Sea Level Rise and Portfolio Choice[*]

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Abstract

Many households face uninsurable background risks due to future sea level rise (SLR). Using detailed local variation in SLR exposure and disaggregated geographic information on households in the United States, I show that SLR exposed households participate less in the stock market compared to their unexposed counterparts within the same neighborhood. This effect is driven by long-run SLR risks as opposed to short-run flood risks and is elevated at times when attention to climate change is high. I provide causal evidence of the effect of SLR risks on household portfolio choices by exploiting plausibly exogenous variation stemming from the adoption of state-led climate change adaptation plans that reduced households' SLR risks. Additional tests isolate the effect of SLR exposure as a background risk from alternative explanations, including changes in house prices, past flooding experiences, endogenous location choices, political beliefs, or differences in risk preferences.

Keywords: Sea level rise, climate change, household finance, portfolio choice, stock market participation, uninsurable background risk.

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Scientists project that sea levels globally can rise by more than 6 feet by the turn of this century (Sweet et al., 2017; DeConto and Pollard, 2016) and the rate of sea level rise (SLR) currently tracks the worst case scenario laid out by the Intergovernmental Panel on Climate Change (IPCC)'s Fifth Assessment Report (Slater, Hogg and Mottram, 2020). According to recent estimates, a 3 feet SLR scenario will leave 4.2 million people in the United States under water, whereas a 6 feet SLR scenario will inundate 13.1 million people (Hauer, Evans and Mishra, 2016). While permanent flooding of certain areas will take place with virtual certainty in a long enough horizon, there is significant uncertainty associated with its timing and costs. Coastal communities are also vulnerable to SLR risks emanating from aggravated chronic flooding and extreme weather events.

In this paper, I study how future SLR risks influence household portfolio choices. Owner-occupied housing comprises the largest asset class in most households' portfolios (Guiso and Sodini, 2013; Gomes, Haliassos and Ramadorai, 2021). The value of real estate is inextricably linked to the land it is built on and therefore, homeownership exposes many households to SLR risks. It is ex-ante ambiguous whether and how SLR risks may induce changes in households' portfolio allocation decisions. On one hand, SLR exposed households may be more willing to take financial risks if, for example, risk preferences drive both SLR exposures and investments in risky financial assets. On the other hand, because houses are illiquid and indivisible assets, homeowners find it costly to adjust their consumption of housing in response to economic shocks (Campbell, 2006). The long-run and undiversifiable nature of physical climate risks also limits individual investors' ability to insure against them (Engle et al., 2020).[1] Thus, SLR risks constitute a source of background risk for exposed households (i.e., a risk that cannot be avoided). In models of portfolio choices, the presence of background risks makes investors less willing to take other types of risks, such as financial risks.[2] I provide evidence consistent with the implications of these models.

A key challenge in my analysis lies in creating a meaningful measure of SLR exposure at the household level. Traditional sources of household data are unsuitable to study the effects of local

[1] Flood insurance is not mandatory in the United States and even homeowners at risk of flooding often do not own flood insurance (Kousky, 2018). The Federal Emergency Management Agency (FEMA) provides subsidized flood insurance to properties that they deem at risk based on outdated maps that do not take future SLR into account. These flood insurance policies are renewed annually and rates are subject to change at renewal such that these policies likely provide little to no hedging benefits against long-term risks such as SLR risks. I discuss the inadequacy of flood insurance markets in the United States and low take-up rates in these markets in further detail in Section 1.

[2] A sufficient condition for a background risk effect to arise is a utility function that exhibits decreasing and (weakly) convex absolute risk aversion. Kimball (1993) and Gollier and Pratt (1996) discuss such classes of utility functions.

physical risks such as SLR risks, because they only provide information on the households' state of residence as the narrowest geographical region. I circumvent this issue by employing the restricted version of the Panel Study of Income Dynamics (PSID) data, which allows me to observe granular geographical location of households. To generate cross-sectional variation in households' exposure to SLR risks, I geocode households' locations and merge them with SLR maps from the National Oceanic and Atmospheric Administration (NOAA). I restrict attention to homeowner households (henceforth, households) who reside in the house they own. I estimate the effect of SLR exposure on household portfolio choices by comparing households with varying degrees of SLR exposure in the same zip code and year, after accounting for a battery of household financial, demographic, and geographic characteristics.[3]

I find strong evidence that SLR exposed households have a lower propensity to participate in the stock market and invest a smaller share of their financial wealth in equities, compared to unexposed households in the same neighborhood. These effects are economically sizable. A one-standard-deviation increase in SLR exposure decreases the propensity of stock market participation by 1.8 percentage points (pp), a 6% decrease since the sample mean of households' participation rate is 30%. The same one-standard-deviation increase in SLR exposure decreases the share of financial wealth invested in risky assets by 1.6 pp, which equals 9% of households' mean risky share. These effects are comparable in magnitude to those estimated by Fagereng, Guiso and Pistaferri (2018) for uninsurable labor income risk.[4] My analysis also yields strong evidence that SLR exposed households are more likely to exit from and less likely to enter into the stock market compared to unexposed households in the same zip code.

To narrow the interpretation about whether these findings are driven by long-run inundation risks or short-run risks associated with more severe and more frequent extreme events, I employ data on storm surge exposure by using the National Storm Surge Hazard maps also provided by NOAA. I augment my baseline analysis with this measure of storm surge exposure. The coefficient estimates in these regressions that include both SLR exposure and storm surge exposure indicate that my findings are primarily attributable to long-run SLR risks.

[3] I also indirectly control for differences in flood insurance purchase rates since the fixed effects I employ in this analysis would absorb all the variation in the publicly available FEMA flood insurance data. However, the location of properties cannot be identified in these data because of privacy protection.

[4] Uninsurable labor income risk is likely the most prominent source of background risk studied in the literature.

In a next step, I examine how the presence of informational frictions and limited attention to SLR risks might reduce the extent to which SLR risks are taken into account by households. Indeed, some recent papers in the literature highlight the key role that attention to climate risks plays in determining housing prices (Bernstein, Gustafson and Lewis, 2019; Baldauf, Garlappi and Yannelis, 2020; Engle et al., 2020). I extend my baseline analysis by implementing two tests that leverage time-series variation in households' attention to climate risks and the salience of flood risks. First, I use the Wall Street Journal climate change index introduced by Engle et al. (2020) to proxy for attention to climate risks. Second, in a research design inspired by Baldauf, Garlappi and Yannelis (2020), I focus on the top ten costliest hurricanes in my sample period and consider households living in states *unaffected* by these hurricanes with the assumption that these households experience an increased salience of climate risks even though they did not bear direct costs due to these extreme weather events. In both of these tests, I find that the negative relationship between SLR exposure and stock market participation is amplified at times when attention to climate risks is elevated, consistent with the notion that informational frictions and limited attention are operative for my findings.

Finally, I provide causal evidence for the relationship between SLR exposure and disinvestment in risky financial assets. As of 2021, the federal government in the United States is yet to take action to address climate risks, making state level actions even more important. Since 2008, 17 states and D.C. have finalized state-led climate change adaptation plans with the goal of protecting residents against the impacts of climate change, including sea level rise.[5] These plans lead to plausibly exogenous decreases in the perception of SLR risks, since the adoption of such climate change adaptation plans reflects state governments' commitment towards mitigating SLR risks for residents and partially resolves the uncertainty in how these risks will be handled by the government. Exploiting this orthogonal source of variation, I test whether households' willingness to take financial risks increases following the adoption of climate adaptation plans. In a staggered diff-in-diff research design, I document that following the adoption of such adaptation plans, a one-standard-deviation increase in SLR exposure of households increases the propensity to participate in the stock market (the share of financial wealth invested in risky assets) by 3.9 (2.7) pp.

When interpreting the results, I emphasize the background risk role of SLR exposure as the

[5]See https://www.georgetownclimate.org/adaptation/plans.html for more information.

underlying channel. However, there exist three potential alternative explanations that can generate the same patterns in the data. Through a series of auxiliary tests, I rule out these alternative explanations. First, one may be concerned that changes in house prices (instead of SLR risks) might crowd out stock holdings of SLR exposed households. I show that SLR exposure reduces household stock market participation even in regions that experienced high house price growth in the recent past, suggesting that second moment effects of SLR exposure matter for household portfolio choices. Relatedly, if SLR exposed houses experience flooding more frequently, the reduced stock market participation by SLR exposed households may be due to direct costs incurred from these flooding incidents. Consistent with the background risk effect of SLR exposure, I find that SLR exposure continues to crowd out stock holdings of exposed households compared to their unexposed counterparts even in regions that experienced no flooding events in the recent past.

Second, households endogenously choose whether to participate in the stock market and where they live. Self-selection based on wealth, for example, likely biases my results downwards as richer households are both more likely to live in SLR exposed houses and participate in the stock market. Nevertheless, I find that my results remain unchanged in a subsample of households who never moved in the entire sample of 20 years (for whom backgrounds risks are also likely to be especially prevalent), indicating that household relocation decisions are unlikely to explain my results. Similarly, Bernstein et al. (2021) document that Republican households are more likely to own SLR exposed houses compared to Democratic households. If Republicans are also less likely to participate in the stock market, the differences in political beliefs may explain the relationship between SLR exposure of one's house and stock market participation. Mitigating this concern, I find no evidence that differences in political beliefs drive my results.

Third, there may be a concern that the observed patterns in the data can be accounted for by unobservables, such as differences in risk preferences. I note that self-selection based on risk preferences would likely bias my results downwards as risk tolerant households are both more likely to purchase SLR exposed houses and participate in the stock market. Supporting this line of argument, my results are robust to controlling for risk aversion at the household level computed from the 1996 survey of PSID, following the methodology of Kimball, Sahm and Shapiro (2009). Furthermore, if unobservables can explain the documented effect, we should again observe a negative relationship between SLR exposure and household stock market participation in a sample of renters. If not, we should see no relationship since SLR exposure should pose little to no threat on renters as rental markets are liquid and renters have no home equity. Thus, I conduct a placebo test in a sample of renters and find no evidence that SLR exposure has an effect on the stock market participation behavior of renters, confirming a homeownership channel.[6]

This paper contributes to two strands of literature. First, my analysis complements studies that investigate the effects of climate risks by providing, to the best of my knowledge, the first evidence on how household portfolio choices are influenced by forward-looking physical climate risks in the form of SLR risks. I contribute to the prior work that examines how SLR risks affect house prices (Bernstein, Gustafson and Lewis, 2019; Murfin and Spiegel, 2020; Baldauf, Garlappi and Yannelis, 2020; Keys and Mulder, 2020) by documenting that the second moment effects of SLR exposure on household portfolio choices. My findings are also complementary to the body of work that investigates households' responses to immediate loss of household wealth due to natural disasters by documenting the effects of physical climate risks yet to materialize. Recent studies in this area focus on career choices (Cen, 2021), human capital accumulation (Billings, Gallagher and Ricketts, 2021), and mortgage decisions (Issler et al., 2019) while I focus on risky asset allocation. More broadly, my paper is related to studies that employ measures of SLR risks (Goldsmith-Pinkham et al., 2021; Giglio et al., 2021) and attention to climate risks (Engle et al., 2020; Choi, Gao and Jiang, 2020; Hu, 2020).

Second, I contribute to the large literature that analyzes the determinants of household portfolio choices by identifying a unique source of background risk, whose importance will likely rise going forward. Models of household portfolio choices in this literature argue that consumers who face background risks respond by reducing exposure to risks they can avoid (Kimball, 1993; Gollier and Pratt, 1996). I measure households' background risks due to SLR risks and provide supportive evidence for the predictions of these models in the data. Other empirical applications of these portfolio models focus on background risks such as uninsurable wage risk (Heaton and Lucas, 2000*b*; Angerer and Lam, 2009; Betermier et al., 2012; Fagereng, Gottlieb and Guiso, 2017) and human

[6]In unreported results, I compare homeowners to renters in a research design akin to the difference-in-differences strategy employed by Schmalz, Sraer and Thesmar (2017) and also find that SLR exposure reduces homeowners' willingness to take financial risks compared to renters. However, there may be a concern that renters are not an appropriate control group for homeowners in this research design, because the balance sheets of homeowners and renters look inherently different. In contrast, the tests I employ throughout the paper do not have this issue as I compare homeowners to homeowners in my main tests and renters to renters in the placebo tests.

capital risk (Cocco, Gomes and Maenhout, 2005; Jansson and Karabulut, 2021), entrepreneurial risk (Heaton and Lucas, 2000*a*), health risk (Edwards, 2008), among others.

1 Background and Hypotheses

There are two primary physical channels through which SLR exposure can affect housing investments. First, there is the risk of slowly rising oceans that will eventually and permanently flood coastal areas. Second, sea level rise is predicted to exacerbate high tide flooding over time and reduce the time between such flood events (Hayhoe et al., 2018; Sweet et al., 2020). Increasing sea levels are also expected to make storm surge flooding (i.e, when the ocean levels rise temporarily due to a storm) and hurricanes more devastating (Marsooli et al., 2019; Knutson et al., 2020).

Either of these channels can adversely affect home values and thus, the housing wealth of households.[7] At the same time, both of these physical channels contain substantial uncertainty about their potential outcomes. While permanent inundation of certain areas will take place with virtual certainty in a long enough horizon, there is significant uncertainty associated with its timing. Case in point, scientists frequently update forecasts of sea level rise in light of new findings, especially due to new research on the melting patterns of Greenland and Antarctic ice sheets (Goelzer et al., 2020; Passeri et al., 2018; Reese et al., 2020). Extreme weather events are more idiosyncratic in nature and therefore, also characterized by high uncertainty in their expected costs, timing, and frequency. Moreover, the adaptation measures governments will need to take to mitigate the effects of sea level rise amplify this uncertainty, because they vary in scope, timing and costs.

The effects of sea level rise are especially relevant for households, because housing investments constitute the largest share of assets owned for most households (Campbell and Cocco, 2007; Chetty, Sándor and Szeidl, 2017) and almost seven out of every ten households are homeowners as of 2020 (U.S. Census Bureau, 2020). Houses are indivisible and illiquid assets and for most households, all real estate wealth is tied to the house they occupy, rendering housing wealth difficult and costly to

[7]There exists mixed evidence in the literature about the pricing of SLR risks in housing markets. Bernstein, Gustafson and Lewis (2019) and Baldauf, Garlappi and Yannelis (2020) find that SLR risks are priced in local real estate markets using NOAA sea level rise data. Murfin and Spiegel (2020) draw attention to land subsidence and rebound as a contributing factor to sea level rise and find limited pricing effects. Keys and Mulder (2020) document a disconnect in coastal Florida real estate where home sale prices only very recently started declining due to sea level rise exposure, but home sale volumes in the SLR exposed communities have been declining for almost a decade.

transact as a response to wealth shocks (Guiso and Sodini, 2013). Hence, the literature exploring the relationship between housing investments and portfolio choices tends to treat housing as a source of background risk (Guiso and Sodini, 2013; Gomes, Haliassos and Ramadorai, 2021). Under fairly general conditions (i.e., a utility function that exhibits decreasing and convex absolute risk aversion),[8] background risks make investors less willing to take other types of risks, such as investments in risky financial assets.

