.” *Nature Human Behavior*.

Spitzer, Yannay, Gaspare Tortorici, and Ariell Zimran. 2020. “International Migration Responses to Natural Disasters: Evidence from Modern Europe’s Deadliest Earthquake.” National Bureau of Economic Research Working Paper 27506.

Stern, Nicholas. 2007. “The Economics of Climate Change: The Stern Review.” Cambridge University Press.

Tiebout, Charles. 1956. “A Pure Theory of Local Expenditures.” *Journal of Political Economy* 64 (5): 416-424.

Wong, T. E., Bakker, A. M. R., & Keller, K. 2017. “Impacts of Antarctic fast dynamics on sea-level projections and coastal flood defense.” *Climatic Change*, 144(2), 347–364.

Figure 1. Historical Sea Level Rise and Projections for the Future

These figures depict historical changes in sea level rise and scientific projections for the future. Figure 1a plots the change in global mean temperature (Celsius) and sea level rise (feet) over the 40 years from 1970 to 2010 (https://climate.nasa.gov/). Figure 1b plots projected future sea level rise (feet) by 2100 for medium and high emission scenarios for all studies with both scenarios considered and mentioned in Goldsmith-Pinkham et al. (2020). Points represent the mean SLR, while bars represent 95% confidence intervals from reported standard deviations in estimates and the assumption of normality.

Figure 1a. Historical Changes in Global Mean Temperature and Sea Level Rise Since 1970

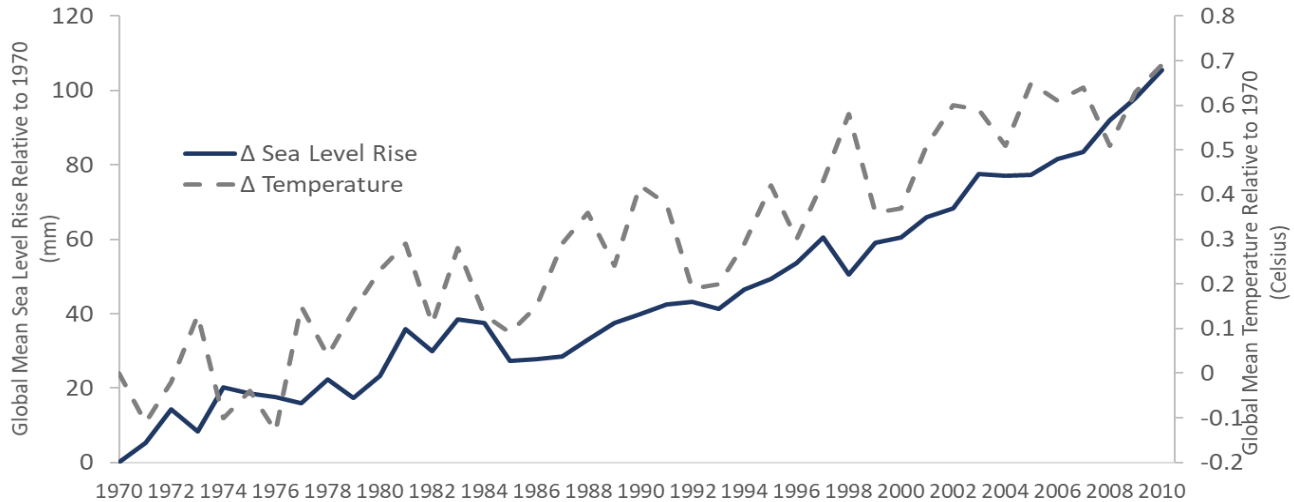


Figure 1b. Future Projections for Sea Level Rise (Feet by 2100) in '01 vs. '17

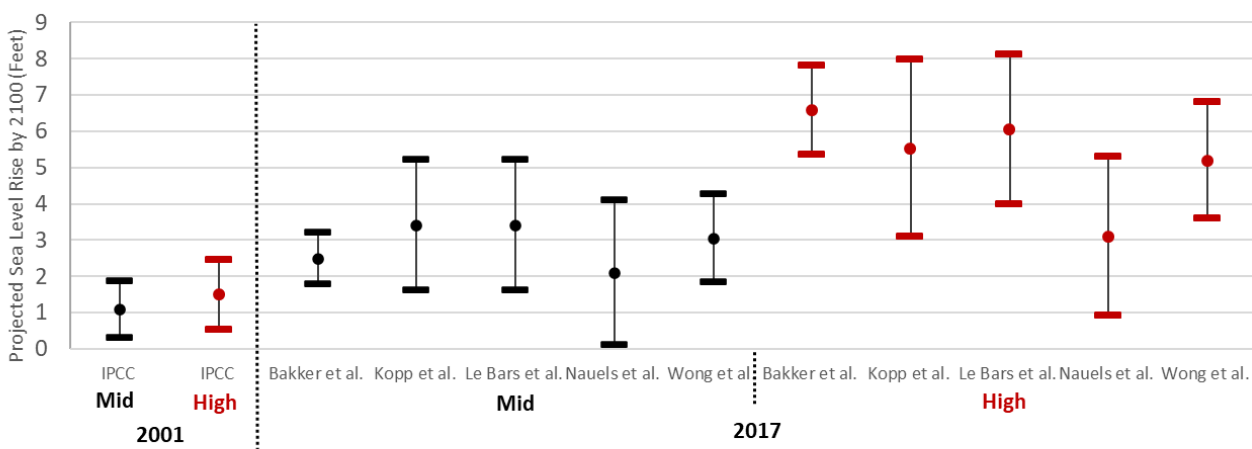


Figure 2. Pew Survey: % who say the issue is a top priority in 2020

This figure depicts the % of participants in a Pew Research Center survey of U.S. adults conducted Jan. 8-13, 2020 who say that "__ should be a top priority for President Trump and Congress", by stated political affiliation (red circles = republicans; blue diamonds = democrats) and the partisan gap between them in order of that gap (largest on the left and smallest on the right). For more details see www.pewresearch.org/.

