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# **Comparative Analyses of Environmental Deprivation and Political Mobilization.**

A dissertation submitted in partial satisfaction  
of the requirements for the degree

Doctor of Philosophy  
in  
Environmental Science & Management

by

Patrick Lee Hunnicutt

Committee in charge:

Professor Mark Buntaine, Chair  
Professor Matto Mildemberger  
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June 2022

The Dissertation of Patrick Lee Hunnicutt is approved.

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Professor Mark Buntaine, Committee Chair

May 2022

Comparative Analyses of Environmental Deprivation and Political Mobilization.

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Patrick Lee Hunnicutt

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# Curriculum Vitæ

## Patrick Lee Hunnicutt

### Education

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- 2021 M.A. in Political Science, University of California, Santa Barbara.
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### Publications

Buntaine, Mark, Bing Zhang, and **Patrick Hunnicutt**. 2021. “Citizen Monitoring of Waterways Decreases Pollution in China by Supporting Government Action and Oversight.” *Proceedings of the National Academy of Sciences*.

**Hunnicutt, Patrick** and William Nomikos. 2020. “Nationality, Gender, and Deployments at the Local Level: Introducing the RADPKO Dataset.” *International Peacekeeping*.

Buntaine, Mark, **Patrick Hunnicutt**, and Polycarp Komakech. 2020. “The Challenges of Using Citizen Reporting to Improve Public Services: A Field Experiment on Solid Waste Services in Uganda.” *Journal of Public Administration Research and Theory*.

O’Neill, Kate, Erika Weinthal , and **Patrick Hunnicutt**. 2017. “Seeing complexity: visualization tools in global environmental politics and governance.” *Journal of Environmental Studies and Sciences*.

## **Abstract**

Comparative Analyses of Environmental Deprivation and Political Mobilization.

by

Patrick Lee Hunnicutt

My dissertation examines how environmental problems both contribute to and are shaped by different forms of political mobilization, through three lines of inquiry. My first chapter tests if international organizations like the United Nations can help restore environmental governance in countries emerging from violent conflict. In my second chapter, I leverage data collected over nine months of fieldwork in Liberia to identify the conditions under which shortages in environmental goods and services spark protest. The final chapter of my dissertation investigates whether air pollution catalyzes or inhibits political participation, using novel data from a major grassroots environmental organization in the United States.

Altogether, my research helps advance our understanding of how environmental problems and politics are deeply intertwined. My first chapter demonstrates that international peacekeeping forces can reshape natural resource management in the wake of violent conflict, potentially providing a pathway to economic development. My second chapter highlights how non-state actors may prove crucial to mitigating the otherwise destabilizing impacts of global environmental problems like climate change. My final chapter bolsters existing research on environmental justice, demonstrating how environmental problems can reinforce the systems of political marginalization they stem from by undermining prospects for mass mobilization.



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# Chapter 1

## Introduction

This dissertation examines how environmental problems both contribute to and are shaped by different forms of political mobilization, through three lines of inquiry. The deprivation resulting from environmental problems often shapes subsequent political mobilization, such as influencing electoral outcomes or sparking bouts of political violence. At the same time, whether and how individuals, communities, and organizations mobilize for politics affects the distribution of environmental deprivation across space and time.

My dissertation's first chapter asks whether international peacekeeping operations help restore environmental governance in countries emerging from violent conflict. My broad argument is that the deployment of United Nations (UN) peacekeeping personnel affects the privatization of natural resource wealth after conflict ends. I specifically hypothesize that UN peacekeeping police increase the probability that foreign firms establish natural resource concessions in conflict-affected settings, because UN peacekeeping police enhance the credibility of government commitments to shield foreign firms' assets from political instability. Quantitative data documenting the subnational deployment of UN peacekeeping police and the subnational allocation of natural resource concessions in post-conflict Liberia support my argument. Deploying 100 UN police to a Liberian clan (i.e., a small town) is associated with a 2.93 percentage point increase in the probability of new extractive sector investment in the clan.

In my second chapter, I shift my focus to how environmental deprivation shapes political mobilization. I leverage quantitative and qualitative data compiled over nine months of fieldwork in Liberia to identify the conditions under which shortages in environmental goods and services like clean water mobilize citizens for protest. In summary, these data reveal that non-state actors called “community chairpeople” mitigate the otherwise mobilizing effect of environmental service shortages on protest. I argue that community chairpeople have this effect because they function as informal brokers who offer otherwise disenfranchised citizens a pathway to eliciting government reform that is as effective as protest but less costly, given the risk of violent state repression. Community chairpeople are similar to other non-state actors that mediate state-society relations around the world, from traditional chiefs in African countries like Zambia and Malawi to village leaders in rural Afghanistan.

My dissertation’s third chapter tests whether exposure to pollution mobilizes citizens for costly forms of environmental advocacy in the United States, such as participating in climate marches or phone-banking for elected officials. While history is littered with examples of citizens collectively mobilizing curb the emission of pollutants that threaten human health (e.g., smog), whether pollution sparks political mobilization remains an active empirical question, in part because the distribution of pollution across space and time is likely correlated with other factors that influence citizens’ willingness to become politically active. We employ a series of instrumental variable regressions to estimate the causal impact of particulate matter 2.5 ( $PM_{2.5}$ ) emissions on aggregate-level political participation among counties in the United States, using data from a prominent national grassroots environmental organization. Our results suggest that pollution undermines political participation, especially in counties that should be more likely to mobilize for politics, all else equal.

Altogether, my dissertation advances our understanding of how environmental prob-

lems and politics are deeply intertwined. My first chapter demonstrates that international peacekeeping forces can reshape natural resource management in the wake of violent conflict, potentially providing a pathway to economic development. My second chapter highlights how non-state actors may prove crucial to mitigating the otherwise destabilizing impacts of global environmental problems like climate change. My final chapter bolsters existing research on environmental justice, demonstrating how environmental problems can reinforce the systems of political marginalization they stem from by undermining prospects for mass mobilization.

## Chapter 2

# International Peacekeeping Encourages Foreign Direct Investment: Subnational evidence from Liberia's extractive sector.

### 2.1 Introduction

What explains subnational allocations of foreign direct investment (FDI) in post-conflict countries? Firms making investment decisions hedge against the risk that future political instability will lead to the expropriation, extortion, or destruction of their assets [1, 2]. Ex-ante, it is difficult for foreign firms to discern the political risk of investment in countries emerging from civil war. Post-conflict settings are information poor environments [3] wherein extensive capacity and legitimacy problems [4] undermine the credibility of state actors' commitments to locally shield investors' assets from political instability. Attacks on foreign-owned investments are well-documented in conflict-affected settings like Nigeria [5], Liberia [6], and Colombia [7], and new research implies that the risk of such events weighs heavily on firms' local investment decisions [8]. Firms may forgo otherwise profitable investments in areas of post-conflict countries where they do not perceive government commitments to deter expropriation, extortion, and violence as

credible.

This article presents a new theory linking the local deployment of United Nations (UN) peacekeeping personnel to subnational allocations of FDI in post-conflict countries. International allocations of FDI follow national policies that strengthen recipient countries' commitments to maintain a political climate that is conducive to investment [9], like extending formal property rights [10] or participating in international trade agreements [11]. I contend that contemporary UN peacekeeping operations work to the same effect but at the local level. UN peacekeeping personnel are generally perceived as effective [12, 13] and impartial [14, 15] actors who deploy subnationally to mitigate the same political risks that shape firms' investment decisions [16, 17].

My general theoretical proposition is that peacekeepers act as commitment devices for post-conflict governments: their presence credibly signals to foreign firms whether state actors will successfully prevent expropriation, extortion, and violence. I specifically argue that variation in the type of UN peacekeeper deployed influences firms' local investment decisions. I hypothesize that UN peacekeeping troops will discourage FDI because their deployment undermines the credibility of government commitments to reduce the political risk of investment at the local level. Conversely, I expect UN peacekeeping police to encourage FDI because their deployment enhances the credibility of government commitments to locally enforce the rule of law.

I test this argument in post-conflict Liberia's extractive sector. The United Nations Mission in Liberia's (UNMIL) operational mandate included helping the government leverage its natural resource wealth to foster long-term peace and development [18]. The mission's personnel intervened to achieve this goal in a way that accords with my theory. UNMIL police supported Liberian National Police operations to restore the credibility of the government's rule of law institutions in resource-rich areas of Liberia. UNMIL troops deployed to remove armed groups from land seized during the war when government

forces could not independently do so.

To quantitatively test my hypotheses, I combine geocoded data on natural resource concessions with data on the location, strength, and composition of UNMIL personnel from 2004 until 2018. I pre-process my data on factors that research and UNMIL reports show to influence the establishment of new peacekeeping bases—like levels of civil war violence and proxies for state legitimacy—to help address the non-random deployment of peacekeepers. My analyses control for a number of on-the-ground conditions in Liberia that likely influenced UNMIL's subnational deployment decisions and new investment, including different lags of conflict and prior investment. A simulation-based sensitivity analysis is used to quantify the robustness of my results to omitted variable bias [19].

I find marginal evidence that even large deployments of UN troops discourage FDI. By contrast, I find strong evidence that even relatively small deployments of UN police are positively associated with the probability of new investment. The positive relationship between UN police and FDI is robust to unobserved confounds capable of inducing eight-times more bias than would the omission of an important covariate already specified in my analysis.

UN police may encourage FDI because they enhance government commitment's to shield firms' assets from political instability. Alternatively, UN police may encourage FDI because they deter expropriation, extortion, and criminal violence themselves. I extend my main analyses to interrogate which of these mechanisms receives the greatest empirical support.

I find no evidence that UN police are associated with the onset of riots, mob violence, and vigilante violence: all plausible deterrents of FDI in post-war Liberia that UN police can mitigate [20]. By comparison, subgroup analyses I conduct using Afrobarometer survey data [21] support the idea that UN police encourage FDI as commitment devices. I find that the positive relationship between UN police and new investment is especially



strong in parts of Liberia where the government's rule of law institutions are weak and most in need of the credibility UN police can generate.

This article makes two contributions. First, it adapts existing theory to reflect the subnational governance problems characterizing many FDI-recipient countries, including those emerging from violent conflict. Over 80 percent of countries in the international system contain areas wherein state actors lack the ability to make and enforce rules [22]. When the level of state governance varies within a host country, foreign firms require assurance that the institutional protections designed to safeguard their assets from political instability will be enforced at the local level. My theory articulates how domestic political factors can shape subnational allocations of FDI when they meet this demand. Relatedly, this article extends research on the subnational political economy of FDI to conflict-affected settings where the commitment problem constraining investment is heightened, whereas prior studies focus on countries like the United States [23] and Mexico [24, 25].

Second, this article demonstrates how UN peacekeepers shape the politics of post-conflict countries outside of their direct effect on conflict. Contemporary peacekeeping missions oversee various peacebuilding processes like restoring the rule of law [17, 26], facilitating local economic development [27, 28], and promoting environmental quality [29]. Yet conventional wisdom narrowly conceptualizes UN peacekeepers as conflict deterrents. Future research must continue accounting for the breadth of activities UN peacekeepers undertake to explain the variation in peace and development observed across conflict-affected settings.

## 2.2 UN Peacekeeping and Subnational Allocations of FDI

UN peacekeeping operations (PKOs) have evolved over the last three decades. The UN Security Council (UNSC) modified its charter for PKOs in the 1990s to address the state collapse that commonly coincides with contemporary conflicts. These reforms authorized the deployment Chapter VII, or “multidimensional,” PKOs that intervene in other processes the UN views as essential to peacebuilding, such as protecting civilians and training domestic law enforcement. Multidimensional UN PKOs are equipped to substitute for the state as the sole provider of security, public goods, and the rule of law, sometimes steering national economic [18] and electoral [26] policies. Since these reforms were implemented, the UN has deployed over 175,000 peacekeepers across 11 countries in sub-Saharan African alone [30]. All 11 countries contain proven reserves of valuable natural resources, from timber to cobalt, and attract various amounts of FDI.

UN peacekeepers operating under a multidimensional mandate plausibly affect FDI because their deployment shapes where firms perceive government commitments to prevent expropriation, extortion, and violence as credible. UN peacekeepers have a reputation as impartial [14, 15] and effective [12, 13] actors who help uphold armed groups' commitments to peace [31, 32]. Multidimensional PKOs in particular respond to the same political conditions that affect firms' investment decisions. Peacekeepers deployed under multidimensional PKOs explain subnational variation in both the rule of law [33] and the onset of criminal [20] and electoral [34] violence.<sup>1</sup>

I specifically argue that the composition of personnel deployed to individual peace-

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<sup>1</sup>My theory assumes that firms prefer UN peacekeepers generate security and political order, rather than hiring private security to do the same. Private security increases firms' operating costs and risks exposing firms to reputational costs that can impede investment if contractors commit human rights abuses [35]. By contrast, UN peacekeepers provide firms with the same public goods as effective state security forces, at no direct cost.

keeping bases within a post-conflict country affects the subnational allocation of FDI. Multidimensional PKOs primarily rely on two types of peacekeepers: UN peacekeeping troops and UN peacekeeping police. The deployment of each kind of peacekeeper affects the credibility of government commitments to mitigate the political risk of investment.

UN troops are deployed to protect civilians and reduce insecurity. Troop contributions from UN member states help “deny terrain to threat actors [and] safeguard the local population...through the robust and proactive projection of force” (Report B.1, p.22, Table A.1). UN troops have more coercive capacity than other peacekeeping personnel, operating with support from attack helicopters and artillery when necessary. When government forces are weak or are parties to the conflict themselves, UN troops leverage their coercive capacity to mitigate the intensity [36, 37, 38] and spread [39] of conflict.<sup>2</sup>

I argue that large deployments of UN troops deter FDI because their presence undermines the government's commitment to prevent resurgent violence near firms' operations, even though UN troops may lead to long-term improvements in local security conditions. Troops' mandate to mitigate violence sees them deployed to particularly unstable areas of post-conflict countries where government forces are ineffective [16]. Moreover, peacekeeping troops are not always effective conflict deterrents. Autessere (2010) documents peacekeepers' struggle to mitigate conflict in the Democratic Republic of the [40]Congo. Peacekeeping troops' capacities to deter violence similarly declined in the Central African Republic following the withdrawal of American, French, and Ugandan forces [41]. Recent research also finds that armed groups attack peacekeeping troops to prevent them from fulfilling their mandate [42, 43, 44].

Local deployments of UN troops may also discourage FDI because their deployment undermines the government's commitment to prevent criminal violence. DiSalvatore (2019) argues that criminal groups both free-ride off the security UN troops generate and

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<sup>2</sup>See Walter et al. (2021) for an extensive review [13].

benefit from the illicit economies UN peacekeepers stimulate [20]. Absent interventions to strengthen national police forces, any surge in crime UN troops trigger may make it easier to extort FDI.

All else equal, foreign firms considering investment within a post-conflict country should be less likely to site new FDI project near areas where UN troops have recently deployed. Peacekeeping troops credibly signal to firms where the local risk of resurgent violence is high.

### **H1: UN peacekeeping troops deter foreign direct investment.**

UN police wield far less coercive capacity than UN troops and are exclusively responsible for restoring the rule of law (Report Z, Table A.1). Police contributions from UN member states either deploy as Individual Police Officers or are organized into Formed Police Units (FPUs) that support government policing operations which do not require a military component.

Local deployments of UN police should encourage FDI because their capacity to restore the rule of law enhances the credibility of government commitments to locally enforce the legal protections it extends to foreign firms' assets. The daily operations UN police undertake are meant to "induce deference [to the rule of law] from the bottom-up" [17, 63]. UN police patrolled alongside national police officers in Liberia because the latter could not unilaterally enforce the rule of law at the local level [17], and provided courts security in the Central African Republic to boost the efficacy of ongoing criminal investigations [41]. Both activities should alleviate firms' concerns that state actors will fail to enforce the legal protections designed to shield firms' operations from political instability. For example, when UN police boost the legitimacy of formal judicial institutions in the eyes of the civilian population, they may also reduce the probability that disputes involving FDI projects are resolved in informal venues where the laws

advantaging foreign firms are irrelevant [45].

UN police also should encourage FDI because they credibly signal to investors where the risk of criminal violence is low. Organized criminal elements can more freely interfere with foreign firms' operations in post-conflict settings, ultimately deterring investment. For example, firms drew down their investments in Colombia following the kidnapping of their employees by criminal groups [7]. UN police make interference like this more difficult since the training they provide domestic law enforcement helps deter crime [20].

All else equal, foreign firms should be more likely to commit post-conflict FDI near areas where UN police have recently deployed. UN police deploy to areas experiencing low-intensity conflicts to restore law and order. Peacekeeping police credibly signal to investors about where state actors can be trusted to reduce the risk of criminal violence, expropriation, and extortion.

**H2: UN peacekeeping police encourage foreign direct investment.**

## 2.3 Setting

I investigate the relationship between UN peacekeeping and FDI within post-conflict Liberia's extractive sector. This West African country presents an appropriate test for my argument. For one, Liberia is an archetypal post-conflict state. Liberia experienced two bouts of civil war between 1989 and 2003. Political stability remains fragile in Liberia, in part due to crises such as the 2014-2016 Ebola epidemic. The subnational governance problems civil war created in Liberia suggest that credible, localized signals of security and the rule of law were required to attract FDI.

### 2.3.1 UN Peacekeeping and Natural Resource Concessions in Liberia

The United Nations Security Council (UNSC) authorized the United Nations Mission in Liberia (UNMIL) in 2003. UNMIL was the first multidimensional peacekeeping mission the UNSC deployed, and remained in Liberia until 2018. Through UNMIL and the UNSC, the UN shaped natural resource governance in post-war Liberia.<sup>3</sup> UN leadership perceived the development of Liberia's natural resources as a pathway to long-term peace and stability: securing resource-rich regions could both accelerate the demobilization of combatants and boost state capacity [18]. The UNSC imposed sanctions on the export of Liberian minerals and timber to prevent their exploitation by armed groups and mandated UNMIL "to assist the transitional government in restoring proper administration of natural resources" (Report B, p. 4, Table A.1).

Published UNMIL Reports of the Secretary General—which describe the mission's progress towards fulfilling its mandate—clearly frame securing and stabilizing Liberia's resource-rich areas as a pathway to long-term peace. Two reports explicitly identify conflict over Liberia's natural resource wealth as a persistent threat to political stability (Reports P and Q, Table A.1). As UNMIL and government forces slowly reclaimed resource-rich areas from ex-combatants, disputes between international concessionaires and local resource users emerged as an important security issue (Reports S-V, X, and Y, Table A.1).

These reports also highlight how UNMIL peacekeepers locally operated in ways that may have influenced foreign concessionaires' investment decisions. Below, I present two key observations from these reports which further motivate my hypotheses.

First, these operational reports document how UNMIL's police may have assuaged

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<sup>3</sup>Liberia contains significant resource wealth. Pre-war mining exports made up over 65 percent of its GDP.

foreign firms' concerns about expropriation and extortion. UNMIL officials repeatedly questioned the capacity of the Liberian National Police (LNP) to independently uphold the rule of law. One early report notes how "the [LNP] urgently require continued mentoring, as well as basic equipment, uniforms, arms and ammunition, vehicles and communication equipment" (Report I, p.6, Table A.1). Despite UNMIL efforts to train and conduct outreach on behalf of LNP officers, public confidence in the LNP's ability to uphold the rule of law remained limited even five years after UNMIL arrived in Liberia (Report N, Table A.1). LNP stations commonly were razed during periods of political unrest (Reports N, O, and S, Table A.1). Concerns about restoring the rule of law were particularly acute outside of the capital city (Report M, p.5, Table A.1). In one outlying county, 42 LNP officers shared just one motorbike to patrol and received salaries paid directly out of their commander's pocket rather than from government coffers (Report M, Table A.1).

Given these capacity problems, UNMIL's police played a direct role enhancing the credibility of government commitments to uphold the rule of law. One report from 2009 bluntly states: "The Liberian National Police...still requires support from UNMIL police advisers and formed police units to carry out even routine patrolling" (Report P, p.6, Table A.1). LNP officers often were "overwhelmed by large crowds" and could only restore public order after UNMIL police arrived on scene (Report V, p.4, Table A.1). For example, UNMIL police assisted the LNP in quelling a riot which broke out after a LNP police station was attacked (Report N, Table A.1). UNMIL police also deployed alongside LNP forces in government operations to combat violent crime (Reports L and O, Table A.1).

Second, UNMIL's operational reports show how its troops and police directly contributed to securing Liberia's natural resource wealth, at the government's request (Report F, Table A.1). Personnel from the mission supported government operations to

evict what it perceived to be illegal squatters on public lands (Report F, p.12, Table A.1). UNMIL troops were vital to reclaiming rubber plantations armed groups seized during the civil war (Reports J-M, R, and T, Table A.1). UN police played a specific role in stabilizing these reclaimed areas, jointly patrolling with LNP officers—ostensibly, to make the LNP’s presence more credible (Reports J and L, Table A.1). One report even hints that UN police took an active role in monitoring the activities of ex-combatants at Liberia’s diamond mines to support implementing the Kimberly Process certification scheme (Report I, p.12, Table A.1).

These reports provide preliminary evidence that UNMIL’s peacekeeping personnel may have affected foreign firms’ decisions to invest in Liberia’s extractive sector. One report states that “international companies informed the mission that their decision to invest in Liberia had taken into account the security cover provided by the UNMIL force” (Report Q, p.4, Table A.1). UNMIL troops were used to provide additional security during government operations to reclaim natural resource deposits, such that their deployment may have undermined government commitments to prevent violence. By contrast, UNMIL police worked alongside LNP officers to maintain law and order in resource-rich regions, such that their deployment may have made the government’s commitment to uphold the rule of law more credible.

## 2.4 Research Design

### 2.4.1 Data

I use data on natural resource concessions and UNMIL’s presence in Liberia from 2004 until 2018 to test my argument. My spatial unit of analysis is a Liberian “clan”: the country’s third-order administrative unit (N=305).



My primary outcome of interest is the onset of new natural resource concessions per clan per month. I form my outcome measure using spatial data on concession areas in Liberia [46]. Observations missing verifiable start dates are excluded from my analysis (n=138), leading to a final sample of 418 natural resource concessions.

Multiple types of concession agreements are in my sample, including: agricultural concessions (to develop agricultural land), mineral development agreements (to begin large-scale industrialized mining operations), and private use permit contracts (to authorize the sale of timber by private land owners). The size and process of establishing different concession agreements varies. While larger agreements require concessionaires to negotiate with the government (e.g., mineral exploration licenses), others have concessionaires negotiate directly with private land owners (e.g., private use permit contracts). Ultimately, the Liberian government is responsible for approving all concession agreements.

Finalizing a concession agreement requires immediate investments that should make firms sensitive to the short-term risk of expropriation, extortion, and violence. Some concession agreements include minimum investment requirements that range from tens of thousands to hundreds of thousands of US dollars per year. Others include annual surface rental fees that cost between tens of thousands to millions of US dollars. Concessionaires are contractually obligated to pay rental fees or back-pay minimum investment requirements regardless of their investment in physical infrastructure at project sites. Concession agreements sometimes require other actions that immediately increase firms' sunk costs. For example, firms typically must purchase operating licenses from the government. Some agreements also require firms to submit \$25,000 to \$150,000 USD performance bonds to the government at signing, or require firms to demonstrate sufficient access to capital and equipment (e.g., bulldozers) in Liberia.<sup>4</sup>

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<sup>4</sup>Additional information on the types of agreements reviewed in this paragraph can be found in

I use the *RADPKO* database to calculate the number UNMIL peacekeeping troops and police deployed per clan-month [30].<sup>5</sup> Both measures are lagged by a single month, since a firm's evaluation of local political conditions seems more likely to occur shortly before they finalize a concession agreement.<sup>6</sup> These data are drawn from publicly available deployment maps which allow foreign parties to track where and in what capacity different types of uniformed peacekeepers are deployed (see Figures A.14 and A.16).

My analysis controls for time-varying factors I expect to affect the onset of natural resource concessions. First, I control for the lagged count of conflict events and the rolling annual mean of conflict events within each clan, following research demonstrating that violence affects both firms' investment decisions [49, 8, 50] and the local deployment of peacekeepers [16].<sup>7</sup>

Second, I include dummy variables denoting the twelve-month period following the removal of sanctions on Liberian timber, rubber, and diamond exports. The UN began enforcing these sanctions between 2001 and 2003, to prevent armed groups from exporting natural resources. Timber and rubber sanctions were officially lifted in October 2006, and diamond sanctions in April 2007. All else equal, firms seeking a foothold in Liberia's extractive sector may have been more likely to establish new concessions in resource-rich clans immediately following the reversal of these sanctions.

Third, I measure the contemporaneous and lagged count of new natural resource concessions established in spatially contiguous clans. The Liberian government advanced

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Appendix A.

<sup>5</sup>While the Geo-PKO dataset offers more coverage and includes excellent information on the types of military troops peacekeeping missions deploy [47], I use RADPKO due to its specific focus on Chapter VII missions and coverage of UN police.

<sup>6</sup>Surprisingly little research documents the FDI decision making process, despite the vast literature on the country-level determinants of FDI. What research exists implies that firms evaluate their own capacity to engage in FDI prior to identifying candidate sectors and host countries [48]. It follows that a firm's assessment of local political conditions might occur after these internal considerations and while finalizing individual projects within a country.

<sup>7</sup>All conflict data are drawn from the Armed Conflict Location Event Database [51].

Figure 2.1: Trends in Sector of Natural Resource Concessions Established, Post-Conflict Liberia

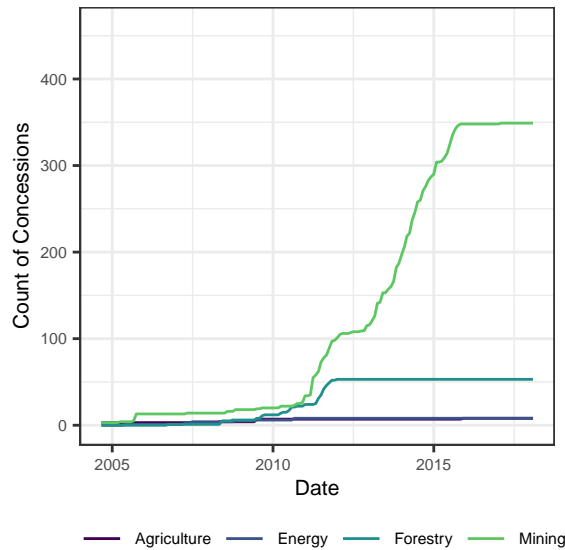
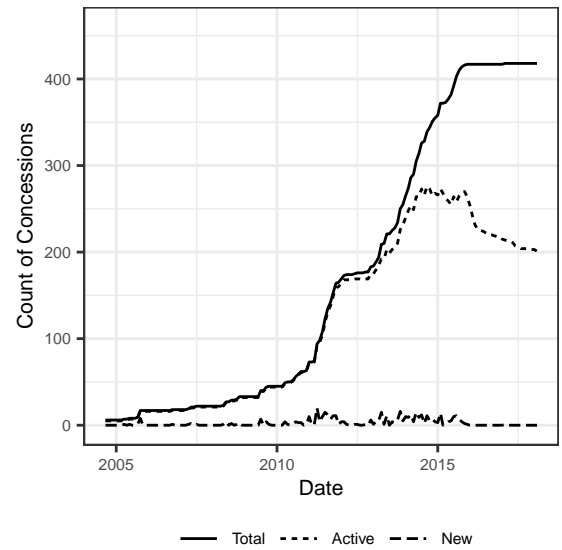


Figure 2.2: Trends in Status of Natural Resource Concessions Established, Post-Conflict Liberia



policy to encourage FDI in “development corridors,” where it required concessionaires to invest in infrastructure that would facilitate nearby investment, generate public goods and services, and spur local economic growth [46]. This policy suggests that foreign investors may have been more likely to establish new concession agreements in clans that were surrounded by existing concession agreements.

## 2.4.2 Descriptive Statistics

Over 400 natural resource concessions were established in Liberia from 2004 to 2018. New concession areas were particularly commonplace from 2011 and 2015 (Figure A.10), and nearly every clan contained an active concession area by 2015 (Figure A.12). The bulk of investment occurred in the mining sector (Figure 2.1) and well into the post-conflict period (Figure 2.2). Gold, diamonds, and iron ore were the main commodities extracted among the 349 mining concessions.

