The social behavior of immigrants during natural disasters: Lessons from the United States*

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Abstract

Natural disasters can disrupt our social fabric and increase political polarization by differentially impacting different subpopulations and exacerbating existing inequities. In this paper, we examine the effects of natural disasters on the divergence of social behavior between immigrants and natives in the United States. First, using individual-level time diary data from 2003-2021, we document that first generation immigrants socialize less, volunteer less, and spend more time in religious activities relative to their native counterparts. Second, we make use of temporal and spatial variation in disaster-induced fatalities to examine the relationship between major disasters and time allocation for different social behavioral outcomes. We find that major disasters affect the social lives of both immigrants and natives, but the effects are significantly more pronounced for immigrants. Finally, we show that immigrants respond to disasters by making significant adjustments in their labor market participation both on the intensive and extensive margins, whereas the effects are milder for natives. Our results further suggest that immigrants face higher levels of barriers to out-migrate following a disaster compared to native counterparts, resulting in disruption of social networks.

Keywords: Disasters, Climate change, Immigration, Social behavior, Religiosity
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1. Introduction

Immigrants plays an integral part in the process of cultural change. They introduce new norms of social behavior and belief systems, which can clash with the natives' ways of lives and arise social tensions. In fact, much of the focus on topics such as cultural diversity, immigrant assimilation, and integration are arguably rooted in the desire to ameliorate – or, in a perverse case, to benefit from – these social tensions. While cultural diversity and integration are recurrent themes in intellectual and political discourses on immigration, systematic analyses of the factors that influence these outcomes remain scarce (Berggren et al., 2023; Kuran and Sandholm, 2008).

A key to achieving both higher tolerance and better assimilation of immigrants in their new communities is socialization. Studies have shown that socialization, particularly during one's "impressionable years" (i.e., youth), can meaningfully affect one's attitudes towards immigrants (Kustov et al., 2021; Alwin and Krosnick, 1991). This is critical because public attitudes on immigration and immigrants are stable over time (Kustov et al., 2021). Contrary to commonly held assumptions, information and contextual factors do not alter such attitudes. Thus, conventional solutions such as raising public awareness about the economic and social benefits of immigration do not help with easing social tensions. However, socialization does. For instance, exposure to neighbors of foreign descent leads to more hospitable behavior towards the group's country of origin (Bursztyn et al., 2024). Thus, this paper focuses on the social behavior of immigrants and the forces that can influence their social lives.

Specifically, we investigate how shocks induced by natural disasters may differentially affect social behavioral outcomes of immigrants and natives. We shed light on the linkage between natural disasters and social behavior in three ways. First, we employ individual-level time use data for the years 2003-2021 from the American Time Use Survey (ATUS) to quantify average differences in time allocated for societal activities between immigrants and natives. This is consistent with the notion that first-generation immigrants have less time to build their social networks in the communities they choose to reside in, causing them to be less social relative to natives. We find that they spend less time on social activities. Additionally, they spend less time on volunteering and on civic engagement activities than natives, while spending more time in religious activities. We show that these patterns hold even when we split the empirical sample across different categories related to employment status and sex.

Second, we link the ATUS data with annual county-level disaster fatalities data obtained from the Spatial Hazard Events and Losses Database for the United States

(SHELDUS) for the years 2003-2020 to study how major disasters impact the social behavior of immigrants. Our central finding is that major disasters affect the social behavior of both immigrants and natives, but the effects are significantly more severe for first-and second-generation immigrants relative to that for the overall population. Individuals residing in counties affected by major disasters spend, on average, 11 minutes less on social activities, 1.3 minutes less in religious activities, 1.6 minutes more in volunteering activities, and 0.63 minutes less in civic engagement activities per day compared to their counterparts in unaffected counties. When we examine the effects separately by immigrant status, we find that major disasters lead to about 30 minutes per day reduction in total time spent on socializing, religious, volunteering and civic engagement activities for both first and second generation immigrants, whereas the effect for natives is much smaller, positive and statistically insignificant. We find that a large part of this overall effect is driven by natural disasters' disproportionate impacts on immigrants' social behavior (measured using daily time spent on various social activities). We conduct a battery of robustness exercises to rule out that our results are driven by our choices of variables, disaster fatality thresholds, sample restrictions, and time-horizons.

Finally, we provide evidence on two specific mechanisms through which natural disasters differentially affect social behavioral outcomes of natives and immigrants: labor force participation and outmigration. We show that citizens reduce labor force participation both on the intensive and extensive margins in the aftermath of disasters, whereas non-citizens respond to disasters by entering labor market and increasing hours worked per week. Our results indicate that immigrants face higher levels of barriers to outmigrate following a disaster compared to native counterparts.

This study makes important contributions to several strands of empirical literature in economics and related disciplines. First, we contribute to the rich literature on the effects of major disasters on individuals and households (Deryugina et al., 2018; Deryugina and Molitor, 2020; Paudel, 2023a; Gallagher and Hartley, 2017; Johar et al., 2022; Paudel, 2023b; Ingwersen et al., 2023; Kamble et al., 2024). This literature is vast, but the focus is overwhelming on employment, income, household finance, migrant-mortality, and human capital, but not as much on their social lives. Although a couple of recent studies have examined the impacts of major disasters on social outcomes with an emphasis on pro-sociality, the literature remains thin and largely relies on case studies of specific shocks (Cassar et al., 2017; Méon and Verwimp, 2022; Rao et al., 2011). Our generalized approach employs detailed time use data on a variety of behavioral outcomes from a nationally representative survey in the U.S. We also explore heterogeneous impact of major natural disasters on social behavior of immigrants, allowing us to conclude that such shocks may

exacerbate disparities in social well-being between immigrants and natives.

Second, we contribute to the emerging literature that links climatic shocks and natural hazards to migration (Boustan et al., 2020; Cattaneo and Peri, 2016; Gröschl and Steinwachs, 2017; Shakya et al., 2022). Studies from both within and outside the United States conclude that extreme climatic events and natural disasters trigger both internal (within country) and international migration (Maystadt et al., 2016; Oliveira and Pereda, 2020; Boustan et al., 2020). In sub-Saharan Africa, temperature and rainfall anomalies led to a displacement of an estimated 5 million people during the period 1960-2000, which averages around 128,000 people annually (Marchiori et al., 2012). These figures are striking and, hence, warrant further investigation. However, out-migration, by itself, only tells us one half of their adaptation story. The extremity of climatic events may vary between locations, but migrants continue to face the consequences of such events even in their new homes. The lives of migrants, once they have settled into their new homes, tell us the second half of the story. We contribute to this understudied topic by probing how natural hazards may affect the social lives of immigrants in the United States.

Third, our study informs the broader literature on the effects of major traumatic events on social outcomes (Bauer et al., 2016; Paudel, 2021). This literature generally focuses on pandemics and wars and finds that such economic shocks tend to influence social connectivity and civic engagement (Bauer et al., 2014; Bellows and Miguel, 2009; Gilligan et al., 2014). However, a majority of these studies are based on laboratory or field-based experimental games, which raises concerns about external validity. It also remains unclear that findings from war can be transferable to natural hazards, which are orthogonal to social and political tensions of a country.

Lastly, our study adds to the resurging literature examining the origins of social institutions and mechanisms of social institutional change (Alesina et al., 2013; Giuliano and Nunn, 2021). This literature finds that environmental instability and past traditional practices can explain both the persistence and change of current social institutions. We contribute to this literature by showing that major natural hazards can alter social and religious behavior of affected individuals, which, if persistent over the long run, may potentially trigger social institutional change.

The remainder of this paper is structured as follows. Section 2 discusses various economic channels through which natural disasters may be expected to affect individuals' social behavior. In particular, we focus on how natural disasters can have differential impacts on labor market outcomes, out-migration, and related mechanisms for immigrants and natives, thus presenting different constraints on social behavior for the two groups. Although theory offers crucial insights regarding potential linkages, it does not provide a

definitive prediction regarding the overall effect. This theoretical ambiguity thus renders this relationship an empirical matter. Section 3 discusses different sources of data used in the study and summarizes our chosen measures for empirical analysis. Section 4 describes econometric models and presents the results. Section 5 delves into the mechanisms outlined in the theoretical section. Section 6 addresses potential concerns regarding empirical analyses and Section 7 concludes.

2. Conceptual Framework

Natural disasters can impact individuals and households in a number of ways. The immediate effects are apparent. They cause physical destruction, claim lives, force people to migrate, and disrupt economic activities (Botzen et al., 2019). However, how these effects interact with one another to jointly affect the medium- to long- term well-being of the affected individuals and households is difficult to determine. The persistence of the effects of a disaster at the micro-level depends, first and foremost, on the magnitude of initial losses of lives and properties. But it also depends critically on the specific attributes of the affected communities themselves – including their shared histories as natives or immigrants and on their collective decisions (Berrebi et al., 2021).

In this section, we discuss ways in which natural disaster shocks might impact social behavior of individuals – focusing specifically on the differential impacts between immigrants and natives.

2.1. Effects through labor market mechanisms

An important potential channel through which natural disasters affect the social behavior of individuals is through their impact on their labor market outcomes (Shakya et al., 2022; Leoni and Boto-García, 2023; Kirchberger, 2017; Paudel, 2024; Belasen and Polachek, 2008, 2009). In the immediate aftermath of a major disaster, as residents invest time and effort to clear the debris, assist one another, rebuild, and take stock of the situation, we can expect a decline in labor force participation rates and earnings. Many firms and organizations are forced to temporarily shut down their operations due to physical damages and the lack of human resources (Meltzer et al., 2021; Zhou and Botzen, 2021). Infrastructural and property damages restrict the workers' ability to return to their jobs, even if some may be prepared and willing to work (Rafi et al., 2024). However, after the dust settles, the precise direction in which the labor market outcomes will change becomes less clear, as countervailing economic forces come into play.

On the one hand, natural disasters reduce labor supply, as they kill many working age individuals and force others to outmigrate (Efobi, 2022). Businesses may permanently shut down due to a decrease in demand for many consumer goods induced by population decline, further reducing the number of available jobs (Zhou and Botzen, 2021). On the other hand, able-bodied individuals may opt to increase their labor supply to replenish lost assets by working longer hours or taking on extra part-time jobs. The destruction caused by the disaster will increase labor demand in certain areas such as construction, fueled by reconstruction activities (Kirchberger, 2017). As immigrant workers tend to hold disproportionate number of construction jobs, we can expect their labor force participation to increase, especially on the intensive margin (How and Kerr, 2019). Other service sectors such as tourism and hospitality are likely to suffer the brunt of the shock, as disaster-prone areas attract fewer visitors, thus resulting in demand-induced job losses (Leoni and Boto-García, 2023). The net effect on labor market outcomes will depend on which of these countervailing forces dominate.

As households are forced to make labor adjustments in the aftermath of a disaster, it inevitably affects their social lives. Working-age adults who increase their labor force participation will have less time for socializing activities. Children's social lives can also suffer if their parents have to work longer hours or take up an extra job to replenish lost assets. Parents who work longer hours face greater time constraints and are thus less able to take their kids to social events and activities. On the other hand, if individuals lose their jobs or reduce labor force participation due to disaster-caused disabilities and other reasons, they will have more time available for non-labor activities including time for socializing. In that case, the size of the effect on social behavior will depend on their marginal rate of substitution between socialization and other activities.

Natives and immigrants face different labor market constraints (Chassamboulli et al., 2024; Abel, 2017). Undocumented immigrants have far less flexibility to choose employers and specific economic sectors than natives. Documented immigrants under temporary visas also face visa restrictions and sponsorship requirements that limit their ability to adjustment their labor market participation. They may simply be unable to leave their current employment, even in the case of severe disabilities. Moreover, because they are less likely to have social and familial ties that they can rely on for financial support, they may have to work longer hours and take extra jobs to cope with the financial challenges brought by the disaster. These differences in labor market constraints between immigrants and natives and the resulting differential impacts of disasters on labor outcomes of the two groups will have implications for their social lives.

2.2. *Effects through out-migration*

Another mechanism through which natural disasters influence social behavior includes the role of out-migration rates. Individuals participate in various social activities within their social networks. When disasters strike and force residents to out-migrate, their social networks get disrupted. Thus, disaster-induced out-migration can have the effect of disrupting one's day to day socializing.

