WORKING PAPER

Tornado Damage Mitigation: Homeowner Support for Enhanced Building Codes in Oklahoma

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Joseph T. Ripberger, University of Oklahoma, Center for Risk and Crisis Management*
Hank Jenkins-Smith, University of Oklahoma, National Institute for Risk & Resilience
Carol L. Silva, University of Oklahoma, Center for Risk and Crisis Management
Jeffrey Czajkowski, Wharton Risk Management and Decision Processes Center
Howard Kunreuther, Wharton Risk Management and Decision Processes Center
Kevin M. Simmons, Austin College and National Institute for Risk & Resilience

*Corresponding author; jtr@ou.edu; 5 Partners Place, 201 Stephenson Pkwy, Suite 2300, Norman, OK 73019.

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Abstract: Tornadoes impose enormous costs on society. Relatively simple and inexpensive enhancements to building codes may reduce these costs by 30% or more. Though promising, only one city in the US has adopted these codes. Why is this the case? This analysis addresses this question by examining homeowner support for more stringent building codes in Oklahoma, a conservative state that routinely experiences damaging tornadoes. Survey data show that support for mandatory mitigation policies like building codes is subject to countervailing forces. Push dynamics, including objective risk, risk perceptions, and damage experience, encourage support for mitigation. Pull dynamics, such as individualistic and conservative worldviews, and skepticism about climate change generate opposition. At the margin, the pull dynamics appear to exert more force than push dynamics, creating a weak basis of support that is not strong enough to overcome the status quo bias in a state that is cautious about regulatory action. The concluding section offers suggestions for changing this equation.

Keywords: Risk Mitigation; Tornadoes; Building Codes; Culture; Risk Perception

1. Introduction

Natural disasters impose enormous costs on society. Some of these losses are avoidable, but individuals are subject to multiple biases that may lead them to oppose mitigation efforts (Meyer and Kunreuther 2017). For instance, people tend to be *myopic*, focusing on overly short future time horizons when evaluating the benefits of these measures; *optimistic* in that they underestimate the likelihood that losses will occur from future disasters; and they exhibit *inertia* so they want to maintain the status quo. The problem can be made especially difficult when citizens are suspicious of, and object to, government-sponsored mitigation measures that impose mandatory costs on households and businesses. In this study, we address two interrelated questions. First, can public support for mandatory mitigation measures be garnered when large losses from disasters are a regular occurrence and broadly experienced by a population? Second, can support be obtained even among a population that is distrustful of government and regulations?

This study addresses these questions by exploring homeowner support for more stringent building code to mitigate damage from tornadoes. We focus on the US State of Oklahoma, where conservative and Republican politicians (who tend to distrust government and regulation) dominate the legislature and state-wide elected offices by large margins (Stanley and Niemi 2015).[1] At the same time, however, Oklahoma experiences more than 65 tornadoes per year that

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[1] As of November 2016, Republican officials hold 40 of 48 seats in the Oklahoma Senate, 71 of 101 seats in the Oklahoma House of Representatives, the Governorship, both seats in the U.S. Senate, and all 5 seats in the U.S. House of Representatives. In the 2016 Presidential Election,

impose significant costs on homeowners (Storm Prediction Center 2017). When choosing between regulation (mandatory building codes) and risk reduction, what do Oklahomans decide, and why?

2. Tornadoes and Enhanced Building Codes in Oklahoma

The contiguous United States experienced 9,928 tornadoes between 2007 and 2014 that produced more than $24 billion in estimated property loss (Storm Prediction Center 2017). A direct hit from the most intense (EF5) tornadoes will sweep even a well-built home from its foundation. However, 96% of tornadoes are rated at the lower end of the Enhanced Fujita Scale, which is summarized Table I (and described in WSEC 2006). In most instances, these "less intense" tornadoes cause damage to but do not destroy wood frame homes.

[Table I]

Even for the most intense tornadoes, most of the structural damage occurs at points along the tornado's path where the tornado was rated an EF2 or lower (Ramsdell and Rishel 2007). For example, a post-event damage survey commissioned by the NWS to evaluate the EF5 tornado that occurred in Joplin, MO on May 22, 2011 - which caused $2.8 billion in damage - determined that 6,149 (86%) of the 7,191 structures that were damaged were exposed to an EF2 or lower tornado (Marshall et al., 2012). Similarly, 80% of the structures damaged by the third most costly tornado in U.S. history—the EF5 tornado that struck Moore, OK on May 20, 2013 and caused $2 billion in damage—occurred at points when the tornado was rated an EF2 or lower

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the Republican Candidate (Trump) received 65.3% of the popular vote; the Democratic Candidate (Clinton) received 28.9% of the vote.

(Burgess et al., 2014). Thus, a substantial fraction of the damage caused by tornadoes comes from less intense tornadoes that produce wind speeds that range from 65 to 135 mph.

These findings have led to calls for upgraded building codes for construction of new homes in states that frequently experience damaging winds produced by EF0, EF1, and EF2 tornadoes (van de Lindt et al., 2012; Prevatt et al., 2012).[2] Surveys of the damage caused by less intense tornadoes have identified causes of structural failure such as failure of toe-nailed truss-to-wall connections, poor attachment to foundations, horizontal "hinge" failure at the gable end truss-to-wall top plate connection, and inadequate structural wall sheathing panels (Prevatt et al., 2012; p. 261). Many of these causes are addressed in building codes that have proven to significantly reduce the amount of property damage caused by hurricanes. (Gurley et al., 2006; Gurley and Masters 2010). A simple adaptation of these codes, some argue, would reduce the property loss caused by less intense tornadoes (Prevatt et al., 2012).[3]

As of this writing, Oklahoma's statewide building code does not include these requirements, although individual communities are free to revise the codes to make them more stringent. In April 2014, the City of Moore, OK adopted one such code, setting standards to mitigate damage

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[2] The new codes are similar to the International Code Council's (ICC) "Standard for Residential Construction in High-Wind Regions" and the American Society of Civil Engineers' "ASCE 7".

[3] Czajkowski and Simmons (2014) have shown the benefits of effective and well-enforced building codes in reducing damage from hail, which often coincides with tornado damage, on the order of 15 to 20 percent lower loss amounts.

caused by high wind events from less intense tornadoes (EF2 or lower). The code increased the wind standard for new dwellings from 90 mph (3-second gust) to 135 mph, which required a series of changes in the way that wood frame homes are constructed, including:

> *Enhanced roof sheathing fasteners and fastener schedules, narrower spacing of the roof framing, enhanced connections in the roof framing including the use of hurricane straps, strengthening of gable end walls and wall sheathing, some structural changes to garages, and wind-rated garage doors* (Simmons et al., 2015).

Estimates of the reduction in future damage vary based on assumptions, but a recent study indicates that these improvements to construction practices could reduce residential tornado losses by 30%, resulting in $10.7 billion in savings over the next 50 years if they were applied across the state of Oklahoma (Simmons et al., 2015). The same study estimates that it would cost approximately $3.3 billion (~$2,000 per home constructed) to implement the codes throughout the state. Based on these estimates, that study concludes that the new building code in Moore, OK “easily” passes a benefit-cost economic effectiveness test for the entire state by a factor of 3.2 to 1 (Simmons et al., 2015).