Figures A.3 and A.8 visualize the deployment of peacekeepers in Liberia over UNMIL’s

Figure 2.3: UNMIL Bases near Guthrie Rubber Plantation, Bomi County, 2006

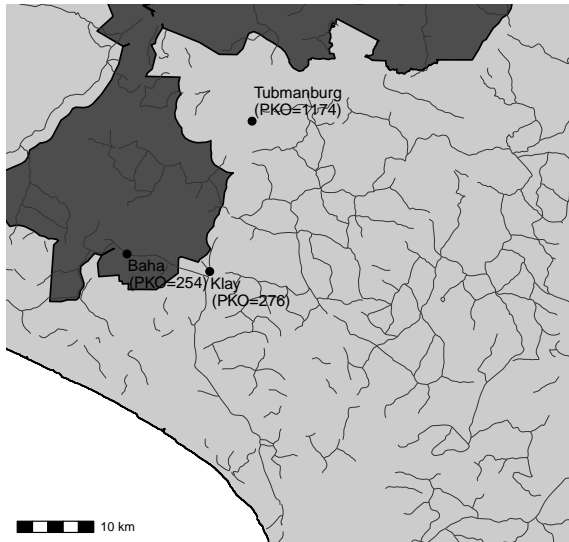
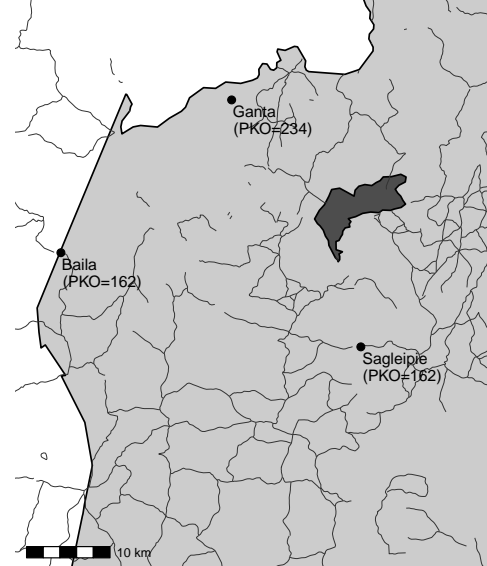


Figure 2.4: UNMIL Bases near Cocopa Rubber Plantation, Nimba County, 2006



tenure. The mission's police force was only deployed to a subset of its operating bases. More than half of UNMIL's police force was stationed at two bases in Liberia's capital city of Monrovia, while the were stationed at 9 bases outside of Monrovia. However, even the relatively small contingents of UN police deployed to outlying bases should be sufficient to signal to firms where the government's rule of law institutions are strong enough to deter criminal violence and enforce the legal protections guaranteed to foreign firms. UN police can be effective when deployed in limited numbers [20].

Deployment data from RADPKO also confirm peacekeepers' operations to reclaim rubber plantations from armed groups. Over 250 peacekeepers were stationed within the concession area containing the Guthrie Rubber Plantation, 120 of which were deployed just two months before UNMIL personnel helped government forces retake the plantation (Figure 2.3). Peacekeepers also were deployed within a 30 kilometer radius of Cocopa Rubber Plantation in Nimba county (Figure 2.4).

### 2.4.3 Identification & Estimation

The local deployment of UN peacekeepers may correlate with other factors which explain subnational allocations of FDI. I adopt two strategies to help address this concern in my statistical analysis. First, I use coarsened exact matching [52] to pre-process my data on eight variables that both existing research and internal UN documents suggest were determinant of where UNMIL sited the peacekeeping bases from which its troops and police could patrol.<sup>8</sup> Second, I implement the simulation-based sensitivity analysis to formally quantify the degree of confounding required to overturn my statistical results.

#### Modeling the UNMIL's Deployment Process

I first match clans on factors that capture the logistical challenges of establishing a new peacekeeping base: their pre-deployment nighttime luminosity, population density, and road density. These measures approximate a clan's level of development. Peacekeeping missions should prefer to site bases in more developed locations because better infrastructure makes conducting local patrols less costly and more effective. Indeed, poor road networks consistently hamstrung UNMIL's operations (Reports F, G, and I, Table A.1). Matching on these variables should also help address selection bias stemming from UNMIL's mandate to help deliver humanitarian assistance (Reports C and F, Table A.1).

For a similar reason, I match clans on their proximity to the set of UNMIL bases established by December 2004. Establishing a new peacekeeping base poses a significant financial risk because peacekeeping missions lack information on the logistical viability of potential host communities [17]. UNMIL may have been more likely to gather information on the viability of host communities in clans nearby the first set of bases the mission established. Therefore, clans in close proximity to these first bases may have been more

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<sup>8</sup>Appendix A.2 provides additional information on how the UN deploys peacekeeping missions.

likely to house new UNMIL bases in the future. The mission's first and second operational reports confirm this intuition, detailing how a new base was constructed at Klay Junction following the deployment of reconnaissance teams from the mission's first base Monrovia (Reports C and E, Table A.1).<sup>9</sup>

I then focus on a set of variables that approximate the local demand for peacekeeping. First, clans are matched on the count of conflict events they experienced between the beginning of the second Liberian civil war in April 1997 and UNMIL's authorization in September 2003, given UNMIL's short-term goal of deescalating wartime violence. Matching clans based on the amount of wartime violence they experienced both follows other researchers' attempts to model the subnational deployment of peacekeepers [33] and is consistent with research demonstrating that peacekeepers select into areas where the risk of violence is high [16].

Next, I match clans on their proximity to the capitals of Liberian districts (the country's second order administrative unit). Doing so should help address concerns that peacekeepers select into locations where the state is better able to project power [53] and, as a result, new investment is more likely. I specifically calculate the minimum geodesic distance between the centroid of a clan and a district capital using spatial data compiled by the United Nations Office for the Coordination of Humanitarian Affairs.

Finally, I match clans on their average forest cover and proximity to gold deposits. As I establish above, UNMIL personnel were tasked with helping secure valuable natural resource deposits from armed groups and other non-state actors. In some cases, UNMIL bases were located in very close proximity to future concession areas (see Figures 2.3 and 2.4). Matching on these characteristics helps assure clans in my final sample are comparable in terms of their attractiveness to both UNMIL and foreign concessionaires.

Table A.6 confirms that matching improves covariate balance. My pre-processed

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<sup>9</sup>As the crow flies, Klay is located approximately 40 kilometers away from Monrovia.

sample consists of 7128 observations across 44 different clans.

Data limitations prevent me from matching on other factors that may confound the relationship between peacekeeping and FDI. Three potentially important omissions include the presence of state security forces, formal judicial institutions, and civil society. At the national level, all three variables plausibly enhance the credibility of government commitments to protect firms’ assets [9, 54].

The theory of investment I propose helps attenuate these concerns. Rather than viewing the presence of state security forces, formal judicial institutions, and civil society as potential sources of bias, my theory positions them as one of the several mechanisms through which UN peacekeepers affect foreign direct investment. Indeed, UNMIL police trained and patrolled with the Liberian National Police (LNP) officers to make their presence more credible (Report E, Table A.1). UNMIL similarly helped rehabilitate Liberia’s correctional system (Report E, Table A.1) and restore civil societies’ access to remote communities (Report I, Table A.1). The credible commitments which existing theory links to investment may have never materialized in Liberia without UNMIL’s intervention.

### **Simulation-based Sensitivity Analysis**

Since data limitations prevent me from perfectly modeling UNMIL’s deployment process, I implement a novel sensitivity analysis which estimates how “strong” an omitted variable would need to be to overturn my results [19]. The analysis simulates how an estimated treatment effect would change if an unobserved confound explained “ $X$ -percent” more residual variance in the treatment and outcome than does a relevant covariate that the researcher specifies. Theoretically-grounded sensitivity analyses are a useful tool for research questions where valid sources of exogenous variation are sparse and the treatment assignment process is both highly politicized and difficult to observe [55]. If a result

is only sensitive to an unobserved confound that induces substantially more bias than would omitting a relevant covariate the researcher specifies—and, based on theory and contextual knowledge, it is unlikely that such a confound exists—then the researcher can be more confident that the relationship they have estimated is not spurious.

### Estimation

I specify the following to estimate the association between subnational deployments of UNMIL personnel and the establishment of new natural resource concessions

$$y_{it} = \alpha + \gamma_1 Troops_{i,t-1} + \gamma_2 Police_{i,t-1} + \mathbf{X}\boldsymbol{\beta} + \theta_q + t + t^2 + t^3 + \epsilon \quad (2.1)$$

where  $\gamma_1$  is the effect of UN troops in clan  $i$  in the month prior to time  $t$ ;  $\gamma_2$  is the effect UN police in clan  $i$  in the month prior to time  $t$ ;  $\boldsymbol{\beta}$  captures the effects of time-varying clan covariates in  $\mathbf{X}$ ; and  $\theta_q$  are quarter-year fixed effects.

I rely on quarter-year fixed effects to account for time-varying factors that may explain trends in new investment across all clans in Liberia, like changes in Liberia’s political climate. I also include three separate time trends and calculate heteroskedastic and autocorrelation consistent standard errors, given the possibility of temporal dependence in my outcome variable [56, 57]. As robustness checks related to spatial autocorrelation arising from regional development programs, I follow Bunte et al. (2018) in clustering my standard errors at the county (first-order administrative unit) and district (second-order administrative unit) level [46].



## 2.5 Results

I find broad support for my argument: while the correlation between UNMIL troops and new resource concessions is negative, the correlation between UNMIL police and new resource concessions is positive (Figure 2.5, model (a), Table A.2). Deploying an additional 1000 troops is associated with a 2.03 percentage point decrease in the probability of new investment. By contrast, deploying an additional 100 UN police is associated with a 2.93 percentage point increase in the probability of new investment.

To help interpret these results, consider how they correspond to changes in the operational units UN peacekeepers organize into. Peacekeeping troops are commonly deployed in “companies” made up of between 80 and 150 personnel. Police are commonly deployed in “formed police units” (FPUs) that consist of 140 personnel.

Only abnormally large shifts in the deployment of UN troops would correlate with a substantively meaningful change in the probability of new investment. At the height of UNMIL's deployment in December 2005—when there were over 16,000 peacekeepers deployed in Liberia—the largest number of companies at a single base was eight. Based on my results, redeploying this entire cluster of companies elsewhere would only be associated with a 1.6 percentage point reduction in the probability of new investment.

By contrast, UN police have a stronger relationship with the probability of new investment. There were 9 FPUs deployed to Liberia in November 2013, when UNMIL's police force consisted of 1641 officers. Deploying just two FPU-sized contingents of UN police to a clan would be associated with a 8.4 percentage point increase in the probability of new investment.

These results hold when I cluster my standard errors at the country and district levels to address potential spatial autocorrelation in the siting of concession areas (model (b) and (c), Table A.2). I also re-estimate Equation 2.1 using logistic regression, since my

Figure 2.5: UN peacekeeping police encourage foreign direct investment, while UN troops do not.

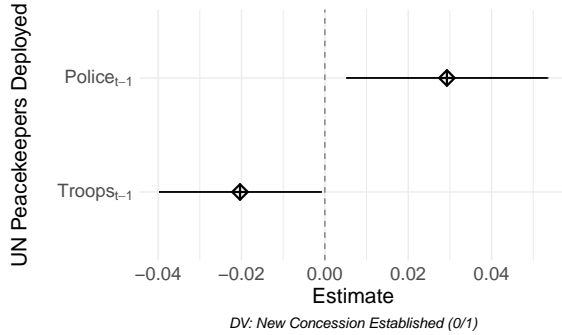


Figure 2.6: UN peacekeeping police immediately encourage foreign direct investment.

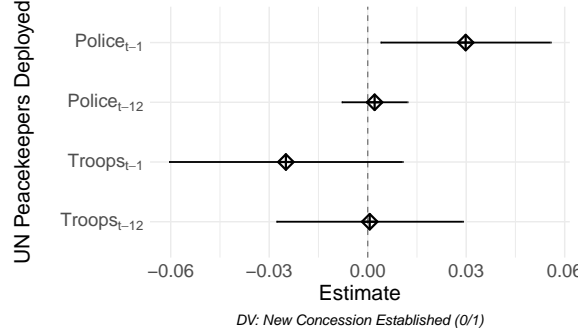


Figure 2.7: \*

*Note:* all results are from OLS regression with heteroskedastic and autocorrelation consistent standard errors. Ninety-five percent confidence intervals are displayed. The variance inflation factors (VIFs) for UN Troops and UN police are 1.49 and 1.38, respectively. Both VIFs are far below the rule of thumb used to detect problematic multicollinearity.

outcome variable is binary (model (g), Table A.2). Doing so does not change the substantive or statistical significance of the association between UN police and new investment, though the negative association between UN troops and new investment falls below the conventional level of significance.

To relax my initial assumption that firms only reference the local deployment of peacekeepers in the month immediately preceding the establishment of a new concession area, I include twelve month lags of UNMIL troops and police in my model (Figure 2.6, model (d), Table A.2). I find that the association between UN police, lagged by a single month, and new investment remains positive and statistically significant when controlling for UN police levels one year prior. However, the weak negative association between UN troops, lagged a single month, and new investment is statistically indistinguishable from zero when specified alongside a twelve month lag of UN troops.

The relationship between UN police and the onset of new concession areas also holds when I restrict my sample to clan-months wherein a maximum of one company of UN troops were deployed (model (e), Table A.2). The positive association between UN police

and firms' investment decisions does not appear to depend on the co-deployment of large contingents of UN troops.

Additionally, I check whether my results hold when I control for the lagged count of new natural resource concessions. It is possible that foreign firms reference their competitors' behavior when deciding where to site a new FDI project, either because their competitors have access to private information about local political conditions or because firms want to avoid establishing new natural resource concessions in already crowded markets. Controlling for the count of new natural resource concessions, lagged by a single month and by twelve months, does not affect my main results (model (f), Table A.2).

### 2.5.1 Unobserved Confounding

The simulation-based sensitivity analysis presented in Cinelli and Hazlett (2020) allows me to formally test how robust my results are to omitted variable bias [19]. Table 2.1 reports two relevant statistics from the analysis. The first,  $RV_{q=1}$ , describes the amount of residual variance in both UN deployment levels and the onset of new concessions an omitted variable would need to explain to change the sign of my results. The second,  $RV_{q=1, \alpha=0.05}$ , describes the amount of residual variance in my treatment and outcome an omitted variable would need to explain to nullify my results at the conventional level of significance.

The relationship between UN troops and FDI appears far more sensitive to omitted variable bias than the relationship between UN police and FDI (Table 2.1). An unobserved confounder would need to explain only 0.6% of the residual variance in my treatment and outcome to nullify the negative correlation between UN troops and new investment. By contrast, an unobserved confounder would need to explain 3.2% of the

Table 2.1: Omitted Variable Bias Sensitivity Analysis  
*Outcome: New Concessions (0/1)*

Treatment	Est.	Std. Error	t-value	$RV_{q=1}$	$RV_{q=1, \alpha=0.05}$
UN Troops (t-1)	-0.020	0.009	-2.381	0.028	0.005
UN Police (t-1)	0.029	0.006	4.650	0.054	0.032

Table 2.2: \*

*Note:* Higher values of  $RV_{q=1}$  and  $RV_{q=1, \alpha=0.05}$  imply that the observed treatment effect is more robust to omitted variable bias.

residual variance in my treatment and outcome to nullify the positive correlation between UN police and new investment.

I next quantify how much stronger an omitted variable would need to be, relative to the bias a covariate I specify would induce as an omitted variable, to overturn the positive correlation between UN police and FDI. This exercise is particularly useful because it allows me to consider whether a “strong-enough” confound plausibly exists outside of my model. I benchmark the strength of unobserved confounding against the bias a clan’s proximity to the nearest gold deposit would induce because I expect this covariate to be especially endogenous to where UNMIL deployed peacekeepers and where firms established concession areas.

Figures A.5 and A.6 shows that the positive correlation between UN police and FDI I estimate is only sensitive to an omitted variable capable of inducing substantially more bias than a clan’s proximity to gold deposits would induce as an omitted variable. This correlation would remain positive and statistically significant even if an omitted variable were about eight-times more confounding than the proximity to gold deposits would be as an omitted variable.

It is difficult to think of a variable that is capable of inducing the level of bias required to overturn my results, exists outside of my battery of covariates, and is not an intermediate outcome linking the deployment of UN police to new investment. The prox-

imity of clans to gold deposits appears highly endogenous to firms' investment decisions and UNMIL's criteria for subnationally deploying personnel. Gold mining operations constitute the bulk of concession agreements established in Liberia, and UNMIL reports reference the mission's operations to monitor the extraction and export of gold. Other observable factors explaining the deployment of peacekeepers and new investment, like local levels of development, are included in my model. While data limitations prevent me from measuring other variables that are logically related to the deployment of UN police and investment, my theory attenuates concerns that these unobservables are, in fact, confounders. Absent the deployment of UN police, the presence of state security forces would not credibly signal to foreign firms that the local risk of extortion, expropriation, and criminal violence is low.

This sensitivity analysis supports a stronger, albeit narrower, interpretation of my main result: conditional on there being no omitted variable that can induce eight-times more bias than would omitting clans' proximity to gold deposits, local deployments of UN police plausibly increase the probability that foreign firms establish new natural resource concessions. By contrast, the relationship between UN troops and FDI I estimate appears far more sensitive to unobserved confounding and should be interpreted as such.

## 2.5.2 Mechanisms

Increasing the local deployment of UN police plausibly encouraged new foreign investment in post-conflict Liberia's extractive sector. Two observationally equivalent mechanisms may explain this relationship. First, UN peacekeeping police may attract FDI because they credibly signal where the government can be trusted to uphold the rule of law. Second, UN peacekeeping police may attract FDI because they uphold the rule of law themselves.

These mechanisms are neither mutually exclusive nor wholly dependent on each other. If UN police make local political conditions more conducive to FDI, then their presence should only further strengthen the government's commitment to mitigate the political risk of investment. Similarly, the widely-held perceptions of UN peacekeepers as impartial [14, 15] and effective [12, 13] implies that their deployment near prospective projects sites alone would enhance the government's commitment to uphold the rule of law.

Nonetheless, I extend my main analyses to investigate which of these two mechanisms has the greatest empirical support. If the positive relationship between UN police and FDI is driven by changes in local political conditions that UN police initiate, then the subnational deployment of UN police should negatively correlate with the onset of riots, mob violence, and vigilante violence. All three measures plausibly approximate the extent of criminal violence and the rule of law in Liberia. Large scale riots and other forms of vigilante violence were among the most significant barriers to restoring the rule of law in Liberia upon UNMIL's deployment [17].

I use available conflict event data to investigate whether UN police are negatively associated with riots, mob violence, and vigilante violence. I first measure the onset of each kind of violence per clan-month. Then, after pre-processing my sample of Liberian clans using the same matching strategy I describe above, I re-estimate Equation 2.1 with the onset of riots, mob violence, and vigilante violence as the dependent variables of interest.

If UN police encourage FDI because they enhance the credibility of government commitments to locally enforce the legal protections investors rely on, then the positive association I estimate above should be stronger in areas where the government's ability to uphold rule of law is relatively weak, and vice versa. The deployment of UN police may not meaningfully shift firms' priors on the political risk of investment in areas where state actors can demonstrably uphold the rule of law. Firms operating in these

area may find the government's commitment to deter criminal violence, expropriation, and extortion sufficiently credible absent the deployment of peacekeepers, such that the positive relationship between UN police and new investment becomes smaller and less precise. By comparison, deploying UN police may cause a larger shift in a firm's priors on the political risk of investment in areas where state actors struggle to enforce the rule of law. In these areas, UN police have the greatest potential to strengthen the government's commitment to prevent expropriation, extortion, and criminal violence. It follows that the positive association between UN police and FDI I estimate in my main analyses should increase when focusing exclusively on areas where the government's rule of law institutions are weak.

I explore whether UN police are more likely to attract FDI to areas where the rule of law is weak using three Afrobarometer surveys conducted in Liberia between 2008 and 2015 [21]. I construct four variables that should approximate the government's capacity to uphold the rule of law at the local level, according to Afrobarometer's survey respondents. Specifically, I calculate the proportion of households per district (Liberia's second-order administrative unit) who actively fear crime, believe the Liberian government cannot deter crime, and negatively evaluate the Liberian courts and the Liberian National Police based on how corrupt, untrustworthy, and illegitimate they perceive each institution to be.<sup>10</sup> I then merge these data into my matched sample of Liberian clans. Finally, I split my matched sample of clans into high and low subgroups along these proxies for the rule of law and re-estimate Equation 2.1.

I find no evidence suggesting that the subnational deployment of UNMIL personnel correlates with changes in local political conditions that would have encouraged FDI. Increasing the number of UNMIL police deployed at the clan-level is not associated with the subsequent onset of riots, mob violence, and vigilante violence (Table A.4), even after

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<sup>10</sup>Appendix A.3 discusses why I cannot aggregate these data to the clan-level.

Figure 2.8: UN police encourage investment in areas where citizens’ evaluations of the rule of law are poor.

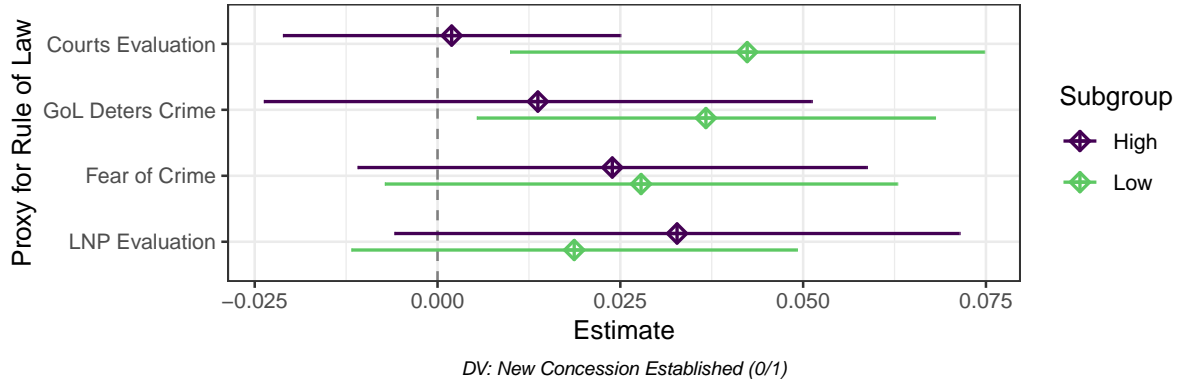


Figure 2.9: \*

Note: all results from OLS regression with heteroskedastic and autocorrelation consistent standard errors. Ninety-five percent confidence intervals are displayed.

controlling for the number of UNMIL troops deployed at the clan-level. This null finding is consistent with evidence that UNMIL personnel failed to reduce citizens’ exposure to crime in postwar Liberia [58].

By contrast, I find much stronger evidence that UN police encourage FDI because they lend credibility to the government’s rule of law institutions (see Figure 2.8 and Table ??). UN police are positively associated with the new extractive sector investment in clans where the majority of citizens negatively evaluate the Liberian courts (*est.* = 0.044, *p-value* = 0.009) and believe the government of Liberia cannot deter crime (*est.* = 0.036, *p-value* = 0.024). These point estimates are larger than the association between UN police and FDI I estimate in my full sample. The correlation between UN police and new FDI in clans where the majority of citizens personally fear of crime is positively signed but falls slightly below the conventional level of statistical significance (*est.* = 0.028, *p-value* = 0.12).

That UN police are specifically associated with new extractive sector investment in



areas where citizens negatively evaluate the courts lends additional credibility to my argument. Establishing a new natural resource concession almost always involves transferring publicly and/or customarily-held parcels of land to foreign concessionaires. This process can be contentious, sparking disputes that stem from competing systems of land tenure within the proposed concession area [59]. It is much less likely that these disputes would be quickly resolved in venues favoring concessionaires' statutory claims to ownership when citizens perceive the courts as biased or ineffective [45]. Deploying UN police should help alleviate this concern and increase foreign firms' willingness to establish natural resource concessions.

## 2.6 Discussion & Conclusion

What explains the subnational allocation of FDI in post-conflict countries? Using data from post-conflict Liberia's extractive sector, this article shows how the local composition of UN peacekeeping forces shapes FDI. I find weak evidence that UN peacekeeping troops discourage FDI because their deployment signals to foreign firms where the government cannot credibly commit to prevent violence. By comparison, I find robust evidence that UN peacekeeping police encourage FDI because they enhance the credibility of government commitment's to uphold the rule of law.

The relationship between UN peacekeeping police and FDI I estimate is likely an upper bound. Extractive sector FDI is particularly vulnerable to political instability. Firms operating natural resource concessions rely on tangible assets that are location specific and do not produce goods for which local demand is inelastic. As a result, they are more likely to draw down during conflict because violence both increases their transaction costs [49] and undercuts their profits [50]. Firms operating in other sectors (e.g., manufacturing) may not be as sensitive to political instability and, therefore, may

not adjust their investment decisions according to local peacekeeping deployments.

My theory and results should generalize to settings where UN peacekeepers are substitutes for the state. UNMIL's initiatives to re-legitimize the state are characteristic of other multidimensional PKOs [60]. Personnel attached to the UN peacekeeping mission in Mali intervene locally to mediate disputes [15] because citizens believe the Malian courts are biased [45]. UN peacekeepers deployed in Côte d'Ivoire helped monitor post-conflict elections to prevent electoral violence and legitimate the Ivorian state [34].

My theory and results should also generalize to settings where international peacebuilders believe reforming natural resource management can foster long-term peace and development. The UN links the mismanagement of natural resources to conflict in four other countries that have hosted multidimensional PKOs: Sierra Leone, Côte d'Ivoire, the Central African Republic (CAR), and the Democratic Republic of Congo (DRC). Quantitatively extending my analyses to include these countries is beyond the scope of this article. However, qualitative data detailing these missions' mandates help bolster the generalizability of my results. Beevers (2018) shows that international peacebuilders pursued a similar policy of preparing natural resources for FDI in Sierra Leone, as do reports from the peacekeeping mission deployed there between 1999 and 2006 (Reports X and Y, Table A.1) [18]. UN peacekeepers deployed to CAR help "support [government efforts]...to tackle the illicit exploitation and trafficking networks of natural resources" that "threaten peace and stability" (Report W, p.3, Table A.1). The trafficking of natural resources similarly shaped UN peacekeeping operations in Côte d'Ivoire and DRC (Reports H and A.1, Table A.1).

My general theoretical proposition—firms are more likely to site new FDI projects in areas where the government's commitment to enforce protections against expropriation, extortion, and violence are credible—illuminates other variables which may explain subnational variation in FDI across a variety of settings. For example, the proximity of

prospective investments to administrative capitals may affect FDI because it predicts how easily foreign firms can access state power [53] and the legal protections it guarantees.

One potential drawback of this study is that data limitations prevent me from quantitatively testing whether UN police directly improved the rule of law near concession areas. However, my theory attenuates this concern because it positions a firm's perception of the government's rule of law institutions as an intermediate outcome linking UN peacekeeping personnel to FDI. This perspective follows existing research demonstrating that firms reference observable host country institutions before committing FDI. It also may be more realistic. Foreign firms with limited resources should be more likely to use the local deployment of UN peacekeepers as a heuristic for determining whether government commitments are credible, rather than continuously monitoring the government's rule of law institutions near prospective concession areas.

This article makes two contributions. First, it develops new theory that incorporates the subnational governance problems foreign firms must navigate when seeking investment in post-conflict states. Second, it adds to a growing literature documenting how UN peacekeeping missions affect multiple dimensions of post-conflict politics. Contemporary peacekeeping missions task their personnel with providing public services, restoring the rule of law, conducting electoral education events, and managing natural resources. To thoroughly evaluate whether UN peacekeepers rebuild peace and restart development, we must consider the full set of activities they undertake when deployed to conflict-affected settings.