The effects of natural disasters on out-migration are well-documented (Boustan et al., 2012; Hornbeck, 2012; Sheldon and Zhan, 2022). For example, Hornbeck (2012) finds that the Dust Bowl of the 1930s led to significant out-migration from areas that experienced high erosion to low-erosion areas. Similarly, Boustan et al. (2012) uses data from 1920 to 1940 to show that young men moved away from tornado-affected areas. Most recently, Boustan et al. (2020) analyze county-level natural disaster data from 1920 to 2010 and find that disasters increase out-migration rates. These results are not surprising. Natural disasters destroy people's homes and properties and force them to move elsewhere in search of new homes. Some move temporarily, but a significant proportion of the out-migrated population never return.

Households that out-migrate in response to a natural disaster shock are likely to experience disruptions in their existing social networks. However, their ability to out-migrate itself depends on their existing networks. Households fleeing post-disaster devastation are likely to move to a place where they have friends and relatives who they can rely on, at least until they decide on a more permanent location. The move forces them to reinvest significant efforts to strengthen their ties not only with their hosts but also with friends and neighbors they left behind. Both ethnographic and quantitative evidence suggests that they indeed do so in a number of ways. They build collective narratives of shared struggles and perseverance to rebuild and recover (Chamlee-Wright and Storr, 2011). They mobilize existing civic and religious organizations to organize collective action (Chamlee-Wright and Storr, 2009; Rayamajhee et al., 2022) . Thus, while disaster-induced out-migration disrupts some networks, they can also strengthen others.

The effects of natural disasters on out-migration rates are heterogeneous and are likely to vary based on the the affected households' economic circumstances and immigrant status (Sheldon and Zhan, 2022). Immigrants, having migrated from a foreign country before, are presumably more likely to migrate again in response to a disaster. However, the opposite may also be true. Establishing social networks in a new place is costly. Having overcome the costs once before, immigrants may be more reluctant to leave their new homes once again, only to restart. Moreover, they may lack the resources and social capital needed

to out-migrate. Both of these scenarios are plausible. Thus, the differential out-migration responses between immigrants and natives is ultimately a matter for empirical exploration.

If immigrants indeed face significant barriers to out-migrate relative to natives, – due to resource constrains and other reasons – they may not be able to avoid the brunt of the social network disruption. The sheer physical devastation brought forth by the disaster destroys physical social spaces and private homes, where residents participate in social activities. Alternatively, if they out-migrate at higher rates, their social lives will still be affected, but they also have other opportunities to strengthen existing social ties and form new ones.

2.3. Other psychological and social factors

Beyond the two mechanisms discussed above, natural disasters can affect the social behavior of individuals in a number of other ways. The loss from the disaster can have lasting mental health effects including higher incidences of post-traumatic stress disorder (PTSD), which can have implications for one's social behavior (Galea et al., 2005; Bertinelli et al., 2023). Individuals with PTSD are more likely to withdraw socially and reduce social participation (Etingen et al., 2018). On the other hand, disasters can induce a sense of solidarity and duty for others, which increases social engagement (Chamlee-Wright and Storr, 2011).

Another equally important factor that explains the extent to which the effects linger postdisater is the conduciveness of the institutional setting for post-disaster reconstruction and recovery processes (Andrabi and Das, 2017; De Juan et al., 2020; Paudel, 2022; Rayamajhee and Paniagua, 2021; Rayamajhee et al., 2021; Paniagua and Rayamajhee, 2022). Specifically, an institutional environment characterized by high levels trust and prosocial norms are more likely to stimulate postdisaster collective action needed for economic coordination and recovery than one where distrust is rampant (Rayamajhee and Bohara, 2021; Chamlee-Wright and Storr, 2011; Shahid et al., 2022).

While a large literature finds that social institutions are important for postdisaster recovery, this relationship can potentially cut both ways (Barone and Mocetti, 2014; Rayamajhee et al., 2024; Rayamajhee, 2020). At an individual level, surviving a major natural disaster can be life-altering in profound ways. One can expect such experience to change an individual's worldview, religiosity, and social predisposition broadly. At a collective level, it can generate shared narratives of experiencing and/or overcoming adversity together and increase a sense of solidarity (Chamlee-Wright and Storr, 2011). Crises can create conditions that force communities to pool their resources together, which can have the affect of enriching existing social relationships and generating new relationships (Storr et al., 2021). On the other hand, they can also have pernicious effects

of disrupting social cohesiveness and increasing social tensions. Major disasters often result in deaths and destruction, and force people to migrate, resulting in the depletion of social infrastructures and relationships (Wang and Ganapati, 2018).

Ultimately, theory alone cannot address the question of whether natural disasters impact the social behavior of individuals and, in particular, whether they affect immigrants and natives differently. Because social behavior is determined by many factors, – both economic and non-economic – it is beyond the purview of economic theory to provide a complete picture. Nonetheless, the mechanisms discussed above offer a compelling hypothesis that natural disasters are likely to disproportionately affect the social behavior of immigrants relative to natives. The remainder of this article focuses on an empirical examination of this relationship.

3. Data and Measures

3.1. American Time Use Survey (ATUS)

We use data from the American Time Use Survey (ATUS) for the years 2003 to 2021 to measure social behavior. The ATUS is conducted by the US Bureau of Labor Statistics (BLS) each year to gather detailed time diary data on a nationally representative sample of US residents. It is the only federal survey that collects detailed time diary data on the full range of nonmarket activities, including time allocated to social activities, volunteering, religious activities, and civic engagement activities. BLS selects ATUS respondents from the outgoing rotation group of the Current Population Survey (CPS), with some adjustments to ensure the sample is representative of the US population. ATUS sample can be linked to the CPS, which contains rich information on individual's demographic data including information regarding the respondents' citizenship status, county of birth, their parents' country of birth, and the year of emigration to the United States. This allows us to identify their immigration status and distinguish between first- and second-generation immigrants, and natives with native parents (henceforth natives). We define the first generation as respondents who are foreign-born and the second generation as those who are born in the US but have at least one foreign-born parent. The final sample includes of 228,455 observations, including 175,924 natives, 34,210 first-generation immigrants, and 18,321 second-generation immigrants.

Our primary interest is in social behavior – measured by time allocated for various social activities. Although work and other activities have social components, ATUS records time allocated for a specific activity as 'social' only if it is reported as a primary activity. For example, religious activity, would be considered a social activity only if it is reported as

a primary activity. However, this is unlikely, given ATUS asks information explicitly on religious activities. Thus, although our focus is on social activities, we report results for religious activities, volunteering, and civic engagement activities. Our dependent variables include four separate measures of social behavior: time spent a) socializing, b) religious activities, c) volunteering, and d) civic engagement activities. In addition, we analyze effects on e) total time spent on these four categories of activities.

Our measure of socializing activities includes activities such as socializing and communicating with others, attending or hosting parties, receptions, or ceremonies, attending meetings of personal interests (not volunteering), attending performing arts, museums, movies/film, gambling establishments with others, and waiting associated with the listed social activities; religious activities include religious and/or spiritual practices such as: attending or participating in religious practices, religious education activities, and waiting and security procedures associated with religious activities; volunteering includes a host of unpaid activities such as: administrative and support activities (e.g., computer use, telephone calls, fundraising), social service and care activities (e.g., food preparation, providing care, and leading counseling), indoor and outdoor maintenance, building and clean-up activities (e.g., building houses), participating in performance and cultural activities, attending meetings, conferences, and training related to volunteering activities, and public health and safety activities; civic engagement activities includes fulfilling civic obligations, and participating in civic engagement activities. Although work (both market and non-market) can involve socializing, our measures exclude any activities that respondents do not report as their primary activity.

Figures 1 (a)-(d) provide some motivation for this study by comparing time use patterns between natives and immigrants (first and second generations) from 2003 to 2021. We make two observations. First, there is a steady downward trend in time spent socializing for both natives and immigrants. Second, first-generation immigrants socialize less (Figure 1 (a)), volunteer less (Figure 1 (c)), and spend more time on religious activities (Figure 1 (b)) relative to natives, whereas the second generation socialize and volunteer more but spend less time on religious activities. Trends for civic engagement activities are less obvious (Figure 1 (d)). Although aggregate data mask underlying factors and demographic composition that can explain many of these differences, these figures paint a compelling picture that the social lives of immigrants deserve an in-depth investigation.

Table 1 provides mean values of the dependent variables used for our analyses for different samples. We focus mainly on socializing throughout the paper, but we present analyses for variables (b)-(d) because these activities often represent forms of socializing. It provides a comparison of mean values of time spent on the four social activities by immigration status.

Columns 1 includes the full sample, whereas columns 2-4 restrict the samples of natives, first-generation immigrants, and second-generation immigrants respectively. Column 5-8 present values for the sample of respondents who report as being employed: column 5 includes the full sample of employed individuals; columns 6,7 and 8 correspond to employed natives, and first- and second- generation immigrants respectively. We further divide the sample into separate panels for women (Panel A), men (Panel B), and both men and women (Panel C). Overall, data show large gaps in the social behavior of immigrants and natives. Across both full and employed-only samples, first-generation immigrants spend less time in socializing and volunteering activities, but spend more time in religious activities compared to natives. The 'socializing gap' is larger for women than men: employed immigrant women spend 33 minutes per day socializing compared to 41 minutes per day for employed native women. For men, the numbers are 35 and 39. The gap is less clear for civic engagement activities. Consistent with recent literature on immigrant assimilation for economic and other outcomes, second generation immigrants seem to catch up and even allocate more time on social activities relative to natives (Abramitzky et al., 2014, 2020). These measures, however, should be interpreted cautiously because various demographic and cohort-specific factors drive these differences. Regression-adjusted comparisons in the appendix reveal similar differences but are less stark and sensitive to model specifications.[1]

3.2. Spatial Hazard Events and Losses Database for the United States (SHELDUS)

We obtained disaster fatalities data from the Spatial Hazard Events and Losses Database for the United States (SHELDUS). SHELDUS compiles county-level hazard data covering natural hazards such as hurricanes, floods, wildfires, and tornadoes going back to 1960 from various sources such as National Centers for Environmental Information, U.S. Department of Agriculture, U.S. Census Bureau, Presidential Disaster Declaration (Open FEMA), and U.S. Geological Survey. The database was originally developed by the Hazards and Vulnerability Research Institute at the University of South Carolina and, since 2018, has been maintained and updated by the Arizona State University's Center for Emergency Management and Homeland Security. We obtain county-level annual information on disaster counts, fatalities, and property damage for 18 types of natural hazards from SHELDUS.

Table 1 summarizes natural hazards for the years 2003-2020.[2] We order eighteen hazard

[1] Regression-adjusted models control for demographic factors (variables: age, age squared, race/ethnicity, education dummies, number of children under 18) and state, survey day, survey month, and survey year fixed effects.

[2] Data for 2021 were unavailable at the time of this analysis.

types by total fatalities. Of the eighteen natural disaster types, heat led to most fatalities (1982), followed by flooding (1649), tornadoes (1413), and hurricanes (1222). Flooding led to most property damages (225 billion USD). These four hazard types constituted 17% of total events but led to 60% of all fatalities during the study period. Heat, coastal hazards, and hurricanes had the highest fatality per event of 1.59, 0.76, and 0.47 respectively. Figure 2 (a) plots annual county-level fatalities data for the years 1960 to 2020, all the years included in the SHELDUS data. Before 1990, average annual fatalities hovered around 600 fatalities per year, with notable spikes in 1972 and 1980 of around 1000 fatalities. Starting 1990, each decade experienced a high fatality peak of 1000 or more fatalities, indicating that high fatality natural hazard events are becoming more frequent.