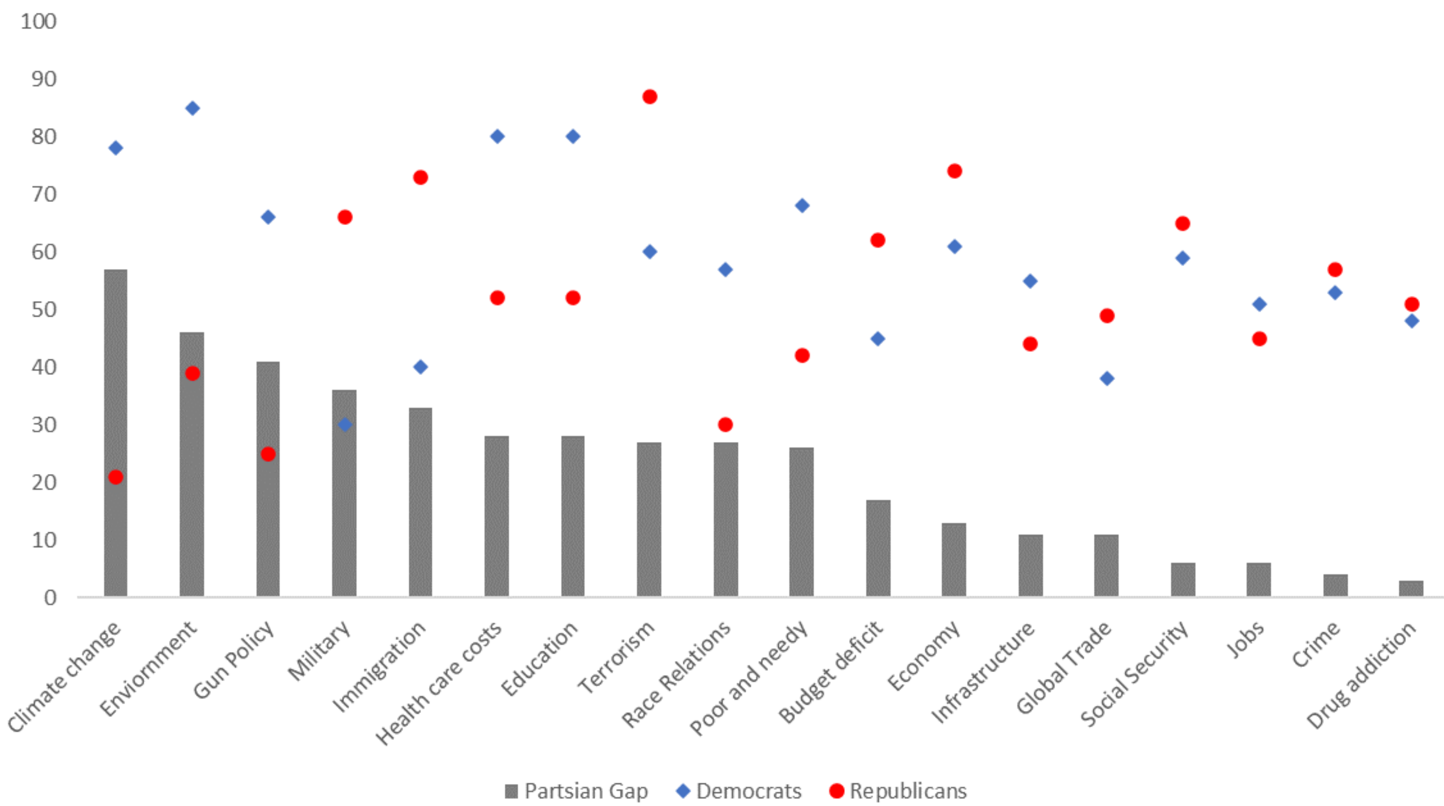
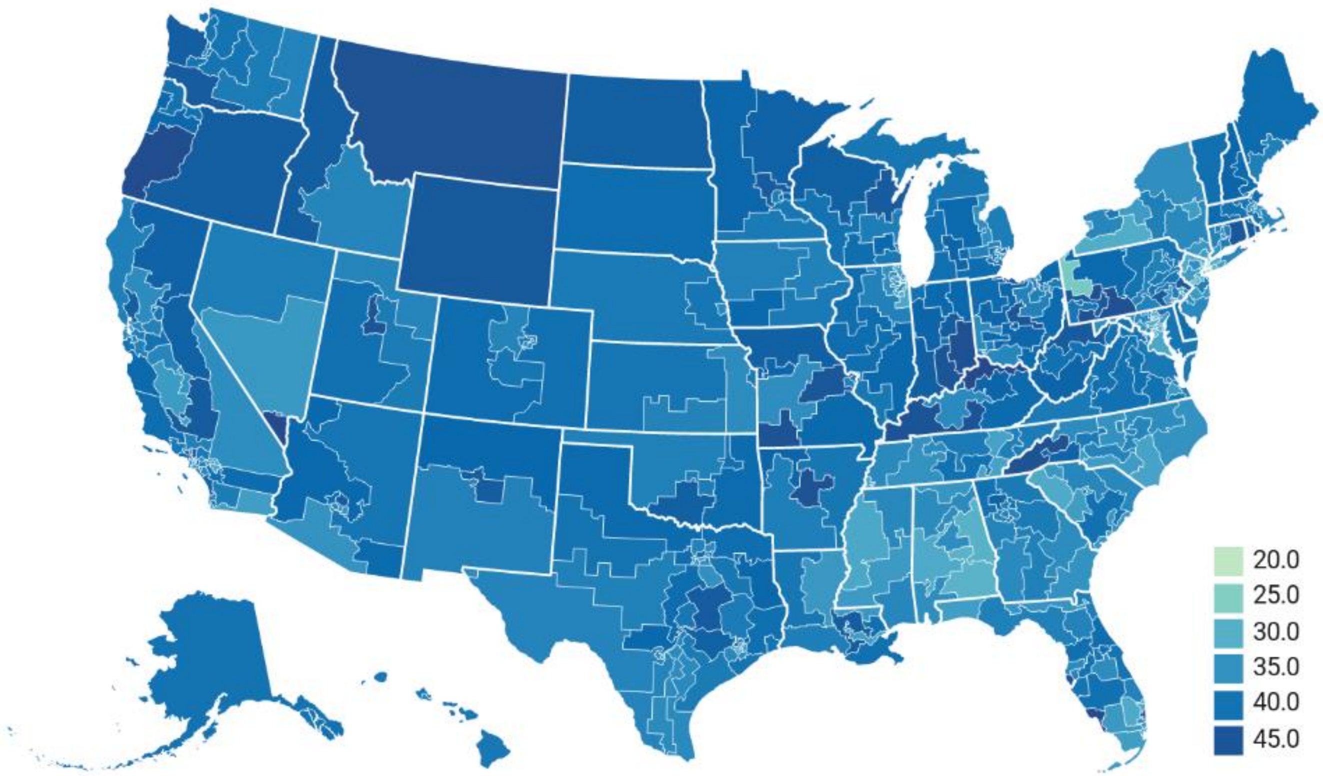