## Chapter 3

# Environmental Deprivation and Political Unrest: Evidence from a Liberian Panel Survey.

### 3.1 Introduction

Under what conditions do shortages in environmental services like clean drinking water catalyze protest? Government failures to provide environmental services both are a persistent barrier to safeguarding human well-being globally [61] and underpin many citizens' grievances with the government [62, 63, 64]. Existing theory suggests that citizens should be more likely to mobilize for protest in response to grievances like environmental service shortages when they believe conventional modes of political participation like voting are insufficient to elicit government reform [65, 66, 67, 68]. This model of mobilization implicitly assumes that citizens cannot affect the policymaking process without directly engaging state actors, overlooking the important role that non-state actors and the informal institutions in which they are embedded affect state-society relations around the world [69, 70, 71, 72].

We offer an alternative explanation of protest mobilization which adapts existing theory to capture how actors and institutions outside of the state shape citizens' responses

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to environmental service shortages. Non-state actors commonly emerge as “brokers” who mediate citizens’ interactions with the government when the state’s capacity to govern is limited [71]. One specific function of these brokers is to demand and elicit government reform on behalf of citizens who believe that conventional forms of political participation will not alleviate their grievances [73, 70, 74]. Non-state actors’ capacities as brokers should moderate the effect of environmental service shortages on protest. Effective non-state brokers affect protest mobilization because they offer aggrieved citizens a pathway to government reform that is as effective as protest but less costly. If citizens believe that non-state actors can elicit government reform on their behalf, then they should be less likely to mobilize for protest when aggrieved.

We construct a six-month long panel dataset of 390 households in Liberia’s capital city of Monrovia to test our argument. These data allow us to estimate how perceptions of non-state actors called “community chairpeople” moderate the relationship between environmental service shortages and respondents’ willingness to protest. Community chairpeople are local leaders active throughout Liberia. They are informally elected and help communities interact with the Liberian government, even though they receive neither pay nor legal recognition from the state. Chairpeople are similar to non-state brokers in other settings, such as traditional chiefs in Zambia [70] and town chiefs in Malawi [75].

We find that community chairpeople who are perceived as effective brokers dampen the otherwise positive association between environmental service shortages and protest. We take two steps to support a more causal interpretation of this result. First, data from three focus groups about protest we conducted in Monrovia help us identify, measure, and specify as covariates the most salient confounds of protest in our study’s setting. Second, we formally quantify the robustness of our main result to omitted variables using a simulation-based sensitivity analysis [19]. The results from this sensitivity analysis suggest that an omitted variable would overturn our result only if it induced substantially

more bias than would omitting a theoretically-relevant covariate we already specify. It is unlikely that such a confound exists and is neither included in the battery of covariates we derived from our focus groups nor differenced out by our time and unit fixed-effects.

One concerning interpretation of our main result is that effective non-state brokers act as substitutes for the government when they redirect citizens' responses to environmental service shortages [76, 77]. Additional data from our survey and interviews we conducted with acting community chairpeople in Monrovia attenuate this concern. We find that citizens who experience environmental service shortages but believe their chairperson is an effective broker report a lower willingness to shirk on tax payments for better environmental services, are less likely to perceive government officials as corrupt, and are less likely to believe that protest is effective. Moreover, chairpeople describe themselves as complements to the Liberian government who work to maintain state-society relations, rather than actors who use government failures as an opportunity to supplant the state.

Three scope conditions inform the generalizability of our theory and results. The state must have some capacity for repression; and non-state actors must both be capable of holding government officials accountable and have some incentive to encourage citizens to seek government reform through means other than protest. These conditions characterize many developing democracies in the Global South, where non-state actors like traditional chiefs mobilize votes for government officials, personally benefit from improving state-society relations, and offer citizens a strategy for achieving reform that avoids the risk of violent repression [73, 70].

This article makes two contributions. First, it extends existing research on protest mobilization. Foundational theories of protest implicitly assume that citizens cannot affect the policymaking process without directly engaging government actors. Our theory relaxes this assumption, articulating how non-state actors who broker citizens' interactions with otherwise unresponsive governments affect the opportunity cost of protest.

The decision to mobilize against the state reflects variation in citizens' exposure to government failures and capacity to elicit government reform through other means. We leverage household panel data to precisely capture this process, identifying the specific conditions under which grievances like environmental service shortages are likely to spark protest. Our mixed methods design allows us to interrogate the internal validity of our results and provides additional face validity for our argument.

Second, this article bolsters emerging research on the political consequences of environmental changes, such as the relationship between experiencing climate-related natural disasters and political participation [78, 79]. Governments frequently fail to provide their citizens with environmental services, like clean drinking water and—of increasing relevance—security from climate change. Foundational work on the environment and violence argues that the relative scarcity environmental service shortages induce can exacerbate political instability absent effective institutions [80], as does more current research [81, 82]. We quantitatively and qualitatively substantiate this claim at the micro-level in a novel setting. Shortages in environmental services can trigger destabilizing cycles of protest and government repression in post-conflict countries like Liberia. Non-state actors who are effective brokers help break this cycle, allowing aggrieved and otherwise disenfranchised citizens an alternative strategy to elicit government reform. Further exploring how non-state actors sustain citizens' access to environmental services represents a critical field of future study.

## 3.2 Theory

Under what conditions do shortages in environmental services mobilize citizens for protest? Government failures to reduce air pollution [62, 63], safeguard drinking water [83], deliver reliable electricity [64], or provide other environmental goods and ser-

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vices frequently underpin citizens' grievances with the state.<sup>1</sup> Foundational theories of mobilization rooted in the concept of "relative deprivation" argue that grievances like environmental service shortages are sufficient to spark protest [85]. While recent scholarship has more precisely articulated the conditions under which grievances lead to protest [86], their role in mobilizing citizens remains unchanged: grievances motivate citizens to make extrainstitutional demands for reform. Contemporary applications of the grievances framework attribute protest to discrete government failures like the inability to address economic crises [87] or reduce police-caused deaths [88].

Other research on the structural determinants of protest contends that grievances are necessary but insufficient to spark mobilization, and instead points to the role of "political opportunity." Two core ideas underpin opportunity-based theories of mobilization. First, aggrieved citizens are rational actors that use protest alongside other forms of collective action to elicit government reform; and second, the institutional environment in which aggrieved citizens are embedded structures the incentives to participate in different kinds of collective action [65, 66, 89, 90]. All else equal, opportunity-based theories of mobilization contend that protest is less likely to emerge in the presence of institutions that either increase the cost of protest or strengthen citizens' abilities to shape the policymaking process through conventional forms of political participation like voting. For example, institutions which facilitate direct democracy are associated with lower levels of protest mobilization because they formalize citizens' access to the policymaking process [91]. The state's capacity to repress dampens protest mobilization by increasing its potential costs [92].

Scholars have usefully begun exploring how opportunity and grievance-based theories of mobilization interact, taking cues from early research that positions political oppor-

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<sup>1</sup>Electricity is an environmental service because generating reliable electricity often requires governments to effectively manage natural resources like rivers in light of environmental changes [84].



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tunity as an intermediate variable linking grievances to protest [65, 66]. Some argue that grievances affect protest mobilization by shaping would-be protesters' expectations of government responsiveness [93, 64]. Harris and Hern (2019) attribute the wave of protest across the African continent between 2011 and 2015 to both unresolved material grievances about living conditions and shared beliefs among citizens that conventional modes of political participation were insufficient to elicit government reform [67]. Relatedly, Hendrix and Haggard (2015) find that the mobilizing effect of food shortages on protest is limited to democracies that are unlikely to repress public dissent [94].

Research on the determinants of political violence similarly suggests how grievances and political opportunity interactively explain protest mobilization. Dyrstad and Hillebrand (2020) show that lower perceptions of external efficacy amplify the positive association between grievances and support for political violence against the state [68].<sup>2</sup> Nemerever (2021) finds that attacks against federal employees tasked with managing public lands in the American West are more common among counties that both experienced grievance-inducing land transfer policies and are governed by sheriffs that serve as elite allies to disgruntled citizens [96].

Whether grievances and political opportunity affect protest mobilization remains an active empirical question, however. This uncertainty partially reflects the lack of systematic evidence documenting how political opportunity moderates the effect of grievances on protest mobilization irrespective of setting [97]. Existing studies either rely on cross-sectional measures of grievances and political opportunity at the individual-level or aggregate time-varying measures of both variables to the group-level. The former measurement strategy helps explain why some citizens are more likely to protest than others, while the latter clarifies why protest is more likely to emerge in some places than others. Nei-

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<sup>2</sup>External efficacy approximates political opportunity at the individual level because it captures whether citizens feel that participating in formal political processes will elicit a response from the government [95].

ther measurement strategy can precisely estimate how an individual citizen’s decision to protest is sensitive to changes in both their own material conditions (e.g., access to environmental services) and the political environment in which they are embedded (e.g., perceptions of government responsiveness).

Moreover, extant research tends to focus exclusively on how “formal” sources of political opportunity—features of state institutions—condition the effect of grievances on protest mobilization. Political opportunity is commonly measured as the openness of city governments [65, 88], the presence of elite allies in formal decision-making bodies [98], the strength of opposition parties [99], the state’s capacity to repress [92, 93], or citizens’ perceptions of external efficacy with respect to conventional modes of political participation [67, 68].

Yet it is likely that actors and institutions which exist outside of the state represent “informal” sources of political opportunity that shape the dynamics of protest mobilization. Citizens frequently self-organize to establish governance, or “institutionalized modes of social coordination to produce and implement collectively binding rules, and/or to provide collective goods,” when the state’s capacity to govern is limited [100, 9]. In practice, this process involves authorizing a variety of non-state actors to establish and/or enforce informal institutions [69]. Despite research documenting how modes of informal governance influence citizens’ perceptions of and interactions with the government [73, 101, 102, 74, 72], no systematic evaluation of their effect on protest exists.

In particular, non-state actors who mediate citizens’ interactions with the government represent an important source of political opportunity. These actors, commonly described as “intermediaries” [71] or “brokers” [103], are deeply embedded in particular communities and come in many forms, including traditional authorities [70, 104], informally elected community leaders [75], and prominent businesspeople [66, 105, 106]. The specific role of non-state brokers is to facilitate the flow of information between citizens

and the government at the local level.

Non-state actors can function as effective brokers because of their role in mobilizing support for the government. Government officials target reform, like better public services, to garner electoral support across a number of settings [107]. These officials often have poor information on where additional services are needed and lack the bureaucratic capacity to unilaterally delivery services. Traditional chiefs, community leaders, and other non-state actors both can help government officials overcome these challenges, given their knowledge about local problems and ability to mobilize voluntary contributions to state-backed service projects. Non-state actors also can sanction government officials who fail to meet citizens' demands for reform, given their ability to mobilize voters [103, 73, 70].

There can be sufficient incentives for non-state actors to productively mediate state-society relations as citizens experience grievances like environmental service shortages. The authority of many non-state actors rests on their ability to satisfy citizens' demands for reform. It is likely that coordinating with the government to satisfy these demands is a more efficient strategy for non-state actors, particularly with respect to providing more complex public goods like better roads. Additionally, non-state actors invest in their own material well-being when they work with the government to improve local public service provision, since they often reside in the communities they represent [73, 70].

Non-state actors should expand citizens' perceptions of political opportunity when they are effective brokers, in at least two ways. First, effective non-state brokers provide citizens with an alternative strategy for resolving their grievances. Traditional chiefs in Zambia help citizens in rural communities secure better public goods and services from the government, as do town chiefs in Malawi [75]. Second, non-state actors can improve citizens' perceptions of external efficacy in their role as brokers. For example, McClendon and Riedel (2015, 2021) show how religious leaders stimulate political participation by

delivering sermons which emphasize individuals' capacity to make change in the face of extensive social, economic, and political problems [108, 109]. Murtazashvili (2016) similarly finds that non-state actors overseeing community-level governance in Afghanistan improve citizens' perceptions of government effectiveness and responsiveness [104].

Foundational theories of protest share one core principle: mobilization occurs when aggrieved citizens believe that conventional forms of political participation are insufficient to change the status quo [85, 65, 66]. In many settings around the world, conventional forms of political participation include interacting with non-state actors to elicit government reform [71]. Incorporating how non-state actors critically mediate state-society relations should further clarify the conditions under which citizens are most likely to mobilize for protest.

To that point, our specific argument is that efficacy of non-state actors as brokers moderates the effect of shortages in environmental services on protest. Non-state actors who successfully facilitate the flow of information and resources between citizens and the government constitute an informal source of political opportunity, either strengthening citizens' external efficacy or directly amplifying citizens' preferences to the government. Doing so ultimately increases the opportunity cost of protest, such that aggrieved citizens should be less likely to mobilize for protest when they believe non-state actors are effective brokers. This generates the following hypothesis:

**H1:** Conditional on perceiving non-state actors as effective brokers, citizens will be less willing to protest after they experience shortages in environmental services.

### 3.3 Setting

We use six months of fieldwork in Liberia's capital city of Monrovia to test our argument. This West African country poses a compelling test for our theory. The two

bouts of civil war Liberia experienced between 1989 and 2003 left its government weak. About 70 percent of Liberians express low levels of trust in government officials, and fewer trust the Liberian National Police [21, 110]. By comparison, non-state actors are politically active in Liberia and enjoy higher levels of trust than do government officials. International actors have coordinated with village chiefs to reform land dispute resolution.<sup>3</sup> Other traditional leaders have co-sponsored initiatives to combat sexual and gender-based violence.<sup>4</sup> Moreover, recent protests following the government's failure to provide environmental services and enact broader political reform have generated anxiety about renewed conflict in Liberia, given how state repression contributed to the country's first civil war.

We focus specifically on “community chairpeople”: non-state actors working at the community-level throughout Liberia. Citizens either organize informal elections to select chairpeople or rely on other customary political institutions to appoint them. Once in power, chairpeople serve between two and four years with various term limits.

## **Background**

Community chairpeople emerged during the second Liberian civil war to coordinate public service provision. They helped deliver World Food Programme aid and liaised with UN peacekeeping personnel. As the Liberian National Police regained strength, chairpeople acted as local reporters on issues like sexual violence. Chairpeople also guided international efforts to conduct community outreach and establish local care centers during the 2014-2016 Ebola crisis.

Community chairpeople remain active in throughout Liberia today. They help settle civil disputes, broker community interests to the government, and coordinate responses

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<sup>3</sup>See press release from the Carter Center.

<sup>4</sup>See report in Front Page Africa.

to flooding during the rainy season. Citizens also rely on chairpeople to manage access to government-provided environmental services like piped drinking water.

These tasks are delegated to community chairpeople because citizens believe they can hold the government accountable. Chairpeople can uniquely coordinate community resources to resolve services shortages; e.g., collecting small donations from wealthy community members to restore electricity. Chairpeople also are credible brokers because they help mobilize votes for government officials during election years.

Along what dimensions are chairpeople similar to other non-state actors who work as brokers? Paramount, clan, and town chiefs are traditional leaders who work alongside community chairpeople in Liberia but are located higher in the country's hierarchy of informal governance. These chiefs are paid as civil servants that the Liberia government formally recognizes under its 1986 constitution (see Chapter VI, Article 56), whereas community chairpeople receive neither legal recognition nor pay from the state.

However, a key similarity between Liberian chiefs and community chairpeople is that both leaders' authority stems from elder councils. These customary political institutions were responsible for appointing chiefs in pre-war Liberia when succession based on kinship was unclear or contested, and remain influential in the selection of chiefs today [70]. Elder councils also oversee the election or appointment of community chairpeople. For example, the elder council of Monrovia's Slipway community intervened in the election of a new community chairperson following bouts of electoral violence.<sup>5</sup> Chairpeople also defer to the elder council when adjudicating serious disputes within the community.

Chairpeople are similar to other non-state actors who operate at the community-level outside of Liberia. Malawian town chiefs share many characteristics with community chairpeople: they are more prominent in urban settings, co-exist alongside other traditional leaders, receive neither pay nor legal recognition from the government, and manage

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<sup>5</sup>See report, accessed June 8, 2021.

their community's interactions with the state [75]. The same parallels can be drawn between community chairpeople and *maliks* (village representatives) in rural Afghanistan, who are elected by community members, derive their authority from the customary mode of governance, and broker their community's interests to the government [104]. Chairpeople are also similar in function to informal civil security patrols formed in post-conflict Guatemala, given that both exist because of the government's inability to deliver goods and services [111].

### **Community Chairpeople, Environmental Service Shortages, and Protest**

From January to February 2020, we conducted three focus groups to explore how community chairpeople condition citizens' responses to shortages in environmental services. Our research team recruited participants from three communities in Monrovia via a random walk protocol. All three communities reportedly experienced significant shortages in environmental services in the years prior but varied in their mobilization for protest. Men and women between the age of 18 and 60 participated in the focus groups and were compensated for their time. We present excerpts from the transcripts of these focus groups below.

We focus specifically on environmental service shortages for two reasons. First, service shortages are a common and salient grievance Liberian citizens experience on behalf of the government. Less than 20 percent of Liberians have reliable access to electricity. Access to safe drinking water and sanitation services is similarly unreliable.<sup>6</sup> These shortages have incited protest in recent years. Protesters often block major roads or the entrances to government offices. These demonstrations draw the attention of government officials who—wanting to re-open blocked roadways—can pressure service providers to

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<sup>6</sup>For more information on service shortages, see fact sheet from the United States Agency for International Development and report from the World Health Organization.

act. Indeed, protests have forced the Liberia Electricity Corporation (LEC) to repair electricity infrastructure throughout Monrovia.

Second, restoring citizens' access to environmental services is one of community chairpeoples' core tasks. Thus, citizens' beliefs about whether their chairperson is an effective broker plausibly conditions their responses to service shortages. When citizens believe their chairperson can hold government service providers accountable, then they may be less likely to protest in response to service shortages

Unsurprisingly, many focus group participants blamed service shortages on the government, commenting "the Government is preventing her citizens from accessing basic services" (FGD 1, R5). Some directly linked protest to service shortages: "The reason why people are protesting in Liberia almost every month is because the government is not providing those basic services to her citizens" (FGD 1, R2).

Participants who condoned protest focused on its ability to elicit "immediate" reform from the government (FGD 1, R5). Others similarly argued protest grabs the government's attention (FGD 1, R4 and FGD 3, R3 and R5), "tells the government that there is an alarming situation" (FGD 2, R2), and lets "[the government] know that it is their responsibility to provide these services" (FGD 2, R4).

Not all participants agreed protest would help resolve service shortages. Some cited the complicated history of non-violent demonstrations and civil conflict in Liberia. State repression of protests against an increased rice import tariff contributed to political instability preceding the first Liberian civil war.<sup>7</sup>

Others participants discounted protest because they thought less costly ways to resolve service shortages existed. Some participants preferred contacting government service providers directly (FGD 1, R2 and R4). If this failed, then participants would deputize community chairpeople to restore services before protesting: "we will contact

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<sup>7</sup>See report in the Liberian Observer.



the government through our community chairperson...[and] if there is no redress, we will protest” (FGD 3, R5). Some claimed the first response to service shortages should always be deputizing chairpeople: “if [we] don’t have toilet, or other basic things like garbage [services]...let the community meet the community chairman...that is why we have a community chairman” (FGD 1, R1).

These responses suggest that community chairpeople can increase the opportunity cost of protest because they are appointed to elicit government reform on their communities’ behalf. Only one focus group participant named their chairperson when asked who organized protest (FGD 1, R3), and more depicted chairpeople as an alternative strategy for achieving reform that precedes protest.

## 3.4 Methods

The extensive fieldwork we implemented in Liberia lets us formally investigate if environmental service shortages and community chairpeople affect protest mobilization as hypothesized in **H1**. We first use novel household panel data to estimate how citizens’ perceptions of community chairpeople moderate the association between environmental service shortages and protest. Then, we use interviews our research team conducted with acting chairpeople in Monrovia to further situate their ability to condition citizens’ responses to shortages in environmental services.

### 3.4.1 Quantitative Analysis

We collected household survey data from 15 communities in Monrovia between January 2020 and July 2020. Survey participants were recruited using a random walk protocol, which should produce an as-if random sample because it prevents enumerators from

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selectively recruiting participants.<sup>8</sup> Then, once a month for six consecutive months, enumerators administered the same survey to participants over mobile phones.<sup>9</sup> Our final sample consists of 390 households.

Using mobile phones to survey respondents helped us overcome constraints that can interrupt data collection in post-conflict settings. For example, we were able to adjust our data collection protocol and remotely continue research activities after the onset of COVID-19 in Liberia, as Appendix B.3 clarifies. Our reliance on mobile phones also allowed research to continue safely and at low cost after gasoline shortages increased transportation prices and sparked general unrest in Monrovia. Appendix B.5 discusses concerns about response bias and attrition that are common to mobile-phone based surveys.

## Measurement

Our dependent variable is survey respondents' stated willingness to mobilize for protest. Respondents were asked how willing they would be to participate in a protest march and to block a major road. Responses were recorded on a five-point Likert scale. We collapse responses to each question into a binary variable indicating whether or not a respondent is willing to mobilize for protest generally.

One concern with our dependent variable is that stating some willingness to protest could just be "cheap talk." We argue that this concern is attenuated in our study. Conceptually, expressing some willingness to protest does map onto our broader construct of interest: the intensity of respondents' opposition to the government. Moreover, data collection began in February 2020, following a series of violently repressed demonstrations in Monrovia. The opposition party leader who organized these protests later fled from

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<sup>8</sup>See Appendix B.1 for a description of this method and the demographic composition of our sample.

<sup>9</sup>Table B.3 contains summary statistics for survey measures used in our analysis.

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Liberia to Sierra Leone. Unsuccessful attempts to extradite him followed. These events heightened political tensions in Monrovia, implying the cost of voicing anti-government sentiment was uniquely high during our study period. Indeed, many focus group participants hesitantly expressed their political views at first, perhaps fearing we would post group recordings on social media. Survey respondents faced the same risk, though enumerators constantly reaffirmed their anonymity. Nonetheless, we encourage readers to interpret our quantitative results as upper bounds, given that stated preferences for protest may not perfectly translate into mobilization.

We operationalize environmental service shortages using respondents' exposure to three shortages over the previous month: electricity blackouts, water shortages, and shortfalls in solid waste collection. These shortages are easily attributable to government actors in Monrovia, including the Liberia Electricity Corporation (electricity), the Liberia Water and Sewer Corporation (water), and the Monrovia City Corporation (solid waste).<sup>10</sup> Survey respondents reported whether each service was available when they tried to access it over the past month. We take a count of the total services respondents could not access (0-3) as our primary measure, and specify additional measures of shortages as robustness checks.

We asked respondents to evaluate their community chairperson along two dimensions that should approximate their ability as brokers: their efficacy ("How confident are you that your community chairperson can fix a problem in your community?") and their interests ("How confident are you that your community chairperson has the same interests as you?"). Responses to these questions were recorded on a five-point Likert scale. We sum how effective and representative respondents believe their chairperson to be as our primary measure, resulting in a score that ranges from zero to eight. As a covariate, we similarly measure respondents' evaluations of district representatives—officials elected to

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<sup>10</sup>Appendix B.2 discusses common causes of shortages in these services.

the Liberian legislature.

Figure B.10 shows how alternatively operationalizing respondents' perceptions of their community chairperson (e.g., as a standardized score centered on the average chairperson evaluation over the study period) and respondents' experiences of environmental service shortages (e.g., dummy variables indicating shortages in individual services) affects our results. Figure B.12 displays our results when we alternatively operationalize respondents' willingness to protest as an index score.

### Estimation

We use two-way fixed effects regressions to estimate how respondents' evaluations of their chairperson moderates the association between experiencing environmental service shortages and stating some willingness to protest. A generalization of our specification is

$$y_{it} = \alpha + \gamma_1 Service_{it} + \gamma_2 Evaluation_{it} + \gamma_3 Service_{it} \times Evaluation_{it} + \beta \mathbf{X}_{it} + \theta_i + \delta_t + \epsilon_j \quad (3.1)$$

where  $y$  indicates whether respondent  $i$  was willing to mobilize for protest in survey wave  $t$ ;  $\gamma_1$  represents the effect of experiencing an additional service shortage when respondents report no change in the evaluation of their community chairperson;  $\gamma_2$  measures the effect of respondents' evaluations of community chairpeople when they report no change in their exposure to service shortages;  $\gamma_3$  measures how the effect of additional service shortages on protest varies over changing evaluations of community chairpeople;  $\mathbf{X}$  is a matrix of time-varying controls (more below);  $\theta_i$  is a participant fixed effect; and  $\delta_t$  is a wave fixed effect. We cluster standard errors at the community-level ( $\epsilon_j$ ), since respondents' willingness to mobilize for protest likely is not independently and identically

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distributed within communities [112].

## Identification

Our panel data allow us to specify wave and participant fixed-effects to control for time-invariant differences between participants, such as age, gender, and tribal affiliation. Therefore, our identification strategy hinges on specifying the correct set of time-varying covariates that might be endogenous to the relationship between environmental service shortages, community chairpeople, and protest.<sup>11</sup>

Feedback about protest from our focus groups inform the covariates specified in our analysis: income, the perceived efficacy of protest, evaluations of elected officials, expectations of violent repression, and the social obligation to protest. Each factor approximates the opportunity cost of protest and should be endogenous to our theoretical relationship of interest. If experiencing service shortages in communities where the chairperson is a poor broker limits economic opportunity, undercuts citizens' evaluations of their elected district representative, increases perceptions of protest's efficacy, lowers expectations of violent repression, and activates social obligations to mobilize, then these covariates might explain willingness to mobilize for protest independent of the interaction between service shortages and community chairpeople.

We caution readers against drawing strong causal conclusions from our analysis. While feedback from focus group participants increases our confidence that the aforementioned covariates capture the most salient dynamics of protest mobilization in our study's setting, we cannot specify the complete universe of potential confounds. As such, we subject our results to the omitted variable bias sensitivity analysis presented in Cinelli and Hazlett (2020). This sensitivity analysis allows researchers to formally quantify how strong an omitted variable would need to be to overturn their results, in relation to how

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<sup>11</sup>We also assume linear additive effects [113].

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much bias omitting a theoretically-relevant covariate the researcher specifies would induce. Results from this sensitivity analysis are particularly useful for studies like ours because they discipline the discussion about conditional ignorability. If a potential confound only nullifies our results when it induces significantly more bias than the covariates we specify would induce as omitted variables, then we can be more confident that any conditional association between environmental service shortages and protest we estimate is not spurious.

### 3.5 Results

Effective community chairpeople moderate the relationship between environmental service shortages and citizens' willingness to protest in a way that accords with our theory. The association between experiencing additional environmental service shortages and stating some willingness to protest decreases as respondents form more positive evaluations of their community chairperson (Figure 3.1). Every point increase in a respondent's evaluation of their community chairperson corresponds with a 2.4 percentage point decrease in their willingness to protest after experiencing additional service shortages. Therefore, moving from a slightly negative to slightly positive chairperson-evaluation appears to dampen the positive correlation between service shortages and protest we observe among respondents whose chairperson-evaluations are very poor ( $te = +0.085, p = 0.026$ ). These results are robust to different measures of service shortages, chairperson-evaluations, and when we measure willingness to protest as an index (Figures B.10 and B.12).

To test whether community chairpeople uniquely condition the relationship between service shortages and protest, we re-estimate our primary specification but include an additional interaction between service shortages and respondents' evaluations of their

Figure 3.1: Effective community chairpeople moderate the association between environmental service shortages on protest.

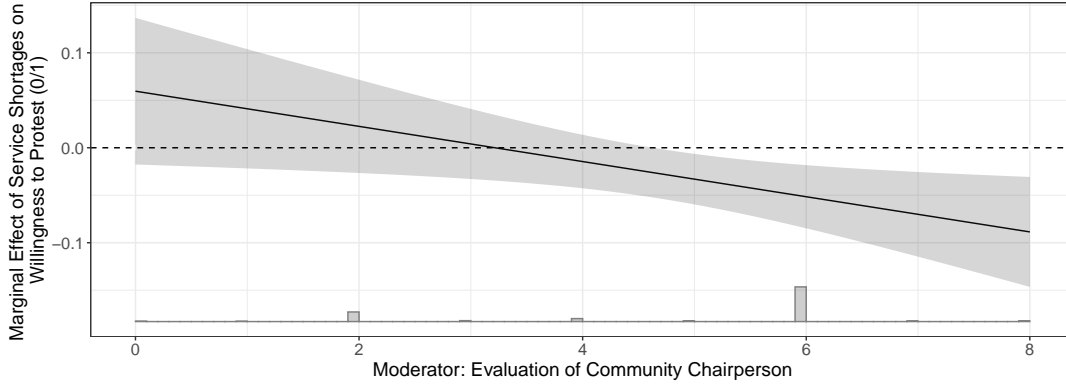


Figure 3.2: \*

*Note:* we measure chairperson and representative evaluations as a score, shortages as a count, and willingness to protest as a dummy variable. We estimate the conditional association between service shortages and respondents' willingness to protest using an OLS regression. The marginal effects plots is generated using the interflex package in R. Ninety-five percent confidence intervals are displayed. Vertical bars on the x-axis represent the distribution of respondents' chairperson evaluations.