Figure 2 (b) plots disaster fatality trends from 1960-2020 for the five U.S. counties with highest annual fatalities during any year. These counties are: i) Orleans, Louisiana (hurricane), Cook, Illinois (heat), Baltimore, Maryland (heat), Jasper, Missouri (tornado), and St. Bernard, Louisiana (hurricane). We are interested in understanding social behavioral change stemming from major natural disasters of the scale represented by the five peaks in Figure 2 (b). So, we create a measure of disaster severity using fatality counts above a threshold of 10 fatalities. In our preferred threshold, we define a natural disaster as "major" if it led to 10 or more deaths. Figure 3 shows the spatial distribution of cumulative disaster fatalities in U.S. counties during the years 2000-2020.[3] Darker (redder) counties had high fatality counts, whereas lighter (whiter) counties had low counts. Most high fatality counties (200 or more deaths) are concentrated along the coastlines on the Arctic Ocean, Atlantic, Ocean (including the Gulf of Mexico and the Gulf of Maine), and the Great Lakes coastline. Several smaller pockets of high fatality counties are scattered along the Tornado valley (Texas, Oklahoma, Kansas, and Nebraska). Midwestern US experienced the least disaster fatalities in the last two decades compared to rest of the US regions.

3.3. Current Population Survey (CPS)

We link the SHELDUS data with the Current Population Survey (CPS) for the years 2003-2019 to understand the mechanisms by which natural hazards influence social behavior. To examine labor market mechanisms, we obtain information on employment status and hours worked per week for immigrants and citizens from the CPS. We restricted the sample to exclude nonworking population. Our final CPS sample includes 12,173,939 individuals aged 15-64, of which 10,972,572 are citizens and 1,201,367 are immigrants. CPS

[3]Plot for 1960-2020 is provided in the appendix Figures A2.

also collects information on respondents' recent migration history. Because the data are collected retrospectively, this does not allow us to estimate the effects of natural disasters on migration. Nonetheless, we can use this information to estimate the relative propensities of immigrants and natives to move out of a county in response to a disaster.

4. Econometric Model and Results

4.1. The Effects of Major Disasters on Social Behavior

In this section, we examine how major natural disaster events affect the social behavior of individuals. To do so, we link the fatalities data at the county-year level from SHELDUS with the measures of social behavior and demographic information from ATUS. The final sample includes 78,554 observations, of which 53,945 are natives, 16,413 are first-generation immigrants, and 8,129 are second-generation immigrants.

For empirical estimation, we start with a parsimonious specification with basic controls (X) and fixed effects for day of week (δ_d), month(η_m), year (τ_y), county (μ_c) and state (θ_s). Our baseline empirical specification is:

$$Y_{idmycs} = \beta_0 + \beta_1 Disaster_{ycs} + \beta_2 X_i + \delta_d + \eta_m + \tau_y + \mu_c + \theta_s + \varepsilon_{idmycs} \tag{1}$$

where Y is a vector of variables for time spent on socializing, religious activities, volunteering, and civic engagement activities by individual i responding to the survey on day d of the week in month m of year y, and residing in county c of state s. Our main explanatory variable of interest is $Disaster$, which is an indicator for the occurrence of a major disaster (defined in Section 3.2) in a county in the given year. Our coefficient of interest β_1 compares individuals residing in counties that experienced a major disaster to those residing in counties that did not in a given year. In the parsimonious version of equation (1), X includes basic controls for the individual's age, age squared, sex, race dummies for Black, Asian, Hispanic, and Other, with Non-Hispanic White serving as the reference category, and five cohort dummies (by decade) with pre-1970 serving as the reference cohort. In the preferred specification, X also includes education levels for high school, some college, and college, number of children, and marital status, in addition to all the controls from the baseline specification. In all specifications, we include controls for day of week, month, year, and county fixed effects ($\delta_d, \eta_m, \tau_y, \mu_c$ and θ_s respectively). Finally, ε is the error term.

We first estimate equation 1 for the full sample. Panel A in Table 3 provides the estimates.

Subsequently, we estimate separate regressions for natives, first generation immigrants, and second-generation immigrants. Results for restricted samples are presented in Panels B, C, and D of Table 3. We adopt this sample restriction approach, because the relevant comparison group for first-generation immigrants is the group comprising of other first-generation immigrants residing in unaffected counties, and that for natives are other natives living in unaffected counties.

Odd columns (1, 3, 5, 7, and 9) present estimates for the baseline model, which includes only a partial set of controls, whereas even columns (2, 4, 6, 8, and 10) provide estimates for the preferred model specifications with full set of controls. For all social behavioral measures including the aggregate socialization measure except volunteering, we find a negative effect for both specifications that include or exclude additional controls including county and year fixed effects.

4.1.1. Overall Effects

Panel A displays results for the entire study sample: natives, first-generation and second-generation immigrants combined. Results illustrate that individuals residing in counties that affected by a major disaster during the given year spend significantly less time socializing with their peers relative to their counterparts who reside in counties not affected by a major disaster. They also spend less time in religious and civic engagement activities, but increase time allocated for volunteering activities. However, we note that only the estimates for socializing activities are statistically significant. On average, individuals residing in major disaster affected counties socialize 11 minutes less, spend 1.3 minutes less time in religious activities, 1.6 minutes more time in volunteering activities, and 0.63 minutes less in civic engagement activities per day. These estimates are consistent irrespective of our choice to include additional covariates described before.

4.1.2. Effects for natives and immigrants

Columns 1 and 2 in panels B, C, and D present the effects on the overall socialization measure for natives, first-generation immigrants, and second-generation immigrants separately. The estimate from our preferred model specification (column 2) in panel B shows a much smaller, positive, and statistically insignificant impact for natives. However, for first-generation immigrants, the effects are large and statistically significant (at the 99% confidence level). As shown in panel C, relative to their counterparts in unaffected counties, first-generation immigrants spend nearly 30 minutes less time in all four activities combined. Likewise, the effect for second-generation immigrants is also a nearly 30 minute

reduction per day, but it is imprecisely estimated. These estimates indicate that natural disasters disproportionately affect immigrants' overall social lives.

Columns 3 and 4 in panels B, C, and D focus on our main variable of interest: namely, time spent on social activities (reported as primary activity). Consistent with our findings for the overall socialization measure, we find that natural disasters disproportionately affect immigrants' social behavior. Although they also negatively impact natives, the effects are small (less than a minute per day) and not statistically significant, as shown in panel B. However, for both first and second generation immigrants (panels C and D), we find large and statistically significant effects. Relative to their counterparts in unaffected counties, first and second generation immigrants residing in disaster affected county reduce total time spent on social activities by roughly 27 and 28 minutes per day respectively.

Columns 5 and 6 in panels B, C, and D display results for time spent on religious activities for the three separate samples. We find a small, positive effect of roughly 1 minute for natives, and a larger, negative effect of about 4 minutes for first-generation immigrants. But these estimates are not statistically significant. For the second-generation immigrants, however, we find a much larger, negative, and statistically significant effect of 8.4 minutes, twice more than that for the first-generation immigrants.

We present results from the preferred specification for volunteering activities in column 8. For each distinct sample in panels B, C, and D, estimates are positive, indicating that natural disasters likely lead to an increase in volunteering efforts. We, however, note that none of the estimates are statistically significant and the estimates for first-generation immigrants are sensitive to model specifications, which gives us less confidence in this relationship. Nonetheless, the effect size for second-generation is sizeable (a 7 minute increase in volunteering activities per day), although estimated with less precision.

Finally, column 10 reports preferred model estimates for civic engagement activities. None of the estimates are statistically significant, indicating a weaker potential relationship for the samples under investigation.

4.1.3. Comparing effects for immigrants relative to natives

Having examined the effects on separate samples organized by immigrant status, we now compare the relative effects across groups. To do so, we run a regression for the aggregate socialization measure (referred to as *overall*) and each of the four separate outcomes with two interaction terms: one between the major disaster dummy and the first-generation immigrant dummy and another between the major disaster dummy and the second generation dummy (with natives as the omitted group). We adapt equation 1 to include interaction terms for disaster dummy and immigrant dummies (for first and second generation separately) to

derive an equation of the following form:

$$Y_{idmycs} = \alpha_0 + \alpha_1(Disas_{ycs} \times Immig1st_{idmycs}) + \alpha_2(Disas_{ycs} \times Immig2nd_{idmycs}) + \alpha_3 X_i + \delta_d + \eta_m + \tau_y + \mu_c + \theta_s + \varepsilon_{idmycs} \quad (2)$$

The coefficients of the interaction terms (α_1 and α_2) measure the differences between the effects of a disaster on the two groups and natives. This alternative approach allows us to take advantage of the statistical power provided by the larger sample size. Unlike the previous analyses where we compared natives (affected) with natives (unaffected), and immigrants (affected) with immigrants (unaffected), the comparison group for this analysis comprises of natives.

Table 4 presents regression results. For all five outcomes of interest, including the total time spent on activities of interest, we find that the coefficients for the interaction term corresponding to first-generation immigrant is negative. We find that, relative to natives, first-generation immigrants spend a total of 20 minutes less time per day in all four types of activities. Analyses for separate categories reveal that spend roughly 8 minutes less time socializing, 8 minutes less time in religious activities, 4 minutes less time volunteering, and 0.4 minutes less time in civic engagement activities. Although sizeable, estimates for socializing and civic engagement activities are imprecisely estimated. Similarly, second-generation immigrants spend approximately 36 minutes less time in all four activities: 32 minutes less time in socializing, 4 minutes less time volunteering, 0.6 minutes more time in volunteering, and 0.38 minutes less time in civic engagement activities. But the effects for the last three measures are not statistically significant. This suggests that the overall effects are mainly driven by effects on social activities (reported as primary activity).

4.2. Dynamic Effects of Natural Disasters

While our baseline regression results reveal insights on the impact of natural disasters on different social behavioral changes among immigrants and natives, they focus solely on the static contemporaneous effects. Considering that the repercussions of natural disasters may linger, it is important to delve into long-term dynamic effects of such shocks on behavioral changes. In an ideal setting, we would rely on an event study specification to evaluate how individual behavioral outcomes evolve over time across areas exposed to different levels of disaster intensities. Because it is not feasible to implement an event study specification in our context[4], we rely on two specific approaches to explore the long-term effects on outcomes

[4]We are not able to run event study specifications in this study because (i) we do not have information on exact date of natural disaster occurrence and our disaster data is available only at the year-county level,

of interest.

First, we enter additional leads and lags of major disaster indicator into our baseline regression as controls, from five years before until five years after. This allows us to observe whether past incidence of major natural disasters induce significant changes in behavioral outcomes. Figure 4 presents point estimates and 95% confidence intervals in relation to disaster-induced changes in overall time allocation for different sub-samples: all, natives only, first generation immigrants only, and second generation immigrants only. We do not observe a consistently uniform pattern, except for a major disaster from two years ago having a significant negative effect on overall time allocation for the entire sample (see Figure 4(a)). Additionally, Figure 4(b) indicates that a major disaster from a year ago results in a significant reduction in overall time allocation among second generation immigrants. Lack of statistical significance in the majority of lag terms highlights the importance of our baseline contemporanoues effects on behavioral outcomes reported in the preceding section. We repeat the same empirical exercise for each activity (socializing, religious activities, volunteering, and civic obligations) and find similar results reported in Figure 4.[5]

Second, we apply the long differences specification commonly used in the climate change econometrics literature to model county-level "changes" in behavioral outcomes over time as a function of long-term "changes" in disaster-related fatalities.[6] Table A6 (see appendix) presents the long difference estimates of disaster-induced changes in social behavior among all individuals in the sample. We find that an additional long-term changes in disaster-induced fatalities led to a 0.23-minute decrease in time spent socializing among individuals in the empirical sample. Similarly, coefficients for time spent in religious activities is positive and significant, as expected. Results from volunteering activities are negative and statistically significant. This is not surprising, since we reported inconsistent estimates for different fatality thresholds in Table 8. One way to reconcile this is that major disasters increase religiosity in the short run but have the opposite long-run effects. Individuals often find short term solace in religious activities but negative experiences can have the effect of depleting one's religiosity. Finally, similar to previous models, estimates for civic engagement are sensitive to model specification. The preferred model with state fixed effects does not show statistically significant relationship between disaster fatalities and civic engagement activities.

Overall, these findings from two approaches, unfortunately, do not provide us with a

(ii) we do not have access to a panel of individual-level behavioral outcomes across different time periods, and (ii) we do not focus on a single event of a large disaster unlike previous studies that take advantage of such settings (Deryugina et al., 2018; Deryugina and Molitor, 2020; Paudel, 2023c).

[5]These results are available from the authors upon request.