Combining the high degree of uncertainty about the costs and timing of the impacts of sea level rise and the illiquid nature of housing wealth, I posit that sea level rise is a source of background risk and arrive at my main hypothesis:

Hypothesis 1. *SLR exposed households are less likely to participate in the stock market and invest a smaller share of their financial wealth in risky assets compared to unexposed households.*

Insofar as households are not aware of SLR risks, informational frictions and limited attention potentially pose constraints for households to consider these risks in their portfolio allocation decisions. Indeed, several papers in the literature emphasize the role of attention to climate change when evaluating how house prices are affected by SLR risks (Baldauf, Garlappi and Yannelis, 2020; Bernstein, Gustafson and Lewis, 2019), when calculating the appropriate discount rates for valuing investments in climate change abatement (Giglio et al., 2021), and when investigating the reasons behind low flood insurance take-up rates (Hu, 2020). These frictions should be, at least to some extent, alleviated at times when attention to climate change is elevated as households seek more information about SLR risks and consider these risks in their portfolio allocation decisions, leading to the following hypothesis:

Hypothesis 2. *The crowding out effect of SLR exposure on stock holdings of households is amplified at times when attention to climate change is elevated.*

Local governments can implement various policies to mitigate the impacts of sea level rise. For example, reforming the flood insurance system such that affordable rates are available for all SLR exposed households and ensuring that coverage is broad would reduce SLR risks and provide protection for households. Similarly, financing and building new levees and flood walls

[8] For examples of these types of utility functions being considered the reader is referred to the works of Kimball (1993) and Gollier and Pratt (1996).

that can withstand strong hurricanes with the best scientific data available can guarantee the safety and financial well-being of the state residents.[9] States face different challenges due to sea level rise and thus, they need to follow different adaptation and mitigation paths. Whether, how, and when states will tackle these challenges and implement pro-climate policies is highly uncertain. As of 2020, 17 states and the District of Columbia have finalized state-led climate change adaptation plans as preparation against the adverse effects of climate change, including sea level rise. If households perceive the adoption of these plans as credible signals of state governments' commitments towards protecting the state residents, the adoption of these plans should resolve some uncertainty emanating from SLR risks. It follows that a reduction in the perceived background risk due to SLR risks should be reflected in increased stock market participation for SLR exposed households following the adoption of these state-led climate change adaptation plans, leading to the hypothesis:

Hypothesis 3. *The propensity to participate in the stock market and the share of financial wealth invested in risky assets increased for SLR exposed households compared to unexposed households, following the adoption of state-led climate change adaptation plans.*

1.1 Flood Insurance and Disaster Assistance in the United States

In principle, insurance markets can alleviate SLR risks and thus, a discussion of flood insurance in the United States is warranted. A standard home insurance does not cover flooding damages in the United States and flood insurance is predominantly provided through the National Flood Insurance Program (NFIP) under FEMA. FEMA creates flood maps to designate areas exposed to different levels of flood risks to set the flood insurance rates, which can be as expensive as a home insurance, if not more (Insurance Information Institute, 2021). Many of these maps have been shown to be outdated (National Research Council, 2009; Kousky, 2018), because they use data of poor quality and inappropriate methods and they do not take into account changed conditions or changing conditions due to climate change. For example, the designation procedure of high flood

[9] Unlike common belief, Hurricane Katrina was not simply too big that it got through the flood defenses of New Orleans. In fact, Horne (2012) reported that the United States Army Corps of Engineers eventually conceded that the levees in New Orleans failed due to flawed engineering and poor maintenance even though Hurricane Katrina only sideswiped the city of New Orleans. The federal government announced nearly $15 billion to finance the construction of new flood protection improvements, but reports show that the new levees are already in need of replacement due to rising sea levels and sinking ground levels.

risk areas does not take into account predictions of sea level rise and the number of inundated buildings can increase by an estimated 60% in some areas after considering predicted sea level rise (Habete and Ferreira, 2017).

One of the most important frictions with the NFIP and the flood insurance policies it provides is that the take-up of flood insurance is only mandatory for properties purchased with a federally backed mortgage that lie in a high flood risk area, while being voluntary for all remaining properties. As such, many households in flood zones do not maintain flood insurances policies (Kunreuther et al., 2019) and take-up rates for flood insurance are incredibly low, even in areas at risk of flooding (Kousky et al., 2018). For example, less than 20% of houses flooded by Hurricane Sandy and an estimated 12% of houses flooded by the 2016 Baton Rouge flooding had flood insurance (Kousky, 2018). Even more importantly, the flood insurance policies are one-year contracts with rates that are subject to change at renewal. Rates are not fixed and can increase drastically over the years. Therefore, these contracts can provide little to no hedging benefits against long-term risks such as SLR risks, as the flood insurance price will rise when the insurance becomes relevant. Perhaps as a consequence, the median tenure NFIP policies is only 2-4 years (Michel-Kerjan, Lemoyne de Forges and Kunreuther, 2012). A further limitation of these flood insurance policies is that the coverage is only up to $250,000 minus deductibles. All things considered, flood insurance likely cannot effectively insure against SLR risks.

A potential explanation for the lack of high flood insurance take-up could be the expectation that the federal government acts swiftly to provide generous disaster assistance to flooding victims. Disaster assistance in the United States comes in two forms: federal disaster loans are low-interest loans that must be repaid and federal disaster grants are subject to a Presidential Disaster Declaration (which is not the case for flood insurance claims).[10] Survivors are required to register and be eligible for either of these types of federal aids. Federal disaster grants are around $5,000 on average per household, whereas the average flood insurance claim payment in recent years was about $69,000 (NFIP, 2020). Hence, federal disaster assistance is not a substitute for flood insurance, but a supplement.

[10] Husted and Nickerson (2014), Langabeer, DelliFraine and Alqusairi (2012), and Reeves (2011) study the probability and delays of Presidential Disaster Declarations and provide evidence that a state's electoral competitiveness, the party affiliation of the President and a state's Governor, and whether a disaster takes place in a reelection year are all determinants whether and how quickly federal disaster assistance may be available for survivors.

2 Data Sources and Main Variables of Interest

2.1 Household Survey Data

Data on households' equity holdings, wealth, income, and demographics come from the Panel Study of Income Dynamics (PSID), a national survey of households widely in the United States used in the household finance literature.[11] The survey data were collected once a year until 1996 and once every two years since 1997. Before 1999, the survey question about stock holdings included stocks in pension accounts and individual retirement accounts (IRAs). Starting from 1999, the same question excludes any stock holdings in IRAs, with a separate question asking whether a household has any stocks in IRAs. I focus on households' stock holdings in brokerage accounts, mutual funds, and investment trusts outside of IRAs since investments in IRAs can be affected by default choices (Beshears et al., 2009). For this reason, I use all the waves from 1999 to 2017 to construct my sample.

The main proxy I use for household equity market participation, *Equity Participation*, is an indicator variable that is equal to one if a household holds any stocks in publicly held corporations, mutual funds, or investment trusts in a given year. I also provide results using an equity market participation measure that includes stock investments in IRAs. Furthermore, I extend my analysis using several alternative measures similar to the ones employed by Giannetti and Wang (2016) and Brunnermeier and Nagel (2008). First, I create a variable measuring the share of financial wealth invested in risky assets, *Risky Share*, which is equal to the net value of stocks held by a household divided by the financial wealth of the household (i.e., sum of cash, stocks, and bonds). Second, I consider changes in stock market participation using two variables that capture entry into and exit from the stock market. In particular, *Entry* is an indicator variable equal to one for households that did not participate in the previous wave of the survey but participate in the current round, and zero for households who did not participate in both the current wave as well as the previous wave. This variable is set to missing otherwise. Similarly, *Exit* is an indicator variable equal to one for households who participated in the previous wave of the survey but do not participate in the

[11]The PSID started collecting information on a sample of roughly 5,000 households in 1968, about 3,000 were representative of the United States population as a whole (i.e., the core sample), and about 2,000 were low-income families (i.e., the Survey of Economic Opportunity (SEO) sample). Some recent examples of papers using PSID data include, but are not limited to: Blundell, Pistaferri and Saporta-Eksen (2016), Chen, Michaux and Roussanov (2020), Giannetti and Wang (2016), Barras and Betermier (2020).

current round, and zero for participants in both the previous and current rounds of the survey. This variable is set to missing otherwise. I also extract a number of other household characteristics from PSID, which I summarize in Table 1 .

2.2 Sea Level Rise Data

I obtain data on sea level rise from the National Oceanic and Atmospheric Administration (NOAA)'s SLR Viewer tool to construct the main variable of interest, the SLR exposure of a household. NOAA provides maps of projected sea level rise up to 10 feet above average high tides with 1-foot increments for the United States except Alaska. These inundation maps show the regions projected to be under water given a certain sea level rise by the end of 2100 and are agnostic about what the actual sea level rise will be at that time. Instead, these maps are meant to be used as a screening tool for the regions under a given risk scenario.

The ideal SLR exposure measure is an indicator variable equal to one if the coordinates of a household's address is within a certain sea level rise layer provided by NOAA, and zero if the coordinates are outside of this layer. Giglio et al. (2021), Bernstein, Gustafson and Lewis (2019), and Baldauf, Garlappi and Yannelis (2020) construct such a measure. As mentioned in the previous section, however, PSID does not provide the addresses of households, just a household's state of residence. Therefore, I use the restricted PSID geospatial data in which the most precise geospatial indicator is the Census Block[12] and construct the SLR exposure measure as the fraction of the area projected to be under water for a given level of SLR at the Census Block level.[13] By definition, this means that two households in the same Census Block have the same SLR exposure.

Figure 1 Panel A illustrates the raw 3 feet sea level rise map over the counties of Florida using NOAA's 3 feet SLR layer and Census county shapefiles based on political boundaries.[14] A careful

[12]A Census Block is the smallest geographic unit used by the Census Bureau for tabulation of 100-percent data. Blocks are typically bounded by streets, roads or creeks. In cities a Census Block may correspond to a city block. There were 11,155,486 Census Blocks in the United States and Puerto Rico in the 2010 Census. About 5,000,000 blocks were reported to have a population of zero while a block that is entirely occupied by an apartment complex might have several hundred inhabitants.

[13]There are other studies in the literature that use SLR measures based on fraction of land exposed. Keenan and Bradt (2020) construct a similar measure at the Census Tract level, and Goldsmith-Pinkham et al. (2021) construct the SLR exposure measure by dividing the number of properties exposed within a NOAA SLR layer by the total number of properties in a school district.

[14]I choose to illustrate this variable at the county level since a sea level rise map of all Census Blocks in any state is difficult to perceive in a figure. However, I provide a snapshot of all the Census Blocks in the vicinity of TIAA Bank Field Stadium in Jacksonville, Florida as an example in the Figure A1 for interested readers.

reader will notice that these legal county boundaries do not correspond to physical county boundaries. As a result, the majority of Monroe County (i.e., the southernmost county in Florida) appears to be covered by water in a 3 feet SLR scenario even though a lot of the area within these legal Census boundaries is ocean water. To take the physical boundaries into account when creating the SLR exposure measure, I make use of the 0 feet SLR layer provided by NOAA. By definition, the intersection of the 0 feet SLR layer and the legal Census boundaries is the natural water area of a given Census area. I calculate the fraction of each Census area that are covered by the 3 feet SLR layer and 0 feet layer. The difference between these two values gives me the fraction of the *land area* that is projected to be under water for a 3 feet sea level rise projection, such that I end up with a continuous SLR exposure measure varying between zero and one. A heatmap of this final measure for the counties in Florida is presented in Figure 1, Panel B. Moreover, Figure 2 depicts the variation in this measure across the continental United States. The regions most at risk of being inundated are the East Coast and the Gulf Coast whereas the West Coast is relatively safe from rising sea levels.

2.2.1 Geographical Factors Influencing Sea Level Rise

The physical processes used to create NOAA SLR maps account for ground elevation, local and regional tidal variation as well as hydrological connectivity and current man-made hydraulic features (e.g., pipes, bridges, levees). One limitation of these SLR maps, however, is that they do not incorporate future changes in coastal geomorphology and assume that the present conditions will remain. To put it differently, this assumption states that ground levels do not rise or sink over time.

Murfin and Spiegel (2020) emphasize the importance of considering subsidence and land rebound and use an alternative measure based on historical trends in regional mean sea levels from 142 tidal stations around the United States. They define a *relative* sea level rise (RSLR) measure as the weighted average trend of the two nearest water stations by inverse distance.[15] I follow their

[15]While this measure has the advantage of taking vertical land motion into account, it also has serious shortcomings. First, the RSLR measure assumes the sea level trends vary linearly between each pair of the 142 tidal stations which potentially introduces large measurement errors. Second, NOAA states that the effects of land subsidence and rebound are "sufficiently unknown that they may compound or offset each other in unpredictable ways, such that including only some processes may cause greater error than ignoring them". Finally, RSLR does not take into consideration hydrological connectivity and is inherently forecasting how much sea level rise will occur based on historical trends. These forecasts are likely to have large degrees of uncertainty as scientists update the end of century sea level rise projections in light of

methodology to recreate the vertical land motion (VLM) component of their measure and plot it in Figure 3. Panel A shows the VLM projections by the end of 2100 in feet based on historical trends at each tidal station location, where positive values indicate that land will rise and negative values indicate that land will sink. Areas in which land is expected to rise substantially compared to current elevation levels are located mainly on the coasts of Alaska. A few areas on the West Coast are also expected to be elevated slightly. Ground levels in most of the continental United States as well as Hawaii and Puerto Rico are expected subside due to erosion and land subsidence, with larger drops observable especially on the Gulf Coast. Panel B shows four histograms to better illustrate the magnitude of vertical land motion based on geography. Taken together, vertical land motion mostly amplifies the risk of inundation due to rising sea levels and only attenuates the risk of inundation in Alaska.[16] Nevertheless, I include VLM in my regressions as a control variable.

2.3 Other Geographical Variables

All else equal, houses that are closer to the coast are likely more exposed to sea level rise risk. At the same time, proximity to coasts is also an amenity as easy access to beaches is a favorable quality for residents. Similarly, high-altitude houses are not only better protected against SLR exposure, but also enjoy housing amenities such as improved views. To control for the potentially confounding effects of distance to coast and ground elevation, I construct two variables measuring these quantities for each Census Block. Block level elevation and distance-to-coast calculations are based on the centroid coordinates of each Census Block.

3 Effect of SLR Exposure on Household Portfolio Choices

3.1 Empirical Strategy

In my baseline empirical analysis, I investigate the relationship between sea level rise exposure and the dynamics of household stock market participation for homeowners. Formally, I estimate

new research. For more information and assumptions made in the generation process of the SLR maps, the reader is referred to: https://coast.noaa.gov/data/digitalcoast/pdf/slr-faq.pdf

[16]Remember that NOAA SLR Viewer does not include SLR maps for Alaska and therefore, there are no households living in Alaska in the sample I use to conduct my analysis.

the following model:

$$\text{Participation}_{i,j,t} = \alpha + \beta \cdot \text{Sea Level Rise Exposure}_{i,j,t} + \gamma \cdot \text{X}_{i,j,t} + \text{c}_{j,t} + \epsilon_{i,j,t} \quad (1)$$

for household i located in zip code j in time t. In this estimation, participation is *Equity Participation* (either excluding or including IRAs), *Risky Share*, *Entry*, or *Exit*. My explanatory variable of interest is SLR Exposure (3 ft), which measures the fraction of the Census Block in which the household i lives projected to be inundated under a 3 feet sea level rise scenario.[17] $c_{j,t}$ denotes zip code by year fixed effects and $X_{i,j,t}$ is a vector of control variables. Specifically, I control for age, marital status, race, educational attainment (i.e., having completed high school or college), family size (i.e., household head, household head's partner, and children), total income, net wealth, whether there is home insurance on the occupied house, elevation of the house in feet, distance to coast in km, and vertical land motion. The coefficient of interest is β, which relates the stock market participation behavior of households to SLR exposure of households. The null hypothesis is that $\beta = 0$, which would indicate that SLR exposure does not affect stock market participation. By contrast, if SLR exposure affects stock market participation, I should expect a negative estimate $\beta < 0$.

Many factors correlated with SLR exposure are also potentially correlated with household stock market participation, which makes identifying the coefficient β difficult. For instance, homes closer to the coast may be more likely to be inundated as a result of future sea level rise, but at the same time they enjoy amenities such as beach access. These amenities likely attract wealthier and older buyers who are also more likely to participate in the stock market and differ from other households in terms of the portion of their financial wealth invested in risky assets (Calvet and Sodini, 2014; Ameriks and Zeldes, 2004). Similarly, elevation serves as a hedge against rising water levels while also providing housing amenities such as improved views. Moreover, households endogenously choose the locations of their homes and the unobserved household characteristics may drive the decision to live in more SLR exposed locations and stock market participation simultaneously.