Figure 3. 2018 Yale Climate Survey: % that "think that global warming is happening" by Congressional District

The 2018 Yale Climate Survey (details here: https://climatecommunication.yale.edu), which asked participants "Do you think that global warming is happening?". This figure depicts the % of democrats in a given congressional district who answered yes minus the % of republicans who answered yes. Darker blue indicates a larger gap between these groups in the answer to this question.



Partisan Gap (% Dems - % Reps):
Believe in Global Warming

Figure 4. Political Affiliation and Feet of SLR Until Inundated

This table shows that controlling for other property observables, residents of properties with more exposure to future rises in sea levels are more likely to be registered Republicans and less likely to be registered Democrats, and this is true even for properties unlikely to inundated without substantial increases in future sea level rise (SLR). In Panel A, the dependent variable is *Pol. Conservative* which takes the value of 100 if the owner is a registered republican, 0 if they are independent, and -100 if they are a democrat. In Panel B, the dependent variable is either 100 if the resident is a Democrat (in blue) or Republican (in red) relative to the omitted group (Independents – so in each regression the other party isn't included at all). These dependent variables are regressed on a dummy variables equal to 1 if the property would be, according to the NOAA, regularly inundated if sea levels were to rise by "X" feet after including property zip code x distance-to-the-coast quantiles x elevation quantile and year-quarter fixed effects as well as the property characteristic controls outlined in Table 3. The coefficients on feet until SLR exposed are plotted, as well as 95% confidence intervals. Standard errors are clustered at the same level as the primary fixed effects.