Figure 3.3: Effective community chairpeople moderate the association between service shortages on protest, but effective district representatives do not.

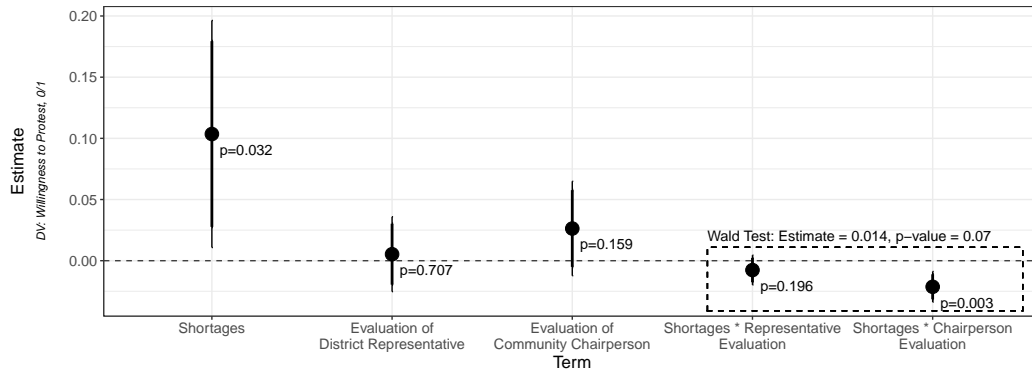


Figure 3.4: \*

*Note:* we re-estimate our primary specification but include an additional interaction between service shortages and respondents' evaluations of their district representative. Both 90 and 95 percent confidence intervals are displayed as thin and thick vertical bars, respectively. The dashed box on Figure3.3 encapsulates the two shortage-elite interactions included in our Wald Test for equivalence. Results from this Wald Test are displayed above the black dashed box.

district representatives. District representatives do not appear to moderate respondents' willingness to protest after they experience additional shortages, at the conventional level

of significance (Figure 3.3). The point estimate for the representative-shortage interaction is nearly three percentage points smaller than the chairperson-shortage interaction. We can only reject the null hypothesis that both shortage-elite interactions are identical at the 10-percent level (Wald test,  $p = 0.07$ ). Therefore, we are marginally confident that community chairpeople uniquely mitigate the risk of protest following government failures.

We perform diagnostic tests to make the inferential strength of our results transparent, in light of the assumptions underlying multiplicative interaction models [114]. Overall, we are reasonably confident that our results are not the product of unreasonable extrapolation and that the conditional relationship between service shortages and willingness to protest is linear (see Appendix B.5).

### Sensitivity Analysis

We implement the omitted variable bias sensitivity analysis proposed in Cinelli and Hazlett (2020) and applied in Hazlett (2020) and Hazlett and Mildemberger (2020) [19, 115, 116]. This analysis estimates the proportion of residual variance in both the treatment and the outcome an omitted variable would need to explain to problematically change an observed treatment effect. To help with interpretation, the analysis benchmarks the strength of a potential confound against a theoretically relevant covariate that would be a significant source of bias if it was an omitted variable. We benchmark our sensitivity analysis against respondents' perceptions of protest's efficacy, given that these perceptions are very likely to be endogenous to our theoretical relationship of interest.

Figure 3.5 shows that an unobserved confounder would need to explain more than 7.6% of residual variance in both the treatment and the outcome to nullify the conditional association between service shortages and protest we estimate. An unobserved confounder 4 times as strong as the efficacy of protest would be as an omitted variable



Figure 3.5: Sensitivity of Point Estimate to Omitted Variable Bias

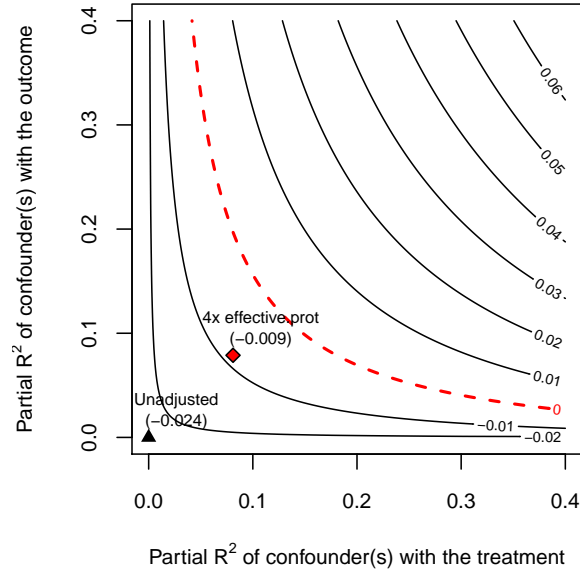


Figure 3.6: \*

*Note:* visualizes the sensitivity of the interaction between respondent's exposure to service shortages and chairperson evaluation to different levels of unobserved confounding. The dashed red line represents the level of confounding at which the unadjusted point estimate we observe (plotted as a black triangle) would be equal to zero. The red diamond (labeled “4x effective.prot”) denotes how our estimated treatment effect would change in the presence of an omitted variable four-times stronger than the efficacy of protest.

would not change the sign of the interaction between service shortages and chairperson-evaluations. An unobserved confounder of the same strength would only just nullify our main result at the conventional level of statistical significance (Figure 3.7). If an omitted variable induced approximately 3.8 more bias than omitting the efficacy of protest would induce, the conditional association between service shortages, chairpeople, and protest we estimate would remain statistically significant.

These results are especially insightful because the perceived efficacy of protest is an “important” covariate. Focus group participants who condoned protest often cited its efficacy. Respondents' perceptions of protest's efficacy also explains substantially more variation in their willingness to protest than do any of the remaining covariates

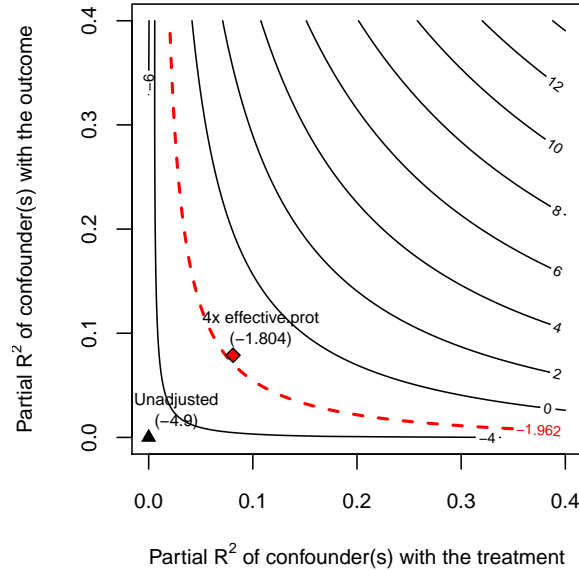
Figure 3.7: Sensitivity of  $t$ -statistic to Omitted Variable Bias

Figure 3.8: \*

*Note:* visualizes the sensitivity of the  $t$ -statistic for the interaction between respondent's exposure to service shortages and chairperson-evaluation to different levels of unobserved confounding. The dashed red line represents the level of confounding past which the unadjusted  $t$ -statistic we (plotted as a black triangle) observe would be statistically insignificant at the conventional level. The red diamond (labeled “4x effective.protest”) denotes how the  $t$ -statistic would change in the presence of an omitted variable four-times stronger than the efficacy of protest.

we specify ( $t = 5.13$ ). Moreover, there are strong conceptual reasons to believe that the perceived efficacy of protest is very endogenous to our theoretical relationship of interest. Respondents who believe protest is effective might live in communities with a history of protest that the government has sanctioned with service shortages. The same respondents also may be more likely to protest because they believe their community chairperson is an ineffective broker, as our argument suggests. We struggle to think of another theoretically relevant covariate that is neither differenced out via our time and unit fixed effects (e.g., ethnicity, tribal affiliation, changes in Liberia's political climate) nor included in our battery of covariates and is approximately 3.8-times more endogenous than the perceived efficacy of protest.

This sensitivity analysis supports a more causal, albeit narrower, interpretation of our main result. Conditional on there being no omitted variable that is 3.8-times stronger than the efficacy of protest, we find that effective community chairpeople plausibly mitigate the otherwise mobilizing effect of environmental service shortages on respondents' willingness to protest.

### 3.5.1 Community Chairpeople and State-Society Relations

Our main analysis provides quantitative evidence that community chairpeople moderate the relationship between environmental service shortages and protest. Respondents who experience shortages are less willing to mobilize for protest as they form stronger evaluations of their chairperson's ability as a broker.

One interpretation of this result is that citizens are exiting formal political processes when they experience service shortages and their community chairperson is an effective broker. This interpretation is concerning for debates regarding the relationship between informal political authority and statebuilding, or efforts to restore the capacity and legitimacy of post-conflict governments [117]. Conventional wisdom positions state and non-state authority as substitutes [76, 77], implying that non-state actors who engage in governance necessarily inhibit statebuilding efforts. If community chairpeople mitigate the mobilizing effects of service shortages on protest because citizens perceive them as substitutes for the Liberian government, the the immediate stability chairpeople provide while the government attempts to resolve service shortages may be less likely to translate into long-term political stability.

We implement two extensions of our main analyses to test whether chairpeople complement or substitute for the Liberian government. First, we test whether community chairpeople moderate other attitudes and behaviors citizens might express after expe-

riencing environmental service shortages that plausibly signal their hesitance to confer legitimacy on the government. Second, we use interviews our research team conducted with community chairpeople in August 2020 to further describe their relationship with the government.

### Quantitative Evidence

We find suggestive evidence that community chairpeople complement district representatives when they displace citizens' frustration with the government. The regression underlying Figure 3.9 interacts service shortages with a categorical variable recording whether respondents evaluated both their chairperson and representative positively, either positively, or neither positively. Respondents who experience additional service shortages and form stronger evaluations of their chairperson exclusively appear eight percentage points less likely to protest, compared to respondents who report no improvement in either elite and experience additional shortages. Forming stronger evaluations of both elites only increases this point estimate by approximately three percentage points. Moreover, we find no evidence that positive evaluations of representatives alone moderate the association between service shortages and protest ( $te = -0.03, p > 0.1$ ).

We also estimate how respondents' perceptions of their community chairperson moderates the association between service shortages and three other measures of government legitimacy: respondents' tax morale, beliefs about government corruption, and perceptions of protest. If service shortages do not correlate with lower levels of tax morale, stronger beliefs about government corruption, and heightened perceptions of protest as an effective tool to catalyze policy change as respondents forms stronger evaluations of their chairperson's capacity as a broker, then we can be more confident that chairpeople facilitate statebuilding.

The correlational evidence presented in Figures 3.9 and 3.11 attenuates concerns that

Figure 3.9: Effective community chairpeople independently moderate the relationship between environmental service shortages and protest, but effective district representatives do not.

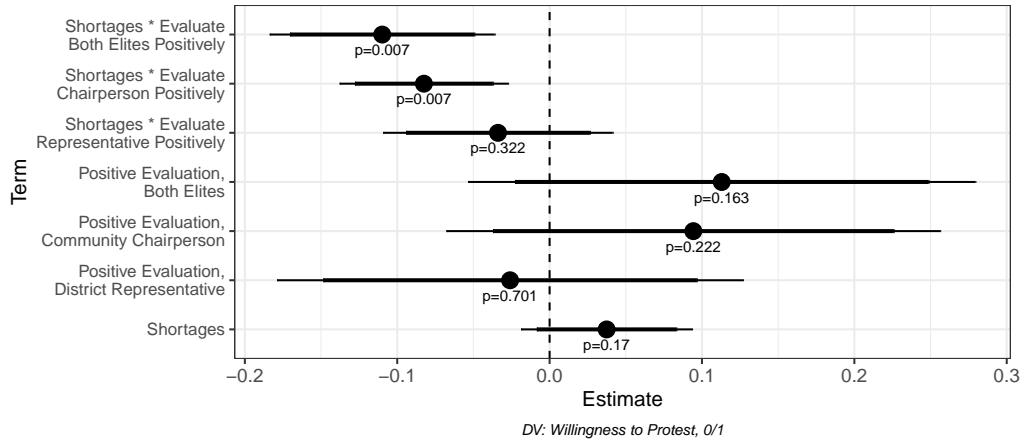


Figure 3.10: \*

*Note:* we create a categorical variable measuring whether respondents evaluated both their chairperson and district representative positively (“Positive Evaluation, Both Elites”), either positively, or neither positively (reference category). Service shortages are measured as a count. All results are from OLS regressions with standard errors clustered at the community-level. Both 90 and 95 percent confidence intervals are displayed as thin and thick bars, respectively.

community chairpeople substitute for the state when they moderate the relationship between government failures and protest. Given the onset of additional service shortages, respondents who report a one-point improvement in their chairperson-evaluation state a lower willingness to shirk on tax payments for better environmental services, are less likely to report that their district representative is corrupt, and are less likely to perceive protest as effective.

### Qualitative Evidence

The opportunity to interview chairpeople from communities where we recruited survey respondents allows us to further comment on their relationship with the government. Chairpeople were recruited from the 15 communities where we sampled survey respondents. In total, we interviewed 12 chairpeople in our implementing partner’s field office

Figure 3.11: Effective community chairpeople moderate other anti-government responses to environmental service shortages.

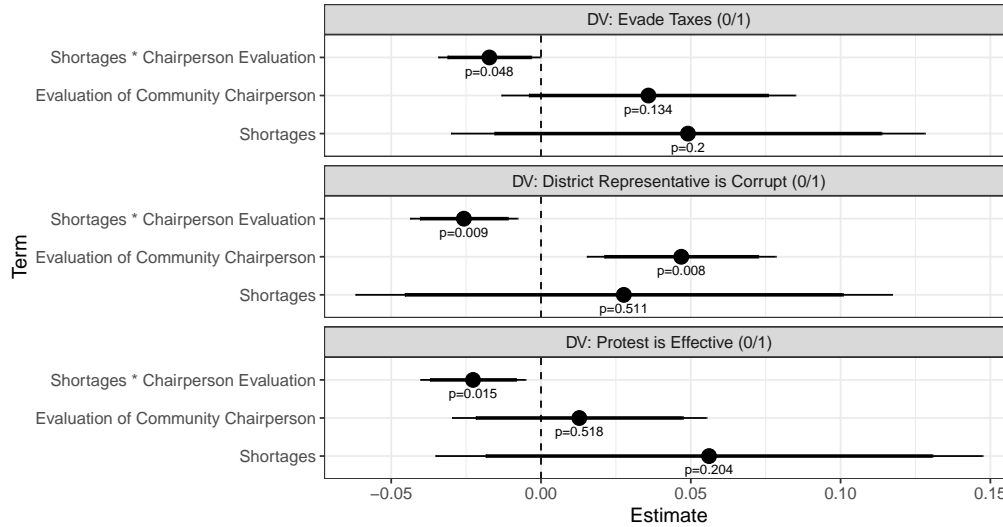


Figure 3.12: \*

*Note:* service shortages are measured as a count. All results are from OLS regressions with standard errors clustered at the community-level. Both 90 and 95 percent confidence intervals are displayed as thin and thick bars, respectively. All results are from OLS regressions with standard errors clustered at the community-level. Both 90 and 95 percent confidence intervals are displayed as thin and thick bars, respectively. Each point estimate corresponds to a different estimating equation. For each estimating equation, we control for respondents' evaluations of their district representative, income, and expectations that the government will repress protest.

to ensure their privacy and the safety of the research team.

Below, we discuss chairpeople's responses to a prompt asking how they would react to two major government failures in their community: unsolved violent crimes and electricity blackouts. Both scenarios are common and are costly for chairpeople and their communities to endure. However, chairpeople cannot unilaterally address either because they lack the legal authority to do so. If chairpeople claim to not act extrajudicially in response to these scenarios, or encourage community members to forgo extrajudicial action, then we can be more confident that they complement the government.

Despite personal frustrations with government officials, chairpeople overwhelmingly expressed support for the state when asked how they would respond to costly government

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failures like unsolved violent crimes and environmental service shortages. For instance, consider one chairperson who said it was “so hard...to get in contact with government officials” because his district representative had “neglected the whole district” in recent years (Interview 1). When asked how he would respond to a prolonged electricity black-out, he promoted “engaging the government constructively” rather than encouraging the community to stage a protest (Interview 1). Furthermore, he would do community outreach to “educate” citizens about the government’s limitations, if the government could not immediately restore electricity (Interview 1). This same chairperson reported having “taken two cases to the police...[about] attempted rape” in recent years rather than pursuing extrajudicial action (Interview 1). These responses collectively indicate a willingness to coordinate with the state when it fails to effectively govern.

Another chairperson similarly described his complementary relationship with the state, despite reporting “serious challenges” for engaging government officials (Interview 2). When asked what he would do if a major crime occurred in his community, he responded: “I would encourage my citizens, especially those [suspects] involved, to abide by the rules of the law...because this country is a country of law” (Interview 2). His statement is representative of how other chairpeople responded to these scenarios: e.g., “give the police a chance...[because] you don’t sabotage police investigations” (Interview 3), or “educate the community to understand that..[when a suspect] is not guilty...you can’t kill them” (Interview 4).

How chairpeople responded to our questions on protest further emphasizes their role as complements to the state. Even though their opinions of protest diverged—some equated it to violence that “brings chaos” (Interview 5) while others emphasized citizens’ “right to protest” (Interview 3)—each chairperson claimed they would intervene on behalf of the government if their community staged a protest. Responses ranged from encouraging citizens to resolve their grievances “diplomatically” (Interview 6) among chairpeople who

condemned protest to ensuring protesters were allowed to “speak...within the confines of the law” (Interview 2) among chairpeople who condoned protest. Chairpeople who did not condone protest outright believed negotiating with the government would be more effective, stating the “best thing is dialogue” (Interview 4) because “there are so many ways that you can engage the government” (Interview 1).

Even though they receive neither funding nor legal recognition from the state and often are frustrated with government officials themselves, the chairpeople we interviewed do not appear to undermine support for the state when given the opportunity to do so. Chairpeople act in place of the government when it is absent, but as an informal extension of the state: e.g., preventing extrajudicial violence and encouraging their constituents to work with the government when experiencing environmental service shortages.

### **3.6 Discussion & Conclusion**

This article presents new insights about the relationship between grievances, political opportunity, and protest. Using original fieldwork from a post-conflict setting, we show non-state actors who citizens perceive as effective brokers mitigate the otherwise mobilizing effect of shortages in drinking water, electricity, and solid waste services on protest.

Three scope conditions underlie our theory and results. Government officials must both be sensitive to non-state actors’ demands for reform and have some capacity for repression, and non-state actors must have some incentive to encourage aggrieved citizens to seek reform through means other than protest.

These scope conditions are not restrictive because they characterize many developing democracies in the Global South. For example, village chiefs in Zambia govern locally, coordinate public goods provision with government officials who depend on them for



mobilizing votes [70], and may offer citizens an alternative path to reform given the the state's proclivity for repression [118]. Baldwin (2013, 2015) argues Zambian chiefs have strong incentives to coordinate with government officials because doing improves their well-being [73, 70].

Additional research exploring what incentives non-state actors have to redirect citizens' grievances through existing institutions would help identify other settings where our theory and results would hold. While formally testing why community chairpeople redirect citizens' grievances with the state through existing institutions is beyond the scope of this study, we propose one explanation that may generalize outside of Liberia. Violent conflict may have directly increased chairpeoples' preferences for state authority, such they are more prone to encouraging aggrieved citizens to engage with the government instead of protesting against it. Exposure to wartime violence can increase citizens' political participation [119] and deference to the state [120]. It is possible that the legacy of civil conflict in Monrovia, where many witnessed wartime violence firsthand [121], shapes chairpeoples' relationships with the government today.

One limitation of our study is that we focus on the relationship between citizens, non-state actors, and the government in an urban setting. There may be fewer incentives for non-state actors to work as brokers that constitute a source of political opportunity in rural locations where the state struggles to both project power and deliver environmental services. Our results may weaken outside of the urban and peri-urban areas surrounding many capital cities in sub-Saharan Africa, though Murtazashvili (2016) finds that *maliks*—village representatives who are similar to community chairpeople—work to the same effect in rural Afghanistan [104].

Nonetheless, this article makes several contributions. First, we advance research on how grievances and political opportunity interact to explain protest mobilization. Our novel data collection strategy tracks monthly variation in citizens' exposure to en-

vironmental service shortages and perceptions of political opportunity, allowing us to disentangle the politics of protest at the micro-level. The multifaceted evidence and robustness checks we present facilitate a more confident interpretation of our results. Our theory articulates how non-state actors represent an important form of political opportunity around the world, and particularly so in areas where citizens are most likely to experience shortages in environmental services.

Second, this article speaks to ongoing debates about the political consequences of environmental problems like climate change. For example, some research implies that the conflict-inducing effects of environmental problems will be particularly acute in settings that lack effective democratic institutions which formally facilitate citizens' mobilization for collective action [122, 123]. Our study attenuates this concern, as does other research demonstrating how informal systems of land tenure help mitigate environmental conflict in Kenya [81].

Government failures to provide citizens with environmental services are pervasive and potentially threaten peace and development around the world. Actors and institutions which exist outside of the state can break the link between these shortages and political instability. While future research should test this proposition outside of Liberia, the practical implications of our results are clear. Policies aimed at mitigating the negative political effects of environmental problems would benefit from coordinating with the local institutions that emerge to sustain citizens' access to environmental services.

# Chapter 4

## Air Pollution Decreases Mobilization for Environmental Advocacy.

### 4.1 Introduction

History is littered with examples of citizens collectively mobilizing to curb the localized emission of pollutants that pose an immediate threat to human health. Scholars analyzing the emergence of contemporary environmental movements in the Global North often point to focusing events like large pollution inversions in 1950s London and Los Angeles and the burning of the Cuyahoga River in 1969 [62]. Government failures to mitigate pollution also motivate more recent grassroots mobilizing efforts by environmental activists in the Global South, including those working in China, India, and Uganda.

Still, whether and how experiencing pollution affects the prospects for mass mobilization remains an active empirical question, despite the obvious link between pollution and politics. Existing research generates competing theoretical predictions regarding the effect of pollution on political participation. On the one hand, pollution may increase political participation. Pollution may be akin to crime [124] or wartime violence [119], spurring political participation by clarifying citizens' grievances with the state and catalyzing group-level processes that facilitate collective action. On the other hand,

pollution may undermine political participation. The health-related impacts of air and water pollution suggest that communities exposed to either face greater barriers to collective action [125]. Empirically resolving this theoretical tension is difficult because the distribution of pollution across space and time is likely correlated with other factors that influence citizens' willingness to become politically active, such as the political power of concentrated interests [126], mobilization against clean energy technologies [127, 128], or discriminatory policies [129, 130, 131, 132, 133].

This manuscript employs a series of instrumental variable regressions to systematically evaluate the effect of pollution on political participation. A cluster of climatic variables that are plausibly orthogonal to political participation, such as planetary boundary layer height and wind speed, allow us to isolate as-if random variation in  $PM_{2.5}$  emissions across American counties between 2016 and 2018. This identification strategy follows extant research on the economic effects of air pollution [125, 134, 135, 136]. We measure political participation using novel data compiled by a prominent grassroots environmental organization in the United States (hereafter, "Organization Z") that focuses on mobilizing support for just solutions to climate change. These data document over 135,000 commitments the organization's members made to participate in various forms of environmental advocacy between 2019 and 2021, including climate marches and phone-banking for elected officials.

Our results suggest that exposure to air pollution undermines aggregate-level political participation. A one standard deviation increase in the average monthly concentration of  $PM_{2.5}$  a county experienced in 2018 results in a 0.26 standard deviation reduction in the number of commitments per capita made by Organization Z members between 2019 and 2021. The negative relationship between average monthly  $PM_{2.5}$  levels and participation persists when we examine different lags of pollution, adjust our standard errors for spatial autocorrelation, and account for three potential violations of the exclusion restriction.

A series of subgroup analyses reveal interesting heterogeneity in the effect of  $PM_{2.5}$  on political participation. We find that the negative relationship between air pollution and participation is especially strong among American counties that are relatively well-educated, overwhelmingly voted Democratic during the 2016 Presidential election, and express high levels of concern about the impacts of climate change—all counties that should face the lowest barriers to collective action, according to existing theory [137, 138, 139, 140]. One concerning interpretation of this counter-intuitive result is that the social contexts which are best equipped to engage in collective action are also most susceptible to demobilization as the cost of participation increases.

Our manuscript makes three contributions. First, it bolsters the limited body of research on aggregate-level political participation. Clarifying the determinants of aggregate-level participation is important because an individual's propensity to participate in collective action cannot be explained without understanding the characteristics of their social context and their position within it [141, 142, 143, 144]. Aggregate-level political participation is also more likely to elicit government reform [145]. For instance, Henderson et al. (2021) show that staff for elected officials only incorporate constituent communications in their advice to their bosses if a critical mass of constituents has taken the time to express a unified point of view [146].

Second, our manuscript begins to help resolve existing theoretical tensions regarding the political consequences of environmental problems. Environmental problems like pollution may simultaneously impede and facilitate collective action: as a grievance that underpins citizens' willingness to become politically active or as a barrier that increases opportunity cost of mobilization. We find greater support for the latter effect, consistent with extant research documenting the negative effect of pollution on economic productivity. Our results may be a lower-bound of the demobilizing effect of air pollution, given that we focus on more information-rich forms of political participation (e.g., contacting

elected officials) rather than voting [147, 148, 146]. If rainfall reduces voter turnout by up to one percentage point [149, 150], so too might acute or chronic exposures to air pollutants that threaten human health [125].

Finally, this manuscript extends a long tradition of research on environmental justice and injustice. The marginalization of peoples and communities based on race, gender, and other identities explains the distribution of environmental problems across space and time [132, 131], from air [151, 152] and water [153] pollution to radioactive waste [154] to climate change [155, 156]. Our results suggest that environmental problems can reinforce the systems of political marginalization they stem from. By undermining the prospects for mass mobilization—arguably, a necessary condition to resolve pressing social problems [157, 158]—pollution may beget further marginalization.

## 4.2 Air Pollution and Political Participation

To understand how air pollution could matter for participation, we distinguish between pollution as a lived experience on the one hand, and as a political grievance on the other. Pollution as a lived experience may undermine political participation, for a number of reasons. First, chronic air pollution contributes to a host of negative health outcomes. Specifically, such pollution has been shown to make lung diseases such as bronchitis more prevalent [159]. As a result, Deryugina et al. (2019) find that higher levels of particulate matter pollution increase mortality, ER visits, and spending on healthcare [125].

In turn, declines in health reduce economic productivity in ways that may inhibit political participation. Amoatey et al. (2021) shows that people experiencing higher levels of air pollution experience more reduced activity days and lost work days [159]. Prolonged exposure to air pollution, which characterizes the experiences of people in

rapidly industrializing cities in the Global South, has been shown to reduce worker output [160, 135], even in the public sector [136]. When productivity declines, people have less free time available to participate in politics [161]. Moreover, if air pollution reduces the productivity of paid labor, it stands to reason that the voluntary labor which civic engagement entails will suffer to an even greater extent.

Even acute exposure to polluted air can negatively affect one's health, dramatically increasing the cost of in-person participation. Short-term, high-intensity pollution events raise rates of asthma above what the U.S. Environmental Protection Agency's pollution standards would predict, among other impacts [162]. Extreme weather events—for instance, wildfires, inversions, and other causes of “bad air days”—may impel people to stay at home to avoid these health consequences, particularly if their planned activities are voluntary. Indeed, public air quality warnings and advisories are intended precisely for this purpose.