I mitigate the possibility that the estimated relationship between SLR exposure and the dynamics

[17] The selection of the sea level rise scenario is informed by Goldsmith-Pinkham et al. (2021) who track the time-series evolution of SLR projections in the scientific literature. Figure A2 shows that the mean SLR forecasts have increased over time, reaching just above 3 feet in 2017. I also provide results for sea level rise exposures under 1 feet and 2 feet scenarios in Table A3.

of household stock market participation is driven by omitted variables in several ways. First, I include in my estimations a large set of household demographic and financial characteristics as controls to absorb any variation that may determine both SLR exposure and household stock market participation behavior as well as geographic determinants such as vertical land motion (Murfin and Spiegel, 2020), distance-to-coast, and elevation. Second, I control for systematic differences across zip codes using zip code fixed effects (c_j) and for macroeconomic conditions using year fixed effects (c_t). In particular, my regressions use zip code by year fixed effects such that I compare households within the same zip code and same year. Therefore, the identifying variation comes from the households in the same neighborhood that differ in SLR exposure. Finally, I exploit various dimensions of cross-sectional heterogeneity to show my results are likely driven by the effects of sea level rise and not some other omitted factors.[18]

Since my specifications include a large number of fixed effects, I estimate all equations using ordinary least squares even when they involve a limited dependent variable. All variables are weighted using PSID population weights throughout the analysis. I cluster standard errors at the household level, because a household's stock market participation is likely persistent over time. The results remain unchanged if I cluster standard errors by state or by year.

3.2 Baseline Results

Table 2 presents estimates of how sea level rise exposure relates to households' stock market participation dynamics. Specifically, I compare the stock market participation behavior of households in the same zip code in a given year, with varying degrees of SLR exposure.

First, I investigate the relationship between participation in the stock market and sea level rise exposure. Table 2 reports household level regressions on stock market participation measures. Column (1) shows that sea level rise exposure has a negative and statistically significant effect on the propensity to participate in the stock market for households. This effect is not only statistically significant, but also economically meaningful. The point estimate in column (1) suggests that a one-standard-deviation increase in 3 feet SLR exposure (4.6 pp) decreases the probability that an SLR

[18]The results to be presented from this point forward are robust only including zip code or year fixed effects as well as including fixed effects at the state level alone or its interactions with year fixed effects. The choice of zip code by year fixed effects represents a compromise between tightening identification and keeping enough statistical variation to exploit cross-sectional heterogeneity.

exposed household participates in the stock market by 1.8 pp compared to an unexposed household living in the same zip code and year. Since approximately 30% of the households participate in the stock market, this implies a 6% decrease in the probability of household stock market participation. I also find a similar, albeit smaller in magnitude, effect when I include stock holdings in IRAs in the dependent variable as shown in column (2). The smaller size of the coefficient in column (2) may partially reflect the rigidity in the allocation of individual retirement accounts which are affected by default choices, rather than the risks to which a household is exposed (Giannetti and Wang, 2016).

Second, I examine the effect of SLR exposure on the risky share of households' financial wealth. Here, I define the dependent variable *Risky Share* as the value of stocks owned divided by the financial wealth (i.e., sum of stocks, bonds, and cash). The point estimate in column (3) implies that the proportion of equity investments in the households' financial wealth is decreasing in their SLR exposures. The economic magnitude of this estimate is also substantial. A one-standard-deviation change in 3 feet SLR exposure (4.6 pp) decreases the risky portfolio share by 1.6 pp, which equals 9% of households' mean risky portfolio share.

Third, I consider the effect of SLR exposure on the changes in stock market participation by focusing on *Entry* into and *Exit* from the stock market. As expected, SLR exposed households are more likely to exit from and less likely to enter into the stock market compared to unexposed households in the same zip code and year. A one-standard-deviation increase in the 3 feet SLR exposure increases (decreases) the probability that households exit from (enter into) the stock market by 5 (1) pp, which equals an 18% increase (9% decrease) in the probability of exiting from (entering into) the stock market compared to the mean exit (entry) rates in the sample.

Overall, the results in Table 2 are consistent with the notion that SLR exposure constitutes a background risk for SLR exposed households through homeownership, decreasing their demand for risky assets as reflected in reduced stock market participation and a smaller share of financial wealth invested in risky assets.

3.3 Long- and Short-run Risks to Households

SLR exposure creates both long- and short-run inundation risks for exposed households. In the long-run, slowly rising oceans will eventually and permanently flood exposed areas. On the other hand, scientists project that rising sea levels will cause more frequent and more severe extreme weather events, such as storm surge flooding, tropical storms, and hurricanes (Marsooli et al., 2019; Knutson et al., 2020). Importantly, both of these physical channels have substantial uncertainty about them and can trigger a background risk effect on the exposed households. While it is a virtual certainty that rising oceans will permanently inundate exposed areas, the timing of this phenomenon is highly uncertain, as reflected in frequently updated forecasts of sea level rise by climate scientists (e.g, see Figure A2 for the evolution of SLR projections throughout my sample period). Extreme weather events such as storm surge flooding and hurricanes also have inherent uncertainties in their expected costs, timing, and frequency.

The analysis conducted above remains agnostic as to whether the uncertainty emanating from long- or short-run inundation risks affects household stock market participation behavior. Even though the SLR maps provided by NOAA aim to illustrate areas exposed to long-run SLR risks in the form of permanent inundation, the implicit correlation between more frequent and more devastating extreme weather events and rising sea levels makes it difficult to disentangle whether long- or short-run SLR risks drive changes in household stock market participation.

To investigate the relative importance of long- versus short-run SLR risks on household stock market participation behavior, I make use of National Storm Surge Hazard Maps also provided by NOAA. These maps depict the storm surge flooding vulnerability in hurricane-prone coastal areas along the East and Gulf coasts. NOAA uses the so-called hydrodynamic Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model to simulate storm surge from tropical cyclones and hurricanes. The SLOSH model simulates 100,000 hurricanes along the East and Gulf coasts to predict areas that are exposed to flooding due to storm surges. I use these storm surge maps that simulate Category 4 hurricanes and compute a Census Block level storm surge exposure to proxy for short-run SLR risks.[19]

Table 3 repeats my baseline analysis with the addition of this storm surge exposure measure.[20]

[19] Similar storm surge exposure measures are also used by Goldsmith-Pinkham et al. (2021) who use maps simulated using Category 3 hurricanes and Ouazad (2021) who uses maps simulated using Category 4 hurricanes. The results in regressions I present where the storm surge exposure measure is added as a covariate are not sensitive to the choice of these different maps. SLR exposure and storm surge exposure measures have a correlation of 0.78 at the county level, consistent with scientists' views on rising sea levels inducing more frequent and more severe extreme weather events. The correlation at the Census Block level is less than half that at 0.36 in the final matched sample of households.

[20] The number of observations drop slightly in Table 3, because NOAA only provides storm surge maps for the East and Gulf coasts. For this reason, observations for the storm surge exposure measure for households residing (mainly) on the West coast are coded missing.

The estimates in columns (1) through (4) for the SLR exposure remain similar to the estimates in the baseline results, both in terms of the coefficients and magnitudes, indicating that the long-run SLR risks induce households to be less likely to participate in the stock market and hold a smaller share of their financial wealth in risky assets. In column (5), the coefficient for the SLR exposure stays positive as in the baseline results and becomes insignificant with a t-stat of 1.58, potentially due to a loss in statistical power as the number of observations go from 1,166 to 485 after the inclusion of the storm surge exposure measure. On the other hand, the coefficients on Storm Surge Exposure are all insignificant for all outcome variables I consider. The main takeaway from Table 3 is that the background risk channel of SLR exposure appears to operative through exposure to long-run SLR risks to as opposed to short-run SLR risks.

3.4 Alternative Explanations and Robustness

The above results indicate that households perceive future SLR risks as an important source of background risk. As such, in the presence of SLR risks, SLR exposed households are less willing to take other types of independent risks (e.g., financial risks) compared to unexposed households living in the same neighborhood in the same year. This effect obtains after controlling for the households' wealth, income, demographic characteristics, and geographical characteristics of the houses in which households reside. Moreover, I use zip code by year fixed effects in my analysis, which capture local economic shocks that may affect household stock market participation behavior. It is possible, however, that there are confounding unobservable factors that affect both SLR exposure and household stock market participation. In what follows, I explore alternative explanations that might drive the findings discussed above.

3.4.1 House Price Changes and SLR Risks

When interpreting the results in Table 2, I highlight the background risk channel generated by SLR exposure as the underlying mechanism. Alternatively, one can argue that changes in the prices of SLR exposed houses leading to a decrease in household wealth could also generate the observed patterns in Table 2. Indeed, many models highlight the role of investment in housing as well as house price risk in explaining the demand for risky assets. For example, Cocco (2005) documents that both the level of housing wealth and house price risks crowd out stock holdings.

It is difficult to disentangle the mean effect of housing wealth from house price risks. Nevertheless, I address the concern above in several ways. First, all my regressions control for the net wealth and home value of households such that the identified relationship between SLR exposure and stock market participation behavior is conditional on the level of household net wealth and current home value. Second, I use zip code by year fixed effects in all specifications which capture local economic conditions including changes in regional house prices, alleviating the concern that changes in mean housing wealth is the primary driver off reduced stock market participation. Third, I use the Zillow Home Value Index data and calculate house price growths over the last 5 years in each zip code. I then split the sample by the median house price growth in each state-year and repeat my baseline analysis.[21]

The estimates for this analysis are presented in Table 4. Again, I find negative and statistically significant (and economically comparable) effects of SLR exposure on household stock market participation behavior in both subsamples. Crucially, even households living in regions that experienced high house price growth have reduced stock market participation and hold a smaller share of their financial wealth in risky assets in the presence of SLR exposure. Overall, these findings indicate that the negative effects of SLR exposure on household stock market participation behavior do not only run through their impact on first moment of housing wealth and second moment effects matter for portfolio choices.

3.4.2 The Role of Past Flooding Experiences

One may be concerned that households with high SLR exposure are also more likely to have experienced a flooding in the past. As a consequence, the observed effect of SLR exposure on household stock market participation behavior may be due to the direct costs of these past flooding incidents as opposed to the background risk channel I highlight. One way to test this hypothesis is to keep track of all flood-related incidents that affected a household's place of residence and examine if these households who have not experienced flooding incidents also exhibit the same stock market participation behavior associated with their SLR exposure.

I make use of the Presidential Disaster Declaration data provided by OpenFEMA to measure

[21] The results remain virtually unchanged when I split the sample by the median house price growth in each year in the entire United States or when I calculate house price growth rates using the house prices over last 3 years for each zip code.

households' past flooding experiences.[22] This database includes disaster ID numbers, declaration dates, declared states and counties, and incident types. I restrict my attention to flood related categories, that is, "Tornado", "Flood", "Hurricane", "Severe Storm(s)", "Typhoon", "Coastal Storm". For any given year in my sample, I create an indicator variable that is equal to one if the county a household lives in experienced a flooding event in the last two years, and zero otherwise.[23] Based on this variable, I repeat my baseline analysis in sample splits for regions that did not experience any flooding events in the recent past and regions that did experience flooding events in the recent past.

Table 5 reports the results based on the sample splits described above. Columns (1) and (2) show that SLR exposed households who did not experience floods in the last two years still have a lower propensity to participate in the stock market and hold a lower share of their financial wealth in risky assets, compared to unexposed households in the same neighborhood who also did not experience floods in the near past. This suggests that even if past flooding experiences reduce household stock market participation, they are unlikely to be the only cause for SLR exposed households. In columns (3) and (4), I repeat the same analysis for households who experienced flooding incidents in the last two years and I find very comparable results. Lastly, columns (5) and (6) show the estimates where I pool these observations and use an indicator variable capturing whether a household's county experienced flooding events in the near past or not. The interaction of this indicator variable with SLR exposure is statistically insignificant in both regressions where the outcome variable is equity participation and risky share. These estimates suggest that past flooding experiences are unlikely to be the driving force between SLR exposure and household stock market participation behavior.

3.4.3 Endogenous Choice of Housing Location

As alluded to in prior discussion, households choose where they live endogenously and there might a concern that this is the driving mechanism behind the effect of SLR exposure on household stock market participation. Unobservable factors influencing the location choice may also be correlated with the stock market participation behavior of households in the stock market. For example, if a

[22] The Presidential Disaster Declaration data is available at https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2.

[23] The results remain unchanged when I construct this variable for any number of years between one and five.

household moves to a location with a different SLR exposure for a reason that may also affect its stock market participation, my estimates would be biased.

To mitigate the concern that housing relocation may drive my findings, I consider households who have never moved across the entire sample period of twenty years. I construct an indicator variable I dub *Nevermover* that equals one if a household has never moved out of the Census Block in which they live during the sample period. By construction, these households bought their homes twenty years or longer ago (in times when SLR risks were arguably much less salient and for reasons likely unrelated to SLR) and their cost of moving was sufficiently high that they resided in the same location for the entire sample period. As such, *Nevermovers* can be thought of a group of households for whom the background risks emanating from SLR exposure are likely to be the most prevalent.

Table 6 presents the results of regressions described above. Columns (1) through (4) show regressions where I interact SLR exposure with the nevermover dummy, which compare households who never moved during the sample period to households who moved with varying degrees of SLR exposure. Columns (5) through (8) show estimates from regressions where the sample is restricted to nevermovers. In all columns, the point estimates stay negative and statistically significant, obtaining slightly larger values in magnitude than the baseline specification, with the exception of the coefficient of *Exit* in column (4). In unreported results, I restrict the sample to only movers in the sample period and estimate statistically zero coefficients for all outcome variables. Taken together, I find no evidence that endogenous choice of housing location drives the effect of SLR exposure on household stock market participation.

3.4.4 Differences in Political Beliefs

In the recent years, one of the defining feature of the public discourse in the United States on climate change has been its partisan nature. For example, Republican President Donald Trump announced his intentions to withdraw the United States from the Paris Climate Agreement in 2017 and his administration eventually gave a formal notice of withdrawal in 2019. Following the 2020 Presidential Election in the United States, Democratic President Joe Biden signed an executive order to rejoin the agreement in 2021.

This divide on climate-related topics along the partisan lines is also present in the general public. According to a 2020 Pew Research Center survey that asked registered voters in the United States about top policy priorities, 11% of Trump supporters thought of climate change as a top priority compared to 68% of Biden supporters (the widest gap for any topic in the survey).[24] Relatedly, recent work by Bernstein et al. (2021) show that this climate change partisanship is reflected in residential choice as SLR exposed houses are more likely to be owned by Republicans and less likely to be owned by Democrats. If political affiliation is also a driver of household stock market participation, then it might constitute an omitted variable which threaten the validity of the results presented in this paper.

To mitigate this concern and get a better understanding of whether differences in political beliefs drive the effect of SLR exposure on household stock market participation behavior, I use a data set containing county-level returns for presidential elections from the MIT Election Lab. More specifically, I count only the votes for the Republican or the Democratic presidential candidate in a given election and compute the share of votes cast for the Republican candidate in a given year using the most recent presidential election in a given year in my sample. I then construct indicator variables identifying households who live in "Republican" counties and ones who live in "Democratic" counties based on either the state median or the national median in a year.

Table 7 presents the results of these sample splits. In all specifications, the coefficients on the interaction term of high Republican share indicator with SLR exposure are statistically insignificant, while the estimates on SLR exposure stay negative and statistically significant. In unreported results where I split the sample based on the Republican share variable, I continue to find negative and statistically significant effects of SLR exposure on equity participation and the share of financial wealth invested in risky assets in both subsamples. Taken together, differences in political beliefs do not appear to be the driving force behind the relationship between SLR exposure and household stock market participation behavior.

3.4.5 Differences in Risk Preferences

Risk preferences play a key role in models of financial decisions. Their role is essential in understanding the demand for insurance, the choice of mortgage type, the frequency of stock trading as well as willingness to buy risky assets. In particular, the interaction of household risk preferences

[24] For a discussion of the results of this survey, see https://www.pewresearch.org/politics/2020/08/13/important-issues-in-the-2020-election/.

with the choice of location to live in and with the stock market participation behavior poses a threat for identification in my analysis. One may be concerned that households' risk tolerance may be an omitted variable that is correlated both with households' SLR exposure and stock market participation.