[6]For more details on the long differences approach, we refer the readers to Burke and Emerick (2016).

consistent picture in understanding the long-term dynamic effects of natural disasters. We also note that long difference estimates presented here need to be interpreted cautiously because our sample size for this specific approach is not big enough to estimate parameters of interest with statistical precision. We believe that future researchers may benefit from availability of detailed panel data on individual time diaries over a longer period of time to estimate both event study and long differences specifications.

5. Mechanisms

We now turn to potential mechanisms through which major disasters may affect the social behavior of individuals.

5.1. Labor Market Outcomes

Because the total time in a day is fixed, an increase in time allocated for one activity inevitably affects time available for other activities. Thus, we can expect that major disasters' effects on time spent on social activities to be affected by their impacts on their labor market outcomes. We examine this using the Current Population Survey (CPS) data for the years 2003-2019, which provides two key variables we analyze in this section: respondents' employment status and hours worked per week. The former lets us analyze how disasters can affect individuals' labor market participation on the extensive margin. It allows us to estimate the likelihood of obtaining a job (or of losing one), thus shrinking (or expanding) the time available for other activities including socializing, volunteering and religious activities. The latter allows us to examine the labor market effects of major disasters on the intensive margin. This helps us estimate how major disasters impacts respondents' hours worked per week, which would also affect their social behavior similarly.

To examine the effects of major disasters on labor market outcomes, we estimate the empirical model of the following form:

$$L_{iycs} = \beta_0 + \beta_1 Disaster_{ycs} + \beta_2 X_i + \delta_d + \eta_m + \tau_y + \mu_c + \varepsilon_{idmycs} \tag{3}$$

where L represents the two dependent variables we are interested in: (1) employment status, and (2) hours worked per week by individual i residing in county c of state s in year y. $Disaster$ is defined the same as in equation (1), equaling to one for counties with fatality threshold of 10 or more. Vector X includes a set of individual controls: sex, age, marital status, dummies for race, education level dummies, and income. The vectors μ_c and τ_y control for county and year fixed effects, respectively. We cluster standard errors at the

state level.

Table 5 reports the effects of natural disasters on the employment status of respondents. Columns 1-2 provide estimates for the overall sample, 3-4 for citizens, and 5-6 for immigrants, respectively. Odd-numbered columns display results for our baseline model, which includes county and year fixed effects but excludes controls. Even-numbered columns provide estimates from our preferred specification, which includes all individual covariates and fixed effects for county and year.

For the full sample (both immigrants and natives), results from both models (columns 1 and 2) indicate that individuals residing in counties experiencing a major disaster are less likely to report being employed relative to their counterparts in unaffected counties. Our preferred estimate shows that experiencing a major disaster decreases the likelihood of being employed for by 0.9%. For the sample comprising of citizens only, we find this effect to be stronger – a decrease in the likelihood of being employed by 1.5%, significant at the 99^{th} percentile confidence level. For immigrants, however, the effects are positive and statistically significant at the 95^{th} percentile confidence level. Estimate displayed in column (6) indicates that immigrants residing in disaster-affected counties are 1.4% more likely to be employed than their counterparts in non-affected counties.

Next, we turn our attention to Table 6, which provides estimates for the effects of major disasters on one's hours worked per week. The econometric model we use for this task is identical to that for employment status with one obvious change: we switch the dependent variable to hours worked per week. We expect the findings to complement those provided in Table 5. Results are organized similarly as before: Odd-numbered columns exclude covariates, even-numbered include them and are our preferred specifications. Similarly, columns 1-2 provide estimates are for the overall sample, 3-4 for citizens, and 5-6 for immigrants, respectively.

Our results from the preferred specification for the full sample suggest that those who are employed tend to reduce hours per week dedicated to work in affected counties. The estimated effect is an average reduction of 0.32 hours of work per week, but it is imprecisely estimated. Although the overall effects are negative, we find a significant heterogeneity based on the individuals' immigrant status. Citizens affected by a major disaster respond by decreasing the number of hours worked per week by 0.49 hours. For immigrants, the effects are positive, although not statistically significant. A possible explanation is that less skilled non-citizens are more likely and willing to find jobs in the construction sector in the aftermath of a disaster, as reconstruction efforts generate new jobs that typically recruit significant undocumented individuals, which can offset the hours lost due to disaster-induced reduction in business activities. On the labor demand side, non-citizens are less likely to

receive public assistance and have lower levels of social support to replenish lost assets than citizens.

Overall, citizens respond to natural disasters by reducing labor force participation both on the intensive and extensive margins, whereas non-citizens respond by increasing entry to labor market and hours worked per week, although the latter is imprecisely estimated. We, therefore, conclude that natural disasters affect the social lives of non-citizens more severely than their native counterparts through the channel of labor force participation. However, it is worth noting that the bulk of the effect on labor supply could come from workers having to cope with the consequences of the disasters or moving away from the affected areas. Next, we examine the role of out-migration as a mechanism linking natural disasters and social behavior.

5.2. Out-migration

Current Population Survey (CPS) reports information on respondents' recent migration history, specifically regarding whether they moved out of their former county-of-residence during the past year. Although this does not allow us to tease out the effects of disasters on migration, we are able to compare the relative propensities to out-migrate between immigrants and natives to out-migrate.

Table 7 presents regression-adjusted estimates of the relative propensity of first and second generation immigrants to move to a different county, state, or country. We find that both the first-and second- generation immigrants are less likely to have moved in the past year relative to natives (the omitted category). Our estimates indicate that first-generation immigrants are, compared to natives, 1.6% to 2% less likely to out-migrate, controlling for individual covariates, and county and state fixed effects. Similarly, second-generation immigrants are 1.1% to 2% less likely to out-migrate, compared to their native counterparts.

These estimates provide some confirmation that immigrants do indeed face higher levels of barriers to out-migrate following a disaster. This can be due to resource constraints and other factors such as lower social support and political capital.

6. Addressing Potential Concerns

We made a number of choices in our analyses regarding sample restrictions and thresholds for what constitutes a "major" disaster. Many such choices an applied researcher makes can affect their findings (Huntington-Klein et al., 2021). In this section, we address some of these concerns that could potentially influence our results.

6.1. Alternative Samples, Variables, and Fatality Thresholds

This study focuses on major disasters because the type of social change that we are interested in requires a major societal upheaval, or so we assume. Previous studies, particularly qualitative ones and/or case studies on post-disaster recovery, have shown that informal, socially embedded institutions have higher adaptability than formal institutions and are thus more able to restructure themselves without undergoing severe depletion (Rayamajhee and Bohara, 2021; Storr et al., 2015; Storr and Haeffele-Balch, 2012). Some studies have shown that experience with disasters can increase social connectivity, measured by the number of associations one participates in (for example, see Lee and Fraser (2019)). However, many of these findings are based on limited sample studies or focus on a narrow set of cases. Thus, it is crucial to also consider how lower fatality thresholds would affect social behavioral outcomes for a larger, nationally representative sample.

In this section, we discuss how alternative variable and fatality thresholds may affect our results. First, instead of using the fatality thresholds, we consider number of disaster-induced fatalities as the main independent variable of interest. Because fatality thresholds are critical for social behavioral change, this is not a preferred approach. Next, we proceed to examine the sensitivity of our results to alternative fatality thresholds. A reasonable suspicion would be that lower fatality disasters will have no effect or smaller effects relative to our preferred threshold. To examine this, we estimate equation (1) with alternative fatality thresholds with different samples. Table 8 summarizes results from 128 separate regressions. Each coefficient corresponds to a separate empirical estimation.

The first rows for each panel (A-D) show the effects of fatality count on the four dependent variables of interest. For the full sample, we find that an additional fatality count decreases average time spent in socializing by 0.15 minutes. However, because we suspect that the number of fatalities have nonlinear effects, we caution our readers not to generalize or emphasize effect sizes from these estimates. That said, for all four samples, the estimated effects of fatality counts on time spent socializing are negative and statistically significant, consistent with our main findings. Similar to our baseline results, we find the effects to be more severe for immigrants than natives. Estimates corresponding to religious activities remain positive and significant as well. The direction of effects on volunteering also remains consistent throughout all samples, but we lose statistical significance for the full sample and natives only sample; effects for first generation immigrants are positive and significant, whereas that for second generation immigrants are negative and significant. Finally, estimates for civic engagement activities are not

statistically significant across all panels.

Rows 2-8 provide estimates using different fatality thresholds to create our major disaster dummy. Results across all panels (A-D) confirm our suspicion that lower fatality thresholds could generally result in lower effect sizes and lower likelihood of obtaining statistically significant effects. We find no significant effects on time spent socializing when we choose a zero-fatality threshold for full, native only, and second-generation only samples. For first-generation immigrants, we find positive effects, but the magnitude is much smaller. For each threshold of 10 fatalities or higher, results are consistently negative for all groups, thus confirming that major disasters lead to a decrease in time spent socializing for all groups. Once again, the effects are more severe (larger) for first-generation immigrants, followed by second- generation immigrants, then natives, regardless of the choice of thresholds.

Similarly, estimates for religious activities (column (2)) from rows 2-8 show consistent findings. For the full sample, when lower fatality thresholds are chosen, the effect sizes are generally smaller and/or not statistically significant, except for the 25-fatality-threshold which gives us a statistically significant (at the 90^{th} percent confidence interval) effect of 4 minutes per day. This effect is smaller than the preferred threshold. Results for the native only sample show identical patterns, but the effect sizes vary slightly. Again, consistent with our prior reporting, we do not find compatible results on the immigrants only sample. For four of seven thresholds, we find statistically significant effects but not for others, including for the chosen threshold. For second-generation immigrants, we find smaller, negative and statistically significant effects for all nonzero fatality thresholds.

We present the results for time spent in volunteering activities in column (3) for all samples. For the full sample, when low fatality thresholds (including zero) are selected, estimates are not statistically significant, whereas for 100 or more fatality thresholds, we find statistically significant and positive effects. Same pattern holds for first-generation immigrants, but the effects are several times larger. Results for second-generation immigrants are negative, but not consistently significant. Finally, findings for civic engagement are noisy and sensitive to choices of thresholds and sample used.

In addition to the above analyses, we modified the baseline specification by replacing the single disaster indicator with two indicators – one for 'small' disasters (indicating disasters that lead to nonzero but less than 10 fatalities) and another for 'large' disasters (indicating disasters that lead to 10 or more fatalities), with 0 fatalities serving as the reference category. The effects for 'small' disasters are small and not statistically significant, whereas those for 'large' disasters are similar in magnitude and statistical significance to the baseline specification.[7]

[7]We omit the results from the manuscript to avoid redundancy.

Overall, these results lead us to conclude that the social effects of major disasters are more severe for immigrants than for natives. This conclusion holds regardless of the threshold chosen to define a disaster as "major." However, as we expected, the choice of the fatality threshold matters when quantifying the effects: low fatality threshold shocks have smaller and less significant effects precisely because they are a less major disaster.

6.2. Measurement error

Our analysis remains vulnerable to measurement error. Because our disaster data are annual, we cannot distinguish between the disasters that occurred earlier during the year versus those that occurred later. Thus, the net effects could be underestimates of the true effects insofar as they pick up effects prior to the event. This is not entirely fixable, given the data that we have. Nonetheless, we can examine whether the effects would be different for the respondents surveyed later during the year compared to those surveyed earlier. This would allow us to gauge the extent to which the measurement error could be problematic. We do so by interacting a dummy for the later-surveyed respondents (defined as those surveyed during the second half of the year) with the major disaster indicator and replacing the disaster indicator from the baseline model. Table 9 presents the results.

Our main narrative holds under this examination. Estimates presented in Table 9 confirm that the effects are indeed more severe for the overall population. Compared to estimates from our main analysis on the full sample (Table 3), we find that the (negative) effect on time spent socializing is 5.5 minutes more severe (-16.23 minutes versus -10.72 minutes) if the respondents were surveyed later during the year. This is also true for the natives-only sample (-13.06 versus -0.92 minutes), although the effects are not statistically significant in either case. For the immigrant-only sample, estimates are close in both magnitude and precision (-24.2 versus -26.79 minutes, at 99^{th} percentile confidence level).