Air pollution's physical effects on health and economic productivity may increase the barriers to participating in voluntary activity, generating the following hypothesis:

**H1:** Air pollution demobilizes political participation.

By contrast, the grievances air pollution may make salient could catalyze political participation. Social scientists' stance on the role grievances play in mobilization has oscillated widely. Initially, driven by scholars such as Gurr (1970) and Morrison (1973), the concept of relative deprivation—the difference between expectations and reality—gained a prominent place in theories of protest and revolution [85, 163]. Yet as scholars began to identify factors that distinguished vibrant movements from lost causes—including resource mobilization [139], political opportunity [140], and framing [164]—grievances faded into the background as a virtually omnipresent scope condition. Scholars such as Gurney and Tierney (1982) increasingly noted that grievances, like public opinion, do

not exist in an objective sense [165]. Rather, they emerge from collective sense-making processes, suggesting that these framing processes account for grievances' role in spurring mobilization.

Still, foundational framing theorists acknowledge that frames' influence increases when they are consistent with their audiences' lived experiences (i.e., grievances) [164]. Indeed, a burgeoning literature in political science connects individuals' personal experiences with their political attitudes and behaviors. People who experience the direct effects of policy successes may recognize their stake in policy outcomes and thus gain motivation to participate in future rounds of contention in those arenas. For instance, Campbell (2003) shows that Social Security's adoption in the United States offered a rallying point for senior citizens to engage in collective political action, often to protect their treasured benefits from retrenchment [166]. Mettler (2005) similarly explains how veterans who received educational benefits from the GI Bill after World War II gained feelings of political efficacy which propelled them into greater political participation later in life [167]. Likewise, those who experience the negative effects of a policy failure (such as New Orleans' preparation for and response to Hurricane Katrina) may be driven to participate due to greater personal commitments to the cause [168].

Grievances may also directly mobilize individuals for politics, irrespective of their framing within social movements. This effect may result from post-traumatic growth, a desire to sublimate the resulting emotions, or engagement in social settings that foster feelings of efficacy among aggrieved individuals. For instance, Blattman (2009) shows that men forcibly enlisted as child soldiers in Ugandan rebel groups were subsequently more likely to participate in politics and even take on leadership positions in their respective communities [119]. Similarly, Bateson (2012) shows that victims of crime are more likely to engage in a range of political activities [124]. Even experts tend to approach political issues through the lens of their experiences with government or other members



of society [169]. Williamson, Trump, and Levine (2018) extend this theory to the aggregate level, demonstrating that communities where police-caused deaths of black people are more prevalent are more likely to protest such violence [88]. Although this injustice had persisted for decades prior to the Black Lives Matter movement, the fact that the most-affected communities have protested more frequently suggests that grievances indeed play an important role in mobilization.

In addition to directly spurring mobilization, grievances can erode the government's legitimacy in the public's eyes. Grievances often arise over the government's failure to provide public goods and services, such as clean air and electricity, which market forces alone tend to struggle to provide at an optimal level for society at large [170]. The resulting loss of faith in the government can in turn spark protest, as De Juan and Wegner (2019) demonstrate in South Africa [64].

The environmental movement represents a bellwether for the grievance theory, as activism around air quality emerged only after pollution reached hazardous levels in industrialized democracies [62]. Since a grievance's tangibility moderates its influence, people are more likely to take action to address a problem that affects them directly and visibly (e.g., air pollution) than a problem that appears temporally and spatially distant (e.g., climate change) [171, 172, 173].<sup>1</sup> Hart and Feldman (2021) find that messages focusing on emissions of local air pollutants from power plants inspire greater intent to participate in politics than similar messages stressing power plants' contribution to climate change [174].

Air pollution's capacity to activate existing or engender new grievances may mobilize citizens for collective action, generating the following hypothesis:

**H2:** Air pollution mobilizes political participation.

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<sup>1</sup>Recent advances in climate science toward attributing current, localized extreme weather events to elevated atmospheric greenhouse gas concentrations may yet reduce the temporal and spatial distance between climate change and people's lived experiences [?].

The countervailing mechanisms underpinning H1 and H2 are not mutually exclusive. Air pollution can simultaneously raise the barriers to collective action and strengthen grievances that motivate citizens to engage in politics. The aggregate effect of air pollution on political participation likely reflects the relative strength of each mechanism in a given setting. For example, a negative relationship between air pollution and participation may suggest that the number of people demobilized by the larger barriers to collective action air pollution produces exceeds the number of people mobilized by the grievances air pollution activates. This averaging of mechanism-specific effects is especially important for our empirical design, which we describe in detail below.

Ex-ante, we anticipate that air pollution is more likely to demobilize citizens. Experiencing the physical effects of air pollution may be necessary for pollution to activate or engender grievances. Yet not all citizens who experience the physical effects of air pollution become aggrieved [126], suggesting that the demobilizing effect of air pollution is realized more frequently than its mobilizing effect.

## 4.3 Methods

### 4.3.1 Measurement

An original cross-sectional dataset of PM<sub>2.5</sub> pollution, political participation, and climatic conditions across 3313 counties in the contiguous United States supports our analysis. We describe the construction of this dataset below.

#### *Participation*

First, we partner with a prominent environmental organization in the United States (hereafter, referred to as “Organization Z”) to measure political participation. Organi-

zation Z emerged in the mid 2010s to coordinate grassroots mobilization on a range of social and environmental issues and their intersections. Its current campaigns focus on achieving a just solution to climate change, expanding access to affordable housing, and demanding police reform. Organization Z's membership skews younger, relative to other environmental organizations in the United States.

Organization Z systematically records when its members electronically commit to participate in various forms of political advocacy it labels as “highbar” actions, such as phone-banking for elected officials the organization endorses, turning out for public demonstrations the organization coordinates, and taking part in the organization's various training activities. The population of commitments Organization Z recorded since January 1 2019—in total, 137,124 commitments from 56,177 of its members—constitute the basis of our dependent variable. We aggregate these data to the county-level using records from Organization Z denoting the zip code in which each of its members reside.<sup>2</sup> We opt for the number of committed actions per capita as our primary dependent variable, and transform this measure into z-score to ease interpretation.<sup>3</sup>

What is the distribution of commitments across Organization Z's membership and the different types of political participation it coordinates? We use the names of Organization Z events included in our data to categorize members' commitments into four groups: general meetings (e.g., participating in a Green New Deal watch party), training activities (e.g., preparation for a climate strike), canvassing (e.g., tabling on university campuses), and rallies (e.g., participating in a climate strike). We could not code 12,026 of the 133,159 commitments to highbar actions in our data, due to the vague naming of some Organization Z events. As such, we encourage readers to interpret the following as

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<sup>2</sup>Members' zip code of residence are matched to zip-code tabulation area IDs from the U.S. Census Bureau, each of which correspond to a single county in the U.S.

<sup>3</sup>County-level population estimates are drawn from the 2016 enumeration of the American Community Survey

exploratory descriptive analyses, rather than a conclusive categorization of Organization Z's programming.

Organization Z members registered approximately 8 commitments between 2019 and 2021, on average. More than 130 members made 50 commitments in the same time period, and 13 members made at least 100 commitments (Figure C.2). Commitments to participate in Organization Z meetings are more prevalent in our data, followed by commitments to engage in training events Organization Z coordinates (Figure C.3). Figure C.4 suggests that Organization Z members were most likely to attend a meeting as their first highbar action. The average minimum number of commitments recorded by an Organization Z member prior to committing to their first training activity, canvassing event, or rally were 2.51, 5, and 5.71 respectively. Figure C.5 visualizes the spatial distribution of participation across all 3,313 counties in our sample.

One advantage of our data is that they capture a broad array of political actions—from campaigning to lobbying to protesting—going beyond the typical focus on predominantly electoral activities. While voting in an election is the most widespread and regular form of political participation, a great deal of public engagement in the democratic process occurs between elections. Unlike the so-called “blunt instrument” of voting for candidates, which does not directly communicate policy preferences [148], “information-rich” forms of participation such as contacting elected officials can change representatives' perceptions of their constituents' desires regarding particular issues [147, 146]).

In addition to focusing on “deeper” forms of political participation than voting, our outcome attenuates concerns about response bias which characterize commonly-used self-reported measures of participation [175, 176]. Electronically RSVP-ing for Organization Z activities on an encrypted online platform likely induces less social desirability bias than do ex-post in-person surveys of political participation. And while members' commitments may not perfectly match their attendance at Organization Z activities, extant research

shows that making plans to engage in politics does encourage additional participation [177]. Nonetheless, we caution readers against treating our dependent variable as a perfectly validated measure of participation, despite the advantages we believe it provides over self-reported data.

### *Pollution*

Second, monthly, high-resolution ground-level fine particulate matter (PM<sub>2.5</sub>) estimates compiled by the Atmospheric Composition Analysis Group (ACAG) at Washington University, St. Louis allow us to construct our county-level measure of pollution [178]. We specifically calculate the average and maximum monthly county-level PM<sub>2.5</sub> estimates recorded in 2016, 2017, and 2018. Figure C.6 visualizes the spatial distribution of these data, and Figure C.11 plots these pollution data alongside Organization Z's participation data. To aid with interpretation, we transform these measures into z-scores.

We focus on PM<sub>2.5</sub> because it is a widespread air pollutant in the United States that is likely to shape political participation. PM<sub>2.5</sub> pollution has a number of point sources, including coal-fired electricity generation [179], wildfires [180], and automobiles [181]. Mitigating PM<sub>2.5</sub> and its co-pollutants has been the focus of various political actors and organizations in the United States. The extensively documented health-related impacts of PM<sub>2.5</sub> [182] suggests that it might undermine political participation by raising the barriers to collective action. However, the US Environmental Protection Agency's mandate under the Clean Air Act to regulate air pollutants which threaten human-health also suggests that exposure to PM<sub>2.5</sub> pollution might mobilize citizens to demand government reform, both within and outside of existing institutions. The Sierra Club's "Beyond Coal" campaign points to the health-related effects of PM<sub>2.5</sub> as justification for phasing out coal-fired electricity around the world.<sup>4</sup> A group of communities in

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<sup>4</sup>See here, accessed 17-February 2022.

Chicago's Southeast Side engaged in a 28-day to protest the nearby siting of a metal-scraping facility that would expose residents to high levels of  $PM_{2.5}$  pollution.<sup>5</sup> Other grassroots environmental organizations in the US similarly focus on mobilizing residents to protest against infrastructure that emits  $PM_{2.5}$ .<sup>6</sup>

We employ county-level aggregates of  $PM_{2.5}$  pollution and political participation, rather than measures aggregated to lower-order administrative units (e.g., US census tracts), to minimize the risk of spillover and non-compliance. Day-to-day activities like commuting to work might expose Organization Z members to  $PM_{2.5}$  pollution both within and outside of their immediate area of residence. Organization Z members similarly may commit to participate in Organization Z activities both within and outside of their immediate area of residence. County-level aggregates of air pollution and political participation are more likely to capture these spatial dynamics than are aggregates at lower-order administrative units.

### *Wind Speed*

Third, we use spatial data on wind speed from the National Oceanic and Atmospheric Administration to instrument average annual  $PM_{2.5}$  concentrations at the county-level. Wind speed affects the dispersion of air pollutants like  $PM_{2.5}$  but is plausibly exogenous to other determinants of political participation.<sup>7</sup> Specifically, we calculate the average wind speed of a county in 2016, 2017, and 2018. Figures C.9 and C.7 visualizes the within and between county variation in our wind speed instrument for the duration of the study period.

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<sup>5</sup>See here, accessed 17-February 2022

<sup>6</sup>See here, accessed 17-February 2022.

<sup>7</sup>See below for a more thorough discussion of potential violations of the exclusion restriction.

### *Controls*

Finally, we use available data from the 2016 enumeration of the American Community Survey to measure three other features of counties that might simultaneously explain aggregate levels of  $\text{PM}_{2.5}$  exposure and political participation: the area of a county, the percent of a county's population that is urban, a county's median income, and the number of people per county with at least a Bachelor's degree. We also specify the number of donations Organization Z members made prior to 2018 as an additional covariate, since prior commitments to mobilize likely correlate with current commitments. Table C.1 provides descriptive statistics for these variables.

### **4.3.2 Identification & Estimation**

Disentangling the relationship between aggregate levels of  $\text{PM}_{2.5}$  pollution and political participation is difficult, for two reasons. First, a wide range of omitted variables might explain variation in both  $\text{PM}_{2.5}$  pollution and political participation. For example, fossil fuel infrastructure and industrial plants both emit  $\text{PM}_{2.5}$  and frequently are the focus of grassroots mobilizing efforts [183, 184].  $\text{PM}_{2.5}$  pollution might also be concentrated in counties with either particularly unresponsive elected officials or especially powerful economic interests [126]—both potential confounds of participation.

Second, a large body of evidence suggests that pollution and politics are deeply endogenous. Scholars of environmental (in)justice extensively document how systemic barriers to political participation, based on race [132, 133], gender [154], or a combination of identities [131], explain the distribution of pollution across space and time. Political scientists similarly conclude that politics can be an important cause of pollution. For example, recent research directly and indirectly ties discriminatory lending and zoning practices (e.g., “red-lining”) to higher levels of (air) pollution in American cities

[129, 130, 185]. It is also possible that political mobilization against renewable energy technologies may explain why places have higher levels of PM<sub>2.5</sub> pollution than others [127, 128].

We employ a series of instrumental variable regressions to help address these threats to identification, following recent work on the economic effects of air pollution [125, 134, 135, 136]. A valid instrumental variable should be plausibly exogenous, correlated with the endogenous treatment of interest, and uncorrelated with other variables that plausibly explain the outcome of interest (i.e., satisfy the “exclusion restriction”). We describe how wind speed satisfies these criteria below.

A county’s average wind speed should strongly predict its experience of PM<sub>2.5</sub> pollution. Wind speed affects the horizontal transport of air pollutants like PM<sub>2.5</sub> [186]. Strong winds are more likely to disperse locally emitted air pollutants, such that the correlation between average wind speed/direction and average PM<sub>2.5</sub> concentration is negative.

In order to satisfy the exclusion restriction (ER), wind speed must be uncorrelated with other factors that influence aggregate levels of political participation. We explicitly address four potential ER violations in our analysis. First, we specify state-level fixed effects to control for the possibility that states’ contemporary regulations towards air pollution reflect differences in historical climatic conditions.<sup>8</sup> This decision also helps address the possibility that the dominant economic sector within a state both reflects historical climatic conditions and predicts contemporary levels of pollution. Second, we control for the relative urbanicity of each county in our sample, given the possibility that historical climatic conditions predict contemporary levels of urbanization and pollution. Another potential violations of the ER is the frequency of severe weather events: the

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<sup>8</sup>For instance, it is possible that states which experience less natural dispersal of air pollution are more likely to adopt policies that go beyond what the Clean Air Act mandates.



same climatic conditions that affect the dispersion of  $PM_{2.5}$  may also make extreme weather events more likely, and those weather events may increase the cost of political participation [149]. We hope to comprehensively address these potential ER violations in the future. As a first step, we estimate the effect of pollution on participation while also controlling for a county’s average relative humidity: a climatic factor that likely correlates with pollution and the onset of extreme weather events.

To test whether air pollution affects political participation, we estimate the following two-stage least squares (2SLS) regression where the first stage is as follows:

$$PM_i = \alpha_i + \gamma_1 WindSpeed_i + \mathbf{X}_i + \delta_i + \mu_i$$

## 4.4 Results

Does air pollution shape political participation? We begin investigating this question by simply regressing our measure of political participation on average  $PM_{2.5}$  pollution recorded at the county-level in 2018. This exercise reveals that  $PM_{2.5}$  pollution negatively correlates with political participation. A one standard deviation increase in a county’s average monthly  $PM_{2.5}$  exposure in 2018 is associated with a  $-0.08$  standard deviation change in the number of commitments made per capita by Organization Z members between 2019 and 2021, at the conventional level of significance. The negative correlation between air pollution and participation persists when we specify state-level fixed effects, control for county-level attributes that may capture the local prospects for collective action, and measure  $PM_{2.5}$  concentrations from 2017 and 2016 (Table ??).

We exploit variation in  $PM_{2.5}$  pollution that reflects differences in counties’ average wind speeds to isolate air pollution’s effect of political participation, given the extensive sources of bias we describe above. Table C.4 reports the results of the first stage rela-

relationship between our climatic instrument and average levels of  $\text{PM}_{2.5}$  pollution in 2016, 2017, and 2018. Wind speed negatively correlates with county-level  $\text{PM}_{2.5}$  concentrations at the conventional level of statistical significance.

Our second stage results indicate that increased exposure to  $\text{PM}_{2.5}$  pollution results in a modest reduction in political participation (Figure C.13). A one standard deviation increase in a county's average monthly  $\text{PM}_{2.5}$  exposure in 2018 results in a  $-0.30$  standard deviation change in the number of commitments made per capita by Organization Z members between 2019 and 2021 (Table C.6, model (a)). This result holds when we control for county-level predictors of participation such as county size (Table Table C.6, model (b)). The negative relationship between a county's average monthly exposure to air pollution and participation persists when we examine less temporally proximate lags of  $\text{PM}_{2.5}$  emissions. A one standard deviation increase in the average monthly level of  $\text{PM}_{2.5}$  pollution in 2016 (and 2017) yields a  $-0.31$  (and  $-0.41$ ) reduction in the number of commitments made per capita by Organization Z members between 2019 and 2021 (Table C.8).

Systematically removing single states and counties from our sample does not affect the substantive or statistical significance of the negative relationship between average exposures to  $\text{PM}_{2.5}$  and participation (Figure C.14). This addresses concerns that our main result reflects the salient nature of air pollution in individual states like California. Relatedly, our main result does not change when we remove four especially high influence observations from our effective sample (Table C.6, model (h)).

The demobilizing effect of average monthly  $\text{PM}_{2.5}$  pollution holds when we adjust our standard errors to account for potential spatial autocorrelation in participation (Table C.6, models (i) and (j)) and measure wind speed as a categorical variable to allow for a non-linearity in its effect of air pollution (Table C.6, model (g)). We also recover a negative effect of mean  $\text{PM}_{2.5}$  exposure on participation when specifying state-level fixed

effects and controlling for a county's urbanicity and relative humidity, alleviating some concern about ER violations which stem from wind speed correlating economic, political, and meteorological differences between counties that also affect participation (Table C.6, models (c), (d), and (e)).

#### 4.4.1 Subgroup Analyses

We also investigate whether our main result varies over demographic features of counties that plausibly moderate the effect of  $PM_{2.5}$  pollution on participation. Specifically, we split counties in our sample into quartiles based on the following variables: median income, population with a Bachelor's degree, Democratic vote share in the 2016 Presidential election, and expressed concern about the pending consequence of climate change in 2016. All else equal, we should expect the barriers to collective action to be lower in wealthier, more-educated, and Democratic counties that perceive high levels of threat from environmental problems like climate change [137, 139, 138].

Interestingly, we find that the demobilizing effect of  $PM_{2.5}$  pollution is concentrated among counties that existing theories suggest should be the most likely to experience collective action in response to environmental problems (Figure C.15). For example, we find that a one standard deviation increase in average monthly  $PM_{2.5}$  levels results in a  $-0.76$  standard deviation change in the number of commitments made per capita between 2019 and 2021 when restricting our sample to counties with residents who overwhelmingly hold Bachelor's degrees (Table C.11). Restricting our sample to counties where residents overwhelmingly voted Democrat in the 2016 Presidential election or believe that climate change is going to harm both their well-being and the well-being of other Americans similarly produces an estimate of  $PM_{2.5}$ 's effect on participation that is negative, statistically significant, and substantively larger than what we estimate in the

full sample (Tables C.12-C.14). By comparison, we fail to reject the null hypothesis that air pollution is unrelated to political participation when we restrict our sample to counties with relatively low levels of income, education, Democratic vote share, and concern about climate change.

## 4.5 Discussion & Conclusion

This paper provides the first systematic estimate of air pollution's effect on political participation around environmental issues. We find that air pollution reduces political participation at the county-level, suggesting that environmental problems may function more as physical barrier to collective action in the aggregate. This result does not preclude the possibility that becoming aggrieved as a result of an environmental problem increases an individual's willingness to engage in politics. While air pollution is ubiquitous and can underpin grassroots mobilizing efforts, it is difficult for individuals to observe under all but the most extreme circumstances (e.g., pollution inversion events). Indeed, experiencing more extraordinary environmental problems like wildfires [116] and severe climatic events [78] increases individual's willingness to become politically active. Future research might investigate whether variation in the attributes of environmental problems conditions their relationship to political mobilization.

Moreover, we find that the demobilizing effect of air pollution is strongest among communities that existing theory hypothesizes to face the lowest barriers to collective action, all else equal [137, 138, 139, 140]. Threshold-based theories of political participation which focus on how individuals' personalities interact with the social context in which they are embedded help explain this counterintuitive result. These theories posit that an individual's willingness to engage in collective action reflects their expectation of how many other members of their social context will mobilize, but that variation exists

in the threshold of expected mobilization past which individuals will be more likely to engage in collective action [142, 187]. Some individuals are “self-starters” who will take up a cause that they believe in even if it is not yet popular, while others will “jump on the bandwagon” once they see a critical mass of people engaging. It may be the case that fewer self-starters reside within social contexts that are more propitious for participation, such that we find a stronger demobilizing effect of air pollution on participation in relatively well-educated and wealthy counties who express political beliefs that are consistent with mobilizing in response to environmental problems.

Our results likely represent a lower-bound of the magnitude of the demobilizing effect of air pollution on aggregate-level political participation, for at least two reasons. First, we measure individuals’ commitments to engage in “deeper” modes of political participation that extant research suggests to be more likely to elicit government reform, such as turning out for climate marches, phone-banking for elected officials, or participation in organizational training [188, 189, 190]. An individual’s willingness to mobilize for collective action in part reflects how effective they think that collective action will be in spurring policy change. Therefore, it seems plausible that air pollution would be even more demobilizing in its relationship to less information-rich and efficacious forms of political participation like voting in elections. Indeed, if rainfall undermines voter turnout [149, 150], so too should potential exposures to pollutants linked to respiratory diseases.

Our results also may lie near the lower-bound of the negative relationship between pollution and participation because of Organization *Z*’s somewhat unique demographic composition and organizational strategy. Organization *Z*’s membership skews young relative to other national environmental organizations in the United States. Moreover, the organization relies on grassroots mobilizing tactics that simultaneously highlight the intersectionality of environmental problems and emphasize how government inaction ex-

plains the incidence and severity of environmental problems like climate change and air pollution.<sup>9</sup> The organization has effectively framed environmental problems in terms of how they affect people's lives at multiple scales [196], enhancing their capacity to mobilize their members using frames focusing on air pollution or public health.

Our proposition that the effect we estimate is a lower bound (in terms of magnitude, rather than direction) accounts for both the positive and negative impacts pollution can have on participation. Air pollution should demobilize the activism we measure here to a lesser extent than it should demobilize more regular forms of participation, like voting. At the same time, air pollution should demobilize the activists in our sample less than those supporting other mass-membership environmental groups which less often employ frames linking environmental problems across multiple scales [131].

How generalizable is the relationship between air pollution and political participation we estimate? Our study's setting suggests one plausible answer. Citizens in the United States express abnormally low levels of external efficacy relative to other countries in the Americas.<sup>10</sup> Perceptions of external efficacy weigh heavily on an individual's decision to engage in collective action: as external efficacy weakens, so too does an individual's willingness to engage in institutionalized modes of political participation like voting or lobbying elected officials [137, 197, 161]. As much suggests that the negative relationship between air pollution and participation we estimate in this manuscript will only replicate in political contexts where citizens express low levels of external efficacy.

It also might be the case that our specific point estimates would not replicate in a study setting where the baseline level of air pollution is extraordinarily high. The average concentration of PM<sub>2.5</sub> for American counties in 2018 was approximately 6 micrograms

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<sup>9</sup>Nonetheless, many of the types of advocacy and electoral activities Organization Z coordinates (e.g., phone banking for elected officials) are common to social movement organizations both within and outside of the environment issue-space [191, 192, 193, 194, 195].

<sup>10</sup>See here, accessed 30-March 2022.

per cubic meter. The average concentration of PM<sub>2.5</sub> in the greater Dehli area during the same year was approximately 80 micrograms per cubic meter.<sup>11</sup> While this discrepancy suggests that the levels of air pollution we observe in the US may be insufficient to demobilize political participation in a setting like Dehli, it does not preclude the possibility that pollution could be demobilizing in settings like Dehli. Indeed, the physical effects of air pollution that raise the cost of collective action should only intensify as the baseline level of air pollution rises. Future research might investigate how the relative intensity of pollution conditions its impact on political participation, in comparison to the absolute quantities this manuscript analyzes.

Concerns about generalizability notwithstanding, this manuscript makes three important contributions. First, we shed light on the determinants on the kind of mass mobilization required to spur government action on pressing social problems like climate change. Second, our analyses helps resolve existing theoretical tensions regarding the political consequences of environmental problems. Finally, our results bolster existing scholarship on environmental justice and injustice, demonstrating how the environmental harms systems of political and social marginalization generate can undermine efforts to reverse such marginalization via mass mobilization.

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<sup>11</sup>See here, accessed 31-March 2022.

# Appendix A

## International Peacekeeping Encourages Foreign Direct Investment: Subnational evidence from Liberia's extractive sector.

### A.1 Description of Concessions Agreements

There are 12 unique types of concessions agreements included in my data. I describe each below, after reviewing publicly-available contracts for concessions in Liberia. Figure A.1 visualizes the distribution of concession areas in my sample by their agreement type. When possible, I include specific information on the costs concessionaires would immediately incur after signing the concession agreement. This information is sourced from scanned concessions agreements underlying AidData's Liberia Concessions Geocoded Research Release, Version 1.0.

#### **Agricultural Concession**

Agricultural concessions involve foreign firms leasing prospective agricultural land from the Liberian government. In exchange for the rights to resources on the leased land—e.g., rubber or palm oil—firms pay the government surface rental fees and royalties.



Annual rental fees for agricultural concessions can exceed \$1 million USD and are due to the government regardless of concessionaires' use of the land (see agricultural concession authorizing one rubber plantation).

### **Class B Mining License**

Class B mining licenses authorize small-scale industrial mining operations, predominantly for rare earth minerals like gold. Concessionaires rent land for mining from the government. Concessionaires also must pay a one-time or annual licensing fee to the government and are required to invest \$50,000 USD in a Liberian bank prior to beginning operations.

### **Community Forest Management Agreements**

Community Forest Management Agreements (CMFA) are made between foreign firms and a specific community that has acquired the right to develop its land from the Liberian government.

### **Development Exploration License**

Concessionaires acquire Development Exploration Licenses (DELs) directly from the Liberian government. Concessionaires interested in undertaking large-scale industrial mining operations typically acquire DELs to explore future mining sites. DELs have licensing fees that can cost \$15,000 USD per year and also include flexible surface rental fees that scale up as companies engage in more pilot mining operations in the concession area. The minimum annual surface rental fees for one DEL in my sample is \$273,000 USD.

### **Forest Management Contract**

Concessionaires hoping to establish large-scale logging operations (≥100,000 hectares) must bid for Forest Management Contracts (FMCs) that the Liberian government manages. To acquire a FMC, foreign firms must submit a large performance bond to the Liberian government and are contractually obligated to invest a minimum sum per hectare of the concession area within a pre-determined time frame, in addition to owing the Liberian government surface rents. These costs can total to approximately \$720,000 USD in a single year (see this FMC).

### **Mineral Development Agreements**

Mineral Development Agreements (MDAs) authorize large-scale industrial mining operations. To enter into an MDA with the Liberian government, foreign firms must purchase a class A mining license (at least \$10,000 USD). Firms are also contractually obligated to make minimum investments per hectare of the concession area, in addition to paying the Liberian government surface rents. At minimum, these costs can total around \$70,000 USD for a single year of operation (see MDA between the Liberian government and BHP Billiton (Liberia), Inc.).