I address this concern in various ways. First, I control for the 1999 risky share of financial wealth as a proxy for the initial risk aversion of households. Assuming risk aversion to be fixed over the sample period, this variable should capture the risk preferences of households accurately.[25] Second, I exploit the 1996 wave of PSID to infer the risk aversion of households. 1996 PSID survey asked respondents a series of questions about their willingness to take jobs with different prospects. All choices were 50-50 chance to either double their current income or cut income by different fractions. Based on these questions, it is possible to divide households into six buckets in terms of their risk preferences. To control for risk aversion, I use fixed effects based on these categories. The underlying assumption behind this specification is that households do not move between different categories after 1996. Third, Kimball, Sahm and Shapiro (2009) compute risk aversion coefficients for these six risk aversion categories from the 1996 wave of PSID assuming CRRA utility. I include these risk aversion coefficients as additional controls in my regressions. Finally, I remove the waves in the 2007-2009 financial crisis as experiences through these years may have affected the risk preferences of households (Malmendier and Nagel, 2011).

The results are presented in Table 8. In all specifications, results remain statistically significant, indicating that risk preferences of households do not drive the effect between SLR exposure and household stock market participation. In fact, the estimates increase in magnitude in all specifications apart from the exclusion of the financial crisis period.

[25] Another way to control for individual risk preferences would be to include household fixed effects in my analysis. As I already employ zip code by year fixed effects, however, the inclusion of household fixed effects would subsume all variation that is remaining, making statistical estimation impossible. Moreover, the SLR exposure measure I use is time-invariant since it is constructed from the NOAA SLR maps that are simply a snapshot in time. Thus, an analysis that incorporates household fixed effects only would forego variation coming from households who have never moved, but rely on variation from households who moved from locations exposed to SLR risks to locations that are unexposed or vice versa. Therefore, the inclusion of household fixed effects in my setting is not feasible as it severely restricts the statistical variation available.

3.4.6 The Role of Proximity to Coast

My sample consists of all households surveyed by PSID between 1999 and 2017, who are the descendants of a representative sample of families first surveyed in 1968. As a result, the respondents are distributed all over the United States, including land-locked states and states far away from the shore. Sea level rise, on the other hand, is most relevant for households living in coastal areas and living close to other bodies of water. By virtue of this fact, studies in the literature investigating the effects of sea level rise have focused on certain geographies. Bernstein, Gustafson and Lewis (2019) consider properties 0.25 miles away or closer to the coast to study whether SLR exposure is priced in the residential real estate prices. Baldauf, Garlappi and Yannelis (2020) and Murfin and Spiegel (2020) use a 50 km and a 30 km restriction from the coast, respectively, to answer the same question. Goldsmith-Pinkham et al. (2021) study the pricing of municipal bonds as it relates to SLR exposure and restrict their sample to watershed counties.[26]

To ensure that the results are driven by households for whom SLR exposure is most relevant, I repeat my analysis after imposing sample restrictions based on distance to coast and watershed counties. In particular, I restrict the sample to households who live 50 km away or closer to the coast,[27] or households who live in watershed counties. Table 9 presents the point estimates for these regressions. The results continue to be statistically significant with the same signs as the baseline results. If anything, the coefficients increase in magnitude as one would expect.

4 Homeownership Channel: Placebo Test on Renters

Housing serves a dual role for homeowners: as a consumption good and as a portfolio asset (Cocco, 2005; Yao and Zhang, 2005). At the event of flooding, a homeowner therefore loses claims to future dividends related to consumption dimension of housing and also faces a negative shock to the asset value. Because housing markets are illiquid, homeowners bear the full brunt of sea level rise risks due to the absence of an efficient flood insurance market in the United States. On the other hand, rental markets allow investors to separate the consumption and investment dimensions of

[26]According to NOAA, coastal watershed counties can be thought of as "the population that most directly affects the coast". For a more detailed definition, please see `https://coast.noaa.gov/htdata/SocioEconomic/NOAA_CoastalCountyDefinitions.pdf`.

[27]The results are not sensitive to this choice. For example, unreported results show qualitatively the same results when this cutoff is chosen as any value in [10, 20, 30, 40, 60, 70, 80, 90, 100] km.

housing. Renters derive utility from consumption of housing services, but do not have a housing component in their portfolios. Moreover, the liquid nature of rental markets allows renters to face smaller costs in the event of negative shocks to their housing consumption. Overall, SLR exposure poses little to no threat to renters as opposed to homeowners.

Exploiting this stark difference between homeowners and renters in terms of exposure to SLR risks allows me to test whether SLR exposure indeed affects household stock market participation through a homeownership channel. In particular, I conduct a placebo test in a sample of only renter households and compare renters in the same zip code and year with varying degrees of SLR exposure. This placebo test also helps mitigating the possibility that the effect of SLR exposure on household stock market participation is due to unobservable differences between SLR exposed and unexposed households.

Formally, I restrict the sample to renter households only and estimate the following empirical model similar to equation 1:

$$\text{Participation}_{i,j,t} = \alpha + \beta \cdot \text{Sea Level Rise Exposure}_{i,j,t} + \gamma \cdot \text{X}_{i,j,t} + \text{c}_{j,t} + \epsilon_{i,j,t}$$

for household i located in zip code j in time t. The outcome and independent variables are the same as in equation 1. $X_{i,j,t}$ is a vector of control variables and $c_{j,t}$ denotes zip code by year fixed effects. Since the sample only consists of renter households, I do not control for house value and whether the household i has home insurance, but instead the rent paid by the household.

4.1 Results: Homeowners vs. Renters

Table 10 presents both the results for homeowners and renters separately. For ease of comparison, odd-numbered columns report the same the estimates as in Table 2 and even-numbered columns report the estimates for the sample that includes renter households only. Column (8) does not report any coefficients, because the number of renter households within the same zip code and year does not exceed one and therefore, I am unable to identify the regression model.[28]

The point estimates in Table 10 indicate that homeowners with SLR exposure are less likely to participate in the stock market, hold a smaller share of their financial wealth in stock, are less

[28] In unreported results, I find statistically insignificant estimates for SLR Exposure (3 ft) when I replace zip code by year fixed effects with zip code and year fixed effects with only 423 observations.

likely to enter into and more likely to exit from the stock market. On the other hand, regressions in the renters sample show negative, but statistically insignificant coefficients. These findings indicate that the effect of SLR effect on household stock market participation operates through the homeownership channel, as SLR exposed renters do not behave statistically differently than unexposed renters when it comes to stock market participation.

5 The Role of Attention to Climate Change

Several papers in the literature emphasize the role of attention to climate change and salience of flood risk in determining house prices and household flood insurance decisions. For example, Baldauf, Garlappi and Yannelis (2020) focus on transaction prices of houses and show that SLR exposed houses trade at a discount when the salience of flood risk is high. Hu (2020) provides evidence that the low salience of flood risk might lead to inattention and thus, to low insurance take-up rates. In this section, I leverage time-series variation in two different empirical strategies to examine the role of attention to climate change.

5.1 Attention to Climate Change: Wall Street Journal Climate Change Index

Engle et al. (2020) construct a climate change news index based on climate news coverage in The Wall Street Journal (WSJ) and show that this index can be used to build climate change hedge portfolios. The WSJ Climate Change News Index implicitly assumes that the number of climate change discussions increases at times when climate risk is high. This WSJ index is available for the entire duration of my sample and publicly made available by the authors. A potential shortcoming of this measure for the analysis in this paper is that the measure might run the risk of inaccurately capturing positive climate news as elevated attention to climate risks. Moreover, if the typical household is not a part of WSJ's audience, the WSJ index might not perfectly correlate with households' attention to climate change. Nevertheless, I use the WSJ Climate Change News Index to proxy for aggregate attention to climate change.

Table 11 reports the results of regressions including interactions between SLR exposure and a high attention indicator variable based on the WSJ Climate Change News Index. The interaction coefficients in all columns are negative and statistically significant (with the exception of the coefficient in column (4) with a t-stat of 1.44), indicating that at times of high attention to climate change, the background risk effect of SLR exposure is higher on household stock market participation behavior. The magnitude of the interaction coefficients are even larger for a subsample of people living 50 km or closer to a coast and households who have never moved during the sample period, likely due to increased levels of background risks. All in all, SLR exposed households appear to have a lower propensity to participate in the stock market and hold a smaller share of their financial wealth in risky assets at times when attention to climate change is elevated.

5.2 Salience of Flood Risk: Major Past Hurricanes

The second empirical strategy I employ assumes that the occurrence of devastating natural disasters such as hurricanes increases the salience of flood risks. Similar to the strategy employed by Baldauf, Garlappi and Yannelis (2020), I identify the top ten costliest hurricanes (listed in Table A5) over my sample period, the year in which they occurred, and the states they hit. I focus on states *unaffected* by these events in the time period following these events, because households' stock market participation behavior in the hurricane affected states might change due to costs directly incurred. Therefore, the identifying variation in this empirical strategy comes from households living in states unaffected by these hurricanes, but for whom the salience of flood risks will be higher due to major hurricanes that recently took place. I create an indicator variable $Hurricane_{st}$ equal to one in an unaffected state s in time period t if there was a major hurricane taking place in period $t-1$. If the effect of SLR exposure on household stock market participation is at least partially operative through the salience of flood risks, then I expect a negative and statistically significant coefficient for an interaction of SLR Exposure and $Hurricane_{st}$.

Table 12 reports the results of this test. Similar to the results above, the interaction coefficients in all columns are negative and significant (with the exception of the coefficient in column (4) with a t-stat of 1.18). The salience effect of major hurricanes is especially large for households living close to the coast in unaffected states and households who never moved during the sample period. Overall, these results provide supportive evidence that the salience of flood risks exacerbates the effects of SLR risks for households.

6 State-Led Climate Change Adaptation Plans

The costs associated with the disastrous effects of sea level rise, in the form of inundation of large areas and increased extreme weather events both in intensity and frequency, will take a significant toll on the economy. Governments will need to assume this burden and spend large amounts of money on emergency response, insurance payouts, and to rebuild flooded infrastructure. If governments fail to plan for these impacts, valuable public investment and significant private investment may literally fall into the sea.

Governments have powerful tools to counteract the negative impacts of sea level rise and reasons to begin planning and adapting now.[29] However, the regulatory environment on climate change in the United States at the federal level has been stagnant until the Paris Agreement in 2015. The election of President Trump and his withdrawal from the Paris Agreement further showed the reluctance of the federal government to enact regulations to meet future climate challenges. The lack of political will at the federal level for prevention against the future impacts of climate change makes state level actions more important and relevant for residents.

As of 2020, 17 states and the District of Columbia have finalized state-led climate change adaptation plans as preparation for the negative effects of climate change. Florida, Maryland, and Virginia are the first three states adopting climate change adaptation plans, all in 2008, whereas North Carolina has been the latest state adopting such a plan in June 2, 2020.[30] State-led climate change adaptation plans (SCCAPs) vary in their scopes, goals, and strategies, but they share the common goal of combating the adverse effects of climate change, including the adverse effects of future sea level rise. I discuss the content of these plans in further detail as they relate to sea level rise in the Internet Appendix Part A2.

[29]These tools include, but are not limited to: zoning regulations to impose restrictions on development in at-risk zones, building code regulations to promote resilient design for new constructions against coastal flooding, establishing setbacks and buffers from the coast, creating soft- and hard-armoring permits to facilitate coastal protection for existing development or critical infrastructure, acquiring vulnerable properties to be demolished and restored or conserved as open space, public parks, or for natural resources, requirements for sellers of real estate to disclose information about a property's SLR vulnerabilities, and tax incentives to encourage preferred development patterns. For detailed discussion of tools governments can employ to prepare for the impacts of sea level rise, see Grannis (2011).

[30]Of all the 18 states (including D.C.) with finalized plans, 16 are in my sample period of 1999-2017. Since NOAA does not provide SLR data for Alaska, I am able to make use of 15 state-led climate change adaptation plans in my analysis. For more information in the timing and content of state-led climate change adaptation plans, the reader is referred to Ray and Grannis (2015).

6.1 Empirical Strategy: Staggered Difference-in-Differences

Although I consider a myriad of alternative explanations that may drive the relationship between SLR exposure and household portfolio decisions in the above analyses, the concern that unobservables drive this relationship might still remain. To alleviate the worry that endogeneity may be biasing my estimations, I exploit the exogenous variation that the adoption of state-led climate change adaptation plans generate.

Similar to the Paris Agreement signaling the commitment of countries worldwide to curb CO_2 emissions, SCCAPs signal the state governments' commitment to protect the state residents and the environment. If households are aware of the adoption of SCCAPs and view them as credible signals, then the perception of background risks SLR entails for households should be significantly reduced.[31] Put differently, one should observe that SLR exposed households increase stock market participation and the risky share of their financial wealth following the adoption of SCCAPs, reflecting the reduced riskiness of their background risks due to future sea level rise. On the other hand, if households do not see SCCAPs as credible signals of commitment, then there should be either no change in their stock market participation behavior or even a reduction in their willingness to take financial risks as the announcement of SCCAPs make SLR risks more salient.

To formally test this hypothesis, I restrict attention to homeowner households and I carry out a staggered diff-in-diff analysis and estimate the following model in equation 2:

$$\begin{aligned}\text{Participation}_{i,j,t} = \alpha + \beta_1 \cdot \text{Sea Level Rise Exposure}_{i,j,t} + \beta_2 \cdot \text{Post SCCAP}_{j,t} + \\ \beta_3 \cdot \text{Sea Level Rise Exposure}_{i,j,t} \times \text{Post SCCAP}_{j,t} + \gamma \cdot \text{X}_{i,j,t} + \text{c}_{j,t} + \epsilon_{i,j,t}\end{aligned} \quad (2)$$

for household i located in zip code j in time t. The outcome and independent variables are the same as in equation 1. $X_{i,j,t}$ is a vector of control variables and $c_{j,t}$ denotes zip code by year fixed effects. Post SCAPP$_{j,t}$ is an indicator variable equal to one for zip code j in the year and all years

[31]Indeed, there is reason to think this may be the case by looking at news in the mainstream media. For example, Mayor Michael Bloomberg announced that \$20 billion would be spent over the next decade to address the threat of rising sea levels and powerful storm surges by building an extensive network of flood walls and levees to protect New York City (NY Times, 2013). Miami Beach is pursuing a \$500 million program of infrastructure upgrades to reduce flooding as a part of their adaptation plan, with an additional \$400 million for projects to prevent flooding and mitigate sea level rise (Wall Street Journal, 2018). The voters in San Fracisco approved a \$425 million bond to start fortifying a sea wall along the bayfront road, the Embarcadero, and the San Francisco airport, which sits on tidal marshlands, is getting a \$587 million makeover to raise its sea wall (NY Times, 2020).

after a climate adaptation plan is adopted in its state, and zero otherwise.[32] The coefficient of interest is β_3 in these model.

My analysis up until this point employs a time-invariant SLR measure according to 3 feet SLR projections. Because the model in equation 2 focuses on the changes in the relationship between SLR exposure and household portfolio decisions over time, I create a time varying SLR exposure measure based on the evolution of sea level rise projections by following the procedure described in Goldsmith-Pinkham et al. (2021). Figure A2 plots the mean SLR projections for each year from 2001 to 2017 as well as the 1st and 99th percentile bounds. There is a clear upward trend in the SLR projections over time, especially in the upper bound. While the average SLR projection is just below 1 foot in the scientific literature in 2001, the average SLR projection triples that amount by 2017 to above 3 feet. The upper bound of SLR projections in 2017 is well over 5 feet. Since NOAA provides SLR layers with 1 foot increments, I compute a time varying SLR exposure measure in two steps. First, I determine the level of 99th percentile SLR projection in a given year. Second, I assign the SLR exposure values to each household based on the NOAA SLR layer that is just above the aforementioned level is determined. For example, the 99th percentile value of SLR projection in 2017 is between 5 feet and 6 feet in Figure A2. Hence, I use the 6 feet SLR layer to compute the SLR exposure of households in 2017.