If building codes provide a cost-effective solution to minimizing the damage caused by tornadoes, why is Moore the only city in OK that has adopted them? What are the barriers to adoption and implementation that are preventing the State of Oklahoma and other tornado-prone states from following Moore’s lead? One answer may involve public attitudes about risk governance, and, more specifically, the perceived tradeoffs between risk reduction and regulation (Vaughan and Turner, 2014). That is, on the one hand, because of the frequency of tornadoes in the state, Oklahomans are keenly aware of the damage they cause and hence the value in reducing these losses. On the other hand, Oklahoma is an ideologically conservative state—with a strong majority of Republicans in the legislature and a pattern of voting for Republican candidates in presidential elections (Stanley and Niemi, 2015)—where regulation is likely viewed as an additional cost imposed on society.

The Republican Party in Oklahoma explicitly opposes infringement on individual property rights (Oklahoma Republican Party Platform Committee, 2013: p. 17). Enhanced building codes reside at the intersection of the tradeoff between risk reduction and protection of private property rights; they would provide a prospective benefit (risk reduction), but they would also impose a state-mandated requirement and cost on homebuilders and buyers. For those who oppose the expansion of mandatory building codes, voluntary (rather than mandatory) risk mitigation programs may be more appealing because they do not infringe upon market interactions and/or impose involuntary costs on individuals.[4]

3. Previous Research and Corresponding Expectations

Previous research on risk perception and behavior has substantially improved our understanding of the social, economic, and psychological mechanisms that influence individual and collective choices about how to reduce losses from natural disasters. For example, early research on mitigation indicates that most homeowners *do not* voluntarily adopt risk reduction measures, even if they are cost-effective (Kunreuther et al. 1978; Palm et al. 1990; Laska 1991).

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[4] Hamburger (2016) notes that a coalition of homebuilders and roofers oppose the update of ASCE-7-10, the new building code standard that includes new wind codes.

Subsequent studies have identified several factors that explain this behavior. For instance, many studies indicate that homeowners do not invest in mitigation measures because they underestimate or ignore the probability that a disaster will cause damage to their home (e.g., Magat, Viscusi, and Huber 1987; Camerer and Kunreuther 1989; Huber, Wider, and Huber 1997; Kunreuther and Pauly 2004). Other studies highlight economic constraints (high costs) and/or a kind of risk myopia by which homeowners – when confronted with potentially costly choices – tend to focus on short-term benefits and ignore or undervalue benefits that accrue over longer periods of time (Kunreuther, Onculer, and Slovic 1998).

Given these tendencies, and the resulting low mitigation adoption rates, researchers have argued that hazard mitigation should involve a combination of voluntary and mandatory risk reduction measures, such as compulsory insurance and/or well-enforced building codes (e.g., Kunreuther and Kleffner 1992; Kunreuther 2006; Kunreuther and Michel-Kerjan 2009). Yet relatively little is known about public support or opposition for the imposition of mandatory risk reduction measures, such as enhanced building codes (see, e.g., Dake 1992; Greenberg et al. 2014; Vaughan and Turner, 2014). This is problematic because mandatory measures are likely to generate different patterns of support and opposition than voluntary measures. For example, mandatory mitigation measures may generate opposition from homeowners who support risk reduction efforts but do not think these measures should be forced upon private citizens by way of building codes. Rather, they might believe that homeowners (and homebuilders) should have the freedom to *choose* to buy (or construct) higher quality homes. Voluntary measures, by comparison, are unlikely to generate this sort of opposition because homeowners (and builders) can “opt-out” if they choose to do so.

We theorize that support for mandatory risk mitigation is governed by a set of *push* dynamics that encourage support for mitigation and a countervailing set of *pull* dynamics that discourage support. Beginning with push dynamics, we draw from research on adoptions of voluntary risk mitigation measures to hypothesize that objective and subjective characterizations of hazard risk will encourage support for mandatory risk mitigation (i.e., Grothmann and Reusswig 2006; Siegrist and Gutscher 2008; Knocke and Kolivras 2007; Thieken, Petrow, Kreibich, and Merz 2006).

We expect that homeowners who live in areas of Oklahoma that routinely experience tornadoes will be more supportive of mitigation than homeowners who live in less tornado prone locations. The same is true of risk perceptions and hazard knowledge—people who believe that tornadoes will occur more frequently in the future and/or understand the risks associated with tornadoes, will be more supportive of mitigation. We also hypothesize that recent experience with tornado damage will trigger memories and evoke risk perceptions that encourage support for enhanced building codes (i.e., McGee, McFarlane, and Varghese 2009).

[Table II]

Even for people who support code improvements, economic costs are likely to influence their decision-making. Therefore, we hypothesize that a critical pull factor is the cost of the regulation with respect to constructing homes. Other *pull* dynamics that discourage support for risk mitigation were identified in a recent study of lack of public support for hurricane risk mitigation in New Jersey following Hurricane Sandy (Greenberg et al. 2014). Individuals who identify with egalitarian and/or communitarian values were shown to be more supportive of mitigation than individuals who do not identify with those values. This finding is consistent with a broader literature on relationship between values ("culture") and individual preferences about how to manage risk in society, which originates with the work of Mary Douglas and Aaron Wildavsky on the "cultural theory of risk" or Cultural Theory (CT) (Douglas and Wildavsky 1982; Douglas 1992; Dake 1992; Thompson, Ellis, and Wildavsky 1990).

Cultural Theorists posit four cultural biases: hierarchy, individualism, egalitarianism, and fatalism (Thompson, Ellis, and Wildavsky 1990; Dake 1991; Rayner 1992). *Hierarchs* place the welfare of the group before their own, and are keenly aware of who is and is not a part of their group. They prefer that people have defined roles in society, and place great value on procedures, lines of authority, stability, and order. *Individualists*, by contrast, experience little if any group identity, and feel bound by few structural prescriptions. They dislike constraints imposed upon them by others and value liberty over order and stability. *Egalitarians* seek strong group identities but prefer minimal external prescriptions on social relationships. They place greater value on equality within the group than they do on liberty or order, and vest authority within the community rather than on experts or institutionally defined leaders. Finally, *fatalists* perceive themselves to be subject to binding external constraints, and to be excluded from the groups with the authority to impose those constraints. They believe that they have little control over their lives and value chance (fate) over order, liberty, and equality.

Given these biases, we expect that individualists will oppose the adoption of statewide building codes because they constrain choice. In their view, homeowners should have the right to choose to build or buy a home that meets an enhanced standard of construction. Egalitarians, by comparison, will support building codes and other mandatory measures because they provide equitable protection for everyone, including homebuyers that may not have the resources to build a higher quality home. We expect that fatalists will oppose almost all risk mitigation measures (including mandatory measures) because they would rather "take their chances" than invest in something that is unlikely to work in the first place. Hierarchs are likely to be divided: if they believe that the "experts" or authority figures in their group support (oppose) enhanced building codes, then they too will support (oppose) them.