Figure 4a. Combined Measure of Political Affiliation - Pol. Conservative

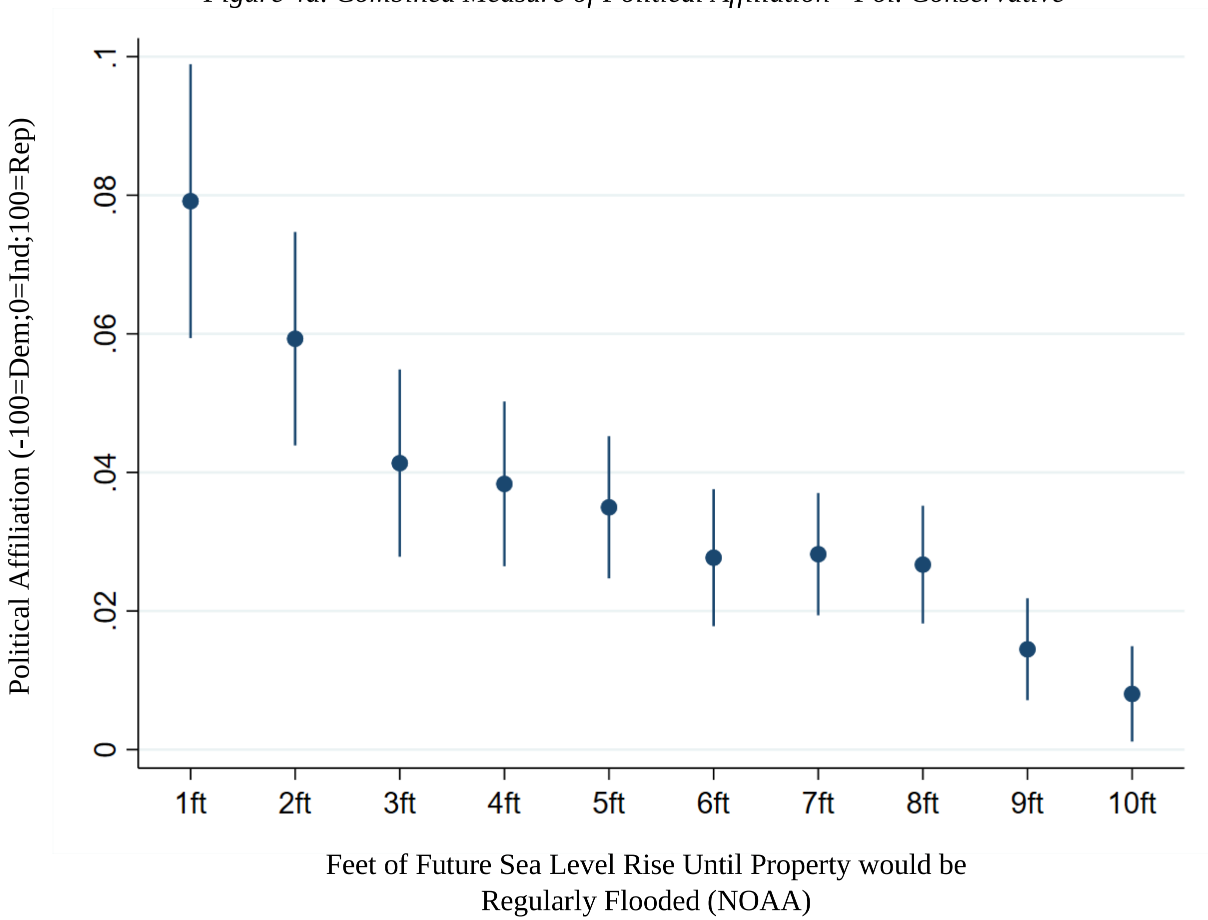


Figure 4b. Decomposing the Republican and Democrat Effects

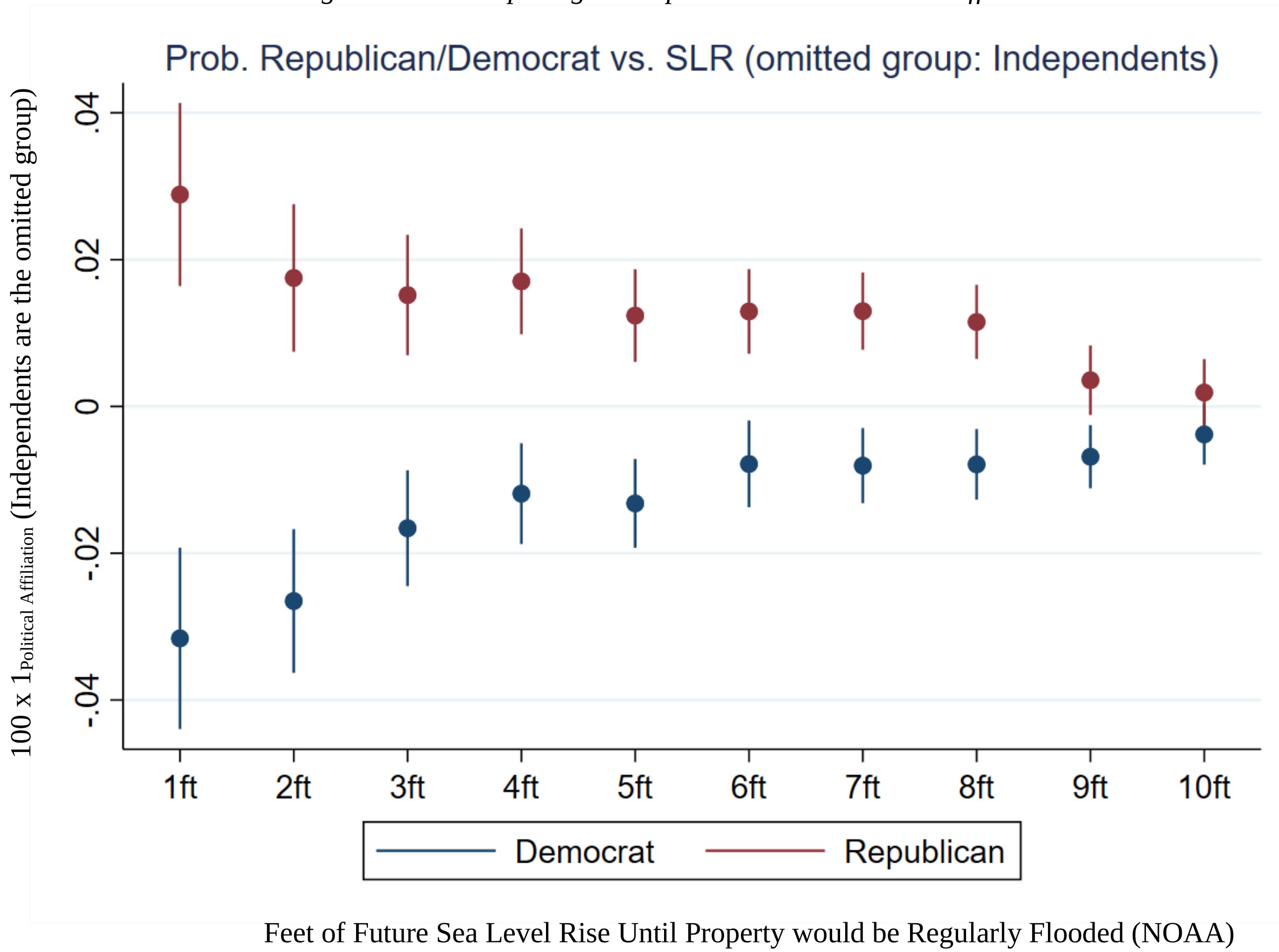


Figure 5. Specification Curve

This figure provides a number of specifications that vary our sample and how we define our controls for distance to coast as well as the inclusion/exclusion of property covariates in the spirit of Simonsohn et al. (2020). We focus on the three main samples used throughout the paper – all voters, voters in properties that sold since 2007 and voters with matched HMDA data. Our specification also varies by changing the distance to coast intervals used in our fixed effects as well as a model incorporating raw (not inflation adjusted) prices. We also provide some models that provide the most restrictive fixed effects – price by zip by distance to coast by elevation by year by quarter property was last sold. This limits identifications to properties sold nearby for similar prices in the same quarter with similar elevation. These restrictive fixed effects generate similar, but slightly nosier estimates. Our two primary approaches used in the paper are highlighted in blue.