6.1.1 Timing of Adoption and Parallel Trends

The causal interpretation of the coefficient β_3 in equation 2 depends on two crucial assumptions. Namely, these are the lack of contaminating events around the time of the shocks and the existence of parallel pre-trends in the outcome variables. Both of these assumptions are inherently untestable. Nevertheless, a discussion of whether they are likely to be satisfied is beneficial.

First, I focus on the possibility of contaminating events around the adoption of SCCAPs. The timing with which these climate adaptation plans are adopted depends on the expected benefits and political costs associated with enacting recommended policies in these plans to mitigate the effects of climate change. The states with more at-risk properties likely stand to gain more from adaptation plans. Moreover, political costs of adopting climate adaptation plans are likely lower in states where the levels of belief and worry about climate change are higher. Figure 4 provides

[32] The estimates of this model are not sensitive to creating an indicator variable equal to zero in the year of adoption.

a depiction of when and where climate adaptation plans have been adopted in the United States. A quick look at this figure shows that climate adaptation plans are mostly eventually adopted in coastal states, with notable exceptions of Louisiana, Texas, and New Jersey. In fact, a one-to-one comparison with Figure 2 reveals that all SCCAP adopting states have at least some level of sea level rise risk, apart from the land-locked state of Colorado. Hence, it seems implausible that whether to adopt an adaptation plan and the timing of adoption are driven mainly by the magnitude of sea level rise exposure of each state.

There is also little evidence that there is geographical clustering in terms of the timing. Neighboring states do not necessarily follow each other in terms of adoption nor is there a clear pattern that plans are adopted along the political party lines. There are early adopter states that are typically Republican (e.g., Alaska) as well as Democratic (e.g., California). There are also states that typically vote for either party that have not adopted climate adaptation plans so far (e.g., Texas and New Jersey) even though they face significant sea level rise risk. Moreover, the staggered structure of equation 2 makes it difficult for contaminating events to threaten the validity of my analysis as it is difficult to think of contaminating events that are staggered both in time and geographic dimensions in the same way SCCAPs are.

Second, I examine the parallel trends assumption which is key for any diff-in-diff estimator. That is, in the absence of treatment, the average change in the outcome variable would have been the same for both treated and untreated groups. To shed light on the validity of this assumption, I follow Roberts and Whited (2013) and perform a paired sample t-test of the difference in average growth rates across the two groups.[33] For this purpose, I create an indicator variable, reflecting a treated household, equal to one if a household's time varying SLR exposure is in the top quartile in a state-year, and zero otherwise. Next, I compute the growth in *Equity Participation* and *Risky Share* and report the p-value of the difference-in-means test and the p-value of the two-sample Wilcoxon test in Table A4. The former tests the hypothesis that mean values of the two groups are the same, whereas the latter tests the hypothesis that the two groups are taken from populations with the same median. The p-values for both tests are statistically insignificant for each outcome variable and hence, the treatment and control groups appear to satisfy the parallel trends assumption.

[33] A similar test is also performed by Lemmon and Roberts (2010).

6.2 Results

Table 13 presents the estimates on how the effect of SLR exposure on household stock market participation behavior changes following the adoption of state-led climate change adaptation plans in a sample of households. Similar to my baseline analysis, I populate these estimations with zip code by year fixed effects such that the interaction coefficient between SLR exposure and SCCAP dummy estimates the incremental change in the effect of SLR exposure following the adoption of SCCAPs.

I start by exploring the effect of SLR exposure following the adoption of SCCAPs on the propensity to participate in the stock market. Column (1) presents a negative and statistically significant coefficient on SLR exposure, consistent with the baseline results in Table 2. The interaction term that identifies the effect of SLR exposure on participation behavior following the adoption of climate adaptation plans is positive and statistically significant. This finding supports the notion that households see climate adaptation plans as local governments' commitment towards protect state residents against the adverse impacts of sea level rise. The economical magnitude is also substantial as one-standard-deviation increase in the time varying SLR exposure (6.2 pp) increases the probability that an SLR exposed households participates in the stock market by 3.9 pp in states after the adoption of climate adaptation plans.

Next, I examine the effect of SLR exposure on households' share of financial wealth invested in risky assets. If climate adaptation plans are seen as public safety nets, then SLR exposed households in adopting states should be more willing to take financial risks following adoptions, as reflected in higher proportion of financial wealth invested in risk assets. The positive and statistically significant interaction coefficient in column (5) is supporting evidence that indeed, households' willingness to take financial risks rises after the adoption of climate adaptation plans. The coefficient on SLR exposure is negative and statistically significant, mirroring the estimates in Table 2. Based on the interaction coefficient in column (5), one-standard-deviation increase in time varying SLR exposure (6.2 pp) increases the risky share of financial wealth by 2.7 pp after climate adaptation plans are adopted.

I perform several additional tests to address different concerns with the analysis above. In columns (2) and (6), I allow for time-varying coefficients on my control variables in the pre- and post-periods by adding an interaction term with *Post SCCAP* for each control variable. Moreover, households' experiences through the 2007-2009 may have confounding effects for my estimates. In columns (3) and (7), I remove observations from the waves in the 2007-2009 financial crisis to ensure the financial crisis period does not constitute a contaminating event. Goodman-Bacon (2018) emphasizes that in diff-in-diff models with variation in treatment timing, untreated observations may influence estimates drastically. This might be of particular concern in my regressions as all households living in land-locked states have both zero SLR exposure and none of the land-locked states adopt a climate adaptation plan (with the exception of Colorado). These households may not be appropriate control groups for households living in SLR exposed states. Thus, I restrict my sample to all households living either in states with SLR exposure and SCCAP adopting states in columns (4) and (8). The coefficients stay positive and statistically significant with similar magnitudes in all these specifications, giving confidence in the robustness of the staggered diff-in-diff analysis.

Overall, the results show that the adoption of state-led climate adaptation plans were effective in alleviating the background risk emanating from SLR exposure for exposed households. Following the adoption these climate adaptation plans, SLR exposed households in the adopting states increase stock market participation and the share of financial wealth invested in risky assets compared unexposed households in the same zip code.

6.3 Placebo Test on Renters

In order to provide additional checks on the internal validity of my estimates, I repeat my analysis after restricting the sample to renters only. If the effect I identify in the analysis above on households stock market participation is driven by unobservables correlated with SLR exposure or contaminating events, then similar increases in the stock market participation of renters following state-led climate change adaptation plans can be expected. If the identified effect is indeed due to SLR exposure, however, I expect to observe no change in the stock market participation behavior of SLR exposed renters compared to unexposed renters in states following the adoption of climate adaptation plans since renters should not be subject to background risk.

Table 14 presents the estimates on a sample of renters. The coefficients of interaction terms in all columns are negative and statistically insignificant, consistent with the notion that renters are not subject to background risk due to SLR exposure and the adoption of climate adaptation plans do not affect renter households' stock market participation behavior.

7 Conclusion

I provide the first evidence that sea level rise risks constitute a source of uninsurable background risk for households. Consequently, SLR exposed shouseholds are less likely to participate in the stock market and hold a smaller proportion of their financial wealth in risky financial assets. One-standard-deviation increase in SLR exposure reduces the propensity to participate in the stock market by 1.8 pp and the share of financial wealth invested in equities by 1.6 pp. These numbers correspond to 6% and 9% decreases compared to the mean stock market participation and mean risky share, respectively. The effect mainly stems from long-run SLR risks as opposed to short-run risks and alternatives explanations including endogenous relocation decisions, differences in risk preferences, past flooding experiences, or differences in political beliefs are unable to account for this effect. Placebo tests based on renter households show statistically insignificant results, which highlights the role of homeownership for sea level rise exposure. Exploiting time-series variation in the attention to climate risks, I also document that the crowding effect of SLR risks on household stock holdings is amplified at times when attention to climate change is elevated.

Local governments have an important role to play in mitigating these risks for households. To test whether the households' perceptions of background risks can be mitigated by state governments, I exploit a plausibly exogenous source of variation in the form of state-led climate adaptation plans. Climate adaptation plans aim to protect residents of the adopting state from the adverse effects of climate change and therefore, provide a public safety net for households exposed to sea level rise. A staggered diff-in-diff analysis around the adoption dates of climate adaptation plans shows that households see these plans as credible signals of state governments' commitment towards protecting citizens. As such, sea level rise exposed households' willingness to take financial risks increases after the adoption of these plans, as reflected in the propensity to participate in the stock market and share of financial wealth in risky assets.

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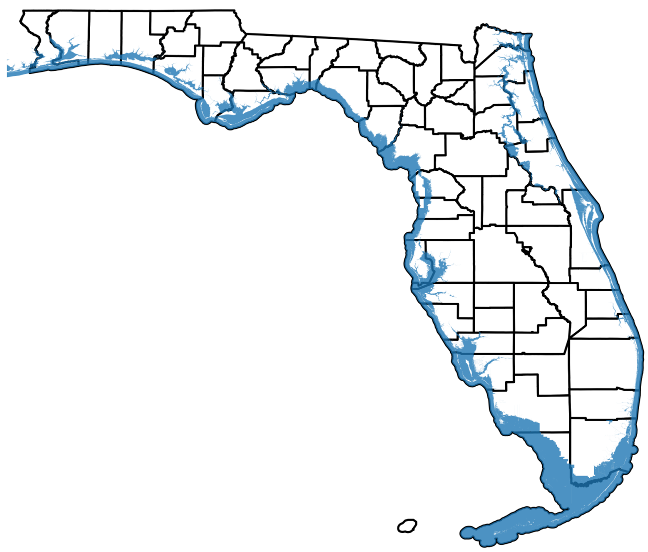
Figure 1: 3 feet sea level rise in counties in Florida

This figure illustrates the regions at risk of being under water in a 3 feet sea level rise scenario by the year 2100. Panel A shows the 3 feet sea level rise projection map provided by NOAA and Panel B shows the heatmap of sea level rise risk exposure in each county, after removing the existent bodies of water in each county.

Panel A



Panel B

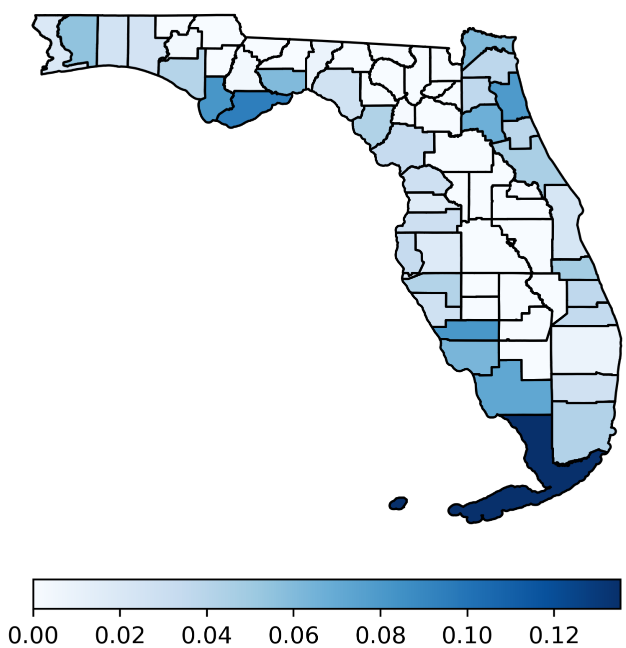


Figure 2: Sea level rise exposure of counties in the United States

This figure illustrates the sea level rise exposure of counties in the continental United States under a 3 feet sea level rise scenario by the end of 2100. The values indicate the fraction of land area of each county that is at risk of being under water if sea level rise by 3 feet globally. The plotted state lines follow political boundaries and not physical boundaries.

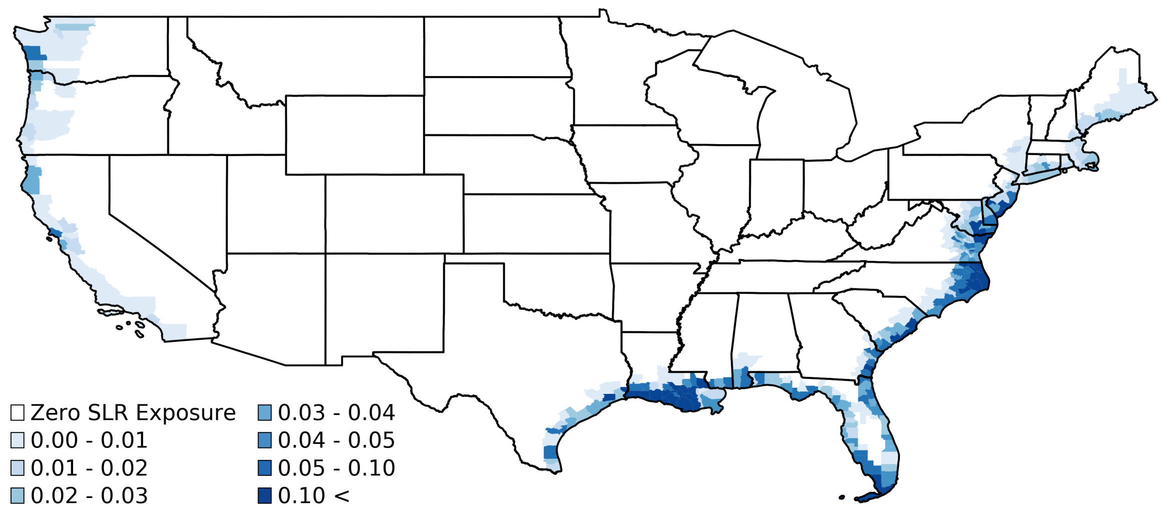
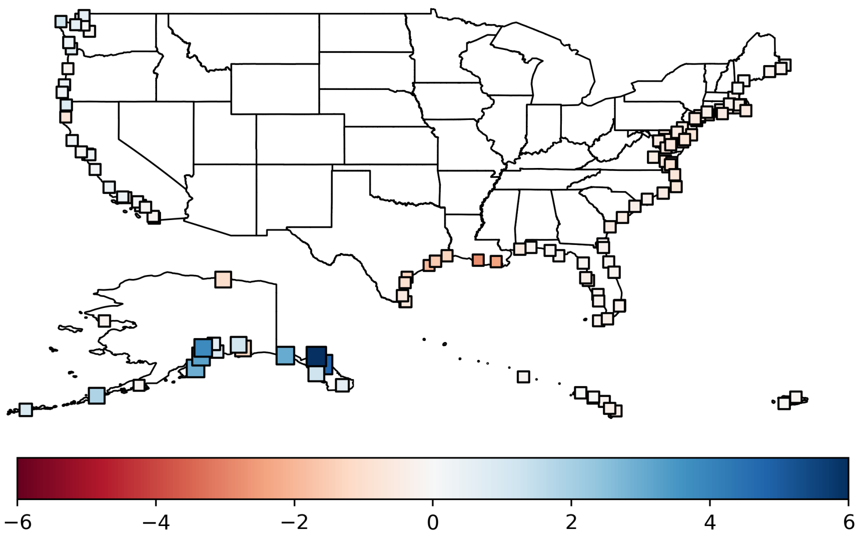


Figure 3: Vertical land motion in the United States

This figure illustrates the projected vertical land motion (VLM) around the United States. The VLM values are reversed such that positive values indicate that land is rising and negative values indicate that land is sinking. The values in the color bar indicate levels of VLM between -6 feet and +6 feet. Panel A illustrates the projected vertical land motion at the tidal station locations. Panel B shows the distribution of projected vertical land motion based in the continental United States and Puerto Rico (PR), Alaska, and Hawaii.