Cultural biases likely represent just one among an overlapping set of broad beliefs and identities that would influence support for mandatory mitigation programs. Oklahoma homeowners are also likely to take cues from the broad positions of the Republican or Democratic Party when formulating preferences about building codes. While rarely taking positions on building codes, the parties represent distinct philosophies and values from which citizens might draw upon when making decisions about new policies. For example, the Democratic Party supports generally liberal (or left-leaning) policies including progressive taxation and government regulation of industry-generated externalities, whereas the Republican Party espouses a more conservative (or right-leaning) policies including reductions in taxation and, more generally, the burdens posed by government regulations (Noel 2013). Given these differences, we expect that homeowners who identify with the Republican Party, the majority party in Oklahoma, will be more likely to oppose mandatory risk mitigation measures (including the adoption of statewide building codes) because they impose government regulations on businesses and individuals.

A related but distinct concept is that of political ideology, representing a broad set of normative values about the "good society" and how it can be achieved. Political parties present (sometimes inconsistent) ideologies in competing for voter support (see, e.g., Downs 1957). At various points in time, political parties in the US have represented quite diverse ideological groups (e.g., conservative southerners as a subgroup of a generally more liberal Democratic party), though in recent decades the primary political parties in the US appear to have become more homogeneous and polarized (Miller and Schofield 2003; Levendusky 2009). Conservatives tend to prefer fewer government interventions, and to reject both evidence and arguments (like that for anthropogenic climate change) that would justify such interventions (Leiserowitz 2006; Kellstedt, Zahran, and Vedlitz 2008). Hence conservatives, who tend to control the ideological landscape in Oklahoma, will be more likely to oppose the more expansive mandatory building codes. We expect that liberals will take a more collective perspective, more conducive to support for building standards imposed broadly on home builders and buyers.

In addition to these "value-based" constraints in states like Oklahoma that are dominated by individualists, Republicans, and conservatives, we again draw from Greenberg et al. (2014) to hypothesize that general skepticism about the risk of global climate change will discourage support for tornado risk mitigation in Oklahoma. As documented in prior research (Leiserowitz et al. 2012), people who believe that anthropogenic climate change is occurring also tend to believe that weather events, such as tornadoes and hurricanes, will become more frequent and intense in the future. Skeptics, by comparison, tend to reject this connection, believing that the frequency and intensity of extreme weather are subject to natural variability and hence no more (or less) likely in the future (Whitmarsh 2011). Given these arguments, we expect that homeowners who are skeptical about the risks of anthropogenic climate change (the majority group in Oklahoma), will be less supportive of enhanced building codes than homeowners who are more concerned about climate change.

We also account for the effects that socio-economic status, age, and gender may have on support for mandatory risk mitigation. Income and education may increase homeowner support for enhanced building codes because higher-income homeowners can pay for more expensive housing and homeowners with higher levels of education may be more aware of the long-term benefits associated with mitigation. In addition, more highly educated homeowners may also be less susceptible to cognitive biases, like risk myopia, that lead to undervaluation of mitigation (Kunreuther, Onculer, and Slovic 1998; Meyer and Kunreuther 2017).

On age, we expect that older respondents will be more supportive of enhanced building codes than younger respondents. Older respondents are more likely to have experienced tornado damage in the past, which is expected to bolster support for mitigation. Older homeowners are also less likely than younger homeowners to be "in the market" for a new home, thus the cost of building codes (i.e. higher prices on new homes) are less constraining financially for older homeowners.

Finally, following Greenberg et al. (2014), we hypothesize that gender may influence risk perceptions and subsequent support for enhanced building codes in Oklahoma. As noted in other areas of study, women often exhibit higher risk perceptions and a greater propensity to engage in protective action than men (Flynn, Slovic, and Mertz 1994; Terpstra and Lindell 2012; Ripberger et al. 2015; Ripberger et al. 2015). Therefore, we expect that female respondents will be more supportive of enhanced building codes than male respondents.

4. Data and Measures

The data for this project were collected by way of the Meso-scale Integrated Socio-geographic Network (M-SISNet), a panel survey that is administered four times a year to an address-based random sample of approximately 2,500 Oklahoma residents. Each wave of the M-SISNet survey contains a large set of reoccurring questions and a small set of wave-specific questions designed to measure household perceptions and opinions about the weather and climate in Oklahoma. The Spring 2015 wave—which was in the field from June 4th to July 22nd, 2015—included reoccurring questions and a wave-specific set of questions about property damage from high-wind events (like less significant tornadoes) and risk mitigation measures. In total, 2,527 M-SISNet panelists completed a survey for the Spring 2015 wave; we use responses from the sub-set of 2,200 respondents who own the residence in which they reside.[5]

The outcome variable in this analysis is a measure of homeowner support for building codes in Oklahoma. To measure such support, we presented the following prompt and information to M-SISNet panelists who own their own home:

> *According to structural engineers, there are steps that some homeowners can take to protect the structure of their homes from damage caused by high-wind events like*

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[5] Respondents who were not homeowners were not asked about their support for the enhanced building codes, and therefore are excluded from this analysis.

> *tornadoes. Though estimates differ, many engineers suggest that these steps can protect the structure of some homes from wind speeds up to 150 mph. While tornadoes differ in the wind speeds they produce, the majority of tornadoes in Oklahoma produce wind speeds that range from 65 mph to 135 mph. On the Enhanced Fujita (EF) scale for tornado damage, these wind speeds are consistent with EF0, EF1, and EF2 tornadoes.*
>
> *In hurricane-prone regions of the United States, building codes often require that new homes are equipped with a number of wind-protective components when they are constructed. Suppose that through a statewide referendum, the state of Oklahoma was considering a law that would mandate similar building codes in Oklahoma. This law would require that all new homes in the state are equipped with a set of components that would protect the structure of the home from the majority of high-wind events that occur in Oklahoma, including most EF0, EF1, and EF2 tornadoes. On average, installing these components during construction would increase the price of new homes in the state by $[RANDOMIZE: 2,000/3,000/4,000]. Because this is a statewide referendum, you would have an opportunity to directly cast a vote for or against this law.*
>
> *Would you vote for or against this law in Oklahoma? As you think about your answer, remember that if this law were to pass, it would cost more to build a home in Oklahoma.*

Survey participants registered their responses on a five-point scale that included the following options: *definitely oppose, probably oppose, not sure, probably support, and definitely support*. Note that this question includes an experiment wherein respondents are randomly assigned to one of three cost conditions with: \$2,000, \$3,000, or \$4,000.[6] This variation allows us to identify the influence of cost on support for building codes. In addition to cost, we expect that responses to this question will be driven by the push and pull dynamics that we describe above.

Beginning with the push dynamics that are expected to encourage support for enhanced building codes, we use the Storm Prediction Center (SPC) tornado database to estimate the spatial risk (frequency) of EF0, EF1, and EF2 tornadoes across the state of Oklahoma (a proxy for objective tornado risk). The tornado database provides information on the date, time, location, and intensity of nearly every tornado in the U.S. since 1950.