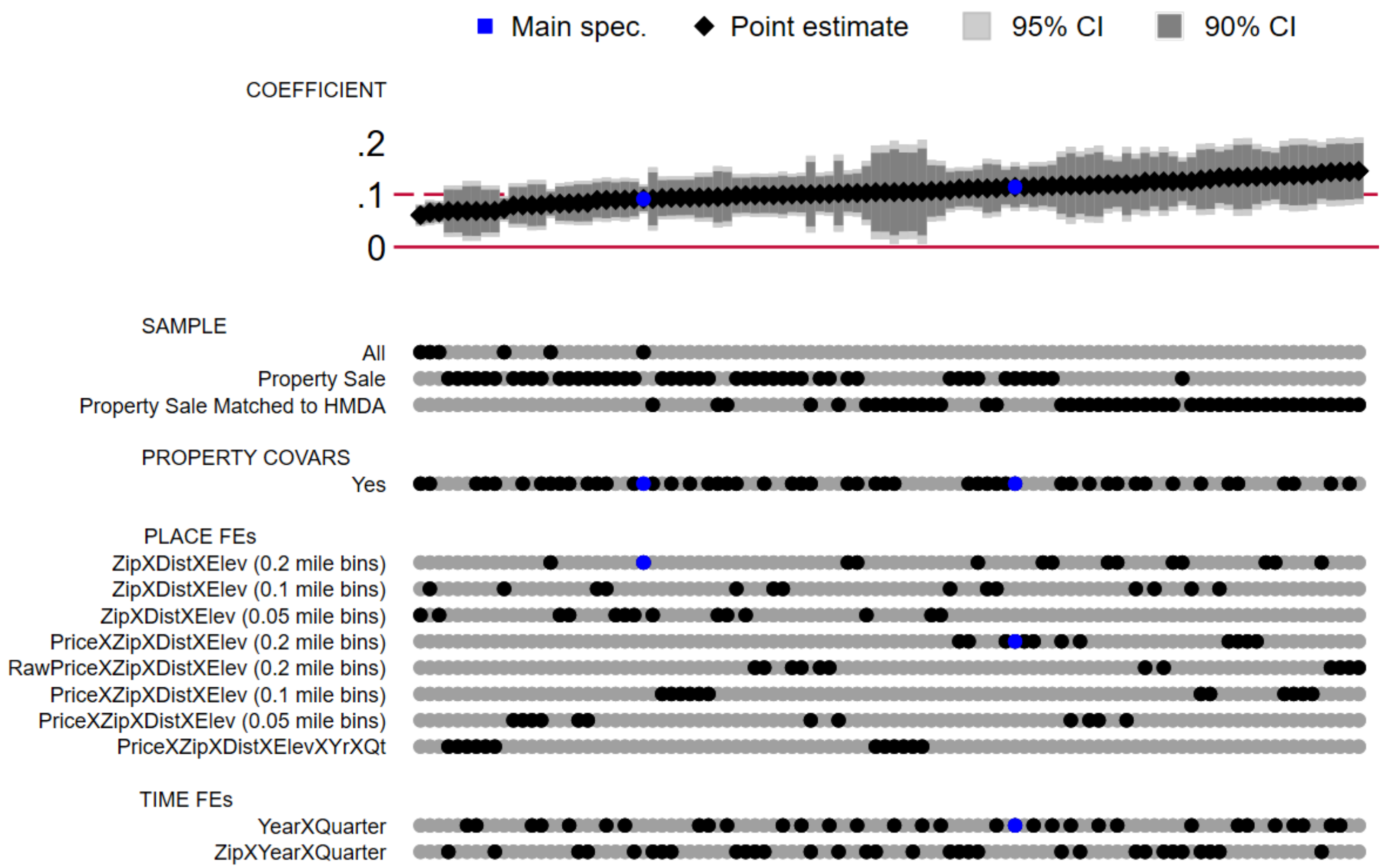


Table 1. County-Level Correlations: Political Affiliation, Sea Level Rise Exposure, and Concern about Climate Change

For the main sample of counties and properties/voters analyzed in our paper this table depicts the county-level correlations in the % of properties with exposure to up to 10 feet of future SLR (*% SLR)*, the % who are registered republicans (*% Republican*), the % who are registered democrats (*% Democrat*), the % who are independents (*% Independent*), the mean of our measure of political conservatism where -100 is for republican, 0 is for independents, and 100 is for democrats (*Avg Pol. Conservative*), the % of respondents who are worried about climate change based off the 2016 Yale Climate Survey (*% Worried*), and the % of respondents who think climate change will personally affect them based off the 2016 Yale Climate Survey (*% Personal*).

	% SLR	% Republican	% Democrat	% Independent	Avg Pol. Conservative	% Worried	% Personal
% SLR	1.00						
% Republican	0.09	1.00					
% Democrat	-0.05	-0.81	1.00				
% Independent	-0.06	-0.26	-0.35	1.00			
Avg Pol. Conservative	0.07	0.95	-0.95	0.05	1.00		
% Worried	-0.26	-0.58	0.56	0.02	-0.60	1.00	
% Personal	-0.18	-0.47	0.57	-0.18	-0.55	0.88	1.00

Table 2 – Descriptive Statistics

This table includes summary statistics from ZTRAX from 2007 to 2017 for properties matched to voters in the L2 database for coastal communities, and when available HMDA data with mortgage borrower ethnicity. Properties are restricted to those with 2 miles of the coast in counties where at least one property would be regularly inundated with 10 feet of future sea level rise based on projections from NOAA. Characteristics of properties and demographics/political affiliation are shown for all properties in our sample (column 1), those with exposure to 10 feet of SLR (column 2), and those not exposed even to 10 feet of SLR (column 3).

	(1) Full Sample		(2) Voters - SLR Properties		(3) Voters - No SLR Properties	
	Mean	*Std Dev*	*Mean*	*Std Dev*	*Mean*	*Std Dev*
Voter Attributes						
Republican	0.23		0.32		0.21	
Democratic	0.50		0.41		0.52	
Independent/Non-major	0.27		0.27		0.27	
White	0.55		0.56		0.55	
Hispanic	0.16		0.18		0.16	
Black	0.13		0.13		0.13	
Asian	0.05		0.03		0.05	
Age of Voter	49.89	(18.74)	51.94	(18.88)	49.41	(18.68)
# of Voters HH	2.03	(0.99)	2.05	(0.97)	2.02	(0.99)
Housing Attributes						
Sales Price (2008)	565,819	(683,926)	568,026	(685,843)	565,192	(683,379)
Income ($000s)	134.9	(192.2)	149.8	(240.8)	130.2	(174.4)
Age of Home	14.68	(29.24)	10.43	(21.65)	15.68	(30.67)
Living Sq Ft	2,936	(5,509)	2,454	(4,125)	3,049	(5,781)
Condominiums	0.05	(0.22)	0.05	(0.23)	0.05	(0.22)
Bedrooms	1.52	(1.95)	1.61	(1.86)	1.50	(1.97)
Bathrooms	1.09	(1.51)	1.28	(1.63)	1.04	(1.48)
Height of Building	1.62	(2.75)	1.29	(2.24)	1.70	(2.85)
Garage	0.01	(0.09)	0.01	(0.10)	0.01	(0.08)
Pool	0.07	(0.25)	0.17	(0.38)	0.04	(0.20)
Observations	16,149,268		3,075,387		13,073,881	