Panel A



Panel B

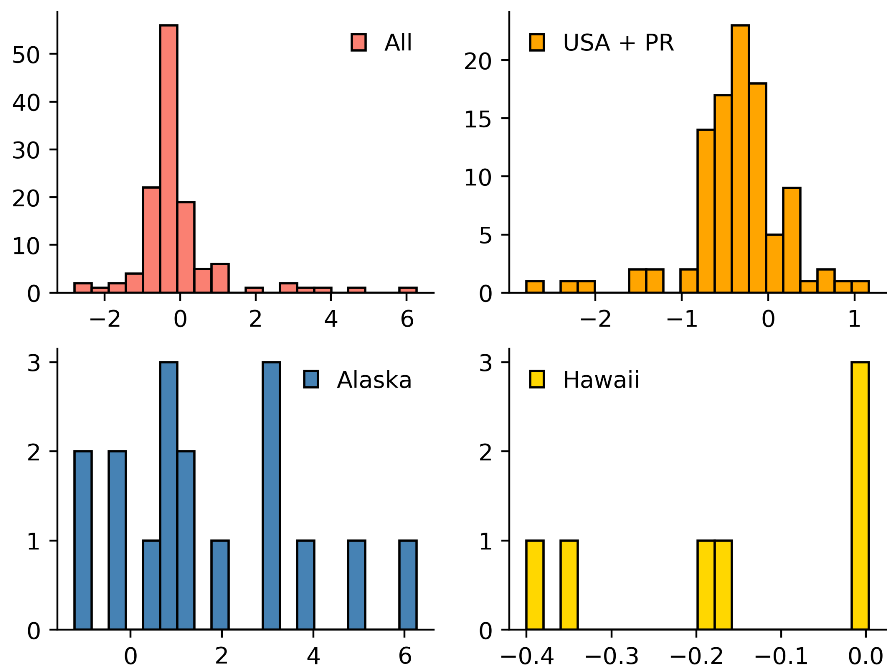


Figure 4: State-led Climate Change Adaptation Plans: Geographical Distribution Over Time

This figure illustrates when and where state-led climate change adaptation plans have been finalized across the United States between 1999 and 2017 (i.e., the sample period considered in this paper). Notably, Rhode Island (plan finalized in 2018) and North Carolina (plan finalized in 2020) have finalized such plans after 2017 and thus, excluded from this figure.

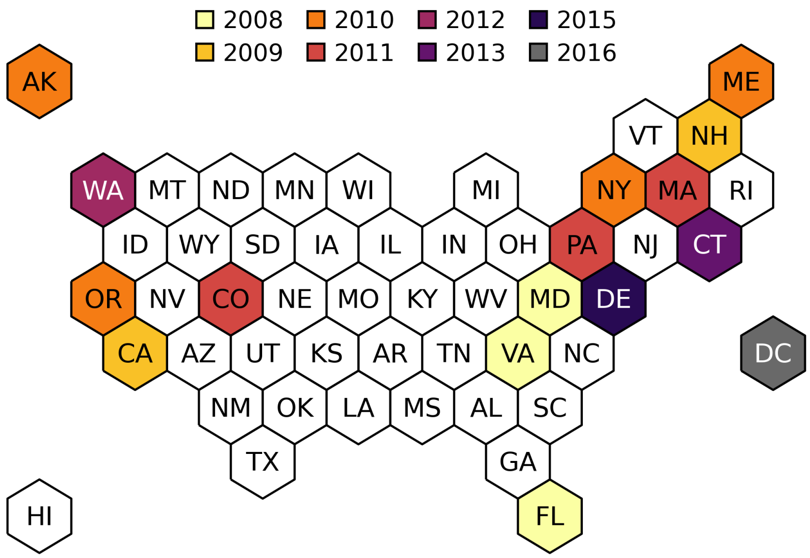


Table 1: Summary statistics

Sample:	Full			Homeowners			Renters		
	Mean	**STD**	**Obs.**	**Mean**	**STD**	**Obs.**	**Mean**	**STD**	**Obs.**
Stock Market Participation:									
Equity Participation	0.22	0.41	75,527	0.29	0.45	44,021	0.09	0.29	31,506
Equity Participation (incl. IRAs)	0.38	0.49	75,437	0.50	0.50	43,967	0.17	0.37	31,470
Risky Share	0.14	0.30	49,255	0.18	0.32	32,514	0.06	0.21	16,741
Entry	0.08	0.27	50,210	0.11	0.31	28,378	0.03	0.18	21,832
Exit	0.30	0.46	10,280	0.29	0.45	8,872	0.39	0.49	1,408
Sea Level Rise:									
SLR Exposure (1 ft)	0.001	0.018	75,856	0.001	0.017	44,276	0.001	0.019	31,580
SLR Exposure (2 ft)	0.002	0.031	75,856	0.003	0.031	44,276	0.002	0.031	31,580
SLR Exposure (3 ft)	0.004	0.048	75,856	0.004	0.046	44,276	0.004	0.052	31,580
Storm Surge Exposure	0.128	0.319	35,740	0.120	0.308	20,456	0.143	0.337	15,284
Demographics and Education:									
Age	51.00	17.60	75,856	54.97	15.99	44,276	43.42	18.06	31,580
Married	0.49	0.50	75,847	0.63	0.48	44,273	0.22	0.41	31,574
Divorced	0.20	0.40	75,847	0.16	0.37	44,273	0.27	0.44	31,574
Male	0.70	0.46	75,856	0.76	0.43	44,276	0.57	0.50	31,580
Non-White	0.28	0.45	75,856	0.22	0.41	44,276	0.40	0.49	31,580
Family Size	2.32	1.39	75,856	2.47	1.35	44,276	2.03	1.41	31,580
College Education	0.31	0.46	73,387	0.35	0.48	42,889	0.23	0.42	30,498
High School Education	0.53	0.50	73,387	0.52	0.50	42,889	0.55	0.50	30,498
Wealth and Income:									
Total Income	61,858	92,250	75,856	75,483	106,478	44,276	35,840	45,603	31,580
Wealth, excl. home equity	182,472	979,994	62,173	272,252	1,210,977	34,801	27,360	219,297	27,372
House Value	128,021	208,710	74,332	197,057	231,184	42,753			31,579
Home Insurance	0.60	0.49	69,523	0.96	0.19	37,943			31,580
Stocks	38,321	281,620	73,835	55,292	342,988	42,586	6,925	82,953	31,249
Bonds	8,135	77,842	73,611	10,835	89,171	42,628	3,072	49,730	30,983
Cash	23,501	101,673	70,902	32,213	121,280	40,846	7,378	42,980	30,056
Financial Wealth	70,650	345,552	68,072	100,393	419,411	38,716	17,243	116,282	29,356
Geographical Variables:									
Elevation (ft)	820	1,103	75,856	860	1,127	44,276	744	1,051	31,580
Distance-to-Coast (km)	267	317	75,856	277	321	44,276	248	308	31,580
Vertical Land Motion	0.49	0.50	75,856	0.50	0.50	44,276	0.47	0.51	31,580

Table 2: Sea level rise and stock market participation

This table reports estimates of how sea level rise exposure relates to households' stock market behavior. The sample includes only homeowner households from 1999 to 2017 PSID waves. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation	Equity Participation (incl. IRAs)	Risky Share	Entry	Exit
	(1)	(2)	(3)	(4)	(5)
SLR Exposure (3 ft)	-0.392***	-0.265*	-0.353***	-0.224**	1.133**
	(-3.59)	(-1.92)	(-4.78)	(-2.49)	(2.20)
Controls	Yes	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes	Yes
Obs.	14,173	14,168	11,012	8,532	1,166
Adj. R^2	0.36	0.41	0.32	0.20	0.17

Table 3: Sea level rise and stock market participation: Long- vs. short-run SLR risks

This table reports estimates of how sea level rise exposure and storm surge exposure relate to households' stock market behavior. The sample includes only homeowner households from 1999 to 2017 PSID waves. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation	Equity Participation (incl. IRAs)	Risky Share	Entry	Exit
	(1)	(2)	(3)	(4)	(5)
SLR Exposure (3 ft)	-0.391***	-0.245*	-0.366***	-0.259***	0.796
	(-3.50)	(-1.78)	(-4.61)	(-3.04)	(1.58)
Storm Surge Exposure	0.020	0.067	0.010	0.145	-0.049
	(0.13)	(0.89)	(0.07)	(1.41)	(-0.10)
Controls	Yes	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes	Yes
Obs.	6,585	6,583	4,685	4,088	485
Adj. R^2	0.43	0.51	0.35	0.31	0.25

Table 4: Sea level rise and stock market participation: House Price Growth

This table reports estimates of how sea level rise exposure relates to households' stock market behavior in areas that experienced high house price growth and low house price growth. The sample includes only homeowner households from 1999 to 2017 PSID waves. The sample is split based on the house price growth in each zip code over the last five years for any given year. The high house price growth sample includes the zip codes that experienced growths higher than the median in a state and the low house price growth sample includes the remaining zip codes. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation		Risky Share	
	High House Price Growth	Low House Price Growth	High House Price Growth	Low House Price Growth
	(1)	(2)	(3)	(4)
SLR Exposure (3 ft)	-0.297**	-0.548***	-0.324***	-0.376***
	(-2.32)	(-4.75)	(-3.57)	(-3.54)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Obs.	8,883	5,290	6,854	4,158
Adj. R^2	0.37	0.34	0.33	0.29

Table 5: Sea level rise and stock market participation: The effect of past flooding incidents

This table reports estimates of how sea level rise exposure relates to households' stock market behavior and the role of past flooding incidents for this relationship. The sample includes only homeowner households from 1999 to 2017 PSID waves. *No Recent Disasters* is an indicator variable equal to one if there were no flooding related incident in a household's county of residence over the last two years, and zero otherwise. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Experienced Floods in the Last 2 Years?	No		Yes		Full	
Dependent variable:	Equity Participation	Risky Share	Equity Participation	Risky Share	Equity Participation	Risky Share
	(1)	(2)	(3)	(4)	(5)	(6)
SLR Exposure (3 ft)	-0.391**	-0.333***	-0.405***	-0.390***	-0.394**	-0.351***
	(-2.57)	(-3.16)	(-3.65)	(-4.18)	(-2.55)	(-3.23)
SLR Exposure (3 ft) x No Recent Disasters					0.009	-0.005
					(0.05)	(-0.03)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	6,911	5,424	7,208	5,543	14,173	11,012
Adj. R^2	0.35	0.29	0.37	0.34	0.36	0.32

Table 6: Sea level rise and stock market participation: Nevermovers

This table reports estimates of how sea level rise exposure relates to households' stock market behavior and compares households who never moved during the sample period to households who did move. The sample includes only homeowner households from 1999 to 2017 PSID waves. A nevermover household is defined as a household who has never moved out of the Census Block in which they live during the sample period. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Sample:	Full			
Dependent variable:	Equity Participation	Risky Share	Entry	Exit
	(1)	(2)	(3)	(4)
SLR Exposure (3 ft) x Nevermover	-0.589***	-0.379**	-0.237***	0.333
	(-4.10)	(-2.36)	(-2.63)	(0.33)
SLR Exposure (3 ft)	0.003	-0.041	-0.053	0.893
	(0.03)	(-0.32)	(-0.92)	(0.81)
Nevermover	0.019	0.000	0.008	0.013
	(1.21)	(0.01)	(0.85)	(0.30)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Obs.	14,173	11,012	8,532	1,166
Adj. R^2	0.36	0.32	0.20	0.17

Sample:	Only Nevermovers			
Dependent variable:	Equity Participation	Risky Share	Entry	Exit
	(5)	(6)	(7)	(8)
SLR Exposure (3 ft)	-0.436***	-0.314***	-0.281*	1.529***
	(-3.83)	(-2.64)	(-1.68)	(3.47)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Obs.	4,692	3,575	2,586	339
Adj. R^2	0.30	0.29	0.14	0.02

Table 7: Sea level rise and stock market participation: Differences in political beliefs

This table reports estimates of how sea level rise exposure relates to households' stock market behavior as well as to a measure of political party affiliation. The sample includes only homeowner households from 1999 to 2017 PSID waves. *High RepShare* is an indicator variable equal to one if the share of voters who voted for the Republican candidate in the last presidential election is higher than the state median in a county-year, and zero otherwise. *High RepShare All* is an indicator variable equal to one if the share of voters who voted for the Republican candidate in the last presidential election is higher than the national median in a county-year, and zero otherwise. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion.* All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation			Risky Share		
Sample:	Full	Full	Distance-to-coast ≤ 50 km	Full	Full	Distance-to-coast ≤ 50 km
	(1)	(2)	(3)	(4)	(5)	(6)
SLR Exposure (3ft) x High RepShare	-0.009		-0.095	0.082		0.021
	(-0.44)		(-0.31)	(0.65)		(0.11)
SLR Exposure (3ft) x High RepShare All		-0.153			0.069	
		(-0.67)			(0.53)	
SLR Exposure (3 ft)	-0.341*	-0.312*	-0.477**	-0.400***	-0.390***	-0.488***
	(-1.86)	(-1.66)	(-2.15)	(-5.86)	(-5.48)	(-4.83)
High RepShare	-0.098		0.415	0.014		0.313
	(-0.44)		(1.06)	(0.29)		(1.07)
High RepShare All		-0.087			-0.060	
		(-1.58)			(-1.56)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	14,169	14,169	2,972	11,008	11,008	2,327
Adj. R^2	0.36	0.36	0.35	0.32	0.32	0.31

Table 8: Sea level rise and stock market participation: Risk preferences

This table reports estimates of how sea level rise exposure relates to households' stock market behavior and controls additionally for different measures of household risk aversion. The sample includes only homeowner households from 1999 to 2017 PSID waves. The sample includes all respondents in the PSID. Columns (1) and (5) additionally control for a household's *Risky Share* in 1999. Columns (2) and (6) additionally control for risk aversion fixed effects, based on the categories extracted from the 1996 wave of the PSID and categories defined in Kimball, Sahm and Shapiro (2009). Columns (3) and (7) additionally control for the risk aversion coefficients based on Kimball, Sahm and Shapiro (2009)'s coefficient estimations on the 1996 wave of the PSID. Columns (4) and (8) exclude the waves 2007 and 2009. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value) Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation			
	Risky Share 1999 incl.	Risk Aversion FEs	Risk Aversion (Kimball, Sahm and Shapiro, 2009)	2007-2009 excl.
	(1)	(2)	(3)	(4)
SLR Exposure (3 ft)	-0.683**	-0.562**	-0.564**	-0.288***
	(-2.06)	(-2.24)	(-2.30)	(-2.88)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Obs.	6,191	4,993	4,993	11,515
Adj. R^2	0.42	0.32	0.32	0.37

Dependent variable:	Risky Share			
	Risky Share 1999 incl.	Risk Aversion FEs	Risk Aversion (Kimball, Sahm and Shapiro, 2009)	2007-2009 excl.
	(5)	(6)	(7)	(8)
SLR Exposure (3 ft)	-0.625**	-0.442*	-0.446*	-0.283***
	(-2.47)	(-1.83)	(-1.86)	(-4.27)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Obs.	5,509	4,030	4,030	8,908
Adj. R^2	0.47	0.28	0.28	0.32

Table 9: Sea level rise and stock market participation: Effect of distance-to-coast

This table reports estimates of how sea level rise exposure relates to households' stock market behavior for subsamples with respect to proximity to coast. The sample includes only homeowner households from 1999 to 2017 PSID waves, but is restricted to households that are 50 km or closer to the coast and households living in watershed counties, as indicated. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Sample:	Distance-to-coast $\leq$ 50 km			
Dependent variable:	Equity Participation	Risky Share	Entry	Exit
	(1)	(2)	(3)	(4)
SLR Exposure (3 ft)	-0.523***	-0.474***	-0.298**	1.492***
	(-3.20)	(-4.20)	(-2.09)	(3.32)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Obs.	2,972	2,327	1,475	361
Adj. R^2	0.35	0.31	0.30	0.08

Sample:	Only Watershed Counties			
Dependent variable:	Equity Participation	Risky Share	Entry	Exit
	(5)	(6)	(7)	(8)
SLR Exposure (3 ft)	-0.332***	-0.294***	-0.191*	1.110**
	(-2.92)	(-3.43)	(-1.89)	(2.47)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Obs.	6,041	4,492	3,440	554
Adj. R^2	0.38	0.32	0.27	0.13