### **Mineral Exploration License**

The Liberian government grants Mineral Exploration Licenses (MELs) to foreign firms interested in exploring for minerals like diamonds and to conduct limited pilot mining operations. Concessionaires are contractually obligated to make minimum per acre investments in concession areas authorized under a MEL, in addition to paying the Liberian government licensing fees and surface rents that vary based on the level of development within the concession area. For one concession in my sample authorized

under an MEL, these annual payments total to approximately \$1.03 million USD.

### **Private Use Permit Contract**

Private land owners can enter into logging agreements with foreign firms after they have acquired a Private Use Permit contract (PUP) from the Liberian government. Foreign firms must submit a performance bond to the Liberian government—sometimes costing \$50,000 USD—prior to entering into a logging agreement with a land owner who has obtained a PUP.

### **Prospecting License**

Firms looking to establish small-scale or artisanal mining operations might acquire a Prospecting License from the Liberian government, for a fee, to explore potential concession areas.

### **Quarry License**

Quarry Licenses authorize foreign firms to operate quarries, and be acquired from the Liberian government for a fee.

### **Reconnaissance License**

Firms looking to mining operations might acquire a Reconnaissance License from the Liberian government, for a fee, to explore potential concession areas. Reconnaissance Licenses do not authorize pilot mining operations.

### **Timber Sales Contract**

Concessionaires interested in conducting small-scale logging operations (>5,000 hectares) may acquire Timber Sales Contracts (TSCs) from the Liberian government. To do so,

Figure A.1: Distribution of Concession Areas per Agreement Type

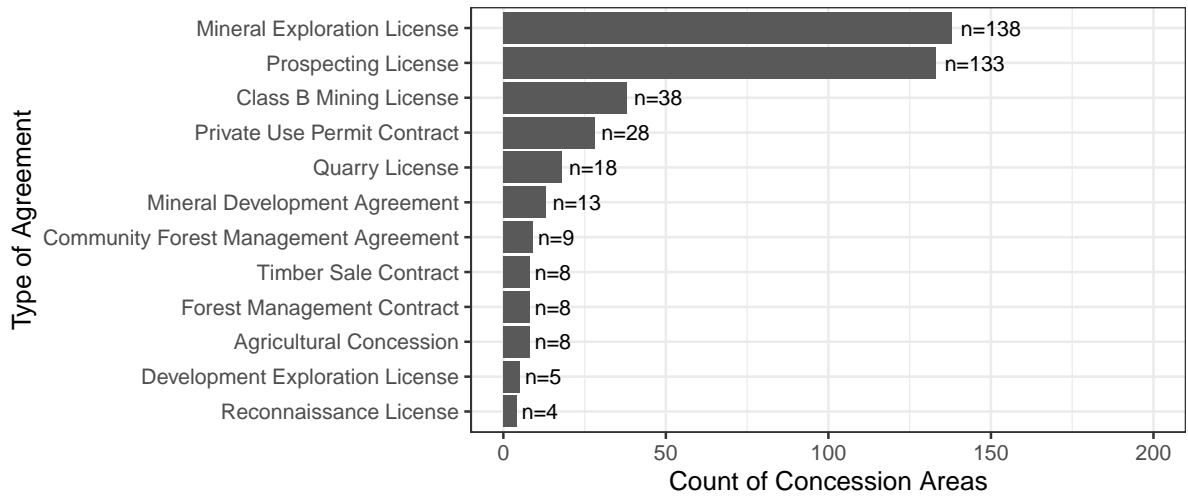


Figure A.2: \*

*Note:* data compiled from AidData Liberia Concessions Geocoded Research Release, version 1.0 [46]. I exclude resource concessions that are missing verifiable start dates (n=138).

concessionaires must post a performance, demonstrate sufficient access to capital and equipment (e.g., bulldozers), and pay the government surface rental fees. For some TSCs, these costs can total up to \$75,000 USD in a single year (see this contract).

## A.2 UN Peacekeeping Deployment

The process of deploying UN peacekeepers proceeds in two stages. First, UN member countries voluntarily contribute different types of peacekeeping personnel upon the establishment of new peacekeeping. Member states are reimbursed up to as much as \$1,428 USD per month for each uniformed personnel they contribute. As much loosely suggests that UN member states may rely on their voluntary personnel contributions of personnel to recover their mandated financial commitments to UN Peacekeeping.

After UN member states determine their voluntary contributions, the UN Security Council (UNSC) oversees how personnel are allocated to individual peacekeeping oper-

ations. The composition of personnel allocated to each mission reflects each mission's unique needs and operational constraints.

Mission-level allocations of personnel are initially determined at the outset of a new peacekeeping mission. For instance, the UNSC determined approximately 11,800 peacekeepers (10,000 troops and 1,800 police) were to be deployed to the newly formed the United Nations Multidimensional Integrated Stabilization Mission in the Central African Republic (MINUSCA) in 2014, following recommendations made by military observers the UN prospectively deploys military observers to countries its anticipates will request a peacekeeping mission.<sup>1</sup> The UNSC subsequently called upon UN member states "to provide troops and police with adequate capabilities and equipment in order to enhance the capacity of MINUSCA to operate and discharge its responsibilities effectively."<sup>2</sup> The UNSC then regularly reviews mission's reports to the Secretary General to determine whether a reallocation of personnel to is required. For example, the UNSC authorized the additional deployment of "750 military personnel, 280 police personnel and 20 corrections officers for MINUSCA" following a formal request by the mission to increase its size.<sup>3</sup>

The second stage of UN peacekeeping deployments occur subnationally. Each mission can autonomously decide how to deploy personnel within its operating area, so long as the deployment fulfills the mission's specific mandate. For example, MINUSCA deployed police to Bangui prior to the full deployment of the mission's personnel to "to support the establishment of the MINUSCA police component."<sup>4</sup> MINUSCA leadership also requested special peacekeeping personnel from the UNSC at the outset of its tenure to deploy for specific tasks, like "the protection of key political stakeholders in

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<sup>1</sup>See Report of the Secretary-General on the Central African Republic submitted pursuant to paragraph 48 of Security Council resolution 2127 (2013) from March 2014.

<sup>2</sup><https://minusca.unmissions.org/sites/default/files/n1429581.pdf>

<sup>3</sup><https://minusca.unmissions.org/sites/default/files/n1508624.pdf>; April-2015 SecGen report

<sup>4</sup>See August 2014 SecGen report, line 63.

Bagui.”<sup>5</sup> Country-level factors constraining the establishment of UN peacekeeping bases are discussed in the main text.

### A.3 Data Limitations for Subgroup Analyses

Limitations in the spatial granularity of Afrobarometer survey responses in Liberia prevent me from aggregating these measures up to the clan-level. Afrobarometer survey responses are assigned a precision code that allow users to identify the most specific administrative unit in which a respondent resides. These codes are defined as below, according to the organization that geocodes Afrobarometer survey responses (see this report for additional information).

- Precision Code 1: “The coordinates correspond to an exact location, such as a populated place or a physical structure such as a school or health center. This code may also used for locations that join other locations to create a line such as a road, power transmission line or railroad.”
- Precision Code 2: “The location is mentioned in the source as being “near”, in the “area” of, or up to 25 km away from an exact location. The coordinates refer to that adjacent location.”
- Precision Code 3: “The location is, or is analogous to, a second-order administrative division (ADM2), such as a district, municipality or commune.”
- Precision Code 4: “The location is, or is analogous to, a first-order administrative division (ADM1), such as a province, state or governorate.”

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<sup>5</sup>See August 2014 SecGen report, line 65.

- Precision Code 5: “The location can only be related to estimated coordinates (e.g. between populated places; along rivers, roads and borders; or more than 25 km away from a specific location). Also used large topographical features (greater than ADM1) such as National Parks which spans across several administrative boundaries.”
- Precision Code 6: “The location can only be related to an independent political entity, but is expected to be disbursed locally. This includes aid that is intended for country-wide projects as well as larger areas that cannot be geo-referenced at a more precise level.”
- Precision Code 7: “The location is unclear. The country coordinates are entered to reflect that subnational information is unavailable.”

Of the 3597 household surveys Afrobarometer enumerated in Liberia between 2008 and 2015, 3509 are geocoded with enough precision to attribute their location to a specific Liberian district. By comparison, only 1520 are geocoded with enough precision to attribute their location to a specific Liberian clan. Thus, relying on clan-level estimates of citizens' perceptions of the rule of law would have resulted in dropping nearly half of the available Afrobarometer responses from my analyses.

Two important assumptions are implicit to this measurement strategy, and I encourage readers to interpret the subgroup analyses I conduct as exploratory in light of these assumptions. First, my measurement strategy assumes that citizens' perceptions of the rule of law in 2008, 2012, and 2015 are valid proxies for their perceptions of the rule of law in the years spanning each wave of the Afrobarometer survey. Second, my measurement strategy assumes that the proportion of respondents per district who perceive the rule of law to be weak closely approximates the proportion of respondents per clan who perceive the rule of law to be weak.

There are compelling reasons to believe that these assumptions are not entirely unreasonable. Citizens who recently witnessed the government repeatedly fail to prevent widespread violence may have perceptions of the rule of law that change slowly over time, such that a respondent's belief about the trustworthiness of the Liberian National Police is relatively stable between 2008 and 2009, and so on. Moreover, it is plausible that district-level estimates of the rule of law closely approximate similar estimates taken at the clan-level. Liberia's judicial system is organized at the county-level, such that citizens residing within a county have similar perceptions of the Liberian courts, irrespective of their clan of residence.



## A.4 Referenced United Nations Peacekeeping Reports

Table A.1: Report List

Document Label	UN Document Number	Publication Date	Mission
A	S/2003/321	Mar-2003	UNAMSIL
B	S/RES/1509	Sep-2003	UNMIL
C	S/2003/1175	Sep-2003	UNMIL
D	S/2004/228	Mar-2004	UNMIL
E	S/2004/229	Mar-2004	UNMIL
F	S/2005/560	Sep-2005	UNMIL
G	S/2005/764	Dec-2005	UNMIL
H	S/RES/1643	Dec-2005	UNOCI
I	S/2006/159	Mar-2006	UNMIL
J	S/2006/743	Sep-2006	UNMIL
K	S/2006/958	Dec-2006	UNMIL
L	S/2007/151	Mar-2007	UNMIL
M	S/2007/479	Aug-2007	UNMIL
N	S/2008/183	Mar-2008	UNMIL
O	S/2008/553	Aug-2008	UNMIL
P	S/2009/86	Feb-2009	UNMIL
Q	S/2009/299	Jun-2009	UNMIL
R	S/2009/411	Aug-2009	UNMIL
S	S/2011/72	Feb-2011	UNMIL
T	S/2011/497	Aug-2011	UNMIL
U	S/2013/124	Feb-2013	UNMIL
V	S/2014/123	Feb-2014	UNMIL
W	S/RES/2217	Apr-2015	MINUSCA
X	S/2015/620	Aug-2015	UNMIL
Y	S/2016/169	Feb-2016	UNMIL
Z	Ref. 2016.10	2016	-
A.1	S/RES/2502	Dec-2019	MONUSCO
B.1	Ref. 2020.01	Feb-2020	-

## A.5 Additional Figures

Figure A.3: Largest Deployments of UNMIL Peacekeeping Police outside of Monrovia

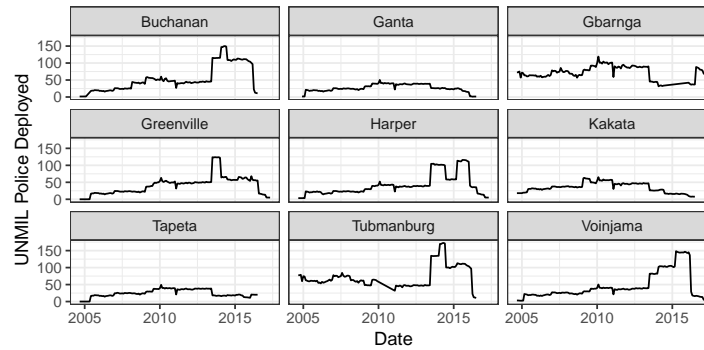


Figure A.4: \*

*Note:* data compiled from the *RADPKO* dataset [?] and are aggregated per base per month. Each facet represents an individual peacekeeping base. The 9 bases displayed are those located outside of Liberia's capital city of Monrovia that also housed the highest number of UNMIL peacekeeping police per month, on average, over UNMIL's tenure.

Figure A.5: Change in estimate given confounding X-times stronger; Hypothesis 2

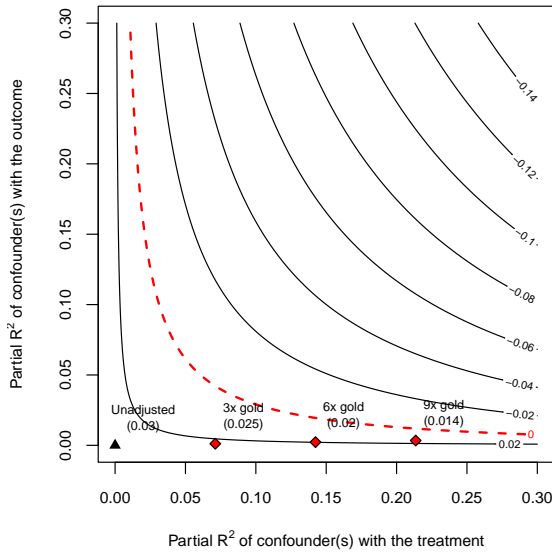


Figure A.6: Change in *t*-statistic given confounding X-times stronger; Hypothesis 2

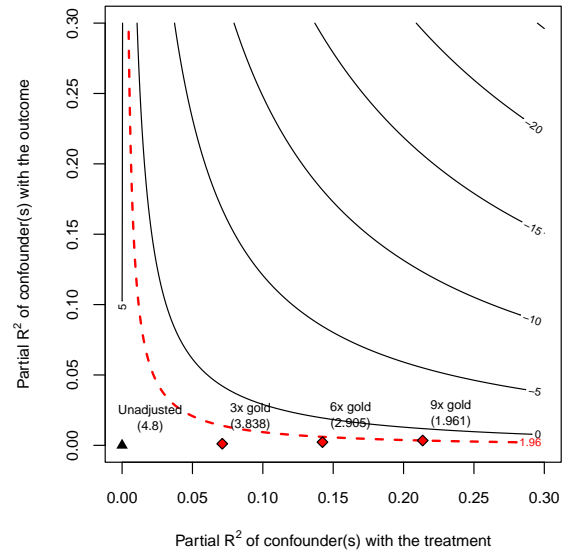


Figure A.7: \*

*Note:* plots generated using the `sensmakr` package in R [19]. Results displayed for the association of UNMIL police (count) and the onset of new natural resource concessions (0/1). Figure A.5 displays how the estimated association between UN police and the onset of new natural resource concessions (displayed as the black triangle, labeled “Unadjusted”) would change if an omitted variable were three, six, and nine times more endogenous than a clan’s proximity to gold deposits (displayed as red diamonds, labeled “3x gold,” “6x gold,” and “9x gold”). Figure A.5 displays how statistical significance of my main result would change in the presence of similar confounding.



Figure A.10: Distribution of New Resource Concessions per Clan, 2004-2018

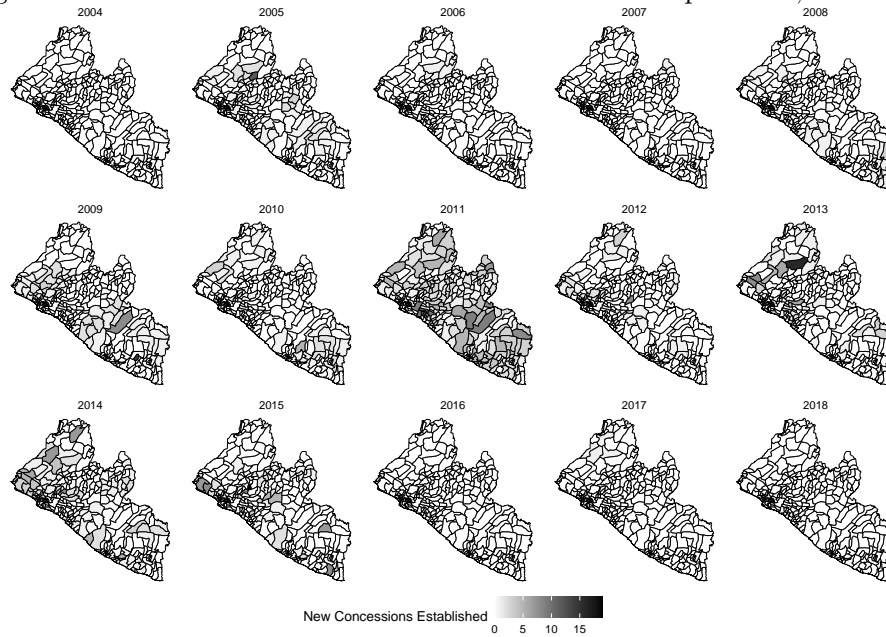


Figure A.11: \*

*Note:* data compiled from AidData Liberia Concessions Geocoded Research Release, version 1.0 [?]. I exclude resource concessions that are missing verifiable start dates (n=138).

Figure A.12: Distribution of Active Resource Concessions per Clan, 2004-2018

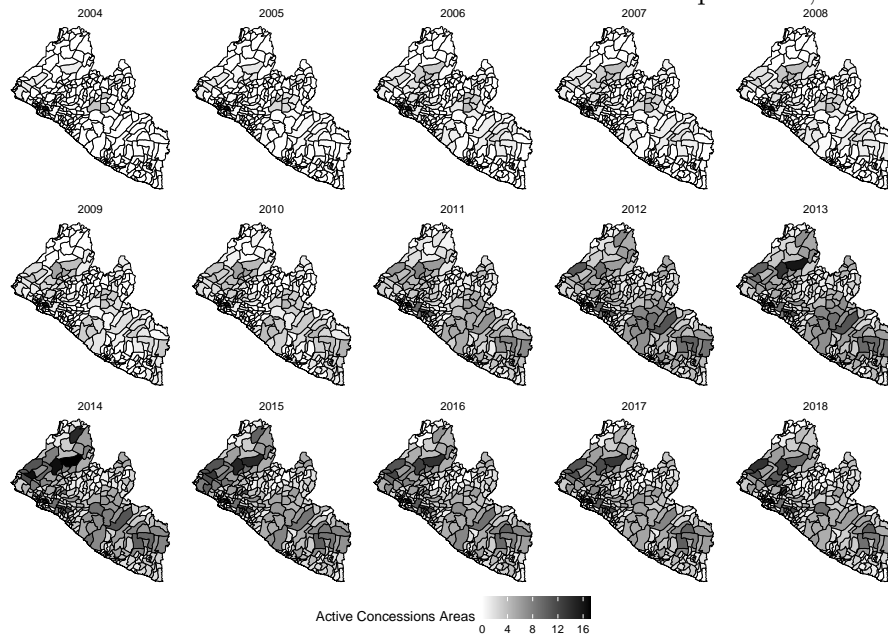


Figure A.13: \*

*Note:* data compiled from AidData Liberia Concessions Geocoded Research Release, version 1.0 [?]. I exclude resource concessions that are missing verifiable start dates (n=138).

Figure A.14: UNMIL Deployment, December 2005



Figure A.15: \*

Note: company-sized units are indicated by a single, vertical line above each deployment flag. For example, River Cess contains one company of UNMIL personnel from Ethiopia.

Figure A.16: UNMIL Deployment, July 2013

Annex II

United Nations Mission in Liberia: deployment as at July 2013

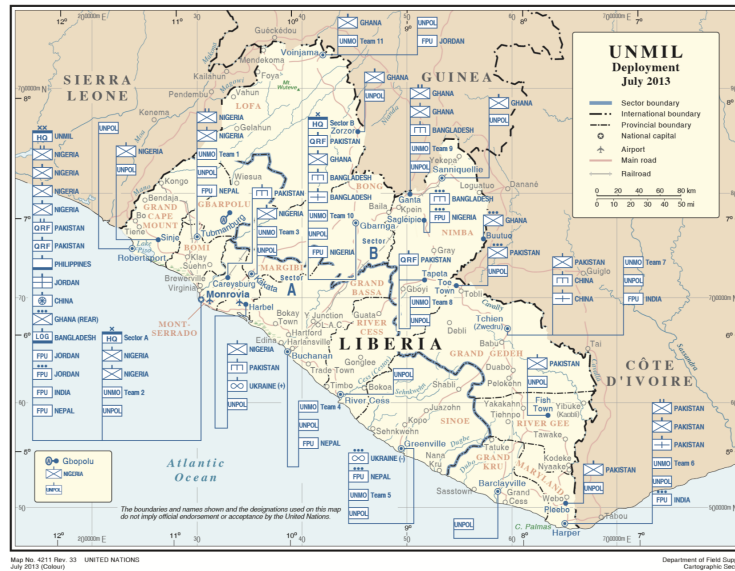


Figure A.17: \*

*Note:* forward police units are indicated by the “FPU” flags attached to active peacekeeping bases. FPUs are found at the following bases: Monrovia, Tubmanburg, Buchanan, Gbarnga, Saglepie, and Greenville. July 2013 base locations are used to infer the location of personnel as of November 2013 (see Hunnicutt and Nomikos (2020) for additional information).



## A.6 Additional Tables

Table A.2: Main Results

	Estimator: OLS					Estimator: GLM	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
UN Police <sub>t-1</sub> (100s)	0.03*	0.03*	0.03*	0.03*	0.04*	0.03*	1.33***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.34)
UN Troops <sub>t-1</sub> (1000s)	-0.02*	-0.02*	-0.02*	-0.03	-0.16**	-0.02*	-1.12
	(0.01)	(0.01)	(0.01)	(0.02)	(0.06)	(0.01)	(0.79)
UN Police <sub>t-12</sub> (100s)				0.00			
				(0.00)			
UN Troops <sub>t-12</sub> (1000s)				0.01			
				(0.01)			
Local Conflict <sub>t-1</sub>	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-12.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.62)
Local Conflict (rolling mean)	-0.01	-0.01	-0.01	-0.03	-0.03	-0.03	-0.95
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(4.48)
Timber Sanctions Lifted	-0.01	-0.01*	-0.01	-0.01*	0.00	-0.01*	0.47
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.62)
Diamond Sanctions Lifted	0.00	0.00	0.00	0.00	-0.01	0.00	-0.55
	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.85)
Adjacent Investment	0.07***	0.07**	0.07**	0.07***	0.05**	0.07***	0.88***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.19)
Adjacent Investment <sub>t-1</sub>	-0.00	-0.00	-0.00	-0.00	0.00	-0.00	0.04
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.08)
New Investment <sub>t-1</sub>							0.02
							(0.02)
New Investment <sub>t-12</sub>							0.01
							(0.01)
Pre-Deployment Conflict	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.02
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)
Distance to First UNMIL Bases	-0.00	-0.00	-0.00	-0.00	0.00	-0.00	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Distance to Nearest District Capital	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.03
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)
Pre-Deployment Road Density	-14.22	-14.22	-14.22	-16.15	-7.21	-16.05	-1515.81
	(9.75)	(9.63)	(11.29)	(10.66)	(11.58)	(10.65)	(1203.09)
Pre-Deployment Population Density	-0.00	-0.00	-0.00	-0.00	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Pre-Deployment Nighttime Luminosity	0.00	0.00	0.00	-0.00	-0.01	-0.00	0.45
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.77)
Distance to Gold Deposit	-0.00	-0.00	-0.00	-0.00	-0.00**	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Average Forest Cover	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Intercept	0.04*	0.04	0.04	0.15	0.04	0.15	-3.63***
	(0.02)	(0.02)	(0.02)	(0.09)	(0.04)	(0.09)	(0.77)
Time Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	No
Clustered SEs	-	County	District	-	-	-	-
Adj. R <sup>2</sup>	0.24	0.24	0.24	0.24	0.15	0.24	
Num. obs.	7084	7084	7084	6600	4206	6600	7084
N Clusters		15	30				
AIC							696.98

\*\*\*p < 0.001; \*\*p < 0.01; \*p < 0.05

Table A.3: \*

*Note:* models (a) through (e) use OLS to estimate the association between UN peacekeepers and the onset of new natural resource concessions per clan-month. Model (g) uses a logistic regression to estimate the same association. To avoid complete separation, quarter-year fixed effects are dropped from model (g). Heteroskedastic and autocorrelation consistent standard errors are specified unless noted otherwise.

Table A.4: UN police are not associated with the onset of riots, mob violence, or vigilante violence.

	DV: Riots (0/1)	DV: Mob Violence (0/1)	DV: Vigilante Violence (0/1)
	(a)	(b)	(c)
UN Police <sub>t-1</sub> (100s)	-0.00 (0.01)	0.00 (0.01)	-0.00 (0.01)
UN Troops <sub>t-1</sub> (1000s)	0.01 (0.01)	-0.00 (0.01)	0.00 (0.01)
Pre-Deployment Conflict	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Distance to First UNMIL Bases	-0.00* (0.00)	-0.00 (0.00)	-0.00 (0.00)
Distance to Nearest District Capital	-0.00* (0.00)	-0.00 (0.00)	-0.00 (0.00)
Adjacent Investment	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)
Adjacent Investment <sub>t-1</sub>	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Pre-Deployment Road Density	-2.61 (9.37)	-0.30 (9.37)	-5.62 (9.37)
Pre-Deployment Population Density	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Pre-Deployment Nighttime Luminosity	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Distance to Gold Deposit	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Average Forest Cover	0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)
Timber Sanctions Lifted	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Diamond Sanctions Lifted	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Local Conflict <sub>t-1</sub>	-0.02 (0.01)	-0.02 (0.01)	-0.01 (0.01)
Local Conflict (rolling mean)	0.02 (0.08)	0.07 (0.08)	0.07 (0.08)
Intercept	0.02* (0.01)	0.01 (0.01)	0.01 (0.01)
Time Trends	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes
Adj. R <sup>2</sup>	0.01	0.01	0.02
Num. obs.	7084	7084	7084

\*\*\*p < 0.001; \*\*p < 0.01; \*p < 0.05

Table A.5: \*

Note: models (a) through (c) use OLS to estimate the association between UN peacekeepers and the onset of riots/mob violence/vigilante violence per clan-month. Heteroskedastic and autocorrelation consistent standard errors are specified unless noted otherwise.

Table A.6: Covariate Balance, Matching

Variable	Diff.Un	Diff.Adj	V.Ratio.Un	V.Ratio.Adj
Pre-UNMIL Conflict	0.46	-0.00	27.52	1.00
Distance to 2004 Bases	-1.17	-0.00	0.54	1.00
Distance to Nearest District Capital	-0.57	-0.00	0.59	1.00
Road Density	-0.07	-0.00	0.61	1.00
Population Density	0.21	-0.00	25.98	1.00
Nighttime Lights	0.22	-0.00	72.28	1.00
Distance to Nearest Gold Deposit	0.06	-0.00	1.10	1.00
ESA Forest Cover	-0.09	-0.00	0.81	1.00

Table A.7: \*

*Note:* matched sample formed using coarsened exact matching.

# Appendix B

## Environmental Deprivation and Political Unrest: Evidence from a Liberian Panel Survey.

### B.1 Sampling

We worked with a Liberian research organization—the Center for Action Research and Training, Liberia—to construct the six-month long panel dataset used in our study. This panel dataset contains information from residents of the Greater Monrovia area, spread across 15 different communities. Recruitment to this panel and data collection proceeded as follows:

- Enumerators recruited thirty-five respondents per community. Twenty were randomly selected to participate in the monthly study; fifteen were used to replenish the panel given attrition.
- Respondents were recruited using a random walk protocol. Within communities, enumerators began recruiting respondents either near heavily trafficked areas, such as markets, or near LEC transformers. We focused on these points of interest to reduce the chance of recruiting respondents to increase the chance that respondents had household connections to basic services or could access them communally.

- Once a month for six months, enumerators contacted respondents and administered a thirty minute-long mobile survey. Respondents were compensated for their participation. Enumerators would attempt re-contacting respondents no more than three times per day for three days. Respondents were removed from the panel and replaced if we could not contact them after three days.

## **B.2 Common Causes of Environmental Service Shortages in Monrovia**

We list common causes for service shortages below, based on conversation we had with service providers and our own observations during the fieldwork.

Solid waste services from the Monrovia City Corporation (MCC) can go short (e.g., no trash pickup) because (1) the MCC did not have enough resources or staff to perform scheduled cleaning; or (2) residents did not deposit waste in MCC bins.