Table 3. Political Affiliation and Sea Level Rise Exposure

This table shows that controlling for other property observables, residents of properties with more exposure to future rises in sea levels are more likely to be registered republicans and less likely to be registered democrats. The dependent variable is a dummy variable equal to 100 if the property would be, according to the NOAA, regularly inundated if sea levels were to rise by 10 feet. We drop any observation with SLR equal to zero feet since those properties are already flooded regularly. These removed observations explain the difference in sample size between column 1 and table 2. In column 1 this is regressed on dummy variables equal to 1 if a resident is a registered republican or a registered democrat (where independents are the omitted group) after including property zip code x distance-to-the-coast quantiles x elevation quantile fixed effects. Standard errors are clustered at the level of the fixed effects structure, namely at the property zip code x distance-to-the-coast quantiles x elevation quantile level. Column 2 is the same as column 1, but SLR exposure is regressed on *Pol. Conservative* which takes the value of 1 if the resident is a registered republican, 0 if they are independent, and -1 if they are a democrat. Column 3 is the same as column 2, but also includes controls for property characteristics including third order polynomials of building age and lot size square footage, as well as fixed effects for the number of bedrooms, bathrooms, building height, assessed building quality, and presence of a garage or pool. Column 4 limits the sample to properties that had an arm's length market transaction since 2007, while column 5 also interacts the primary fixed effects with most recent transaction price quantile fixed effects, to flexibly control for potential unobservable differences. Column 6 further limits our sample to voters in properties for which we can match HMDA records to property transactions. Standard errors are double clustered at the level of the fixed effects structure, namely at the property zip code x distance-to-the-coast quantiles x elevation quantile x transaction price quantiles and year-quarter levels. Standard errors are shown in parentheses. P-Values: * 10%; ** 5%; ***1%.

	(1)	(2)	(3)	(4)	(5)	(6)
	SLR(%)	SLR(%)	SLR(%)	SLR(%)	SLR(%)	SLR(%)
Republican Affiliation	0.123***					
	(0.024)					
Democratic Affiliation	-0.066***					
	(0.019)					
Pol. Conservative		0.091***	0.082***	0.103***	0.114***	0.133***
		(0.014)	(0.014)	(0.022)	(0.023)	(0.036)
Property Controls	-	-	Y	Y	Y	Y
ZipxDistxElev FEs	Y	Y	Y	Y	-	-
PricexZipxDistxElev FEs	-	-	-	-	Y	Y
Year-Quarter FE	-	-	-	-	Y	Y
Price Sample	-	-	-	Y	Y	Y
Income Sample	-	-	-	-	-	Y
R-sq	0.849	0.849	0.849	0.854	0.887	0.897
Obs	15,991,572	15,991,572	15,991,572	4,030,127	4,030,127	1,644,878
Obs (drop singletons)	15,974,444	15,974,444	15,974,440	4,014,166	3,913,983	1,579,318

Table 4. Controlling for Other Demographics

This table shows that controlling for other resident observables, residents of properties with more exposure to future rises in sea levels are more likely to be registered republicans. The dependent variable is a dummy variable equal to 100 if the property would be, according to the NOAA, regularly inundated if sea levels were to rise by 10 feet. In column 1 this is regressed on *Pol. Conservative* which takes the value of 1 if the resident is a registered republican, 0 if they are independent, and -1 if they are a democrat, after controlling for voter age, whether they are non-white, and household gross income, as well as property zip code x distance-to-the-coast quantiles x elevation quantile x transaction price quantiles and year-quarter fixed effects. Column 2 is the same as column 1, but instead of any linear controls includes fixed effects for voter age, to more flexible control for any potential non-linear effects. Column 3 is the same as column 2, but also adds fixed effects for black, hispanic, and asian ethnicities. Column 4 is the same as column 3, but includes fixed effects for income deciles. Column 5 is the same as column 4, but includes fixed effects for years of education. All models contain less observations than Tables 1 & 3 because we require observations to contain HMDA based measures of income which are not available for cash purchases as well as some transactions that are not-matchable to property records (see Billings (2019) for HMDA matching procedures and a discussion of matching ZTRAX to HMDA more broadly). Standard errors are clustered at the same level as the primary fixed effects and are shown in parentheses. P-Values: * 10%; ** 5%; ***1%.

	(1)	(2)	(3)	(4)	(5)
Dependent variable	SLR (%)	SLR (%)	SLR (%)	SLR (%)	SLR (%)
Pol. Conservative	0.130***	0.133***	0.120***	0.119***	0.119***
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Voter Age (yrs)	0.002*				
	(0.001)				
Non-white	-0.025				
	(0.041)				
HH Gross Inc ($000s)	0.001				
	(0.001)				
PricexZipxDistxElev FEs	Y	Y	Y	Y	Y
Year-Quarter FE	Y	Y	Y	Y	Y
Age FE	-	Y	Y	Y	Y
Race FE	-	-	Y	Y	Y
Income Bkt FE	-	-	-	Y	Y
Educ Yrs FE	-	-	-	-	Y
R-sq	0.897	0.897	0.897	0.897	0.897
Obs	1,640,372	1,640,375	1,640,375	1,640,372	1,631,500

Table 5. Future vs. Current Flood Risk

This table shows that controlling for other property observables, properties with more exposure to future rises in sea levels, not just higher current flood risk, are more likely to be registered republicans. The dependent variable is a dummy variable equal to 100 if the property would be, according to the NOAA, regularly inundated if sea levels were to rise by 10 feet. In column 1 this is regressed on *Pol. Conservative* which takes the value of 1 if the owner is a registered republican, 0 if they are independent, and -1 if they are a democrat, after controlling for voter age, whether they are non-white, and household gross income, as well as property zip code x distance-to-the-coast quantiles x elevation quantile and year-quarter fixed effects. The sample excludes any properties that would be inundated regularly with less than 1 foot of future SLR. Column 2 is the same as column 1, but includes fixed effects for highest expected feet of storm surge flooding based on NOAA simulations for that parcel. Column 3 is the same as column 2, but excludes properties in the west coast of the united states, which don't have hurricanes. Column 4 is the same as column 1, but includes all properties and the dependent variable is a dummy variable equal to 1 if the property is currently exposed to storm surge related flooding regressed on both owner political affiliation. Column 5 is the same as column 3, but the dependent variable is the expected feet of storm surge flooding. Standard errors are clustered at the same level as the primary fixed effects and are shown in parentheses. P-Values: * 10%; ** 5%; ***1%.