Similar pattern emerges when we examine the effects on the *overall* socialization measure. The effects for the full sample increase from -11.60 (not statistically significant) to -20.97 minutes (statistically significant). For the native only sample, it changes from 1.7 to -13.6 minutes, although the estimates are not statistically significant in either case. For the immigrant-only sample, they increase from -29.75 to -31.21 minutes (statistically significant in both cases).

While we cannot rule out measurement error, these analyses provide strong support for our central finding that the effects of major disasters are more severe on immigrants than on their native counterparts.

7. Conclusion

Throughout the paper, we focused on the social behavior of immigrants and the differential impacts of major natural disasters on their social lives. We showed that that first-generation immigrants spend less time socializing relative to their native counterparts. They also tend to volunteer less and spend less time in civic engagement but spend more time in religious activities. These differences are understandable, as immigrants have not had enough time to develop deep social ties and rich social networks within their new communities. Then, we analyze how major natural disasters, defined as those leading to high fatalities, affect the social behavior of immigrants. Indeed, we find that that such large shocks disproportionately affect immigrant households. Although major disasters affect everyone, the effects on immigrants' social lives are far more severe compared to their effects on natives.

The paper also provides evidence on two important mechanisms to explain the differential impacts on immigrants and natives. We show that citizens reduce their labor market participation to cope with the disaster shock. They do so both on the intensive and extensive margins – by reducing both their labor market participation rates and number of hours worked. On the other hand, immigrants respond quite differently. They enter labor market at a higher rate and also increase the number of hours worked per week. We argue that these differential responses may be due to differences in levels of labor market freedoms for the two groups. Both documented and undocumented immigrants face significant hurdles to change jobs, move, or temporarily stop working due to legal restrictions. We also compare the relative propensity of immigrants to outmigrate relative to natives. Findings suggest that immigrants may face more barriers to outmigrate following a major disaster compared to natives.

Lastly, we want to highlight a core limitation of this study. We focus on social behavior using time diary data because it offers relatively tangible measures of socialization outside of an experimental setting. The advantage in doing so is that it lets us examine the relationship on a nationally representative sample. The downside is that we cannot measure if immigrants' socialization (measured using time diary data) directly relates to assimilation or native- immigrant interaction – although we plausibly assume that our socialization measure is positively correlated with native-immigrant exchange. Moreover, the focus of this paper is on social behavioral change, which does not sufficiently capture underlying social norms or social cohesion level. We rely on quantifiable behavioral measures, rather than stated attitudes and beliefs because persistent cultural changes are difficult to observe using available attitudinal and values data. Individuals can quickly

adapt to 'new normal' following a major cultural shift, so most of the observable changes tend to be related to short-term attitudes rather than persistent, fundamental change in norms and beliefs (Kiley and Vaisey, 2020). Thus, while our study may have some implications for the link between major disasters and social institutional change, the details and mechanisms of change are areas we leave aside for future research. Finally, we acknowledge that ecological fallacy may arise when measuring the relationship between county-level incidence of major natural disasters and individual-level behavioral outcomes. As detailed micro-level data on disasters becomes available in the near future, future research may benefit from mitigating potential bias from ecological fallacy.

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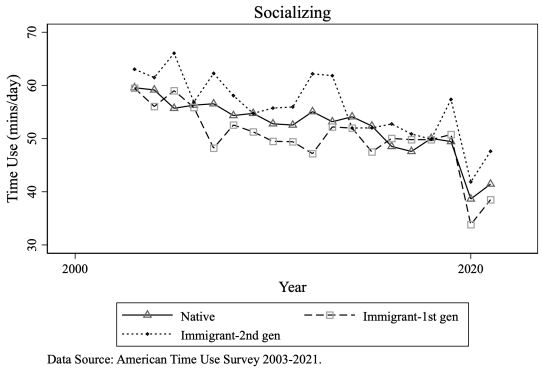
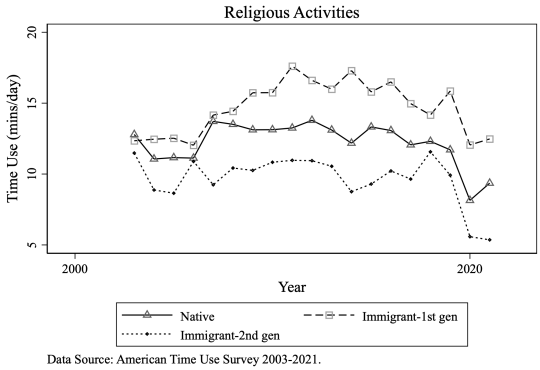
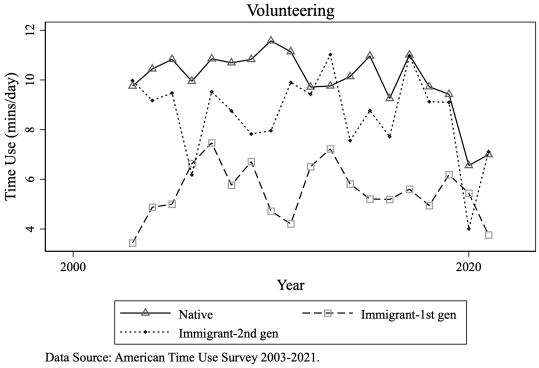


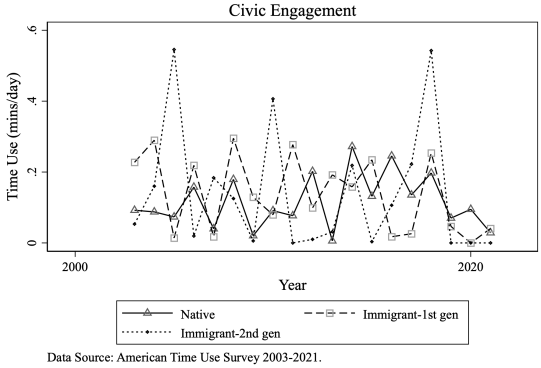
(a) Social activities



(b) Religious activities

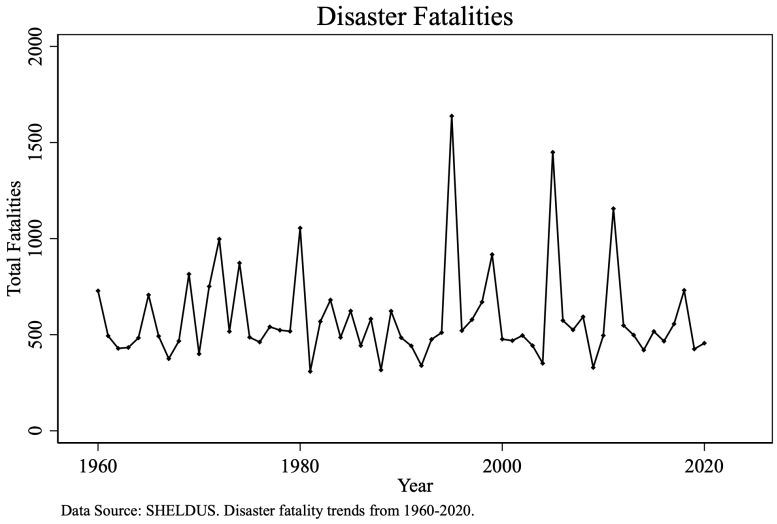


(c) Volunteering activities

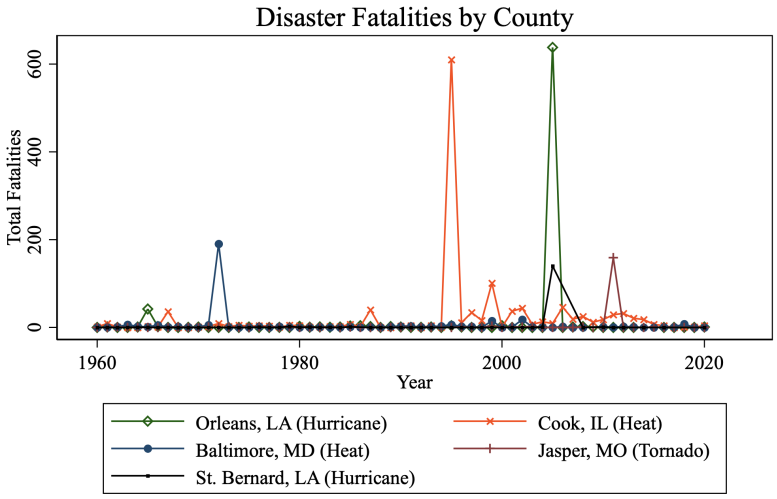


(d) Civic engagement activities

Figure 1: Daily time spent on different activities, 2003-2021.



(a) Disaster Fatalities



(b) Disaster Fatalities by County (five counties with highest fatality events, 1960-2020)

Figure 2: Temporal variation in disaster fatalities, 1960-2021

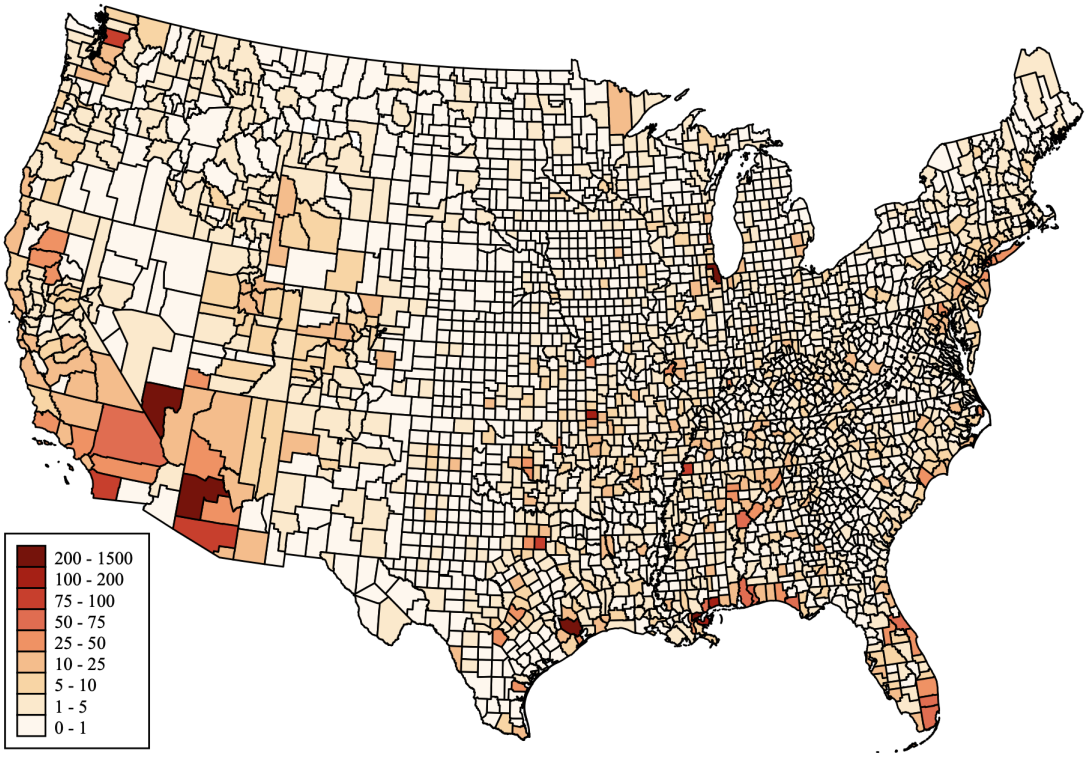
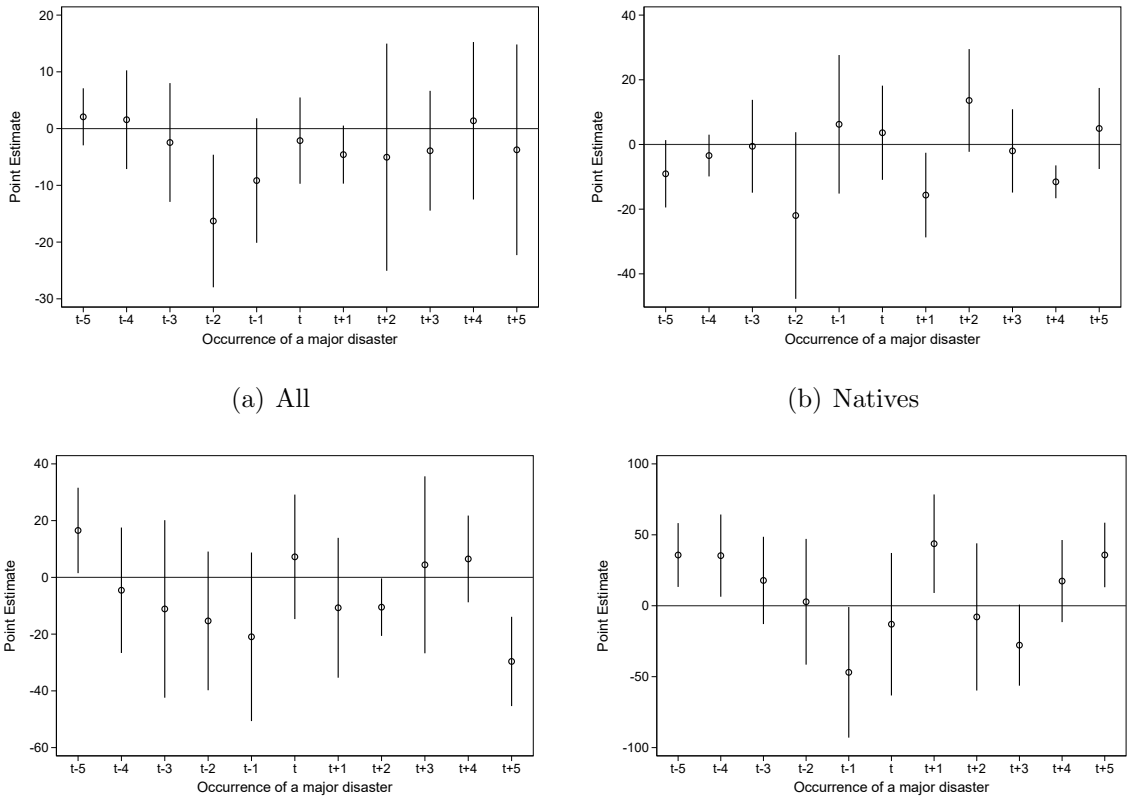