Water services from the Liberian Water and Sewer Company (LWSC) can go short because (1) LWSC pipes broke; (2) drought; (3) mismanagement (e.g., LWSC incorrectly stops services for paying customers); and (4) illegal connections to LWSC pipes.

Electricity from the Liberia Electricity Corporation can go short because (1) LEC transformers/meters fail; (2) illegal connections to LEC transformers; (3) LEC fails to provide timely maintenance because international funding causes shortage of required supplies (e.g., transformers).

## **B.3 Adjustments to Data Collection**

After COVID-19 emerged in Liberia, we adjusted our data collection protocols so that they complied with public health ordinances in Monrovia. Our research team at

the Center for Action Research and Training (CART) in Monrovia made this decision collaboratively, acknowledging that the suspension of project activities posed a significant financial risk to project staff, many of whom rely on payment from the project as their primary source of income (approximately \$200 USD/month). As other opportunities for employment in Liberia receded given the impact of COVID-19—e.g., the termination of other research activities that employed project staff—salaries from our project became the sole source of income for a majority CART’s employees.

Specifically, we:

- Limited the number of enumerators working in the CART office to three. No more than three enumerators were allowed into the CART office at one time.
- Committed to halting data collection indefinitely if an enumerator displayed COVID-19 symptoms.
- Limited the length of the workday. To ensure that enumerators could easily comply with the government’s public health order, we worked from 8AM to 12PM. Enumerators were compensated the same amount for each day of work, despite the shortened workday.
- Provided enumerators with personal protective equipment. Prior to entering the CART office, enumerators were required to use a CART-provided hand-washing station. Enumerators also received hand-sanitizer and a face mask for use throughout the workday.
- Physically separated enumerators in the CART office. Enumerators worked in separate rooms of the CART office to ensure that they remained at least six feet away from each other throughout the workday.

- Disinfected all project equipment and working areas at the end of each workday. The CART supervisor used Clorox to disinfect the phones, tablets, and working areas enumerators used during each workday. The CART manager wore gloves and a face mask while disinfecting workstations.
- Encouraged enumerators to travel on foot to the CART office, if possible.
- Provided enumerators a larger travel stipend to ensure that enumerators can take a private cab to and from the CART office if necessary.

## B.4 Qualitative Data Collection Activities

Block quotations for the qualitative evidence we include in the main text from the focus group discussions and interviews we conducted are listed below.

### B.4.1 Focus Group Discussion 1: Jan-29-2020

- R2: “When there is no food for the citizen to eat, there will plenty noise behind the government. In other words, ‘a hungry man is an angry man.’ The reason why people are protesting in Liberia almost every month is that the government is not providing those basic services for her citizens.”
- R4: “The good side of protest is that it calls government attention, and the bad side is properties can get damage.”
- R4: “When government cannot provide services you need, you should continue to engage government or the agency that is responsible for providing that particular services that you are lack of.”

- R5: “The government is preventing her citizens from accessing basic services. Those agencies that are responsible for distributing these services like LEC [Liberian Electricity Corporation], LWSC [Liberia Water and Sewer Company] and MCC [Monrovia City Corporation] are not being monitored by the government. As a result, they go about doing their own things, which is seriously affecting us. At times, you will have credits in your meter but your light will just go off, and to get LEC to come and repair your meter is like a war; the same with LWSC and MCC.”
- R5: “The good side of protest is that result is immediate, and bad side is properties get damage, people get wounded in the process.”
- R5: “When I cannot access services that government should be providing for me, like LEC I will be patient and wait for God and government time. While waiting I will in provides by buying my flash light to sleep on, secondly if it is water that I cannot get, I will get water from the community well, and for dirt I will bury my dirt under the ground.”

#### **B.4.2 Focus Group Discussion 2: Jan-31-2020, Seven Participants**

- R2: “The benefit of protest is it tells the whole world the poor performance of a particular government. It also tells the government that there is an alarming situation in the country that needs to be attended to.”
- R2: “Protest is not the best way to make change in Liberia. From our history, protest is not good for us. People always losing their lives in protest, properties damaged and protest also drive investors away.”



- R4: “If the government is not providing services to us as citizens, we will protest to make them to know that it is their responsibility to provide these services to us.”

### **B.4.3 Focus Group Discussion 3: Feb-03-2020, Seven Participants**

- R3: “Protest can also bring the government to attention.”
- R5: “The first thing is we will contact the government through our community chairperson. If there is no redress, we will protest.”
- R6: “The benefit of protest is you can get quick result. The bad side of protest is people will get injured in the process, some may will lose their lives and property will be damaged.”

### **B.4.4 Community Chairperson Interviews: Sep-2020**

- Interview 1: In describing how he used a television interview about iron contamination in his community to get government assistance, he comments “The water has iron in it...Slowly, slowly, slowly, you be dying, you don’t know. So that’s it. It’s so hard for me to get into contact with the government officials; I was so lucky that day when I did that interview and [was] surprised to see them in my community.”
- Interview 1: Asked how the government treats him generally, he responds “The representative? District number eight? The man neglected the whole district. The man neglected the whole district.”
- Interview 1: “That has been happening. I have taken two cases to the police; rape, attempted rape.”

- Interview 1: “The community youth wanted to stage a protest to block the road. I told them ‘No, under my leadership, you don’t do that.’...So what we do, we engage the government constructively, and listen...I educate them. I tell you, if I go to meeting, if I go to LEC, I come from there...and use the town crier to make an announcement.”
- Interview 1: “We can’t stage protest. The issue here; protest has two-fold. And that fold is: one, positive, and two, negative. And the negative aspect is more severe than the positive aspect.”
- Interview 1: “There are so many ways that you can engage the government, I really know that. That sitting in the street [i.e., protest] will not make government come in.”
- Interview 2: “In general, you know, we have serious challenges, because sometimes government at the time you be in need of them, they will not respond to you immediately.”
- Interview 2: “I think I would encourage my citizen, most especially those who are involved, to abide by the rules of law, to go through the investigation. Because, this country is a country of law; nobody is above it...I would encourage my citizens to always be law-abiding.”
- Interview 2: “The people will have to speak [i.e. protest] through their constitutional guidance...You let them speak, but it should be in the confines of the law.”
- Interview 3: “Well, you give the police a chance to do their investigation. You don’t sabotage police operations.”
- Interview 3: “That is their [i.e. citizens’] right to protest.”

- Interview 4: “We educate our community to understand that alleged crime does not mean that the man is guilty, so you can’t kill them. Because, in the past, our community was noted for beating on [suspects], killing [suspects].”
- Interview 4: “We would advise that protest is not the way, especially in this COVID-19 period...So the best way is dialogue.”
- Interview 5: “We put it under control. There are people that are not satisfied with the government. But we don’t; you know, the protest, it can bring chaos. So, we go to get a meeting and talk it.”
- Interview 6: “When we have issues, we manage to channel [them] diplomatically...In other communities, they are throwing stones and taking placards.”

## B.5 Additional Robustness Checks

### B.5.1 Diagnosis of Linear Interaction Effects

We refit our primary specification using the kernel smoothing estimator [114], which allows us to flexibly estimate the functional form of the marginal effects of service shortages on willingness to protest across the full range of respondents’ evaluations of community chairpeople. Figure B.3 plots the results of a standard linear multiplicative interaction model next to the results of the kernel estimation. The marginal effects of service shortages on willingness to protest the kernel estimator fits over various evaluations of community chairpeople appear reasonably linear and mimic the conditional marginal effects generated using a linear multiplicative interaction model.

Figure B.1 also demonstrates that there is fairly common support for our moderating variable across different values of treatment. Respondents’ evaluations of their

Figure B.1: Respondents' evaluations of their community chairperson vary over different exposures to service shortages.

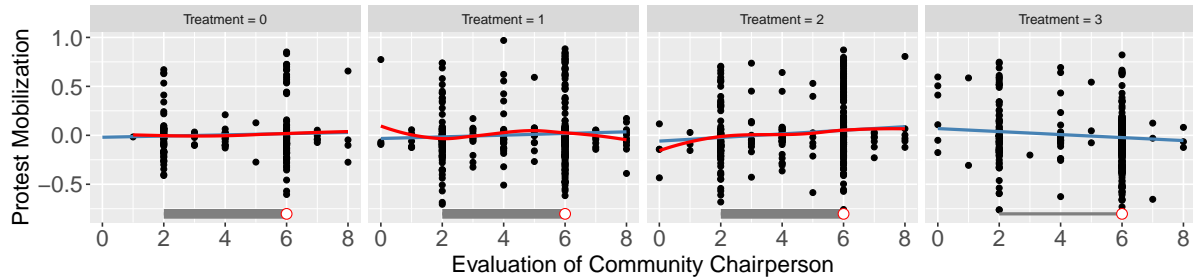


Figure B.2: \*

*Note:* figure generated using the interflex package in R. “Treatment” is defined as the count of environmental services respondents report having gone short in the past month; blue lines visualize the linear association between chairperson evaluations and willingness to protest at each level of treatment; and the red line visualizes the association between chairperson evaluations and willingness to protest at each level of treatment using a kernel-smoothing estimator. We measure respondents' evaluations of community chairpeople as an index reflecting their effectiveness and inclusiveness.

Figure B.3: The conditional effect of shortages on willingness to protest is plausibly linear.

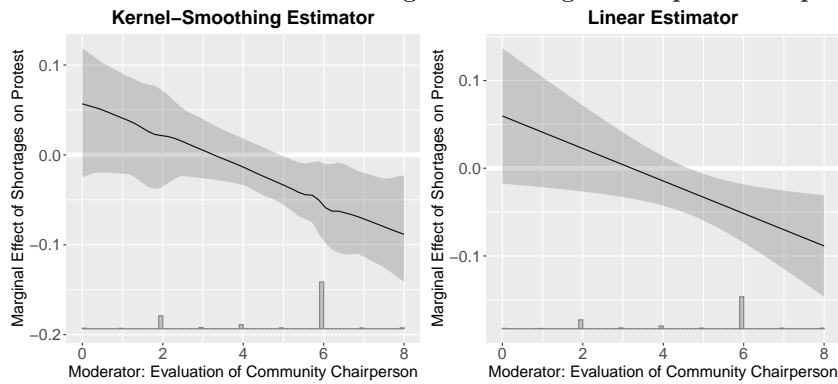


Figure B.4: \*

*Note:* figure generated using the interflex package in R. “Treatment” is defined as the count of environmental services respondents report having gone short in the past month; blue lines visualize the linear association between chairperson evaluations and willingness to protest at each level of treatment; and the red line visualizes the association between chairperson evaluations and willingness to protest at each level of treatment using a kernel-smoothing estimator. We measure respondents' evaluations of community chairpeople as an index reflecting their effectiveness and inclusiveness.

community chairperson vary from scores of 0 to 4. However, the majority of these responses are clustered around scores of 1 (“ineffective”/“self-interested”) and (“effective”/“representative”), particularly among respondents who experience shortages in all three services.

### **B.5.2 Reporting Errors**

The conditional relationship between service shortages and protest mobilization we observe might be due to respondents systematically overstating the environmental service shortages they experienced in the last month to “justify” their decision to protest. In anticipation of this challenge, the research team had designed a protocol to verify respondents’ reports of service shortages.<sup>1</sup> However, this protocol was halted during the first month of implementation due to the COVID-19 pandemic.

As an alternative strategy, we explore whether the number of service shortages citizens report is positively correlated with other measures capturing their dissatisfaction with the government: their willingness to protest, perceptions of government officials, and opposition to Liberian President George Weah. If reports of service shortages are systematically higher among respondents who are dissatisfied with the government, then our measure of service shortages may just reflect political attitudes rather than the objective material conditions of respondents.

To measure respondents’ support for President Weah, we rely on two proxy variables: their ethnicity and their community. Specifically, we code respondents as supportive of President Weah if they are of the Kru or Bassa tribe or if they live in Popo Beach, Central West Point, Slipway, Vai Town, or Zondo Town. Members of the Kru and Bassa tribe constitute the bulk of support for the Weah administration. These citizens

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<sup>1</sup>The design of the survey instrument also minimizes this risk. Respondents are asked about their willingness to mobilize for protest after they report to enumerators whether they experienced shortages in electricity, water, and solid waste services in the previous month.

expressed continuous support for the President during the economic recession that has followed the onset of COVID-19 in Liberia and despite widespread discontent towards the government’s COVID-19 response. The aforementioned communities are referred to as “slum communities” in Monrovia and were the main targets of the President’s “Pro-Poor” campaign platform that saw him elected in 2018.

Figure B.5: Co-ethnicity and co-partisanship with the incumbent party does not predict overreporting of service shortages in the hypothesized direction.

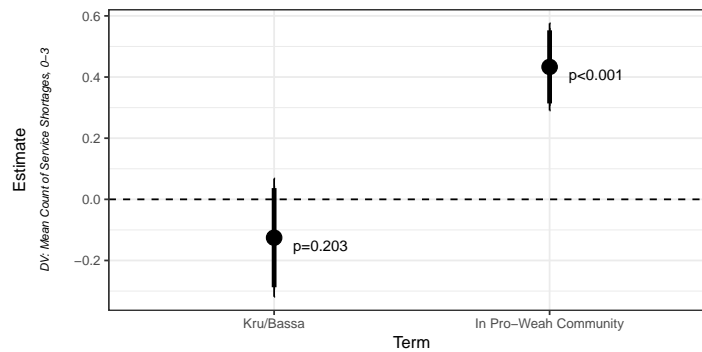


Figure B.6: \*

Note: results from OLS regressions. All regressors are specified as dummy variables. Both 90 and 95 percent confidence intervals are presented respectively as thin and thick bars.

Figure B.7: Respondents’ dissatisfaction with the government does not predict overreporting of service shortages in the hypothesized direction.

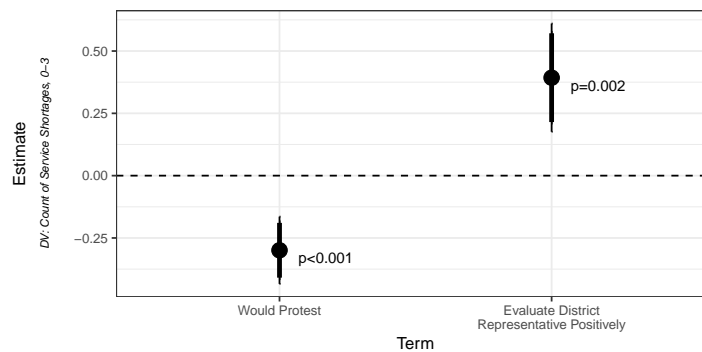


Figure B.8: \*

Note: results from OLS regressions. All regressors are specified as dummy variables. Both 90 and 95 percent confidence intervals are presented respectively as thin and thick bars.

We find no evidence suggesting respondents who oppose the incumbent government report higher counts of service shortages per survey wave than do respondents who are not frustrated with the government (Figure B.5). Respondents who are co-ethnics with President Weah do not report different counts of service shortages per month than do respondents who are not co-ethnics with President Weah. Moreover, respondents in Pro-Weah communities like Vai Town appear report slightly *more* service shortages per month than do respondents who do not reside in Pro-Weah communities. This pattern is inconsistent with concerns implying respondents' reports of service shortages reflect their frustration with the government rather than their living conditions.

Broader indicators of citizens' dissatisfaction with the government similarly do not comport with concerns about reporting bias (Figure B.7). Counterintuitively, respondent who state some willingness to protest report *fewer* counts of service shortages per month than do respondents who state no willingness to protest. Respondents who evaluate their district representative positively report *greater* exposure to service shortages than those who evaluate their representative negatively. We would expect the sign on each of these point estimates to be flipped if respondents were strategically over-reporting their experience of service shortages to justify their frustration with the government.

### **B.5.3 Design Effects and Attrition**

To ensure that our findings are robust to design effects, we test whether the number of times that respondents participate in the survey predicts their willingness to mobilize for protest. We find no evidence that the number of times participants have been surveyed affects their willingness to mobilize for protest at the conventional level of statistical significance (SI Table B.1).

We also investigate whether respondents who drop out from the panel over the study

period (n=37) are meaningfully different from those who remain in the panel, since the same factors that might predict attrition could predict respondents' evaluations of their community chairperson, experience of service shortages, and willingness to mobilize for protest. To test whether attrition is plausibly exogenous, we test for balance among the variables used in our main analysis between respondents who dropped out of the panel and those who did not (see SI Table B.2). We find that subjects who remain in our panel are comparable to those that drop out over the study period, along all of the variables we use in our main analysis (see below).



## B.6 Additional Tables and Figures

Table B.1: Respondents are not more likely to express a willingness to mobilize for protest as they participate in additional panel waves.

	Estimate	Standard Error	N
Rounds Sampled	-0.07	0.09	2016

Note: + p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

Table B.2: Balance between subjects who did and did not drop out of the panel.

Variable	Abs. Std. Mean Difference
Count of Shortages (0-3)	0.01
Income (0-9)	0.02
Willingness to Protest (0/1)	0.03
Believe Repression is Likely (0/1)	0.04
Protest Effective (0/1)	0.06
Evaluation of District Representative (0-8)	0.05
Expressive Benefits from Protest (0/1)	0.07
Evaluation of Community Chairperson (0-8)	0.09

Table B.3: Summary Statistics, Survey Measures

Group	Variable	Mean	Min	Max	SD	N
Protest	Willingness to Mobilize	0.13	0.00	1.00	0.34	2016
Service Shortages	Count	2.04	0.00	3.00	1.03	2014
	One Shortage	0.90	0.00	1.00	0.30	2014
	Two Shortages	0.69	0.00	1.00	0.46	2014
	Three Shortages	0.45	0.00	1.00	0.50	2014
	Electricity Shortage	0.83	0.00	1.00	0.38	1927
	Water Shortage	0.72	0.00	1.00	0.45	1988
Elite Evaluations	Solid Waste Shortage	0.79	0.00	1.00	0.41	1363
	Community Chairperson	5.02	0.00	8.00	1.73	2003
Covariates	District Representative	4.07	0.00	8.00	2.06	2005
	Efficacy of Protest	1.86	0.00	4.00	0.97	2013
	Expressive Benefits of Protest	0.31	0.00	1.00	0.46	2015
	Income	2.90	0.00	9.00	1.85	2012
	Repression Likely	0.48	0.00	1.00	0.50	1809

Table B.4: Main Results; Community Chairpeople, Environmental Service Shortages, and Protest

	DV: Willingness to Protest (0/1)		
	(A)	(B)	(C)
Service Shortages (0-3)	0.09*	0.10*	0.04
	(0.03)	(0.04)	(0.03)
Evaluation of Community Chairperson (0-8)	0.03	0.03	
	(0.02)	(0.02)	
Evaluation of District Representative (0-8)	-0.01	0.01	
	(0.01)	(0.01)	
Positive Evaluation, Community Chairperson (0/1)			0.09
			(0.07)
Positive Evaluation, District Representative (0/1)			-0.03
			(0.06)
Positive Evaluation, Both Elites (0/1)			0.11
			(0.08)
Expect Repression (0/1)	0.01	0.01	0.01
	(0.04)	(0.04)	(0.04)
Protest Effective (0/1)	0.05***	0.05***	0.05***
	(0.01)	(0.01)	(0.01)
Social Obligation to Protest (0/1)	-0.07	-0.07	-0.07
	(0.05)	(0.05)	(0.05)
Income (0-9)	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)
Shortages×Evaluation of Chairperson	-0.02**	-0.02**	
	(0.01)	(0.01)	
Shortages×Evaluation of Representative		-0.01	
		(0.01)	
Shortages×Evaluate Chairperson Positively			-0.08**
			(0.03)
Shortages×Evaluate Representative Positively			-0.03
			(0.03)
Shortages×Evaluate Both Elites Positively			-0.11**
			(0.03)
R <sup>2</sup>	0.47	0.48	0.48
Adj. R <sup>2</sup>	0.32	0.32	0.32
Num. obs.	1795	1795	1799
N Clusters	15	15	15

Note: \*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$

Table B.5: Secondary Results; Community Chairpeople, Environmental Service Shortages, and Other Anti-Government Attitudes/Behaviors

	DV: Tax Evasion <sup>1</sup>	DV: Gov't is Corrupt <sup>2</sup>	DV: Protest is Effective <sup>3</sup>
Service Shortages (0-3)	0.05 (0.04)	0.03 (0.04)	0.06 (0.04)
Evaluation of Community Chairperson (0-8)	0.04 (0.02)	0.05** (0.01)	0.01 (0.02)
Evaluation of District Representative (0-8)	-0.01 (0.01)	-0.12*** (0.01)	0.01 (0.00)
Expect Repression (0/1)	-0.13* (0.05)	-0.19** (0.06)	-0.15** (0.04)
Income (0-9)	0.00 (0.01)	-0.01 (0.01)	-0.05* (0.02)
Shortages×Evaluation of Chairperson	-0.02* (0.01)	-0.03** (0.01)	-0.02* (0.01)
R <sup>2</sup>	0.44	0.71	0.45
Adj. R <sup>2</sup>	0.27	0.63	0.30
Num. obs.	1794	1728	1795
N Clusters	15	15	15

Note: \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

<sup>1</sup>**Tax Evasion:** we ask respondents to indicate whether they should pay less, the same, or more in taxes to receive better services from the government. We collapse these responses into a dummy variable that takes a value of 0 if respondents are not willing to pay additional taxes and a value of 1 if respondents are willing to pay additional taxes.

<sup>2</sup>**Gov't is Corrupt:** we ask respondents how corrupt they think their district representative is, on a five-point Likert scale. We collapse these responses into a dummy variable that takes a value of 0 if respondents believe their district representative is not corrupt and a value of 1 if respondents think their district representative is corrupt.

<sup>3</sup>**Protest is Effective:** we ask respondents how effective they think protest is to achieve change in Liberia, on a five-point Likert scale. We collapse these responses into a dummy variable that takes a value of 0 if respondents believe that protest is ineffective and a value of 1 if respondents think protest is effective.

Outcome: <i>Willingness to Protest (0/1)</i>						
Treatment:	Est.	S.E.	t-value	$R^2_{Y \sim D   X}$	$RV_{q=1}$	$RV_{q=1, \alpha=0.05}$
<i>Shortage × Chairperson</i>	-0.024	0.005	-4.917	1.7%	12.3%	7.6%
df = 1392	<i>Bound (1x effective.prot): <math>R^2_{Y \sim Z   X, D} = 2\%</math>, <math>R^2_{D \sim Z   X} = 2\%</math></i>					

Figure B.9: Sample Demographics (N=370)

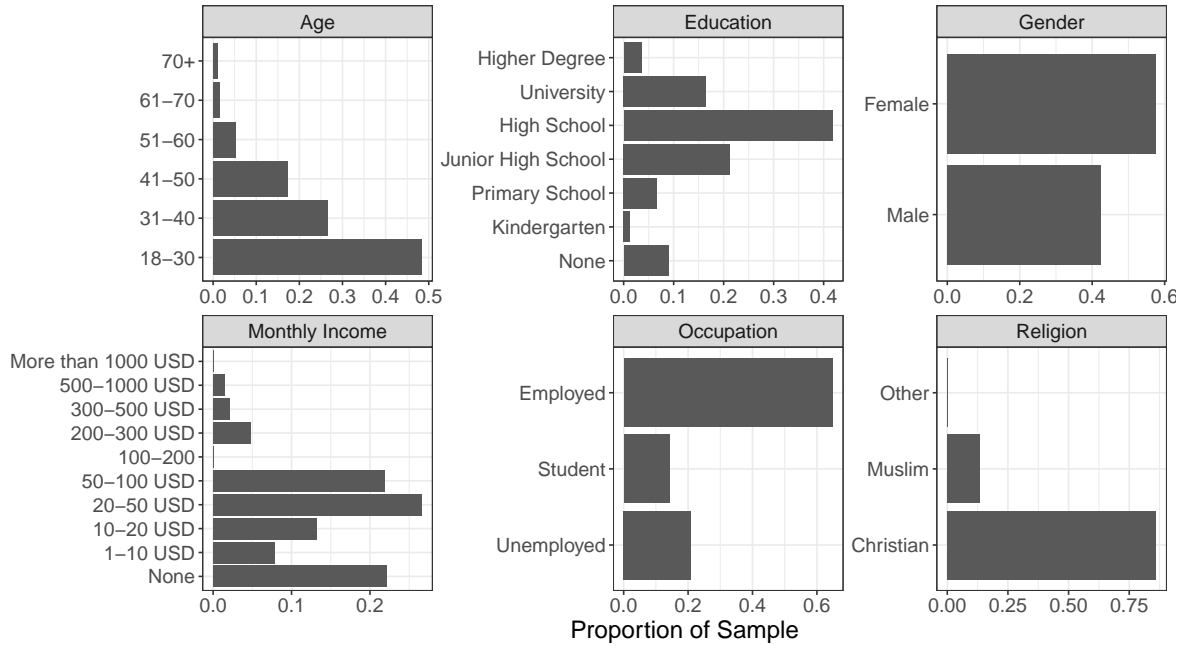
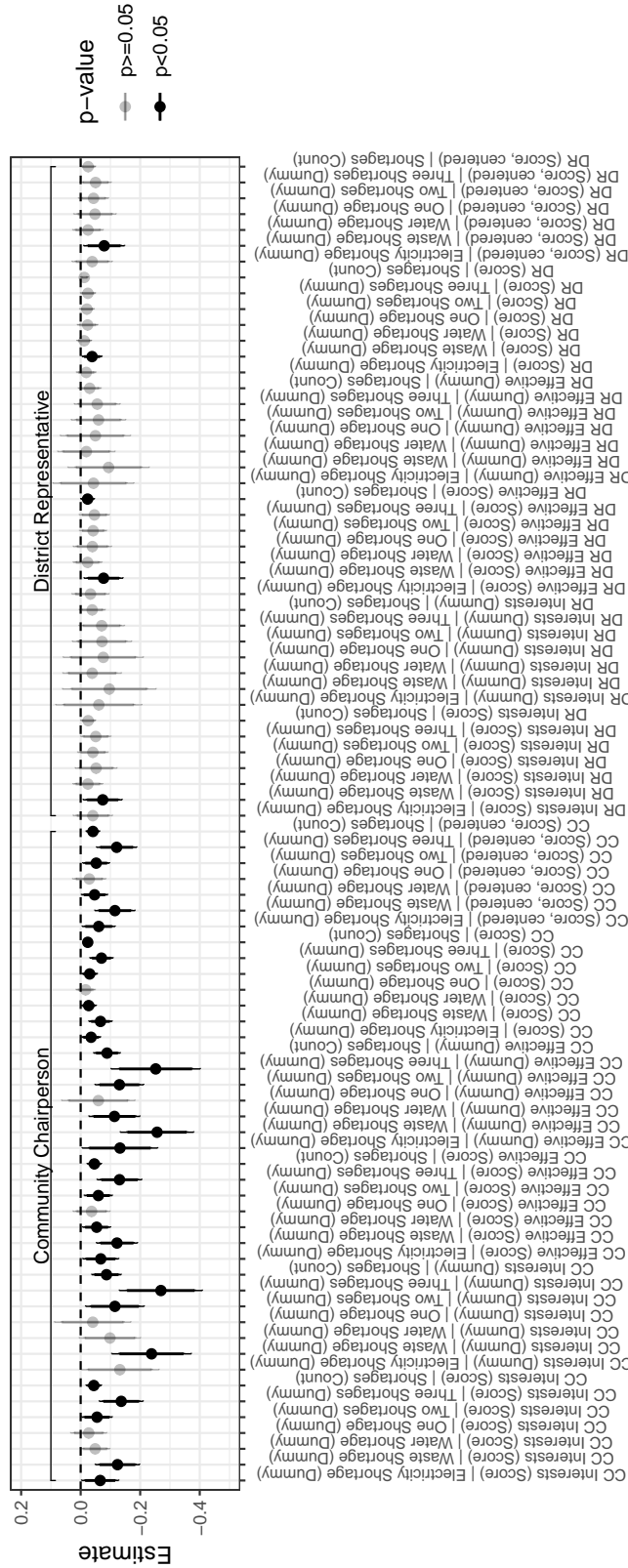


Figure B.10: Robustness of Main Results to Alternative Specifications (Protest Mobilization Operationalized as Dummy Variable)



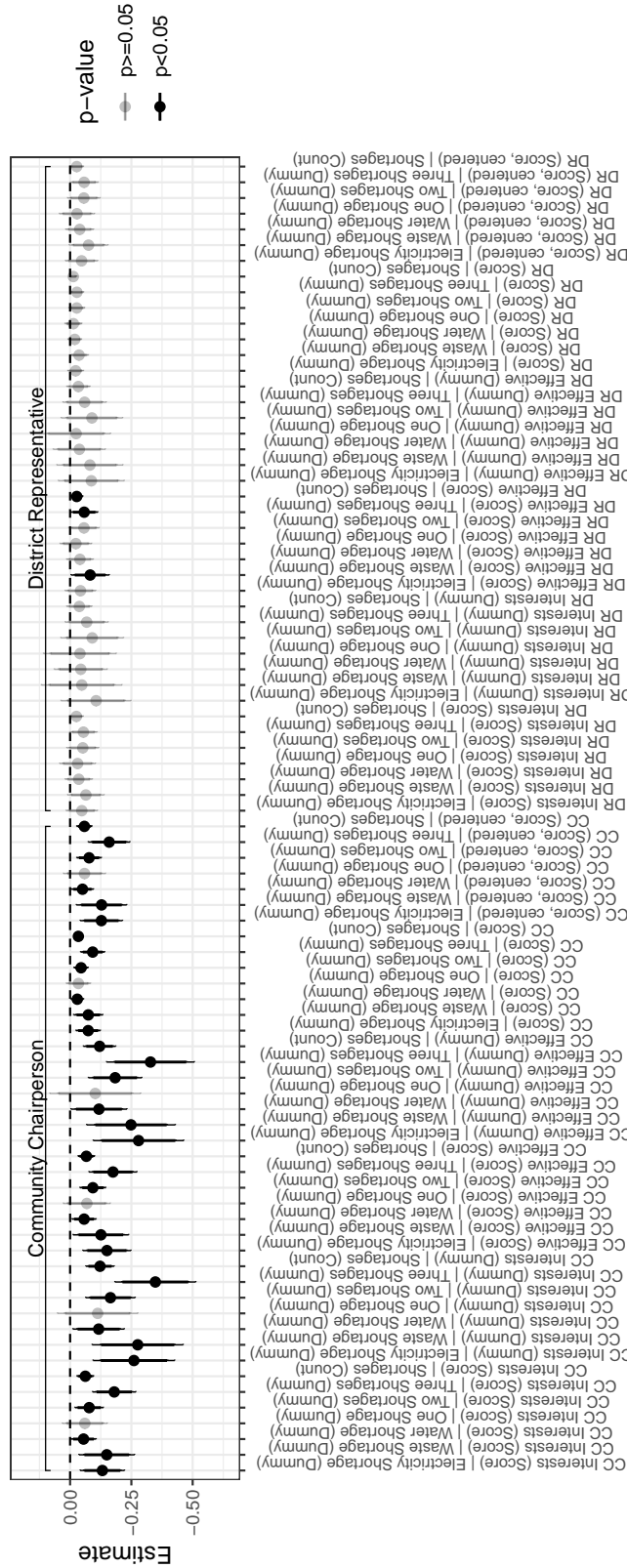
Evaluation | Service Shortage

Figure B.11: \*

Note: each point estimate corresponds to the service shortage-elite evaluation interaction (see  $\gamma_3$  in estimating equation) from a single estimation. The constitutive terms of this interaction, and how they are operationalized, are listed on the x-axis. Black point estimates are significant at the 5-percent level, grey point estimates are significant at the 10-percent level, and transparent estimates are not statistically significant. This figure demonstrates that the main results presented in B.4 are not extremely sensitive to various measurement strategies.