	SLR (%)			Storm Surge Exposure	Expected Storm Surge Feet
Dependent variable	(1)	(2)	(3)	(4)	(5)
Pol. Conservative	0.114***	0.110***	0.130***	-0.000	-0.002
	(0.023)	(0.022)	(0.024)	(0.000)	(0.003)
Property Controls	Y	Y	Y	Y	Y
PricexZipxDistxElev FEs	Y	Y	Y	Y	Y
Storm Surge FEs	-	Y	Y	-	-
Year-Quarter FE	Y	Y	Y	Y	Y
Exclude West Coast	-	-	Y	-	-
R-sq	0.887	0.891	0.886	0.733	0.769
Obs	4,030,127	4,030,127	3,182,015	4,065,858	4,065,858

Table 6. Rental Properties: Owners vs. Renters

This table shows that controlling for other property observables, owners (rather than renters) of non-owner-occupied properties with more exposure to future rises in sea levels are more likely to be registered republicans. The dependent variable is a dummy variable equal to 100 if the property would be, according to the NOAA, regularly inundated if sea levels were to rise by 10 feet. In column 1 this is regressed on *Owner Pol. Cons.* which takes the value of 1 if the owner is a registered republican, 0 if they are independent, and -1 if they are a democrat, after controlling for voter age, whether they are non-white, and household gross income, as well as property zip code x distance-to-the-coast quantiles x elevation quantile and year-quarter fixed effects. The sample is just non-owner-occupied residences. Column 2 is the same as column 1, but interacts the primary fixed effects with the most recent transaction price of the house fixed effects and includes property controls (i.e. third order polynomials of building age and lot size square footage, as well as fixed effects for the number of bedrooms, bathrooms, building height, assessed building quality, and presence of a garage or pool). Column 3 is the same as column 2, but looks at voter registration of the residents of non-owner-occupied properties (aka the renters), not the owners, *Renter Pol. Cons*. Column 4 is the same as column 3, but includes both renter and owner (conservative) political affiliation. Standard errors are clustered at the same level as the primary fixed effects and are shown in parentheses. P-Values: * 10%; ** 5%; ***1%.

	(1)	(2)	(3)	(4)
Dependent variable	SLR (%)	SLR (%)	SLR (%)	SLR (%)
Owner Pol. Cons.	0.127*	0.189**		0.179**
	(0.068)	(0.086)		(0.087)
Renter Pol. Cons.			0.051	0.016
			(0.032)	(0.030)
Property Controls	-	Y	Y	Y
ZipxDistxElev FEs	Y	-	-	-
PricexZipxDistxElev FEs	-	Y	Y	Y
Year-Quarter FE	-	Y	Y	Y
R-sq	0.859	0.925	0.925	0.925
Obs	4,534,077	1,047,819	1,047,819	1,047,819

Appendix

Figure A1. Additional Specification Curve

This figure provides results for two additional samples, properties only within 1 mile of the coast and the inclusion of properties with exposure at less than 1 foot of SLR. We also include our main results from earlier as comparison.