Given our interest in less intense tornadoes, we limit the data to every EF0, EF1, or EF2 tornado that was reported in the continental U.S. between 1985 and 2014 (n = 33,582 tornadoes). Then, we use kernel density estimation (KDE) to estimate the annual probability of an EF0, EF1, and EF2 tornado within 5 km of every point in Oklahoma.[7] To facilitate interpretation, we standardize these scores such that zero indicates an average risk of less significant tornadoes, negative scores indicate lower than average risk, and positive scores indicate higher than average

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[6] Simmons et al. (2015) estimate that enhanced building codes will increase construction costs by approximately \$2,000 (or \$1 per sq. ft.). In personal conversations, homebuilders have expressed the view that this estimate is a lower bound, so we include \$3,000 and \$4,000 to capture the upper bound.

[7] For more information on this approach to estimating objective tornado risk, see i.e., Dixon et al., 2011; Marsh and Brooks 2012; Coleman and Dixon 2014.

risk. The units of measurement represent standard deviations from the average. Figure 1 plots the spatial distribution of this variable.

[Figure 1]

We measure subjective tornado risk with a question about the future frequency of tornadoes: *do you think that tornadoes will happen more frequently, less frequently, or with about the same frequency over the next few springs as they have this spring? [2 = more; 1 = same; 0 = less].* We measure damage experience by asking respondents if (in the past three years) the structure of their home has been damaged by an extreme weather event [1 = yes; 0 = no] and tornado knowledge by asking respondents to answer a set of four factual questions about when tornadoes generally occur in Oklahoma (in the Spring, between 3:00 PM and 9:00 PM), the direction they typically travel (in a diagonal line, from southwest to northeast), and the damage rating that most tornadoes receive (EF0-EF1, with wind speeds that rand from 65 to 110 miles per hour). For each "correct" answer, respondents receive one point on the tornado knowledge scale, which ranges from 0 (no correct responses) to 4 (all correct responses).

[Table III]

Moving on to the pull dynamics that we expect will discourage support for enhanced building codes in Oklahoma, we measure cultural biases by asking respondents to rate the degree to which a set of four culture statements describe their outlooks on life. Using the questions described in Ripberger et al. (2015), each respondent rated their affinity to each of four cultural types, and were asked a "tie-breaker" question when affinities for two of the types tied for first place (question wording is shown in Appendix B). For the analysis that follows, we place respondents into a "culture" category (egalitarian, individualist, hierarch, or fatalist) based on the statement that they rate the highest. If two or more statements are given the same (highest) rating, we ask respondents to “break the tie” by identifying the statement that comes closest to their outlook on life.

We measure party identification by asking homeowners to indicate which political party they most identify with: the Democratic Party, Republican Party (or GOP), Independent, or Other. In this analysis, respondents who marked Other are included with Independents. As an alternative to measures of partisanship, we include a measure of self-identified political ideology. The scale ranges from “strong liberal” (1) through “middle of the road” (4) to “strong conservative” (7).

To measure skepticism about global climate change we asked respondents the following question: *On a scale from zero to ten, where zero means no risk and ten means extreme risk, how much risk do you think global warming poses for people and the environment?* To make this a measure of skepticism, we reverse code this scale, making 0 the least skeptical and 10 the most skeptical.

To account for the socio-economic and demographic characteristics that may influence homeowner support for enhanced building codes, we use questions that measure household income, age, gender, and education. All question wording is included in Appendix A.

As noted above, the M-SISNet is a panel survey. Questions on subjective tornado risk, damage experience, skepticism about global climate change, and socio-economics/demographics were included in the Spring 2015 wave of the survey, the same wave as the referendum question. Questions on tornado knowledge were included in the Fall 2015 wave, which was in the field

December 11, 2015 – February 1, 2016. Approximately 88% (1,950) of the homeowners who responded to the Spring 2015 wave responded to the Fall 2015 wave of the survey. Questions on culture, party identification, and ideology were on the Winter 2015 wave, which was in the field March 6, 2015 – April 27, 2015. Roughly 91% (2,001) of the homeowners who responded to the Spring 2015 wave responded to the Winter 2015 wave of the survey. Though small, this panel attrition explains the different sample sizes shown in Table III.

Table III also summarizes the distribution and central tendency of our measures. For categorical (binary) variables, percentages are listed instead of means. On average, homeowners in the sample believe that tornadoes are going to happen more frequently in the future (mean = 2.14 on the 3-point scale) and are highly knowledgeable about the hazard (mean = 2.93 on the 4-point scale). Likewise, a significant portion of the sample (21%) has recent experience with weather damage. If our theory is correct, these *push* dynamics will increase support for tornado risk mitigation, even if the program is mandatory. At the same time, however, the sample is dominated by individualists (49%), Republicans (47%), conservatives (mean = 4.61 on the 7-point scale), and homeowners who are somewhat skeptical of climate change (mean = 4.32 on the 10-point scale). These *pull* dynamics are expected to lessen support for mandatory risk mitigation programs, even if those programs limit the damage caused by tornadoes.

In the analysis that follows, we assess the balance between the push-pull dynamics by exploring support for enhanced building codes in the entire sample of homeowners. Then, we exploit variation within the sample to identify the influence of each factor on support for the program. We do this with a set of logistic regressions that model support for building codes as a function of the variables we describe above. As shown in previous research (Swedlow and Wycoff 2009; Jones 2011; McCright and Dunlap 2011; Ripberger et al. 2012) cultural biases, partisanship, political ideology, and skepticism about global warming are highly correlated with one another, so we estimate separate models that include these variables in isolation, followed by a single model that includes all the explanatory variables. Before we estimate these models, we use the multiple imputation approach outlined in Blackwell et al. (2015) to impute entries for missing observations in 5 "complete" datasets.[8] We estimate the models using data from all 5 datasets and present mean point estimates and standard errors.

To facilitate interpretation, we scale the numeric inputs to the model by dividing them by two standard deviations so that we can directly compare the resulting coefficients to coefficients for untransformed binary indicators (Gelman 2008). In addition, we present our results as "marginal effects" rather than logit coefficients. The marginal effects approximate expected differences in the predicted probability that support for enhanced building codes = Yes, given a 1-unit difference in an independent variable when the other variables in the model are held constant. The marginal effects are calculated at the sample mean of the independent variables and the standard errors are calculated using the delta method (Greene 2003).

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[8] We also estimate the models using listwise deletion of missing values. As shown in Appendix B (Table B-1), the results we get when using this approach are quite consistent with the estimates we present in Table 4.

5. Results

Figure 2 plots the distribution votes for the enhanced building code referendum among all homeowners in the sample that completed this portion of the survey (n = 2,200). As the figure indicates, almost two thirds of the homeowners in the sample said that they would probably or definitely vote in favor of the referendum. When the reported increase in the cost of constructing new homes due to the enhanced building code was $2,000, the percentage support ("definitely" plus "probably") was 65%; at $3,000 it fell to 62%; and at $4,000, which is almost twice the estimated cost of mitigation, 60% of homeowners indicated that they would probably or definitely vote in favor of the enhanced building code.