Figure 3: Disaster fatalities in US counties, 2000-2020



(a) All

(b) Natives

(c) First Generation

(d) Second Generation

Figure 4: Dynamic effects of major natural disasters on total time allocated to all activities combined (socializing, religious and spiritual, volunteering and civic obligations).

Table 1: Time Spent Socializing, Religious Activities, and Volunteering by Employment and Immigrant Status (minutes per day)

	All (1)	Natives with Native Parents (2)	Immigrants (3)	Second-Generation Immigrants (4)	All (5)	Natives with Native Parents (6)	Immigrants (7)	Second-Generation Immigrants (8)
I. All					**II. Employed Only**			
Panel A. Women								
Socializing	43.25	43.98	37.78	47.59	40.16	41.13	32.80	46.31
Religious Activities	9.03	8.53	12.65	6.31	6.47	6.00	9.71	4.11
Volunteering	7.76	8.71	4.58	5.86	6.56	7.28	3.95	5.30
Civic Engagement	.06	.07	.03	.08	.10	.10	.05	.15
N	127,664	98,866	18,797	10,001	69,785	54,995	9,901	4,889
Panel B. Men								
Socializing	38.34	38.19	37.30	41.31	37.98	38.68	34.89	39.73
Religious Activities	6.01	5.50	9.25	3.75	5.29	4.82	7.84	3.07
Volunteering	6.27	6.60	4.58	7.00	4.95	5.26	4.21	4.28
Civic Engagement	.12	.11	.14	.17	.14	.11	.19	.28
N	100,791	77,058	15,413	8,320	67,987	51,363	11,802	4,822
Panel C. Both Men and Women								
Socializing	40.87	41.22	37.54	44.35	39.01	39.88	34.03	42.64
Religious Activities	7.57	7.09	10.95	4.99	5.84	5.39	8.61	3.53
Volunteering	7.04	7.70	4.58	6.45	5.71	6.25	4.10	4.73
Civic Engagement	.09	.09	.09	.12	.12	.10	.13	.23
N	228,455	175,924	34,210	18,321	137,772	106,358	21,703	9,711

Notes: Data come from the American Time Use Survey (ATUS) from waves 2003-2021. Data are nationally representative and weighted using ATUS sampling weights to ensure so that each year receives the same weight. Variables are measured in minutes per day.

Table 2: Summary of Natural Hazards 2003-2021

	(1) **Hazard count**	(2) **% of total**	(3) **Fatalities**	(4) **Fatality /event**	(5) **Property Damage (millions)**	(6) **PD (million) /event**
Heat	1248	0.53	1982	1.59	36	0.03
Flooding	26859	11.33	1649	.06	225985	8.41
Tornado	10354	4.37	1413	.14	35797	3.46
Hurricane/Tropical storm	2606	1.10	1222	.47	184766	70.90
Coastal	1376	0.58	1048	.76	372	0.27
Wind	88702	37.43	933	.01	22352	0.25
Winter weather	12132	5.12	613	.05	10034	0.83
Lightning	8089	3.41	546	.07	847	0.10
Wildfire	2079	0.88	331	.16	32190	15.48
Severe Storm/Thunderstorm	66959	28.26	294	.00	4985	0.07
Avalance	928	0.39	279	.30	10	0.01
Landslide	963	0.41	192	.20	1657	1.72
Fog	234	0.10	14	.06	34	0.15
Earthquake	104	0.04	11	.10	2192	21.08
Hail	10772	4.55	3	.00	26029	2.42
Volcano	8	0.00	2	.25	16	2.01
Tsunami/Seiche	56	0.02	1	.02	81	1.45
Drought	3492	1.47	0	.00	2704	0.77
Total	236961	100.00	10533	.04	550088	2.32

Notes: Column (1) shows the total hazard count at the county-level for the specific hazard type covering the duration of the study period 2003-2021. If an event affects multiple counties, it is counted for all affected counties, but the damages (columns (5) and (6)) and fatalities (columns (3) and (4)) correspond to the effects at specific counties. Property damage (columns (5) and (6)) are in millions (US dollars). Hazards are ordered is ascending order according to total fatality counts. Data source: SHELDUS.

Table 3: Effects of Natural Disasters on Social Behavior

	(1) Overall	(2) Overall	(3) Social	(4) Social	(5) Relig	(6) Relig	(7) Volun	(8) Volun	(9) Civic	(10) Civic
Panel A: All										
Major Disaster	-13.001	-11.064	-10.603***	-10.728***	-2.056	-1.291	0.267	1.581	-0.609	-0.625
	(10.104)	(8.179)	(3.173)	(2.431)	(3.815)	(3.388)	(4.198)	(3.691)	(0.582)	(0.600)
N	78554	78545	78554	78545	78554	78545	78554	78545	78554	78545
Mean	74.12	74.12	52.79	52.79	12.06	12.06	9.14	9.14	0.13	0.13
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Panel B: Natives										
Major Disaster	1.119	1.720	-0.441	-0.925	0.827	1.255	1.738	2.420	-1.005	-1.031
	(10.724)	(10.914)	(4.945)	(5.116)	(2.777)	(2.888)	(5.287)	(5.281)	(1.098)	(1.102)
N	53945	53943	53945	53943	53945	53943	53945	53943	53945	53943
Mean	74.64	74.64	52.80	52.79	11.28	11.28	10.42	10.42	0.14	0.14
	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
Panel C: Immigrants-1st generation										
Major Disaster	-33.194***	-29.759***	-25.695***	-26.798***	-4.989	-3.960	-2.729	0.688	0.219	0.311
	(4.149)	(2.243)	(6.044)	(7.304)	(4.720)	(3.318)	(4.698)	(3.569)	(0.237)	(0.302)
N	16413	16405	16413	16405	16413	16405	16413	16405	16413	16405
Mean	71.41	71.43	50.44	50.45	15.57	15.57	5.28	5.28	0.13	0.13
	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
Panel D: Immigrants-2nd generation										
Major Disaster	-25.498	-29.683	-22.325**	-28.374**	-9.385***	-8.352***	6.214	7.045	-0.002	-0.002
	(18.994)	(20.351)	(10.934)	(12.044)	(2.175)	(2.029)	(10.548)	(11.015)	(0.001)	(0.002)
N	8129	8129	8129	8129	8129	8129	8129	8129	8129	8129
Mean	75.95	75.95	57.55	57.55	10.03	10.03	8.28	8.28	0.09	0.09
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Time use data come from the 2003-2020 waves of the ATUS. Disaster data come from SHELDUS. The unit of observation is at the ATUS respondent level. Dependent variables are measured in minutes per day. The variable of interest is *Major Disaster*, which indicates occurrence of a disaster causing 10 or more fatalities in a county in the given year. Basic controls include individual's age, age squared, sex, four race dummies (white as reference) and five cohort dummies (by decade, pre-1970 as reference). All specifications control for day of week, month, year, and state fixed effects. Preferred specification (even-numbered columns) include additional controls for: education (three dummies), number of children, and marital status. Data are weighted using ATUS sampling weights. Std errors (in parentheses) are clustered at the state level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4: Effects of Natural Disasters on Social Behavior by Immigrant Status

	(1) Overall	(2) Social	(3) Relig	(4) Volun	(5) Civic
Disaster × Immigrant-1st	-19.949**	-7.950	-7.843***	-3.747	-0.408
	(9.532)	(6.419)	(2.150)	(2.523)	(0.340)
Disaster × Immigrant-2nd	-35.788***	-32.296***	-3.734	0.622	-0.379
	(7.041)	(3.708)	(2.898)	(7.130)	(0.244)
N	78554	78554	78554	78554	78554
Mean	74.12	52.79	12.06	9.14	0.13
Controls	Yes	Yes	Yes	Yes	Yes
County fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Effects of Natural Disasters on Labor Market Outcomes: Employment Status

	(1)	(2)	(3)	(4)	(5)	(6)
	All	All	Citizens	Citizens	Non-citizens	Non-citizens
Major Disaster	-0.008**	-0.009**	-0.014**	-0.015***	0.007*	0.014**
	(0.004)	(0.003)	(0.006)	(0.005)	(0.004)	(0.007)
Observations	637066	637066	503799	503799	69249	69249
Controls	No	Yes	No	Yes	No	Yes
County fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 6: Effects of Natural Disasters on Labor Market Outcomes: Hours Worked Per Week

	(1) All	(2) All	(3) Citizens	(4) Citizens	(5) Non-citizens	(6) Non-citizens
Major Disaster	-0.308	-0.321	-0.445**	-0.488**	0.111	0.171
	(0.329)	(0.315)	(0.216)	(0.202)	(0.497)	(0.490)
Observations	419630	419630	331170	331170	43759	43759
Controls	No	Yes	No	Yes	No	Yes
County fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Relationship between Immigrant status and Propensity to Outmigrate (regression-adjusted)

	(1)	(2)	(3)
	migrated	migrated	migrated
Immigrant-1st gen	-0.020***	-0.020***	-0.016***
	(0.003)	(0.003)	(0.006)
Immigrant-2nd gen	-0.020***	-0.019***	-0.011***
	(0.005)	(0.005)	(0.004)
Observations	1354298	1354298	1354298
Controls	Yes	Yes	Yes
County fixed effects	No	Yes	Yes
Time fixed effects	No	No	Yes