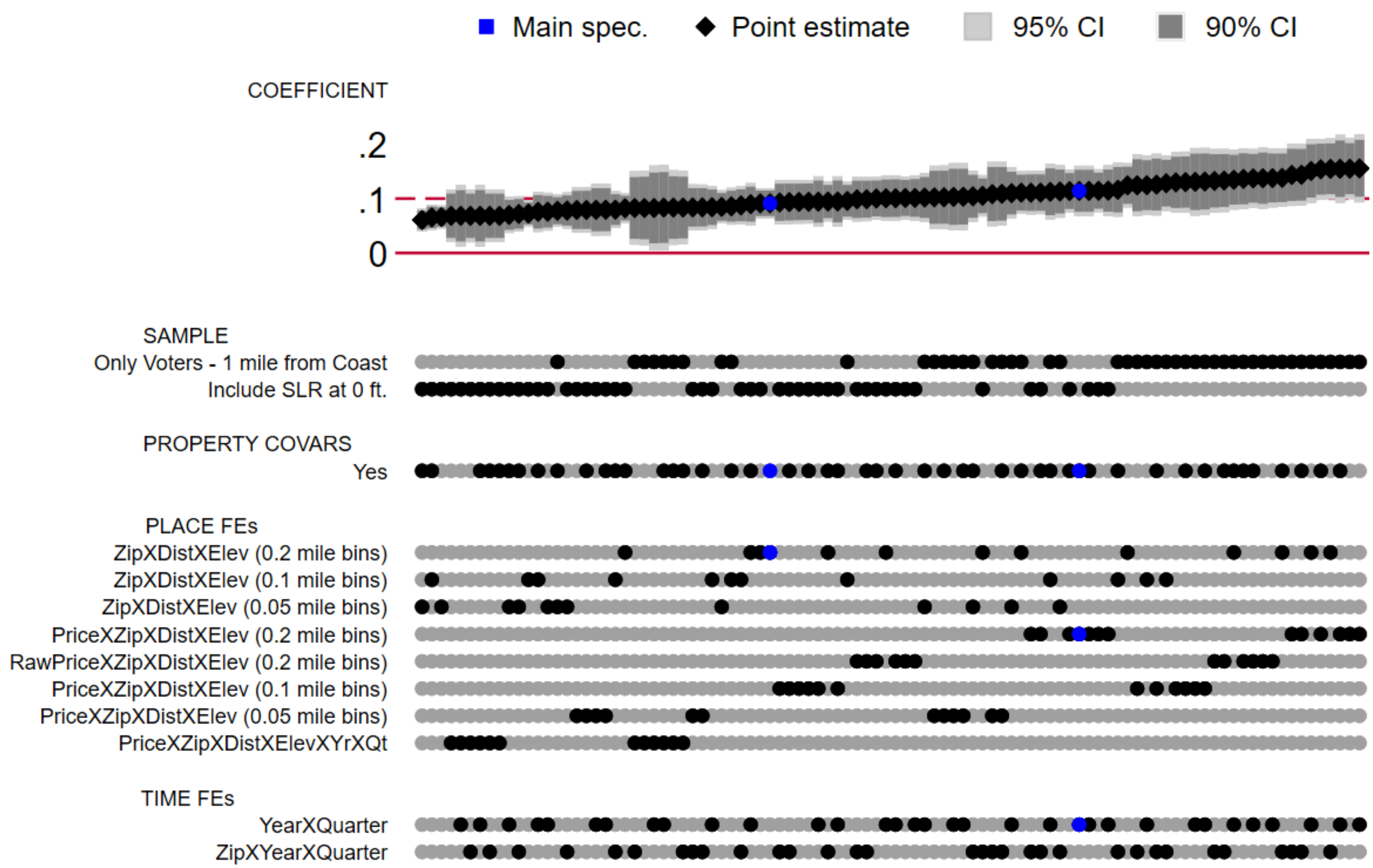
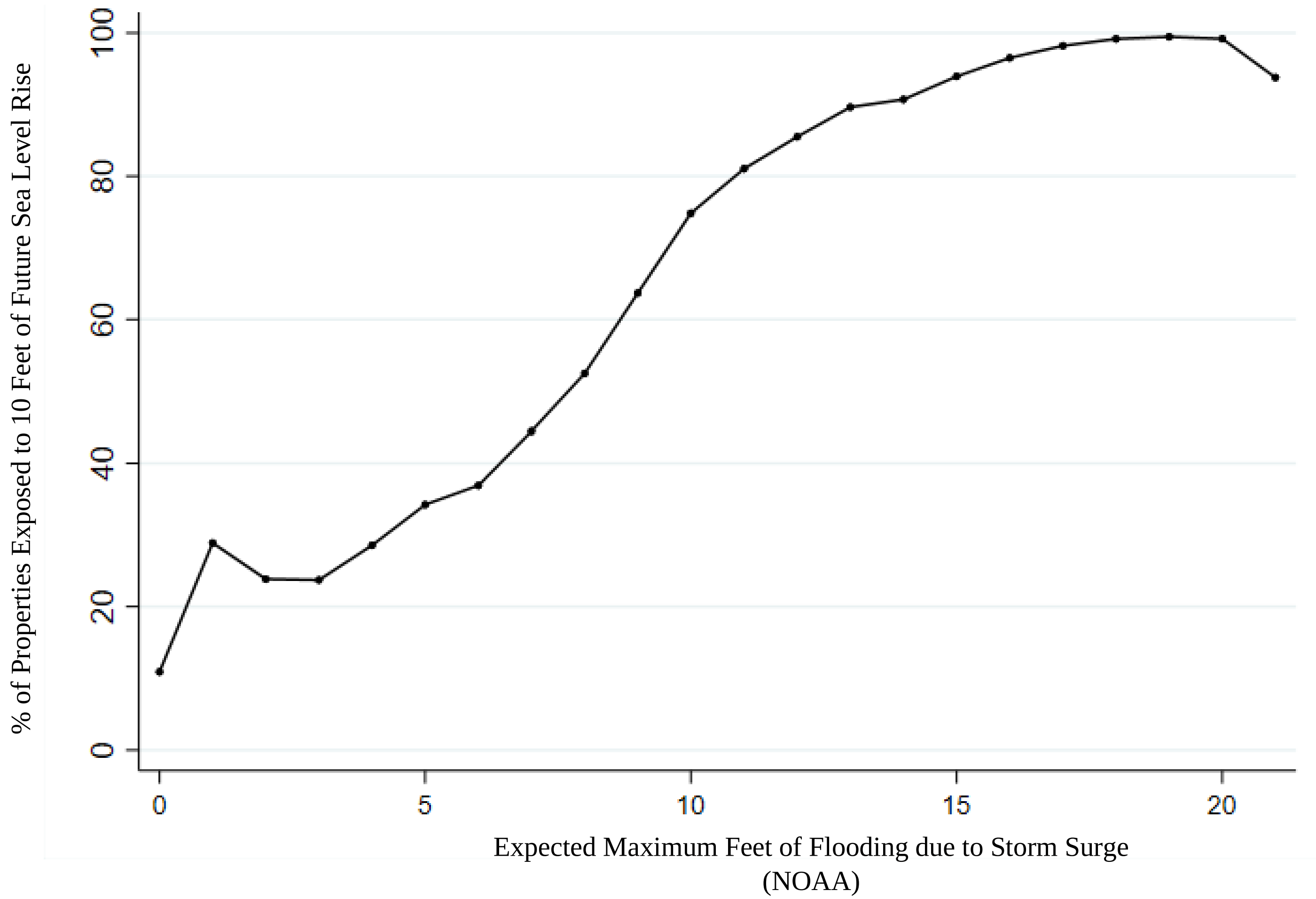


Figure A2. Storm Surge vs. Future Sea Level Rise Exposure

This figure shows for a given properties expected maximum feet of flooding due to storm surge, the probability it would be exposed to regular flooding with 10 feet of future sea level rise exposure.



Appendix Table A1. Identifying Variation

This table shows how much of SLR exposure is unexplained after the inclusion of different controls and fixed effects. This represents our main sets of fixed effects that control for location and helps to determine how much variation is left using more granular fixed effects for the full sample in columns 1 through 3 as well as just the sample of voters that lived in properties that had a recent property sales transaction.

	(1) SLR(%)	(2) SLR(%)	(3) SLR(%)	(4) SLR(%)
Explained Variation (R^2)	0.71	0.85	0.85	0.89
Property Controls	-	-	Y	Y
ZipxDist FEs	Y	-	-	-
ZipxDistxElev FEs	-	Y	Y	-
PricexZipxDistxElev FEs	-	-	-	Y
Observations	16,092,264	16,092,264	16,092,264	4,065,858