[Figure 2]

More than a third of the homeowners in the sample indicated that they are unsure or do not support the adoption of building codes that would protect new homes from damage caused by less significant tornadoes even when the cost of new construction was as low as $2,000. When the costs of new construction increased to $4,000 this percentage increased to 40%.

To statistically test for the impact of cost on building code support while also controlling for the impact of other pull and push factors, we use binary logistic regression to explore the difference between respondents who support the referendum (y = 1) and respondents who are not sure or oppose it (y = 0).[9] Table IV presents the marginal effects (and standard errors) from our

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[9] Extensive comparisons of survey responses with voting behavior on public referenda show that survey respondents who express uncertainty typically vote "no" if they decide to vote at all (e.g.,

regression models. As noted above, some of the "pull" variables are correlated, so we use separate models to estimate the effects of culture, partisanship, ideology, and climate change beliefs. The fifth column in Table 4 shows the results when all the variables are included in a single model. As a group, the five models demonstrate that support for code enhancement is modestly reduced by increases in the price of new homes, as noted from the data in Figure 2. On average, the probability of support decreases by approximately 0.05 as new home prices increase from $2,000 to $4,000.

[Table IV]

Beginning with the push variables hypothesized to encourage support for the building code enhancement, the estimates from all 5 models show that greater objective tornado risk, greater subjective (perceived) tornado risk, and experiencing damage from an extreme weather event all increase homeowner support for the building code referendum. In the complete model (5), a two standard deviation increase in objective tornado risk corresponds with a 0.04 increase in the probability of support for building codes. Increases in subjective tornado risk and tornado knowledge (by two standard deviations) produce similar increases in the probability of support (increases of 0.05 and 0.04, respectively). The same is true of recent experience with weather damage—the probability of support for building codes is 0.04 higher among respondents who have this experience. With one exception, (Model 1, where tornado knowledge is not statistically significant), the push effects in all 5 models are positive and statistically significant.

Carson et al. 1987; Champ and Brown 1997). We follow this logic in treating "not sure" responses as opposition to the building code referendum.

The second set of estimates in Table IV speak to the *pull* dynamics that constrain support for enhanced building codes in Oklahoma. Model 1 shows that cultural biases significantly influence support for the referendum. Consistent with our expectations, fatalists, hierarchs, and individualists (the predominant group in Oklahoma) are less likely to support the referendum than are egalitarians. All else equal, support among hierarchs and individualists is roughly 0.11 lower than expected support among egalitarians; support among fatalists is even lower (0.14). These differences remain significant, but diminish in size when partisanship, political ideology, and beliefs about climate change are held constant (Model 5).

Models 2 and 3 indicate that partisanship (Republican and Democrat) and political ideology also constrain support. The marginal effects from Model 2 indicate that the difference in support between Republicans and Democrats is 0.11, with Republicans being significantly less supportive than Democrats. Independents are also less supportive than Democrats, but the difference between the two groups is smaller (0.06). Model 3 tells a similar story for ideology. The difference between liberals and conservatives is roughly 0.16, with conservatives being significantly less supportive than liberals. Though sizable, these differences are suppressed in Model 5 making the estimated coefficients statistically insignificant, which is unsurprising given the high correlations among cultural dispositions, partisanship, ideology, and skepticism about climate change.[10]

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[10] Pearson correlations: Republican vs. political ideology = 0.59; Republican vs. skepticism about climate change = 0.44; political ideology vs. skepticism about climate change = 0.59.

Model 4 shows that beliefs about climate change are influential as well. Homeowners who are skeptical about climate change are significantly less supportive of enhanced building codes than homeowners who are worried about climate change. In fact, the expected difference in support between the two groups is 0.17, which is the largest effect we observe in the data. Though somewhat reduced in size, this difference remains statistically significant and relatively large (0.12) when culture, partisanship, and political ideology are held constant (Model 5).

The final set of socio-economic and demographic estimates in Table IV (income; education; age; gender) shows that general education and age also influence support for building codes. Consistent with our expectations, the probability of support among homeowners with a college degree is 0.09 higher than the probability of support among homeowners who did not graduate college. The difference between older and younger homeowners is smaller (0.06), but statistically significant. Contrary to our prediction, household income has little or no discernable influence on support for the policy, suggesting that economic considerations have little bearing on homeowners' preferences over prospective enhancements of building codes for new homes in Oklahoma.[11] The same is true of gender—the effect is positive but not statistically significant.

As a group, the estimates in Table VI provide consistent support for our theory that the tension between risk and regulation in Oklahoma is governed by a set of *push* dynamics that encourage

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[11] This null result for income may both reflect the mitigation requirements are imposed only on future residential construction. Thus, from the perspective of our respondents, all costs would be deferred until (and if) they purchased a new home built *after* the new regulations take force.

support for mandatory mitigation programs and a countervailing set of *pull* dynamics that discourage support. Up until now, we have investigated these dynamics in isolation, revealing the relative effect of each variable in the push and pull sets. Now, we extend this analysis to explain how the variables in the respective sets combine to influence support for building codes.

To accomplish this, we use the parameter estimates from Model 5 (in Table VI) to estimate the probability that three different groups of homeowners will support building codes—an average, push, and pull group. For the average group, we set the numeric inputs to the model at their mean values and the categorical indicators to their modes. For the push group, we increase objective tornado risk, subjective tornado risk, weather damage experience, and tornado knowledge to their max values (Table II), while holding the other inputs to their average value. For the pull group, we set culture to fatalist, party to Republican, and political ideology and skepticism about global climate change to their max values. Then, we use these settings to predict the probability of support for each group. To account for and display the uncertainty in these predictions, we use the simulation approach outlined in King, Tomz, and Wittenberg (2000). The distributions of these simulations are shown in Figure 3.

[Figure 3]

The simulations generate a mean probability of support for the building code enhancements of approximately 0.64 for the average group, with 95% confidence intervals that range from 0.58 to 0.70.[12] When the push parameters are maximized (the push group, as described above), the

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[12] Not surprisingly, the mean level of support for the "Average" group is nearly identical to the mean in the raw data.

estimated probability of support *increases* to roughly 0.76 [95% CI: 0.69, 0.82], revealing a combined effect of 0.12 [95% CI: 0.03, 0.20] for the push dynamics. When the pull parameters are maximized (the pull group, described above), the estimated probability of support *decreases* to approximately 0.40 [95% CI: 0.32, 0.50], yielding slightly larger combined effects of 0.24 [95% CI: 0.12, 0.34] for the pull dynamics.

These findings indicate that the net effects of the pull dynamics in our models are stronger (on average) than those of the push dynamics. That is, the net "pull" effects of ideology, partisanship and cultural dispositions can substantially erode support for the enhanced building codes – drawing it well below a 50% threshold among the most conservative, Republican and fatalistic survey respondents. Note however, that these findings are subject to considerable uncertainty, as indicated by the spread for each group shown in Figure 3.