Table 8: Alternative Fatality Thresholds

Panel A: All (N=78,555)					**Panel B: Natives with Native Parents Only (N=53,946)**			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
VARIABLES	Socializing	Religious Activities	Volunteering	Civic Engagement	Socializing	Religious Activities	Volunteering	Civic Engagement
Fatalities	-0.152***	0.0315**	0.0209	-0.00442	-0.0984*	0.0483***	0.0139	-0.00524
	(0.0393)	(0.0130)	(0.0322)	(0.00466)	(0.0555)	(0.0168)	(0.0364)	(0.00697)
Alternative Fatality Thresholds								
No Fatality	-0.607	0.821	-0.327	-0.0647	-2.014	1.060	-0.252	0.0144
	-2.093	-0.698	-1.594	-0.0773	(2.582)	(1.033)	(1.795)	(0.0841)
10 fatalities	-12.57***	-0.635	0.951	-0.548	-4.179	1.76	-0.0184	-0.843
	(2.351)	(2.643)	(3.319)	(0.494)	-3.867	-2.249	-5.25	-0.882
25 fatalities	-9.950	4.063*	-0.488	-0.707	-3.477	5.516*	-2.144	-0.827
	(11.51)	(2.030)	(5.005)	(0.497)	(13.19)	(3.126)	(5.603)	(0.797)
50 fatalities	-11.66	3.651	1.060	-0.777	-5.186	5.055	-0.731	-1.020
	(13.24)	(2.374)	(5.535)	(0.601)	(15.72)	(3.847)	(6.568)	(1.007)
75 fatalities	-25.79***	3.018	0.869	-0.482	-25.63***	4.778	-0.589	-0.525
	(1.509)	(2.997)	(5.953)	(0.355)	(4.535)	(4.249)	(6.874)	(0.581)
100 fatalities	-26.62***	6.136***	7.247***	-0.0999	-22.26***	8.885***	6.317***	0.0643
	(2.078)	(0.587)	(1.311)	(0.136)	(2.402)	(0.888)	(1.250)	(0.0707)
150 fatalities	-26.62***	6.136***	7.247***	-0.0999	-22.26***	8.885***	6.317***	0.0643
	(2.078)	(0.587)	(1.311)	(0.136)	(2.402)	(0.888)	(1.250)	(0.0707)

	Panel C: First-gen Immigrants Only (N=16,445)				Panel D: Second-gen Immigrants Only (N=8,164)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
VARIABLES	Socializing	Religious Activities	Volunteering	Civic Engagement	Socializing	Religious Activities	Volunteering	Civic Engagement
Fatalities	-0.330***	0.0167	0.0921**	-0.00150	-0.202**	-0.0277**	-0.0436*	5.60e-07
	(0.0581)	(0.0243)	(0.0350)	(0.00212)	(0.0776)	(0.0134)	(0.0255)	(4.71e-06)
Alternative Fatality Thresholds								
No Fatality	6.434*	0.532	-1.295	-0.342	-3.393	-1.103	1.003	0.000829
	(3.486)	(1.589)	(1.738)	(0.302)	(7.272)	(1.173)	(2.014)	(0.000838)
10 fatalities	-27.31***	-5.056*	0.765	0.0213	-26.16***	-4.174*	7.934	-0.000937
	(5.950)	(2.590)	(2.369)	(0.0781)	(8.036)	(2.460)	(9.774)	(0.000757)
25 fatalities	-20.46	4.685*	9.762	-0.287	-32.55***	-4.376**	-7.070*	-0.000382
	(15.76)	(2.485)	(7.113)	(0.258)	(6.414)	(1.733)	(3.899)	(0.00105)
50 fatalities	-20.39	4.694*	9.763	-0.288	-33.47***	-3.645**	-6.063	0.00154
	(15.84)	(2.490)	(7.127)	(0.259)	(7.709)	(1.503)	(3.753)	(0.00110)
75 fatalities	-26.63**	2.926*	9.147	-0.142	-28.13***	-4.494**	-6.073*	0.00146
	(11.90)	(1.489)	(7.730)	(0.198)	(7.687)	(1.731)	(3.525)	(0.000997)
100 fatalities	-42.08***	1.886	19.92***	-0.334	-29.82***	-3.883**	-4.876	0.00120*
	(4.714)	(2.074)	(1.898)	(0.342)	(10.80)	(1.682)	(4.559)	(0.000675)
150 fatalities	-42.08***	1.886	19.92***	-0.334	-29.82***	-3.883**	-4.876	0.00120*
	(4.714)	(2.074)	(1.898)	(0.342)	(10.80)	(1.682)	(4.559)	(0.000675)

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Effects of Natural Disasters on Social Behavior - Later Surveyed

	(1) Overall	(2) Social	(3) Relig	(4) Volun	(5) Civic
Panel A: All					
Surveyed Later × Disaster	-20.976*	-16.233***	-2.568	-1.868	-0.307
	(11.503)	(6.008)	(2.123)	(4.550)	(0.354)
N	78545	78545	78545	78545	78545
Mean	74.12	52.79	12.06	9.14	0.13
	(1)	(2)	(3)	(4)	(5)
Panel B: Natives					
Surveyed Later × Disaster	-13.605	-13.065	-2.507**	2.588	-0.621
	(14.215)	(7.826)	(1.210)	(5.744)	(0.604)
N	53943	53943	53943	53943	53943
Mean	74.64	52.79	11.28	10.42	0.14
	(1)	(2)	(3)	(4)	(5)
Panel C: Immigrants-1st generation					
Surveyed Later × Disaster	-31.211***	-24.202***	-2.002	-5.678*	0.670
	(4.244)	(3.597)	(3.345)	(2.938)	(0.511)
N	16405	16405	16405	16405	16405
Mean	71.43	50.45	15.57	5.28	0.13
	(1)	(2)	(3)	(4)	(5)
Panel D: Immigrants-2nd generation					
Surveyed Later × Disaster	-23.881***	-10.969	-1.732	-11.179**	-0.002
	(7.760)	(12.079)	(2.526)	(4.606)	(0.002)
N	8129	8129	8129	8129	8129
Mean	75.95	57.55	10.03	8.28	0.09
Controls	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

ONLINE APPENDIX
for
"The social behavior of immigrants during natural disasters: Lessons from the United States"
by
Veeshan Rayamajhee and Jayash Paudel
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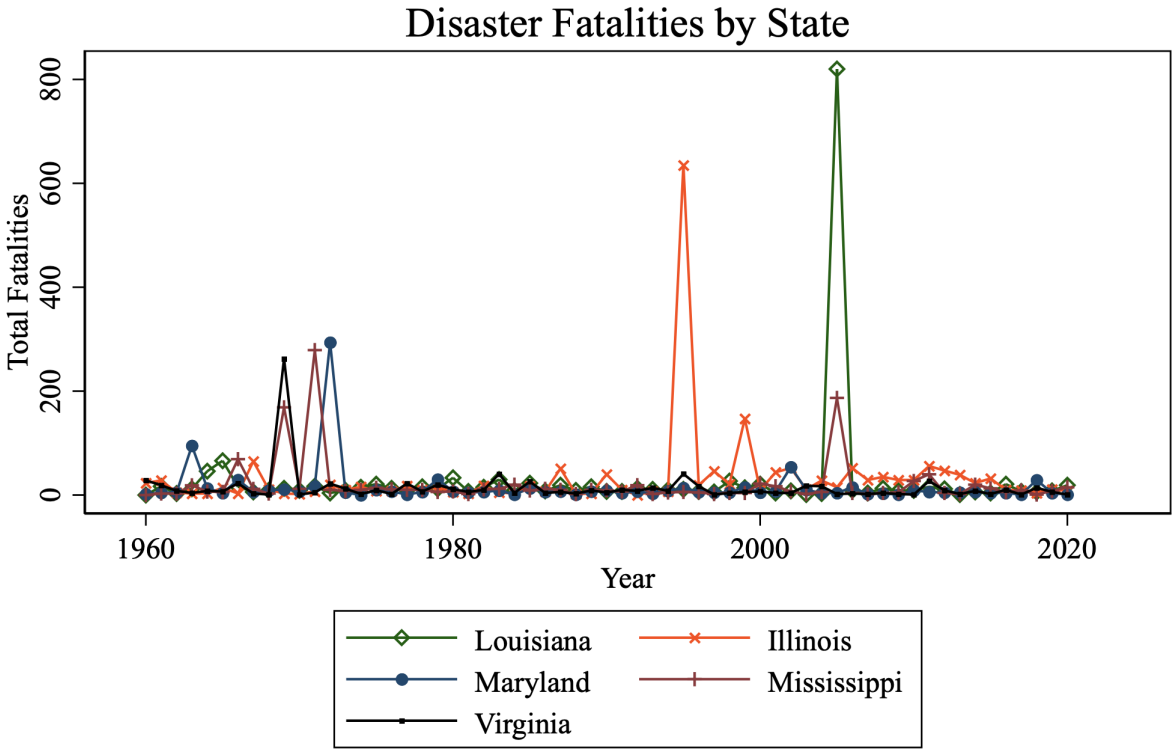

Data Source: SHELDUS. Disaster fatality trends from 1960-2020 in states with five highest fatality events.

Figure A1: Five highest disaster fatality states, 1960-2020

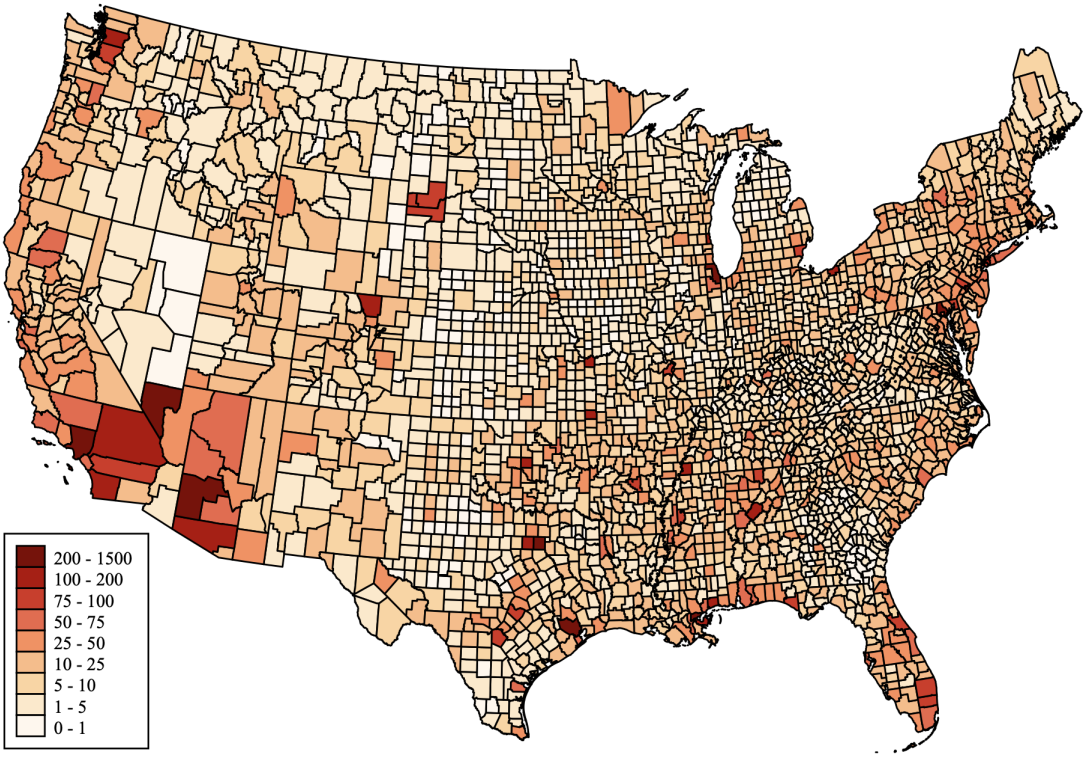

Figure A2: County-level aggregate disaster fatalities, 1960-2020

Table A1: Relationship between immigrant status and social behavior (regression-adjusted)

VARIABLES	Socializing	Socializing	Religious Activities	Religious Activities	Volunteering	Volunteering	Civic Engagement	Civic Engagement
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: All								
Immigrant- 1st gen	-0.989	-1.201	4.005*	3.945	-4.305**	-4.594**	0.0160	0.0164
	(3.501)	(3.461)	(2.379)	(2.379)	(1.688)	(1.718)	(0.140)	(0.139)
Immigrant- 2nd gen	0.729	0.504	0.0922	0.0579	0.682	0.451	0.00169	0.00146
	(2.244)	(2.232)	(0.412)	(0.411)	(0.807)	(0.807)	(0.0586)	(0.0592)
Observations	228,455	228,455	228,455	228,455	228,455	228,455	228,455	228,455
R-squared	0.034	0.034	0.069	0.070	0.010	0.012	0.002	0.002
Additional Controls	No	Yes	No	Yes	No	Yes	No	Yes
Panel B: Women Only								
Immigrant- 1st gen	-4.719	-4.901	3.943	3.852	-6.254***	-6.523***	-0.0574**	-0.0568**
	(5.826)	(5.752)	(2.994)	(2.958)	(1.378)	(1.309)	(0.0236)	(0.0241)
Immigrant- 2nd gen	-0.166	-0.348	-0.0903	-0.190	-1.729*	-1.999**	-0.00525	-0.00465
	(3.771)	(3.750)	(0.761)	(0.763)	(0.953)	(0.944)	(0.0584)	(0.0575)
Observations	127,664	127,664	127,664	127,664	127,664	127,664	127,664	127,664
R-squared	0.039	0.040	0.083	0.084	0.013	0.016	0.003	0.003
Additional Controls	No	Yes	No	Yes	No	Yes	No	Yes
Panel C: Men Only								
Immigrant- 1st gen	3.160	2.825	4.222	4.190	-2.248	-2.566	0.105	0.106
	(4.980)	(5.110)	(4.187)	(4.195)	(3.376)	(3.451)	(0.327)	(0.322)
Immigrant- 2nd gen	1.611	1.303	0.122	0.144	2.921**	2.741**	0.00213	0.000635

	(3.658)	(3.662)	(0.429)	(0.442)	(1.346)	(1.338)	(0.122)	(0.122)
Observations	100,791	100,791	100,791	100,791	100,791	100,791	100,791	100,791
R-squared	0.034	0.035	0.055	0.055	0.012	0.013	0.003	0.003
Additional Controls	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. DATA from American Time Use Survey 2003-2021. Regressions are weighted using the ATUS sampling weights to account for sampling issues. Dependent variables are measured in minutes per day. All regressions include controls for the respondent's age, age squared, race/ethnicity, as well as state, survey day, survey month, and survey year fixed effects. Additional controls include education dummies (for high school, some college, college or more, with no high school as the omitted category) and the number of children under 18 in the household.