Table 10: Sea level rise and stock market participation: Placebo test on renters

This table reports estimates of how sea level rise exposure relates to households' stock market behavior. The sample includes all households from 1999 to 2017 PSID waves. Odd-numbered columns include only homeowner households and even-numbered columns only include renter households in the sample. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. In Columns (2), (4), (6), and (8), *Log(House Value)* and *Home Insurance* are replaced by *Rent*. All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation		Risky Share	
Sample:	Homeowners	Renters	Homeowners	Renters
	(1)	(2)	(3)	(4)
SLR Exposure (3 ft)	-0.392***	-0.102	-0.353**	-0.168
	(-3.59)	(-1.52)	(-4.78)	(-1.23)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Obs.	14,173	13,389	11,012	5,074
Adj. R^2	0.36	0.48	0.32	0.34

Dependent variable:	Entry		Exit	
Sample:	Homeowners	Renters	Homeowners	Renters
	(5)	(6)	(7)	(8)
SLR Exposure (3 ft)	-0.224**	-0.073	1.133**	
	(-2.49)	(-1.04)	(2.20)	
Controls	Yes	Yes	Yes	
Zip Code x Year FEs	Yes	Yes	Yes	
Obs.	8,532	9,108	1,166	
Adj. R^2	0.20	0.46	0.17	

Table 11: Sea level rise and stock market participation: Attention to climate change proxied by the WSJ index

This table reports estimates of how sea level rise exposure relates to households' stock market behavior at times when attention to climate change is elevated. The sample includes only homeowner households from 1999 to 2017 PSID waves. *High Attention* is an indicator variable equal to one if the WSJ Climate Change News Index constructed by Engle et al. (2020) is larger than its time-series median over the previous year, and zero otherwise. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion.* All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation			Risky Share		
Sample:	Full	Distance-to-coast ≤ 50 km	Only Never-movers	Full	Distance-to-coast ≤ 50 km	Only Never-movers
	(1)	(2)	(3)	(4)	(5)	(6)
SLR Exposure (3 ft) x High Attention	-0.435*	-0.587**	-0.542**	-0.228	-0.378**	-0.358***
	(-1.80)	(-2.22)	(-2.05)	(-1.44)	(-2.32)	(-3.45)
SLR Exposure (3 ft)	-0.219*	-0.316*	-0.192**	-0.262***	-0.337***	-0.160
	(-1.77)	(-1.79)	(-2.26)	(-3.18)	(-2.63)	(-1.53)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	14,173	2,972	4,692	11,012	3,227	3,575
Adj. R^2	0.36	0.36	0.30	0.32	0.31	0.29

Table 12: Sea level rise and stock market participation: Attention to climate change proxied by major hurricanes

This table reports estimates of how sea level rise exposure relates to households' stock market behavior at times when the salience of flood risks is elevated. The sample includes only homeowner households from 1999 to 2017 PSID waves. $Hurricane_{st}$ is an indicator variable equal to one in an unaffected state s in time period t if there was a major hurricane taking place in period $t-1$. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation			Risky Share		
Sample:	Full	Distance-to-coast ≤ 50 km	Only Never-movers	Full	Distance-to-coast ≤ 50 km	Only Never-movers
	(1)	(2)	(3)	(4)	(5)	(6)
SLR Exposure (3 ft) x $Hurricane_{st}$	-0.444**	-0.571**	-0.582**	-0.146	-0.235*	-0.318***
	(-2.03)	(-2.35)	(-2.15)	(-1.18)	(-1.78)	(-2.72)
SLR Exposure (3 ft)	-0.238**	-0.344**	-0.219**	-0.298***	-0.394***	-0.203**
	(-2.05)	(-1.99)	(-3.31)	(-3.31)	(-2.89)	(-1.99)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	14,173	2,972	4,692	11,012	2,327	3,575
Adj. R^2	0.36	0.36	0.30	0.32	0.31	0.29

Table 13: Sea level rise and stock market participation: State-led climate change adaptation plans

This table reports estimates of how sea level rise exposure relates to households' stock market behavior around the adoption of state-led climate change adaptation plans. The sample includes all homeowner households from 1999 to 2017 PSID waves. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation			
Sample:	Full	Full	Exclude 2007 & 2009	Drop Un-treated
	(1)	(2)	(3)	(4)
SLR Exposure x Post SCCAP	0.633***	0.561**	0.628****	0.521**
	(2.78)	(2.32)	(2.88)	(2.07)
SLR Exposure	-0.293***	-0.296***	-0.221***	-0.215
	(-3.63)	(-3.66)	(-2.92)	(-1.50)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Controls x Post SCCAP	No	Yes	No	No
Obs.	14,173	14,173	11,515	7,941
Adj. R^2	0.36	0.36	0.37	0.39

Dependent variable:	Risky Share			
Sample:	Full	Full	Exclude 2007 & 2009	Drop Un-treated
	(5)	(6)	(7)	(8)
SLR Exposure x Post SCCAP	0.431***	0.346**	0.409**	0.416***
	(3.19)	(2.22)	(3.04)	(2.82)
SLR Exposure	-0.266***	-0.262***	-0.213***	-0.289***
	(-4.83)	(-4.77)	(-4.20)	(-4.12)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Controls x Post SCCAP	No	Yes	No	No
Obs.	11,012	11,012	8,908	5,906
Adj. R^2	0.32	0.32	0.32	0.33

Table 14: Sea level rise and stock market participation: Placebo test on renters around state-led climate change adaptation plans

This table reports estimates of how sea level rise exposure relates to households' stock market behavior around the adoption of state-led climate change adaptation plans. The sample includes all renter households from 1999 to 2017 PSID waves. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1 and are weighted using PSID population weights. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation			
Sample:	Full	Full	Exclude 2007 & 2009	Drop Un-treated
	(1)	(2)	(3)	(4)
SLR Exposure x Post SCCAP	-0.019	-0.029	-0.020	-0.057
	(-0.26)	(-0.37)	(-0.25)	(-0.70)
SLR Exposure	-0.003	-0.005	-0.011	0.021
	(-0.10)	(-0.19)	(-0.32)	(0.59)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Controls x Post SCCAP	No	Yes	No	No
Obs.	13,819	13,819	11,215	8,481
Adj. R^2	0.49	0.49	0.48	0.53

Dependent variable:	Risky Share			
Sample:	Full	Full	Exclude 2007 & 2009	Drop Un-treated
	(5)	(6)	(7)	(8)
SLR Exposure x Post SCCAP	-0.196	-0.177	-0.203	-0.193
	(-0.79)	(-0.74)	(-0.82)	(-0.77)
SLR Exposure	-0.001	-0.001	0.0004	0.002
	(-0.01)	(-0.27)	(0.01)	(0.03)
Controls	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes
Controls x Post SCCAP	No	Yes	No	No
Obs.	5,227	5,227	4,286	3,174
Adj. R^2	0.37	0.38	0.38	0.40

Internet Appendix

for

Sea Level Rise and Portfolio Choice

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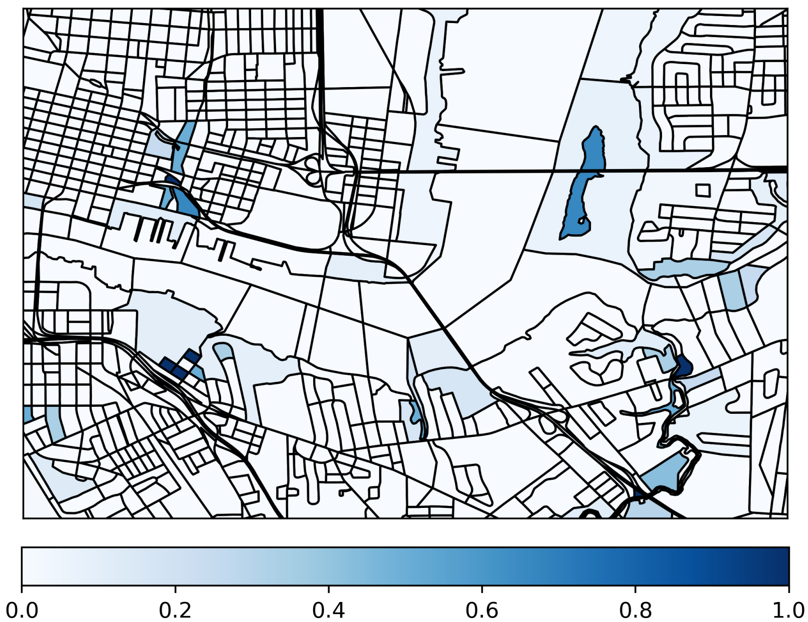
A1 Additional Figures & Tables

Figure A1: 3 feet and 6 feet SLR risk exposures of census blocks around the TIAA Bank Field Stadium

This figure illustrates the Census Blocks exposed to 3 feet and 6 feet SLR around the TIAA Bank Field Stadium, home of the Jacksonville Jaguars NFL team. Panel A shows the exposure of Census Blocks under a 6 feet sea level rise scenario and Panel B shows the exposure of Census Blocks under a 3 feet sea level rise scenario.

Panel A



Panel B

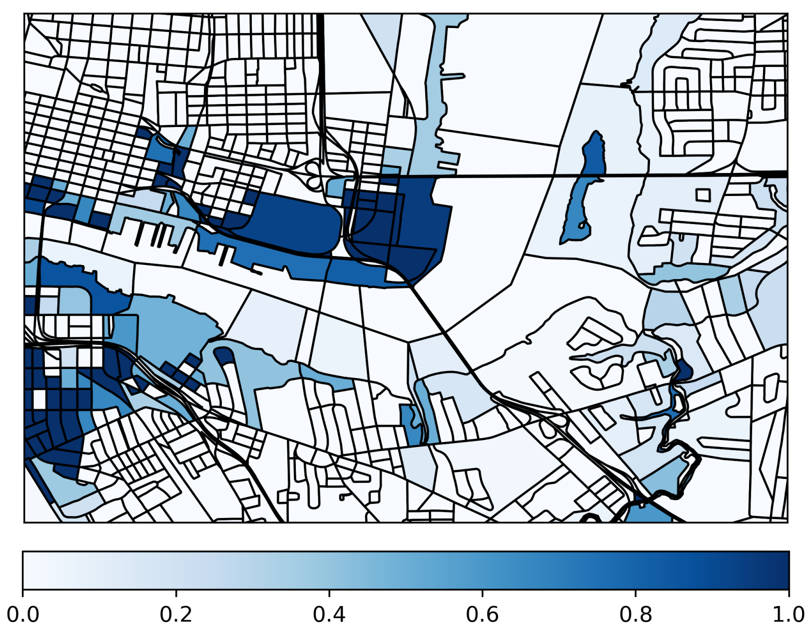


Figure A2: Evolution of sea level rise projections over time

This figure reports the evolution of sea level rise projections over time. The black line is the mean of sea level rise forecasts across major scientific studies from 2001 and 2017. The upper bound is the 99th percentile and the lower bound is the 1st percentile. For details on how this time-series was created, the reader is referred to Goldsmith-Pinkham et al. (2021).

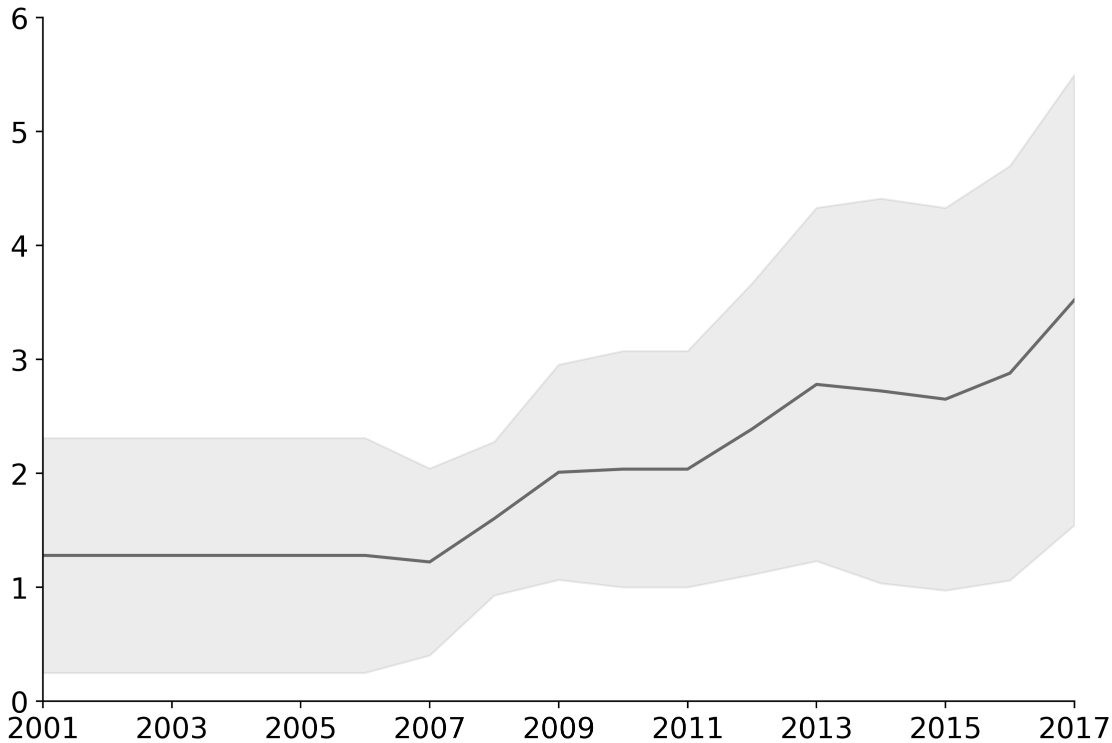


Table A1: Variable Definitions

Variable	Definition	Data Source
Stock Market Participation Variables		
Equity Participation	An indicator variable equal to one if the household holds any shares in publicly held corporations, mutual funds, or investment trusts in a given year.	PSID
Equity Participation (incl. IRAs)	An indicator variable equal to one if the household holds any shares in publicly held corporations, mutual funds, or investment trusts in a given year, including holdings in pensions or individual retirement accounts.	PSID
Risky Share	The value of stocks held by the household divided by the financial wealth (stocks, cash, and bonds) of the household.	PSID
Entry	An indicator variable equal to one if a household did not participate in the stock market in the prior survey year but does in the current survey year. This variable is defined only for households that did not participate in the stock market in the prior survey year.	PSID
Exit	An indicator variable equal to one if a household participated in the stock market in the prior survey year but not in the current survey year. This variable is defined only for households that participated in the stock market in the prior survey year.	PSID

Table A1: Variable Definitions - *Continued*

Income, Wealth, and Other Demographic Variables		
Age	The age of the household head in years.	PSID
Age Squared	The square of the age of the household head.	PSID
Married	An indicator variable equal to one if the household head is married.	PSID
Divorced	An indicator variable equal to one if the household head is divorced.	PSID
Male	An indicator variable equal to one if the household head is male.	PSID
Non-White	An indicator variable equal to one if the household head's race is different than white.	PSID
Family Size	The number of family members in a given year.	PSID
Log(Total Income)	The natural logarithm of the total family income in 2017 dollars.	PSID
Ihs(Wealth, excl. Home Equity)	Inverse hyperbolic sine of the family net wealth, excluding home equity, in 2017 dollars. I use the asinh function instead of natural logarithm, because there are many observations with negative values. asinh provides a way of renormalizing the data without dropping negative values.	PSID
College Education	An indicator variable equal to one if the household head has at least 16 years of education.	PSID
High School Education	An indicator variable equal to one if the household head has between 12 and 6 years of education.	PSID
Log(House Value)	The natural logarithm of the house value in 2017 dollars if the household owns the house they reside in.	PSID
Rent	Monthly rent paid in 2017 dollars.	PSID
Home Insurance	An indicator variable equal to one if the household has home insurance, zero otherwise.	PSID
Nevermover	An indicator variable equal to one if the household does not relocate to a new house in the sample period 1999-2017.	PSID
Owner	An indicator variable equal to one if the household is the owner of the house they reside in.	PSID
Risk Aversion	Risk aversion coefficient as computed by Kimball, Sahm and Shapiro (2009). This variable is created by using the series of questions in the 1996 wave of the PSID survey about different gambles. For more information, the reader is referred to Kimball, Sahm and Shapiro (2009).	PSID, Kimball, Sahm and Shapiro (2009)

Table A1: Variable Definitions - *Continued*

Geographical Variables		
SLR Exposure (1 ft)	Sea level rise (SLR) exposure of the household under the 1 ft sea level rise scenario computed at the Census Block level. For a given Census Block, SLR exposure (1 ft) is computed as the area covered by the 1 ft SLR layer minus the area covered by the 0 ft SLR layer.	NOAA
SLR Exposure (2 ft)	Sea level rise (SLR) exposure of the household under the 2 ft sea level rise scenario computed at the Census Block level. For a given Census Block, SLR exposure (2 ft) is computed as the area covered by the 2 ft SLR layer minus the area covered by the 0 ft SLR layer.	NOAA
SLR Exposure (3 ft)	Sea level rise (SLR) exposure of the household under the 3 ft sea level rise scenario computed at the Census Block level. For a given Census Block, SLR exposure (3 ft) is computed as the area covered by the 3 ft SLR layer minus the area covered by the 0 ft SLR layer.	NOAA
Storm Surge Exposure	Exposure of households to storm surges based on NOAA's SLOSH model using 100,000 Category 4 hurricane simulations at the Census Block level.	NOAA
Post SCCAP	An indicator variable equal to one in the year and for years after a State Climate Change Adaptation Plan is finalized in a state, zero otherwise.	Georgetown Climate Center
Elevation (ft)	Ground elevation in feet of the centroid of the Census Block in which the household resides.	USGS
Distance-to-Coast (km)	The distance to the closest coastline of the Census Block in which a household resides in kilometers. I compute the length of the line that connects the centroid of the Census Block to the coastline perpendicularly.	Self-constructed
Vertical Land Motion	The vertical land motion component of the relative sea level rise variable defined in Murfin and Spiegel (2020). The variable is based on historical trends from 142 tidal stations. For each Census Block, vertical land motion is defined as the weighted average ground level change of the two nearest tide gauges, where weighting is done by inverse distance.	NOAA

Table A2: Sea level rise and stock market participation: Expanded table with control variables

This is an expanded version of Table 2. The coefficients of control variables are suppressed in Table 2, but are explicitly presented in this table.