6. Implications

Between 1989 and 2013 Oklahoma experienced 1,597 tornadoes that produced roughly $30 billion in insured losses. If tornadoes continue at this rate, the state will experience more than $100 billion in insured losses over the next 50 years. Other states, such as Alabama and Missouri face a similar plight. Engineers indicate that relatively simple and inexpensive enhancements to building codes may reduce insured losses by 30% or more. Though promising, only one city in the US—Moore, OK—has adopted these codes. Why is this the case? What is stopping other communities and states in tornado prone regions of the US from adopting more stringent building codes?

One answer to these questions may be found in public views about risk and regulation. In Oklahoma, support for mandatory mitigation policies like building codes is subject to countervailing forces. Push dynamics, such as risk perceptions and damage experience, encourage support for mitigation. Pull dynamics, like individualistic and conservative worldviews, generate opposition. At the margin, the support-eroding pull dynamics appear to exert more force than do support enhancing push dynamics. Homeowners in Oklahoma tend to recognize the risks that tornadoes pose, but are reluctant to resort to compulsory efforts to manage those risks. Currently, the balance of these dynamics favors building codes (65%), but that balance is tenuous—only 27% of our respondents say they would be "certain" to vote for mandatory codes in a hypothetical state-wide referendum, while 35% said they would "probably" vote for them. Extensive comparisons of survey responses with voting behavior on public referenda show that survey respondents who express uncertainty often vote "no" if they decide to vote at all (e.g., Carson et al. 1987; Champ and Brown 1997). Thus, our data indicate that public support for policy change is likely, in reality, to be relatively modest.

Modest public support for a policy of this kind is unlikely to result in policy adoption. Early evidence indicates that the new building code in Moore, OK is having little or no effect on the price and volume of home sales, despite increases in the cost of construction (Simmons and Kovacs, 2017). This suggests that the costs of the new code are likely to fall disproportionately on home builders, which would explain why the coalitions opposing enhanced building codes have included the home construction industry (National Association of Homebuilders 2016). At the state level, entrenched opposition by Oklahoma home builders is therefore likely to make passage of the enhanced building codes quite challenging.

Changing this equation, our results suggest, will require an increase in the push dynamics and/or amelioration in the pull dynamics that influence support for building codes. Those interested in increasing the likelihood of adoption of mandatory mitigation policies should target these dynamics. For instance, they might consider enhancing the "push" side of the equation through public information campaigns that highlight the benefits of enhanced building codes and/or the losses that communities might incur if they fail to adopt them. In addition to emphasizing individual homeowners' benefits/costs of mitigation, which may strengthen the push side of the equation, the program should emphasize the negative externalities of inaction, which could weaken the pull side. When tornadoes strike poorly constructed homes, the debris field often produces missiles that damage adjacent homes, even if those adjacent homes are built to higher standards (Lee 1974). In situations like this, market externalities (the increased risks for adjacent homeowners) can serve to justify government-imposed enhanced building standards. This kind of argument would directly address the reluctance of many homeowners to support an expansion of government regulations. Similar dynamics were evident in increasing public support for laws against public smoking and drunk-driving. Historically, large segments of the population were resistant to government intervention—if people want to harm themselves, why stop them? Over time, however, community programs and advertisement campaigns brought awareness to the negative externalities of these activities, and consequently, strengthened the support for regulation (see, e.g., McMillen et al 2003; Elder at al 2004).

In addition to community programs and/or advertisement campaigns, policymakers who are interested in fostering support for building codes in states like Oklahoma might consider ways to assure that the value of the enhanced building code is captured in the price of the home. As noted above, current evidence indicates that homebuilders bear the additional costs of complying with the new codes in Moore, OK (Simmons and Kovacs 2017), and homebuilders are active and potent participants in the building code policy arena. If the value of the "hardened" (or "fortified") homes is recognized (see, e.g., Awondo et al 2017), such that the sale prices of these homes captures (or perhaps even exceeds) the added building costs, homebuilders would be less likely to oppose the added building codes. To facilitate this recognition, a program targeting realtors and home-buyers might highlight the "tornado resilience" of hardened homes as a distinguishing feature in localities that adopt building codes. This may increase demand for new homes in this area (relative to old homes in the same area, or new homes in a different area), and thereby allow home builders to recapture the added costs of construction. Homebuyers would benefit by way of safety improvements, damage mitigation, and (ideally) higher resale values. Such a program would likely be even more effective if insurance companies—who are likely to benefit from mitigation—are willing to adjust premiums for the hardened homes (Czajkowski et al 2016).

Absent proactive efforts to encourage support and/or limit opposition, widespread adoption of building codes that reduce losses from tornadoes in states like Oklahoma will be difficult to accomplish. Instead, we will likely see a patchwork of reactive mitigation policies that are adopted in the wake of major disasters, like the devastating tornado that struck Moore, OK on May 20, 2013 that caused $3 billion in damage. Like many disasters, the Moore tornado was a singular "focusing event" that led to major policy change (Birkland 1998)—in this case, an enhanced building code that was adopted less than a year after the tornado. Other communities may follow Moore’s lead, but it will be unfortunate if we are forced to rely on future disasters to generate the strong push for risk mitigation that overwhelms public opposition to regulation.

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Tables and Figures

Table I: Operational Enhanced Fujita Scale for Tornado Damage

EF Scale	Wind Speeds (MPH)	Characteristic Damage to Residential, Wood Frame Houses
0	65-85	Threshold of visible damage; loss of roof-covering material (less than 20%), gutters and/or awning; loss of vinyl or metal siding.
1	86-110	Broken glass in doors and windows; uplift of roof deck and loss of significant roof-covering material (20% or more); collapse of chimney; garage doors collapse inward; failure of porch or carport.
2	111-135	Entire house shifts off foundation; large sections of roof structure removed; most walls remain standing; exterior walls collapsed
3	136-165	Most walls collapsed, except small interior rooms
4	166-200	All walls collapsed
5	Over 200	Destruction of engineered and/or well-constructed residence; slab swept clean.

Table II: The Push and Pull Dynamics that are Expected to Influence Support for Enhanced Building Codes Among Homeowners in Oklahoma

Push Dynamics: Encourage Support for Mitigation in Oklahoma	*Pull* Dynamics: Discourage Support for Mitigation in Oklahoma
Objective Tornado Risk	Cultural Bias
Subjective Tornado Risk	Partisanship
Weather Damage Experience	Political Ideology
Tornado Knowledge	Skepticism about Global Climate Change