Table A2: Effects by Disaster Type (Sample: All)

VARIABLES	(1) Socializing	(2) Religious Activities	(3) Volunteering	(4) Civic Engagement
Severe x Avalance	4.148	-26.87***	-36.49**	-0.00954
	(8.971)	(3.794)	(13.87)	(0.681)
Severe x Coastal	53.05***	-16.83***	-49.93***	0.159
	(10.71)	(2.844)	(2.704)	(0.302)
Severe x Flooding	48.49	-20.46***	-54.46***	0.750*
	(33.91)	(5.388)	(3.528)	(0.392)
Severe x Fog	-26.07**	-16.89***	-41.75***	0.138
	(11.27)	(5.213)	(4.775)	(0.564)
Severe x Heat	25.17***	-11.36**	-44.16***	0.323
	(6.683)	(5.264)	(7.559)	(0.510)
Severe x Hurricane	-33.41***	-44.75***	-55.49***	1.144***
	(12.38)	(5.312)	(6.095)	(0.372)
Severe x Landslide	10.82	-24.42***	-53.51***	0.352
	(10.69)	(2.952)	(4.116)	(0.289)
Severe x Lightning	201.4***	-22.39***	-56.30***	1.040***
	(57.90)	(3.181)	(4.381)	(0.241)
Severe x Storm	18.72	-20.01***	-52.93***	1.070**
	(22.50)	(5.508)	(4.345)	(0.498)
Severe x Tornado	47.22	-29.72***	-51.75***	0.430
	(59.71)	(6.962)	(4.066)	(0.393)
Severe x Wildfire	45.85***	-15.08***	-46.79***	-0.0446
	(6.401)	(2.189)	(2.922)	(0.126)
Severe x Wind	27.80**	-17.37***	-50.22***	0.469
	(11.81)	(3.910)	(7.109)	(0.593)
Severe x Winter weather	30.90***	-18.96***	-51.87***	0.303
	(6.015)	(3.389)	(4.539)	(0.519)
Observations	15,100	15,100	15,100	15,100
R-squared	0.093	0.075	0.042	0.027
Controls	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes
Mean	54.92	12.61	9.652	0.148

Notes: Severe disasters are defined as those leading to casualties. Alternative severity threshold chosen due to sample limitation issues. All models include interaction terms for hazard types (n=18) and severe dummy. Non-severe hazard types are omitted for brevity. Interaction terms that identified no observations in the sample are omitted. Fixed effects for diary day, survey month, year, and state are included. All models include controls for education levels, age, age squared, sex, race categories, and cohort. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A3: Effects by Disaster Type (Natives)

VARIABLES	(1) Socializing	(2) Religious Activities	(3) Volunteering	(4) Civic Engagement
Severe x Avalance	55.63***	6.828	-64.19***	0.321
	(10.06)	(4.423)	(19.25)	(0.375)
Severe x Coastal	89.59***	15.86***	-82.17***	0.356
	(17.10)	(4.248)	(6.129)	(0.432)
Severe x Flooding	84.61***	11.93	-92.68***	0.401
	(27.02)	(8.522)	(5.895)	(0.404)
Severe x Fog	4.118	13.71***	-76.88***	0.0488
	(14.72)	(3.909)	(8.393)	(0.361)
Severe x Heat	68.37***	15.62*	-77.96***	0.290
	(13.78)	(8.153)	(9.088)	(0.435)
Severe x Hurricane	-11.49	-1.616	-87.67***	0.522
	(15.13)	(6.968)	(8.248)	(0.534)
Severe x Landslide	96.28***	8.093*	-87.85***	0.677
	(14.15)	(4.342)	(6.322)	(0.516)
Severe x Lightning	273.4***	8.658**	-90.05***	0.653
	(29.97)	(4.100)	(5.896)	(0.395)
Severe x Storm	63.51**	12.05**	-88.58***	0.821
	(25.00)	(5.503)	(7.382)	(0.598)
Severe x Tornado	14.73	-4.931	-81.94***	-0.101
	(12.95)	(4.813)	(7.162)	(0.116)
Severe x Wildfire	76.67***	16.56***	-77.18***	0.468
	(12.47)	(3.808)	(5.542)	(0.407)
Severe x Wind	79.45***	13.75**	-85.94***	0.415
	(15.39)	(5.632)	(9.766)	(0.413)
Severe x Winter weather	72.99***	15.04***	-90.00***	0.323
	(12.18)	(5.182)	(7.965)	(0.385)
Observations	10,484	10,484	10,484	10,484
R-squared	0.115	0.068	0.050	0.024
Controls	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes
Mean	54.07	12.08	10.82	0.129

Notes: Severe disasters are defined as those leading to casualties. Alternative severity threshold chosen due to sample limitation issues. All models include interaction terms for hazard types (n=18) and severe dummy. Non-severe hazard types are omitted for brevity. Interaction terms that identified no observations in the sample are omitted. Fixed effects for diary day, survey month, year, and state are included. All models include controls for education levels, age, age squared, sex, race categories, and cohort. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A4: Effects by Disaster Type (First generation immigrants)

VARIABLES	(1) Socializing	(2) Religious Activities	(3) Volunteering	(4) Civic Engagement
Severe x Avalance	-69.99	-72.82***	-2.081	-4.219
	(52.03)	(22.24)	(6.093)	(5.362)
Severe x Coastal	36.00	-55.35***	-7.509	-5.859
	(31.04)	(9.203)	(5.468)	(3.980)
Severe x Flooding	-74.08***	-65.53***	-5.076	-4.123
	(25.09)	(9.081)	(7.215)	(5.004)
Severe x Heat	-2.246	-40.36*	9.190**	-4.754
	(25.23)	(21.26)	(4.080)	(4.947)
Severe x Landslide	-22.01	-62.77***	-12.20*	-6.330
	(21.58)	(7.570)	(6.663)	(3.892)
Severe x Lightning	-13.61	-66.07***	-14.48**	-0.370
	(23.28)	(12.03)	(6.481)	(2.678)
Severe x Storm	-27.25	-27.22***	7.503	-6.036
	(41.98)	(9.838)	(7.505)	(6.143)
Severe x Tornado	-16.01	-31.65*	8.887	-1.007
	(33.48)	(18.05)	(9.023)	(2.363)
Severe x Wildfire	17.96	-52.11***	-2.448	-4.740*
	(16.37)	(8.137)	(4.230)	(2.453)
Severe x Wind	-51.13**	-35.68***	12.05**	-3.250
	(20.83)	(12.26)	(5.899)	(4.458)
Severe x Winter weather	-8.113	-56.94***	5.709	-4.243
	(20.26)	(10.97)	(5.913)	(4.353)
Observations	3,097	3,097	3,097	3,097
R-squared	0.178	0.205	0.133	0.091
Controls	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes
Mean	56.67	14.68	5.510	0.266

Notes: Severe disasters are defined as those leading to casualties. Alternative severity threshold chosen due to sample limitation issues. All models include interaction terms for hazard types (n=18) and severe dummy. Non-severe hazard types are omitted for brevity. Interaction terms that identified no observations in the sample are omitted. Fixed effects for diary day, survey month, year, and state are included. All models include controls for education levels, age, age squared, sex, race categories, and cohort. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Effects by Disaster Type (Second generation immigrants)

VARIABLES	(1) Socializing	(2) Religious Activities	(3) Volunteering	(4) Civic Engagement
Severe x Avalance	68.85	-26.13**	-19.48	-0.0712
	(44.18)	(10.98)	(22.05)	(0.0598)
Severe x Coastal	148.1***	5.147	-12.70	-0.0245
	(35.10)	(5.876)	(11.56)	(0.0213)
Severe x Flooding	365.8***	-16.42*	-5.968	-0.0238
	(33.63)	(9.364)	(25.49)	(0.0204)
Severe x Heat	98.06***	-27.26**	-12.02	-0.0254
	(34.26)	(12.56)	(13.61)	(0.0218)
Severe x Lightning	173.7***	-32.45*	-4.674	-0.0265
	(48.29)	(17.78)	(12.65)	(0.0233)
Severe x Storm	135.7**	-44.87***	-11.57	-0.0249
	(55.93)	(14.18)	(18.70)	(0.0217)
Severe x Tornado	296.6***	-8.091	-10.33	-0.0246
	(38.73)	(9.472)	(8.583)	(0.0213)
Severe x Wildfire	161.2***	0.431	-5.325	-0.0245
	(32.79)	(6.638)	(10.09)	(0.0213)
Severe x Wind	145.0***	-10.96	-8.777	-0.0254
	(50.56)	(9.415)	(17.59)	(0.0222)
Severe x Winter weather	111.5***	-26.79***	35.87***	-0.0243
	(40.48)	(7.510)	(12.88)	(0.0211)
Observations	1,519	1,519	1,519	1,519
R-squared	0.341	0.164	0.208	0.003
Controls	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes
Mean	57.23	12.03	10.07	0.0395

Notes: Severe disasters are defined as those leading to casualties. Alternative severity threshold chosen due to sample limitation issues. All models include interaction terms for hazard types (n=18) and severe dummy. Non-severe hazard types are omitted for brevity. Interaction terms that identified no observations in the sample are omitted. Fixed effects for diary day, survey month, year, and state are included. All models include controls for education levels, age, age squared, sex, race categories, and cohort. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A6: Long Difference Estimates of the Effects of Disasters on Social Behavior

VARIABLES	(1) △ Socializing	(2) △ Socializing	(3) △ Religious Activities	(4) △ Religious Activities	(5) △ Volunteering	(6) △ Volunteering	(7) △ Civic Engagement	(8) △ Civic Engagement
△ fatalities	-0.104***	-0.237***	0.0768***	0.130***	-0.0391*	-0.0702***	0.00412**	0.00345
	(0.0264)	(0.0190)	(0.0177)	(0.00793)	(0.0197)	(0.0256)	(0.00155)	(0.00226)
Observations	201	201	201	201	201	201	201	201
R-squared	0.002	0.218	0.008	0.159	0.001	0.332	0.002	0.157
Fixed Effects	No	State	No	State	No	State	No	State

Notes: Dependent variable in all regressions are the differences in time spent on socializing, religious activities, volunteering, and civic engagement in 2006 and 2018. All specifications 1-8 are estimated with long differences between the years 2006 and 2018. 2006 time use estimates are calculated as averages for the years 2004-2008, whereas those for 2018 are averages for the years 2016-2020. Specifications 1, 3, 5, and 7 are estimated without fixed effects, whereas 2, 4, 6, and 8 include state fixed effects. Standard errors are clustered at the state level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.