Dependent variable:	Equity Participation		Equity Participation (incl. IRAs)		Risky Share		Entry		Exit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SLR Exposure (3 ft)	-0.392***	-0.469***	-0.265*	-0.337**	-0.353***	-0.389***	-0.224**	-0.316***	1.133**	1.147**
	(-3.59)	(-3.93)	(-1.92)	(-1.98)	(-4.78)	(-5.04)	(-2.49)	(-3.01)	(2.20)	(2.29)
Age	-0.003	-0.004	0.006**	0.006*	-0.003	-0.003	-0.002	-0.002	-0.016*	-0.019*
	(-1.13)	(-1.20)	(2.13)	(1.94)	(-1.45)	(-1.40)	(-1.06)	(-1.08)	(-1.68)	(-1.96)
Age Squared	0.000*	0.000*	-0.000	-0.000	0.000**	0.000**	0.000	0.000	0.000	0.000*
	(1.81)	(1.81)	(-1.22)	(-1.22)	(2.08)	(2.02)	(1.24)	(1.19)	(1.57)	(1.82)
Married (1/0)	-0.009	-0.006	0.043	0.055	-0.033	-0.031	0.012	0.022	0.190**	0.190**
	(-0.34)	(-0.18)	(1.40)	(1.51)	(-1.44)	(-1.24)	(0.73)	(1.07)	(2.32)	(2.23)
Divorced (1/0)	-0.049*	-0.046	-0.007	-0.004	-0.044*	-0.037	-0.010	-0.008	0.270***	0.256***
	(-1.94)	(-1.52)	(-0.25)	(-0.11)	(-1.96)	(-1.53)	(-0.64)	(-0.37)	(3.21)	(2.99)
Male (1/0)	0.009	0.016	-0.008	-0.015	0.028	0.034	-0.015	-0.019	-0.057	-0.077
	(0.35)	(0.52)	(-0.27)	(-0.45)	(1.20)	(1.34)	(-0.99)	(-0.99)	(-0.71)	(-0.94)
Non-White (1/0)	-0.075***	-0.052*	-0.080**	-0.052	-0.050***	-0.035*	-0.036**	-0.036*	0.034	-0.019
	(-3.18)	(-1.94)	(-2.56)	(-1.44)	(-2.81)	(-1.75)	(-2.28)	(-1.95)	(0.38)	(-0.19)
Family Size	-0.015***	-0.018***	-0.030***	-0.036***	-0.009*	-0.009*	-0.010***	-0.014***	-0.025	-0.030
	(-2.91)	(-2.81)	(-4.65)	(-4.57)	(-1.88)	(-1.77)	(-2.93)	(-3.04)	(-1.20)	(-1.38)
Log(Total Income)	0.047***	0.042***	0.078***	0.077***	0.029***	0.025**	0.018**	0.015	-0.034	-0.026
	(4.33)	(3.39)	(6.56)	(5.62)	(3.20)	(2.54)	(2.37)	(1.60)	(-0.94)	(-0.70)
Ihs(Wealth excl. Home Equity)	0.009***	0.010***	0.017***	0.019***	0.006***	0.006***	0.003***	0.004***	-0.018***	-0.020***
	(11.58)	(10.77)	(17.86)	(16.80)	(9.19)	(8.76)	(6.07)	(5.46)	(-3.42)	(-3.51)
College Education (1/0)	0.200***	0.214***	0.205***	0.204***	0.108***	0.110***	0.055***	0.062***	-0.297**	-0.334***
	(6.61)	(6.14)	(6.73)	(5.79)	(4.21)	(3.92)	(2.88)	(2.66)	(-2.54)	(-2.84)
High School Education (1/0)	0.057***	0.067***	0.061**	0.066**	0.041**	0.042*	0.009	0.010	-0.086	-0.113
	(2.73)	(2.64)	(2.50)	(2.26)	(2.04)	(1.89)	(0.80)	(0.69)	(-0.74)	(-0.98)
Log(House Value)	0.034***	0.040***	0.039***	0.046***	0.033***	0.036***	0.020***	0.027***	0.097**	0.115**
	(3.53)	(3.53)	(3.39)	(3.45)	(3.78)	(3.79)	(3.10)	(3.38)	(2.09)	(2.44)
Home Insurance (1/0)	-0.025	-0.022	0.030	0.038	0.021	0.033	-0.010	-0.009	-0.308	-0.362
	(-0.99)	(-0.69)	(0.88)	(0.89)	(0.81)	(1.12)	(-0.53)	(-0.37)	(-1.23)	(-1.38)
Elevation (ft) / 1000	0.067	0.061	0.011	-0.005	0.031	0.028	0.004	-0.006	-0.179	-0.190
	(1.21)	(1.08)	(0.19)	(-0.08)	(0.65)	(0.58)	(0.08)	(-0.11)	(-1.42)	(-1.49)
Distance-to-coast (km) / 1000	0.090	0.531	3.178	3.748	-0.289	-0.113	0.499	0.586	8.972	9.733
	(0.05)	(0.28)	(1.46)	(1.54)	(-0.22)	(-0.08)	(0.49)	(0.49)	(1.34)	(1.41)
Vertical Land Motion (ft)	0.382**	0.396**	0.012	0.007	0.238**	0.227**	0.255**	0.284**	-1.049***	-1.032***
	(2.49)	(2.27)	(0.05)	(0.03)	(2.21)	(2.03)	(2.11)	(1.97)	(-3.33)	(-3.17)
Zip Code x Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample:	Full	SRC	Full	SRC	Full	SRC	Full	SRC	Full	SRC
Obs.	14,173	9,573	14,168	9,569	11,012	8,385	8,532	5,096	1,166	1,073
Adj. R^2	0.36	0.33	0.41	0.36	0.32	0.30	0.20	0.16	0.17	0.17

Table A3: Sea level rise and stock market participation: 1 feet and 2 feet sea level rise scenarios

This table reports estimates of how sea level rise exposure relates to households' stock market behavior. The sample includes only homeowner households from 1999 to 2017 PSID waves. Full sample includes all respondents in the PSID and SRC sample includes only the respondents in the main PSID sample, as indicated in the table. Controls include *Age, Age Squared, Married, Divorced, Male, Non-White, Family Size, Log(Total Income), Ihs(Wealth)* excluding home equity, *College Education, High School Education, Log(House Value), Home Insurance, Elevation x 1000, Distance-to-Coast x 1000, Vertical Land Motion*. All variables are defined in Table A1. Parameter estimates are obtained by OLS. All regressions include a constant term and fixed effects indicated in the table, whose coefficients I do not report. t-statistics, based on standard errors clustered by household, are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Dependent variable:	Equity Participation		Equity Participation (incl. IRAs)		Risky Share		Entry		Exit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SLR Exposure (1 ft)	-0.838*	-1.183*	-0.578	-0.881	-0.722*	-0.878*	-0.368	-0.722	0.930	1.026
	(-1.74)	(-1.81)	(-1.43)	(-1.53)	(-1.84)	(-1.83)	(-0.99)	(-1.18)	(0.85)	(0.93)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample:	Full	SRC	Full	SRC	Full	SRC	Full	SRC	Full	SRC
Obs.	14,173	9,573	14,168	9,569	11,012	8,385	8,532	5,096	1,166	1,073
Adj. R^2	0.36	0.32	0.41	0.36	0.32	0.30	0.20	0.16	0.17	0.16

Dependent variable:	Equity Participation		Equity Participation (incl. IRAs)		Risky Share		Entry		Exit	
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
SLR Exposure (2 ft)	-0.433**	-0.515**	-0.239	-0.316	-0.495***	-0.553***	-0.300**	-0.454***	0.833	0.864*
	(-2.18)	(-2.24)	(-1.19)	(-1.28)	(-3.93)	(-4.17)	(-2.01)	(-2.60)	(1.56)	(1.65)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zip Code x Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample:	Full	SRC	Full	SRC	Full	SRC	Full	SRC	Full	SRC
Obs.	14,173	9,573	14,168	9,569	11,012	8,385	8,532	5,096	1,166	1,073
Adj. R^2	0.36	0.33	0.41	0.36	0.32	0.30	0.20	0.16	0.17	0.16

Table A4: State-led Climate Change Adaptation Plans: Parallel Trends

This table compares the growth rates in *Equity Participation* and *Risky Share* between the treatment and control group in the period before state-led climate change adaptation plans are adopted. The treatment group consists of households who are in the top quartile in terms of sea level rise exposure in a state-year and the control group consists of all other households. I present the *p*-value of a difference-in-means test, which tests the hypothesis that mean values of the two groups are the same. I also present the Wilcoxon *p*-value of the two-sample Wilcoxon test, which tests the hypothesis that the two groups are taken from populations with the same median.

	Mean Growth High SLR Exposure (Treated)	Mean Growth Low SLR Exposure (Control)	Difference	p-value	Wilcoxon p-value
Equity Participation Growth	-0.045	-0.005	-0.04	0.28	0.28
Risky Share Growth	-0.0076	-0.0047	-0.0029	0.9285	0.26

Table A5: Sea level rise and stock market participation: List of top ten costliest hurricanes in the United States

This table reports the top ten costliest hurricanes in the United States in the sample period 1999-2017, when these hurricanes took place, and which states they have hit.

Name	Year	Affected States
Charley	2004	FL, GA, SC, NC
Ivan	2004	AL, FL, LA, TX
Frances	2004	FL
Katrina	2005	LA, MS, AL, FL
Wilma	2005	FL
Rita	2005	LA, TX
Ike	2008	TX, LA
Irene	2011	SC, NC, GA, VA, MD, PA, DE, NJ, NY, CT, RI, MA, ME
Sandy	2012	SC, NC, GA, VA, MD, PA, DE, NJ, NY, CT, RI, MA, ME
Matthew	2016	FL

A2 State-led climate change adaptation plans: Risks, costs, and adaptation strategies

Governments' responses to climate change typically include mitigation and adaptation strategies. Mitigation strategies are related to acts that are aimed at combating climate change directly. In particular, policies that aim to reduce greenhouse gas emissions such as carbon taxes and cap-and-trade schemes fall into this category. While policies towards mitigation are often at the forefront of climate change discussions, the realization of proposed mitigation policies in the United States has been limited.

Adaptation strategies aim at making each state more resilient and prepared towards the adverse effects of climate change. As such, there is substantial heterogeneity in what adaptation strategies include depending on the geographic challenges of each state. For instance, California mainly suffers from wildfires, drought, and water scarcity whereas Louisiana is much more affected sea level rise, hurricanes, and severe storms. It is not, therefore, surprising to also see significant heterogeneity in the timing of adoptions of such plans and how states plan to tackle issues relevant for them.

Figure 4 shows the geographic distribution and timing of state-led climate change adaptation plans across the United States. All states who finalized such adaptation plans are coastal, with the exception of Colorado, New Hampshire, and Pennsylvania.[34] Nevertheless, the adaptation plans of all of these states emphasize the significant risks they face due to sea level rise. These risks take the form of inundation of large populated areas, increased severity and frequency of hurricanes and storm surges, salt water intrusion into groundwater caused by flooding rivers and estuaries leading to water scarcity.

Costs associated with the risks of sea level rise in most states with plans are also economically sizable. Massachusetts' plan emphasizes less than a foot of sea level rise by 2050 could damage assets worth an estimated $463 billion just in Boston. The plan cites the estimated costs of evacuation

[34] As a land-locked state, Colorado mainly faces the risk of water scarcity and wildfires due to climate change. New Hampshire and Pennsylvania both cite increased flooding and severe storms as significant risks they face due to climate change even though both of these states have limited coastlines. However, the settlement pattern in New Hampshire has taken place largely around rivers and lakes with floodplains. Pennsylvania's adaptation plan further cites salt water intrusion in the Delaware River as a significant risk due to sea level rise.

alone in the Northeast region from sea level rise and storms during a single event to be between $2 billion and $6.5 billion. Florida's plan points out that barrier islands, which already host extensive development of high value oceanfront real estate, are at significant risk from sea level rise and the costs incurred due to beach erosion are $600 million per year and rising. California's plan suggest that out of state's $4 trillion real estate assets, $2.5 trillion is at risk from extreme weather events, sea level rise, and wildfires with a projected cost up to $3.9 billion per year over this century.

Consider the case of Florida for an illustration of the process that leads to a climate change adaptation plan. On July 12-13, 2007, Florida Governor Charlie Crist hosted "Serve to Preserve: A Florida Summit on Global Climate Change" in Miami, gathering leaders of business, government, and science together. At the conclusion of the summit, Governor Crist signed an executive order and established the Florida Governor's Action Team on Energy and Climate Change. The executive order directed that the team devise an Action Plan including strategies to reduce greenhouse gas emissions and, in a second-phase, long-term strategies for reducing climate impacts to society, public health, the economy, and the environment. The final Energy and Climate Change Action Plan ("Action Plan") was submitted to the Governor on October 15, 2008. The Action Plan provides 50 separate policy recommendations covering topics like a Florida cap-and-trade scheme, government policy and coordination, adaptation strategies related to such as transportation and land use, infrastructure, coastal resources, extreme climate events and emergency response and many more.

Despite the heterogeneity in state adaptation plans, there are many common strategies proposed by all states. Promoting resilient design in new residential development and infrastructure and discouraging projects in areas that cannot be adequately protected from flooding or erosion are common in most adaptation plans. These strategies also include incorporation of new building design criteria and codes for resisting future loads that may result in sea level rise related hazards. All plans also emphasize the importance of scientific data collection, analysis, and risk assessment to guide their decision making and policy making efforts. Many plans demonstrate ambition towards reforming the local and national insurance markets such that insurance rates reflect risks from climate change and be affordable, with policies particularly discouraging high risk development along the coasts.