Table III: Descriptive Statistics

	Mean/ Percent	St. Dev.	Min	Max	N	Survey Wave[#]
Vote in Building Code Referendum	3.64	1.19	1	5	2,200	Sp-15
Vote for Building Code (Yes = 1)*	62%	-	0	1	2,200	Sp-15
Cost: $2,000*	33%	-	0	1	2,200	Sp-15
Cost: $4,000*	33%	-	0	1	2,200	Sp-15
Cost: $4,000*	33%	-	0	1	2,200	Sp-15
Objective Tornado Risk	0.31	0.75	-2.84	1.18	2,200	Sp-15
Subjective Tornado Risk	2.14	0.53	1	3	2,178	Sp-15
Weather Damage Experience*	21%	-	0	1	2,194	Sp-15
Tornado Knowledge	2.93	0.78	0	4	1,902	F-15
Cultural Bias: Egalitarian*	22%	-	0	1	1,992	W-15
Cultural Bias: Fatalist*	8%	-	0	1	1,992	W-15
Cultural Bias: Hierarch*	21%	-	0	1	1,992	W-15
Cultural Bias: Individualist*	49%	-	0	1	1,992	W-15
Partisanship: Democrat*	34%	-	0	1	1,961	W-15
Partisanship: Independent*	20%	-	0	1	1,961	W-15
Partisanship: Republican*	46%	-	0	1	1,961	W-15
Political Ideology (Conservative = 7)	4.65	1.70	1	7	1,965	W-15
Skepticism about Global Climate Change	4.32	3.13	0	10	2,184	Sp-15
Household Income	76,735	80,785	$10K	$1,750K	1,936	Sp-15
Education (College = 1)*	51%	-	0	1	2,199	Sp-15
Age	59.91	13.86	21	92	2,200	Sp-15
Gender (Male = 1)*	39%	-	0	1	2,193	Sp-15

*Indicates categorical (binary) variable

[#] Wave W-15 was fielded in the winter of 2015; Sp-15 was fielded in the spring of 2015; F-15 was fielded in the fall of 2015.

Table IV: Multiple Imputation Logistic Regression Models of Homeowner Support for Building Codes to Mitigate Tornado Damage

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Cost: $3,000 (v. $2,000)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.03)
Cost: $4,000 (v. $2,000)	-0.04* (0.03)	-0.05* (0.03)	-0.05* (0.03)	-0.05** (0.03)	-0.05* (0.03)
Objective Tornado Risk	0.05** (0.02)	0.05** (0.02)	0.04** (0.02)	0.05** (0.02)	0.04** (0.02)
Subjective Tornado Risk	0.08*** (0.02)	0.08*** (0.02)	0.07*** (0.02)	0.06*** (0.02)	0.05** (0.02)
Weather Damage Experience	0.05** (0.02)	0.05** (0.02)	0.05* (0.03)	0.04* (0.03)	0.04* (0.03)
Tornado Knowledge	0.03 (0.02)	0.04* (0.02)	0.04* (0.02)	0.04* (0.02)	0.04* (0.02)
Individualist (v. Egalitarian)	-0.11*** (0.03)				-0.06* (0.03)
Hierarch (v. Egalitarian)	-0.11*** (0.03)				-0.07** (0.04)
Fatalist (v. Egalitarian)	-0.14*** (0.04)				-0.11** (0.05)
Republican (v. Democrat)		-0.11*** (0.02)			0.01 (0.03)
Independent (v. Democrat)		-0.06** (0.03)			-0.002 (0.03)
Political Ideology			-0.16*** (0.02)		-0.09*** (0.03)
Skepticism about Climt Chng				-0.17*** (0.02)	-0.12*** (0.03)
Household Income	-0.002 (0.02)	0.004 (0.02)	0.001 (0.02)	0.01 (0.02)	0.002 (0.02)
College (v. No College)	0.11*** (0.02)	0.11*** (0.02)	0.10*** (0.02)	0.10*** (0.02)	0.09*** (0.02)
Age	0.05** (0.02)	0.06*** (0.02)	0.07*** (0.02)	0.06*** (0.02)	0.06*** (0.02)
Male (v. Female)	0.02 (0.02)	0.02 (0.02)	0.03 (0.02)	0.04 (0.02)	0.04 (0.02)
Constant	-0.20** (0.09)	-0.25*** (0.09)	-0.09 (0.09)	-0.16* (0.09)	-0.01 (0.09)
Observations	2,200	2,200	2,200	2,200	2,200
Log Likelihood	-1411.61	-1410.71	-1395.82	-1390.03	-1379.69
Akaike Inf. Crit.	2851.21	2847.43	2815.65	2804.06	2795.38
Imputations	5	5	5	5	5

Note: average approximate marginal effects, calculated at the means of the independent variables; average standard errors in parentheses; *p<0.1; **p<0.05; ***p<0.01.

Figure 1: Objective Risk from Less Significant Tornadoes in Oklahoma

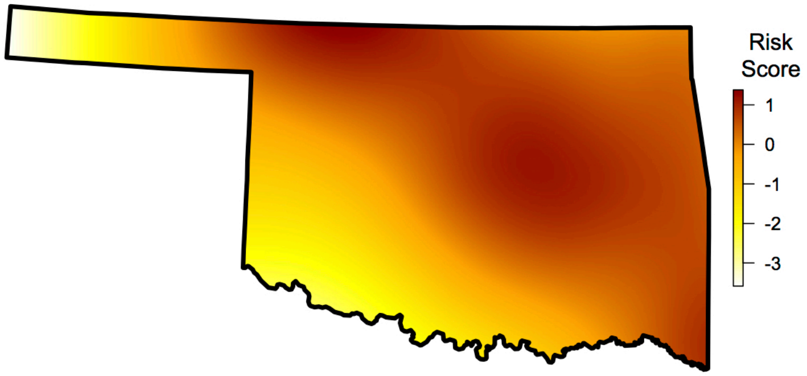


Figure 2: Distribution Homeowner Responses to a Hypothetical Referendum that Would Require Enhanced Building Codes for Tornado Risk Mitigation in Oklahoma

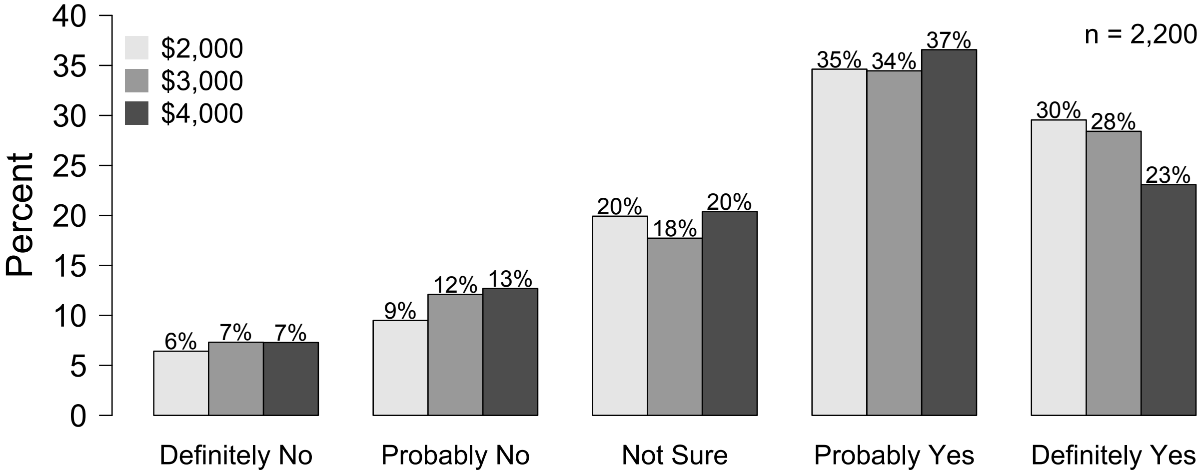
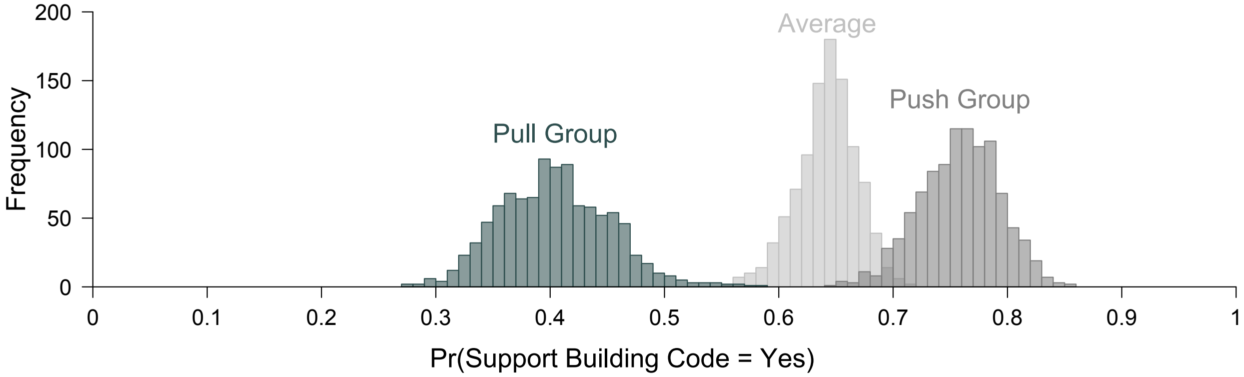


Figure 3: Simulated Probability of Support for Building Codes by Group



Appendix A: Question Wording

Cultural Affinity:

{Egalitarian} My most important contributions are made as a member of a group that promotes justice and equality, to combat unfairness and corruption in society. Within my group, everyone should play an equal role without differences in rank or authority. It is easy to lose track of what is important, so I have to keep a close eye on the actions of my group. It is not enough to provide equal opportunities; we also have to try to make outcomes more equal.

{Individualist} Groups are not all that important to me. I prefer to make my own way in life without having to follow other people's rules. Rewards in life should be based on initiative, skill, and hard work, even if that results in inequality. I respect people based on what they do, not the positions or titles they hold. I like relationships that are based on negotiated "give and take," rather than on status. Everyone benefits when individuals are allowed to compete.

{Hierarch} I am more comfortable when I know who is, and who is not, a part of my group, and loyalty to the group is important to me. I prefer to know who is in charge and to have clear rules and procedures; those who are in charge should punish those who break the rules. I like to have my responsibilities clearly defined, and I believe people should be rewarded based on the position they hold and their competence. Most of the time, I trust those with authority and expertise to do what is right for society.

{Fatalist} Life is unpredictable and I have very little control. I tend not to join groups, and I try not to get involved because I can't make much difference anyway. Other people make the rules; I just have to abide by them. Getting along in life is largely a matter of doing the best I can with what comes my way, so I just try to take care of myself and the people closest to me. It's best to just go with the flow, because whatever will be will be.

Income: *Thinking specifically about the past 12 months, what was your annual household income from all sources?*

Age: *How old are you?*

Gender: *Are you male or female? [1 = male; 0 = female]*

Education: *What is the highest level of education you have COMPLETED? [1 = Less than High School; 2 = High School/GED; 3 = Vocational or Technical Training; 4 = Some College (no degree); 5 = 2-year College/Associate's Degree; 6 = Bachelor's Degree; 7 = Master's degree; 8 = PhD, JD, or MD]*

Appendix B: Model Results and Robustness

Table B-I: Logistic Regression Models of Homeowner Support for Building Codes to Mitigate Tornado Damage

	Mode 1	Model 2	Model 3	Model 4	Model 5
Cost: $3,000 (v. $2,000)	-0.03 (0.03)	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.03)
Cost: $4,000 (v. $2,000)	-0.04 (0.03)	-0.04 (0.03)	-0.04 (0.03)	-0.04 (0.03)	-0.04 (0.03)
Objective Tornado Risk	0.07*** (0.02)	0.07*** (0.02)	0.06*** (0.02)	0.07*** (0.02)	0.06*** (0.02)
Subjective Tornado Risk	0.10*** (0.03)	0.10*** (0.03)	0.09*** (0.03)	0.08*** (0.03)	0.07*** (0.03)
Weather Damage Experience	0.07** (0.03)	0.07** (0.03)	0.07** (0.03)	0.07** (0.03)	0.07** (0.03)
Tornado Knowledge	0.03 (0.02)	0.03 (0.02)	0.03 (0.02)	0.04 (0.03)	0.04 (0.03)
Individualist (v. Egalitarian)	-0.13*** (0.04)				-0.08** (0.04)
Hierarch (v. Egalitarian)	-0.13*** (0.04)				-0.09** (0.04)
Fatalist (v. Egalitarian)	-0.15** (0.06)				-0.12** (0.06)
Republican (v. Democrat)		-0.10*** (0.03)			0.01 (0.04)
Independent (v. Democrat)		-0.04 (0.04)			0.02 (0.04)
Political Ideology			-0.14*** (0.03)		-0.05 (0.04)
Skepticism about Climt Chng				-0.16*** (0.03)	-0.12*** (0.03)
Household Income	-0.03 (0.03)	-0.03 (0.03)	-0.03 (0.03)	-0.03 (0.03)	-0.02 (0.03)
College (v. No College)	0.10*** (0.03)	0.11*** (0.03)	0.10*** (0.03)	0.10*** (0.03)	0.09*** (0.03)
Age	0.05** (0.02)	0.06** (0.02)	0.07*** (0.02)	0.06** (0.02)	0.06** (0.03)
Male (v. Female)	0.03 (0.03)	0.03 (0.03)	0.04 (0.03)	0.04 (0.03)	0.04 (0.03)
Constant	-0.18* (0.11)	-0.26** (0.10)	-0.12 (0.11)	-0.16 (0.10)	-0.04 (0.11)
Observations	1,502	1,502	1,502	1,502	1,502
Log Likelihood	-921.92	-923.00	-916.44	-910.02	-904.62
Akaike Inf. Crit.	1,871.85	1,872.00	1,856.88	1,844.04	1,845.24

Note: approximate marginal effects, calculated at the means of the independent variables; standard errors in parentheses; $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$.

As shown in Table B-I, the estimates we get when using listwise deletion of missing values are quite consistent with the estimates we present in Table IV, which rely on multiple imputation. There are, however, a few noteworthy differences. First, the push and pull estimates are a bit larger (on average) than the estimates from the model using imputed data, with one exception—the difference between liberals and conservatives (political ideology) is smaller and becomes statistically insignificant when culture, party, and skepticism about climate change are held constant. Second, the estimates shown in Table B-1 are less precise (larger estimated standard errors) because there are fewer observations. Because of this, while the estimates of the effects of cost ($4,000 vs. $2,000) and tornado knowledge are similar (in size) to the estimates from the model using imputed data, but are statistically insignificant. Overall, however, the consistency of the results shown in Tables IV and B-I indicate that the results described in this paper are robust.