Figure B.12: Robustness of Main Results to Alternative Specifications (Protest Mobilization Operationalized as Index Variable)



Evaluation | Service Shortage

Figure B.13: \*

Note: each point estimate corresponds to the service shortage-elite evaluation interaction (see 73 in estimating equation) from a single estimation. The constitutive terms of this interaction, and how they are operationalized, are listed on the x-axis. Black point estimates are significant at the 5-percent level, grey point estimates are significant at the 10-percent level, and transparent estimates are not statistically significant. This figure demonstrates that the main results presented in B.4 are not extremely sensitive to various measurement strategies.

## Appendix C

# Air Pollution Undermines Mobilization for Environmental Advocacy.

### C.1 Tables & Figures

Table C.1: Summary Statistics

Variable	No. Observations	Mean	Std. Dev.	Min	Max	Range
Average Monthly PM <sub>2.5</sub> Concentration, 2016 (µg/m <sup>3</sup> )	3279.00	5.97	1.65	1.82	9.94	8.12
Average Monthly PM <sub>2.5</sub> Concentration, 2017 (µg/m <sup>3</sup> )	3279.00	6.06	1.41	1.47	12.20	10.73
Average Monthly PM <sub>2.5</sub> Concentration, 2018 (µg/m <sup>3</sup> )	3279.00	6.03	1.40	2.08	12.37	10.28
Maximum Monthly PM <sub>2.5</sub> Concentration, 2016 (µg/m <sup>3</sup> )	3279.00	7.38	1.64	3.00	16.20	13.20
Maximum Monthly PM <sub>2.5</sub> Concentration, 2017 (µg/m <sup>3</sup> )	3279.00	7.64	1.82	3.30	27.40	24.10
Maximum Monthly PM <sub>2.5</sub> Concentration, 2018 (µg/m <sup>3</sup> )	3279.00	7.69	1.76	3.60	19.50	15.90
Total Commitments, 2019-2021	3313.00	41.11	264.01	0.00	7845.00	7845.00
Commitments per 1000 residents, 2019-2021	3313.00	0.16	0.51	0.00	13.31	13.31
Wind Speed, 2016 (unit)	3279.00	1.24	0.59	0.06	4.30	4.24
Wind Direction, 2016 (unit)	3279.00	220.01	43.28	31.03	338.93	307.91
PBL Height, 2016 (unit)	3279.00	902.13	216.55	390.87	2002.66	1611.80
Air Pressure, 2016 (unit)	3279.00	96557.95	5610.24	68266.34	101818.53	33552.19
Relative Humidity, 2016 (percent)	3279.00	70.26	9.27	28.53	87.08	58.56
Air Temperature, 2016 (K)	3279.00	287.81	4.73	273.18	300.63	27.45
Wind Speed, 2017 (unit)	3279.00	1.24	0.57	0.15	4.43	4.28
Wind Direction, 2017 (unit)	3279.00	219.90	39.24	54.67	320.11	265.45
PBL Height, 2017 (unit)	3279.00	916.13	217.10	416.77	2025.12	1608.35
Air Pressure, 2017 (unit)	3279.00	96507.56	5599.43	68251.99	101780.36	33528.37
Relative Humidity, 2017 (percent)	3279.00	69.23	9.70	27.42	85.75	58.32
Air Temperature, 2017 (K)	3279.00	287.68	5.02	273.54	301.12	27.59
Wind Speed, 2018 (unit)	3279.00	1.02	0.61	0.04	4.55	4.51
Wind Direction, 2018 (unit)	3279.00	212.67	40.71	63.20	344.39	281.20
PBL Height, 2018 (unit)	3279.00	899.52	233.81	399.22	2309.88	1910.66
Air Pressure, 2018 (unit)	3279.00	96624.28	5627.25	68252.83	101881.60	33628.77
Relative Humidity, 2018 (percent)	3279.00	71.52	10.69	27.64	87.49	59.85
Air Temperature, 2018 (K)	3279.00	287.23	5.00	275.24	299.99	24.75
Percent of Population in Urban Areas	3311.00	41.02	31.46	0.00	100.00	100.00
Median Household Income (USD)	3313.00	25416.35	5526.58	7529.00	62933.00	55404.00
Population with Bachelor's Degree	3313.00	12586.43	45453.85	2.00	1348250.00	1348248.00
County Area (km <sup>2</sup> )	3313.00	3116601.05	9649022.24	5296.04	380460285.99	380454989.95
Total pre-2018 Donations	3313.00	0.03	0.32	0.00	10.00	10.00
Democratic Vote Share, 2016 (percent of total vote)	3285.00	0.32	0.15	0.03	0.91	0.88
Concern re: US Climate Change Impacts, 2016 (percent of population)	2996.00	53.18	4.45	43.83	72.07	28.24
Concern re: Personal Climate Change Impacts, 2016 (percent of population)	2996.00	35.95	4.11	28.89	56.90	28.00

Table C.4: First Stage Results  
DV: Average Monthly PM<sub>2.5</sub> Concentration

	(a)	(b)	(c)	(d)	(e)	(f)
Wind Speed	-0.65*** (0.03)	-0.52*** (0.03)	-0.44*** (0.03)	-0.33*** (0.03)	-0.62*** (0.03)	-0.45*** (0.03)
Median Income		-0.00*** (0.00)		-0.00*** (0.00)		-0.00*** (0.00)
Population w/Bachelor's Degree		0.00*** (0.00)		0.00*** (0.00)		0.00*** (0.00)
County Area		-0.00*** (0.00)		-0.00*** (0.00)		-0.00*** (0.00)
Organization Z Offices		-0.10* (0.05)		-0.16** (0.05)		-0.13* (0.05)
(Intercept)	0.66*** (0.03)	1.14*** (0.10)	0.55*** (0.04)	1.30*** (0.10)	0.76*** (0.04)	1.65*** (0.09)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Weak Instruments Test	p 0.01	p 0.01	p 0.01	p 0.01	p 0.01	p 0.01
Wu-Hausman Test	p 0.01	p 0.01	p 0.01	p 0.01	p 0.01	p 0.01
Adj. R <sup>2</sup>	0.16	0.29	0.06	0.24	0.13	0.33
Num. obs.	3279	3279	3279	3279	3279	3279

\*\*\*p < 0.001; \*\*p < 0.01; \*p < 0.05

Table C.5: \*

Note: Models (a) and (b) regress county-level average monthly PM<sub>2.5</sub> concentrations from 2018 on county-level average monthly wind speeds from the same year. Models (c) and (d) regress county-level average monthly PM<sub>2.5</sub> concentrations from 2017 on county-level average monthly wind speeds from the same year. Models (e) and (f) regress county-level average monthly PM<sub>2.5</sub> concentrations from 2016 on county-level average monthly wind speeds from the same year.

Table C.6: Second Stage Results, Average Monthly PM<sub>2.5</sub> (2018) v. Political Participation (2019-2021)

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Average Monthly PM <sub>2.5</sub> , 2018 (standardized)	-0.30*** (0.08)	-0.38*** (0.10)	-0.42** (0.14)	-0.33*** (0.09)	-0.32*** (0.12)	-0.40** (0.13)	-0.31*** (0.07)	-0.38*** (0.10)	-0.38* (0.15)
Median Income		0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.00* (0.00)
Population w/Bachelor's Degree		-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
County Area		-0.00*** (0.00)	-0.00** (0.00)	-0.00*** (0.00)	-0.00** (0.00)	-0.00** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	-0.00* (0.00)
Organization Z Offices		0.80*** (0.12)	0.66*** (0.11)	0.80*** (0.11)	0.77*** (0.12)	0.66*** (0.11)	0.81*** (0.12)	0.80*** (0.12)	0.80*** (0.12)
Urbanicity			0.00*** (0.00)		0.00*** (0.00)		0.00*** (0.00)		
Relative Humidity					0.02*** (0.00)	0.02*** (0.01)			
(Intercept)	-0.00 (0.02)	-0.53*** (0.12)		-0.57*** (0.11)	-1.70*** (0.27)		-0.58*** (0.11)	-0.53*** (0.12)	-0.53* (0.21)
State Fixed Effects	No	No	Yes	No	No	Yes	No	No	No
Wind Speed as Categorical Variable	No	No	No	No	No	No	Yes	No	No
Cluster Robust SEs (State-level)	No	No	No	No	No	No	No	No	Yes
Conley HAC Robust SEs	No	No	No	No	No	No	No	No	No
Adj. R <sup>2</sup>	-0.06	0.08	0.17	0.11	0.01	0.20	0.11	0.08	0.01
Num. obs.	3279	3279	3279	3278	3279	3278	3279	3276	3279
N Clusters									49

\*\*\*p < 0.001; \*\*p < 0.01; \*p < 0.05

Table C.7: \*

Note: All models use measures of PM<sub>2.5</sub> and wind speed from 2018.

Table C.8: Second Stage Results, Average Monthly PM<sub>2.5</sub> (2017, 2016) v. Political Participation (2019-2021)

	(a)	(b)
Average Monthly PM <sub>2.5</sub> (standardized)	-0.41*** (0.11)	-0.31*** (0.06)
(Intercept)	-0.00 (0.02)	-0.00 (0.02)
Adj. R <sup>2</sup>	-0.12	-0.05
Num. obs.	3279	3279

\*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$

Table C.9: \*

Note: Model (a) uses measures of PM<sub>2.5</sub> from 2017. Model (b) uses measures of PM<sub>2.5</sub> from 2016.

Table C.10: Subgroup Results: Median Household Income

	DV: Commitments per capita, 2019-2021 (standardized)			
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Average Monthly PM2.5, 2018 (standardized)	-0.188 (0.119)	-0.045 (0.108)	-0.559 (0.411)	-0.334 <sup>+</sup> (0.191)
State Fixed-Effects?	Yes	Yes	Yes	Yes
Covariates?	Yes	Yes	Yes	Yes
N	778	776	772	750

Note: <sup>+</sup> p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

Table C.11: Subgroup Results: Population w/Bachelor's Degree

	DV: Commitments per capita, 2019-2021 (standardized)			
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Average Monthly PM2.5, 2018 (standardized)	-0.43 (0.378)	-0.066 (0.1)	-0.231 <sup>+</sup> (0.132)	-0.762 <sup>**</sup> (0.26)
State Fixed-Effects?	Yes	Yes	Yes	Yes
Covariates?	Yes	Yes	Yes	Yes
N	762	776	774	766

Note: <sup>+</sup> p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001



Table C.12: Subgroup Results: Democratic Vote Share in 2016 Presidential Election

	DV: Commitments per capita, 2019-2021 (standardized)			
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Average Monthly PM2.5, 2018 (standardized)	-0.03 (NaN)	-0.279 <sup>+</sup> (0.026)	-1.155* (0.145)	-1.155* (0.57)
State Fixed-Effects?	Yes	Yes	Yes	Yes
Covariates?	Yes	Yes	Yes	Yes
N	784	774	771	760

Note: <sup>+</sup> p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

Table C.13: Subgroup Results: Concerned about impacts of climate change in US.

	DV: Commitments per capita, 2019-2021 (standardized)			
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Average Monthly PM2.5, 2018 (standardized)	-0.019 (0.07)	0.139 (0.133)	-0.145 (0.1)	-0.748** (0.289)
State Fixed-Effects?	Yes	Yes	Yes	Yes
Covariates?	Yes	Yes	Yes	Yes
N	713	708	704	695

Note: + p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

Table C.14: Subgroup Results: Concerned about impacts of climate change in personal life.

	DV: Commitments per capita, 2019-2021 (standardized)			
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Average Monthly PM2.5, 2018 (standardized)	0.098 (0.137)	-0.05 (0.05)	-0.151 (0.092)	-0.383* (0.173)
State Fixed-Effects?	Yes	Yes	Yes	Yes
Covariates?	Yes	Yes	Yes	Yes
N	710	707	700	695

Note: + p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

Figure C.1: Distribution of Organization Z Members' Commitments across Types of Highbar Actions

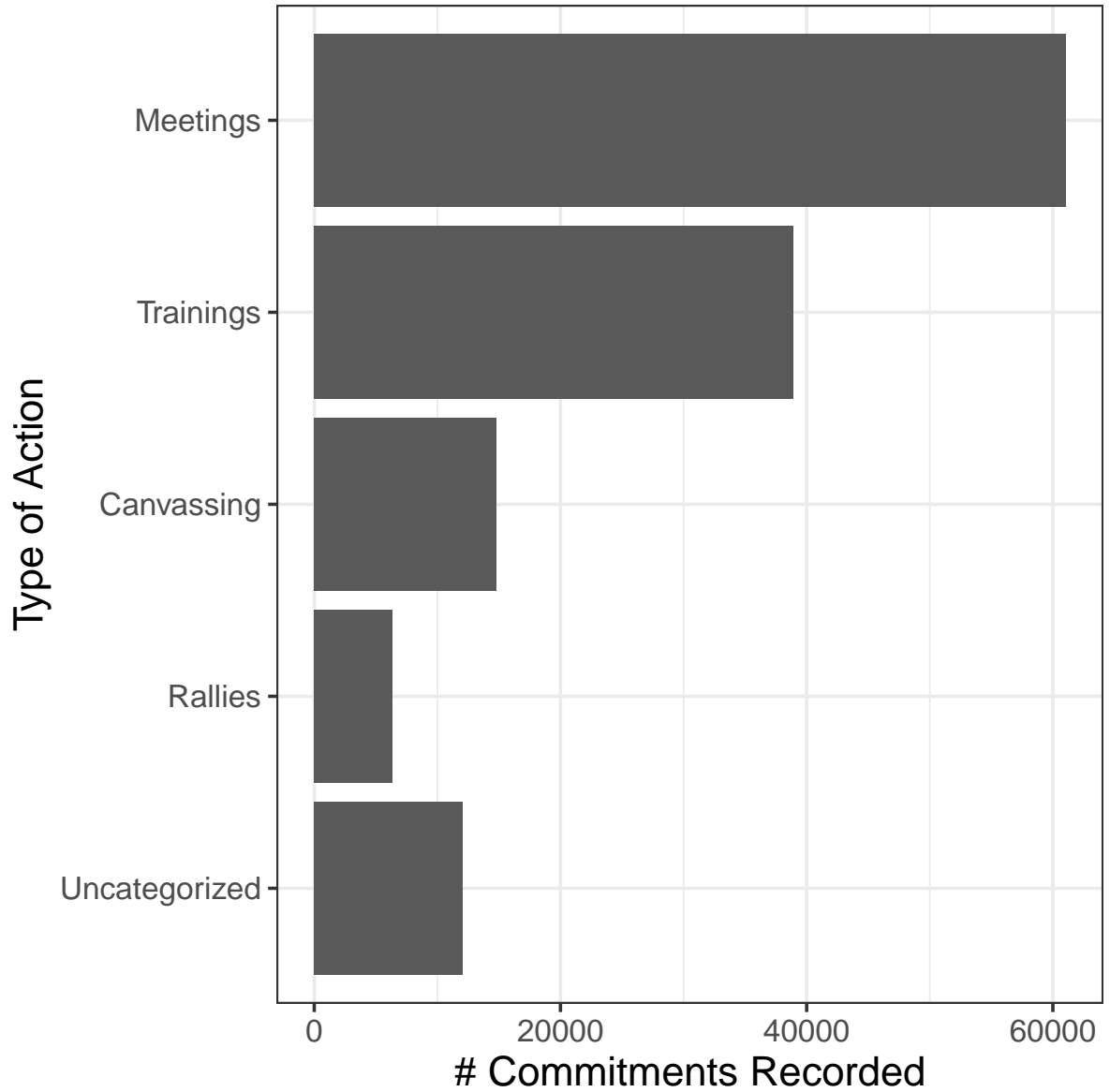


Figure C.2: Distribution of Commitments across Highbar Actions

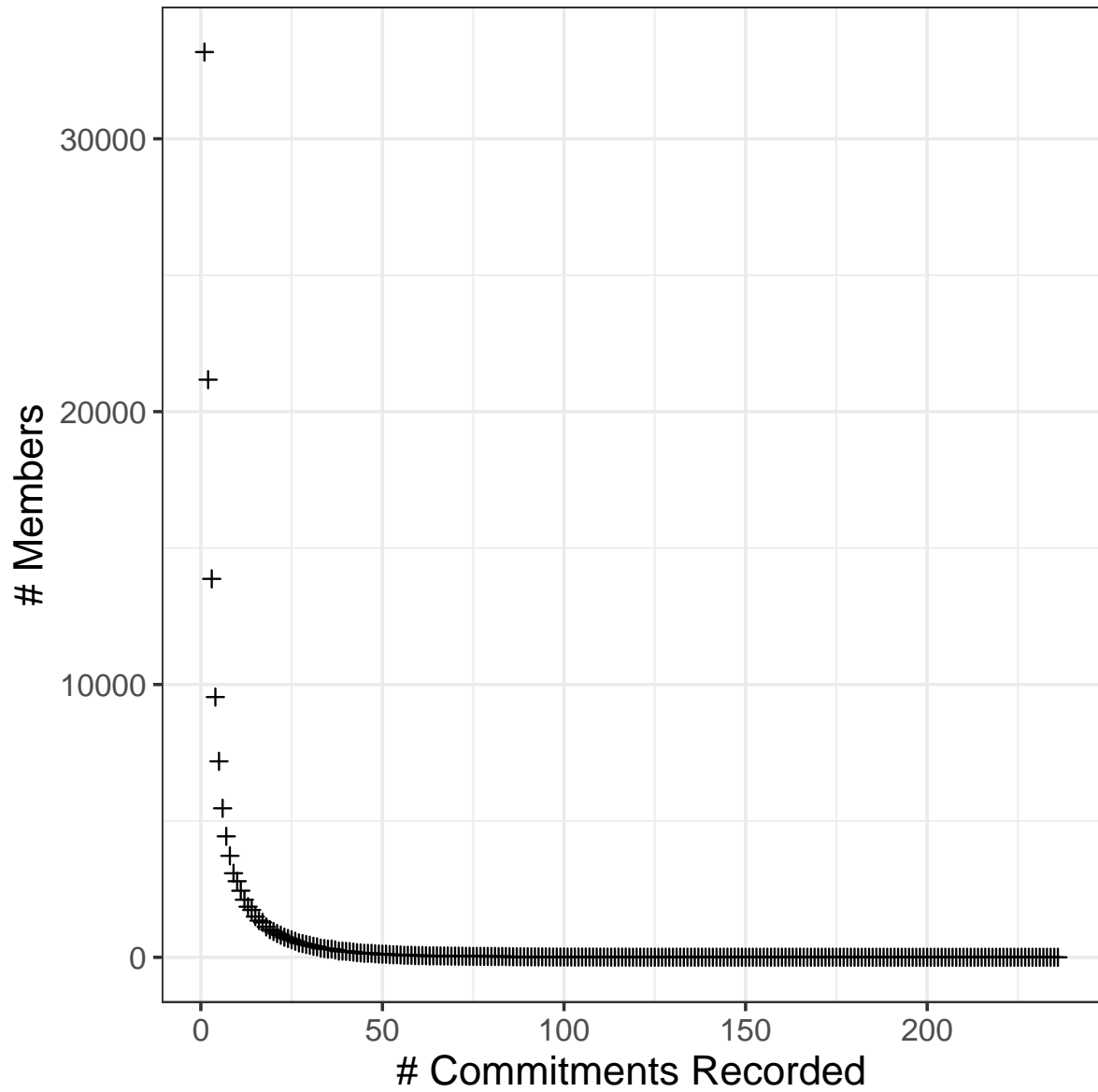


Figure C.3: Recorded Number of Commitments per Organization Z Member

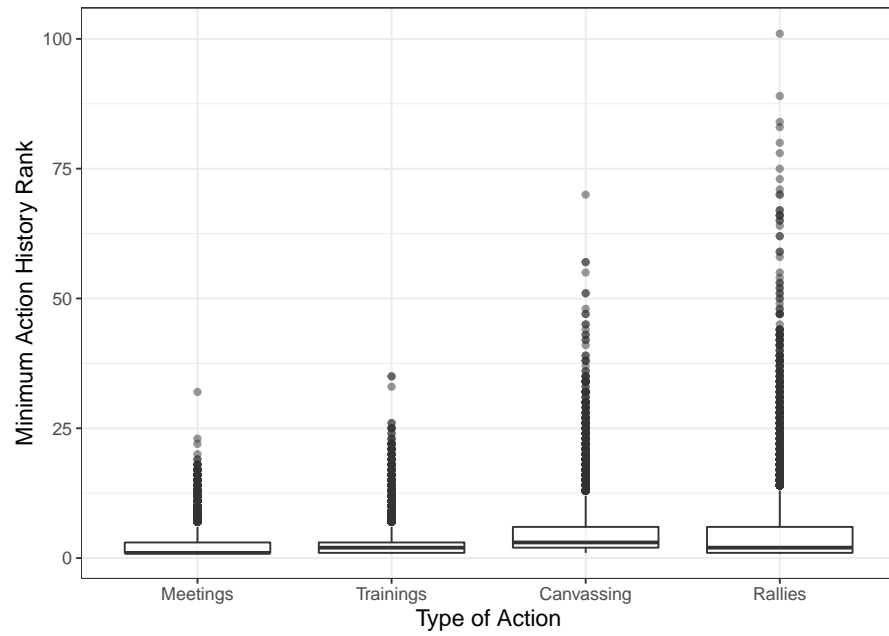


Figure C.4: Minimum Number of Commitments per Organization Z Member prior to First Highbar Action of Each Type

Figure C.5: Organization Z Mobilization, 2019-2021

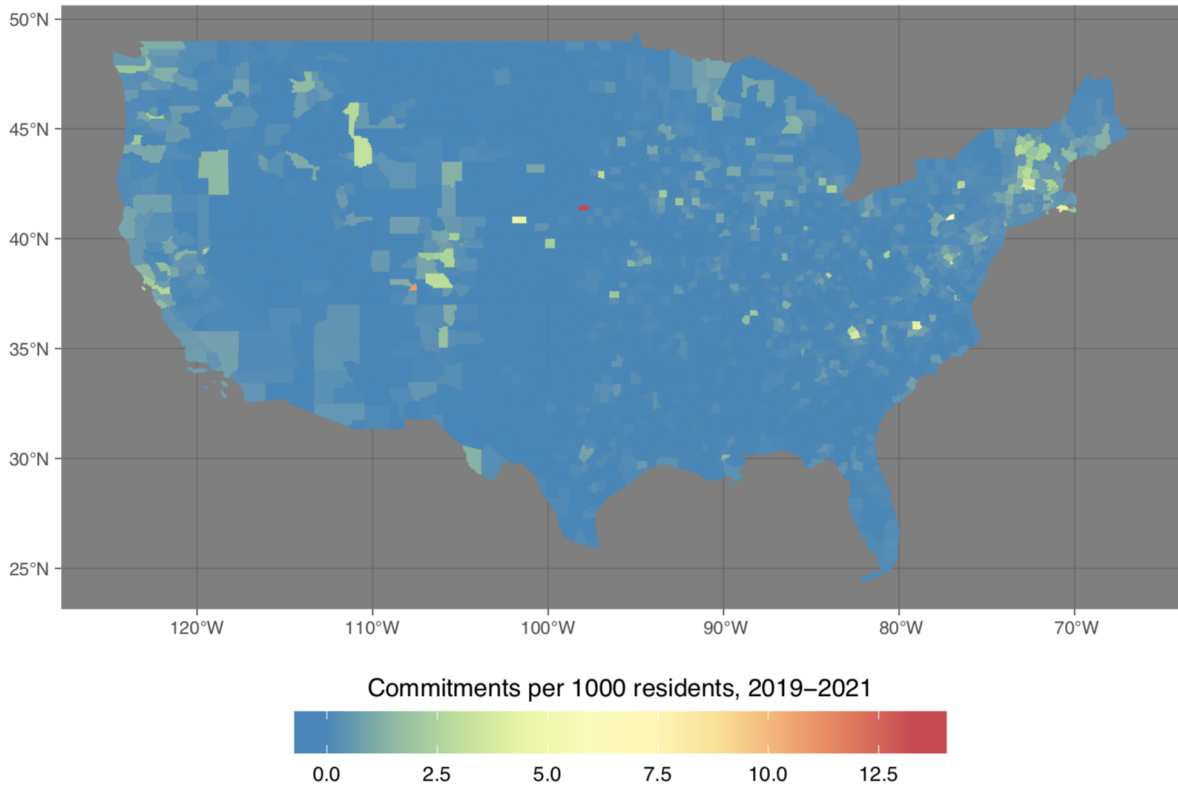


Figure C.6: PM<sub>2.5</sub> Pollution, 2016-2018

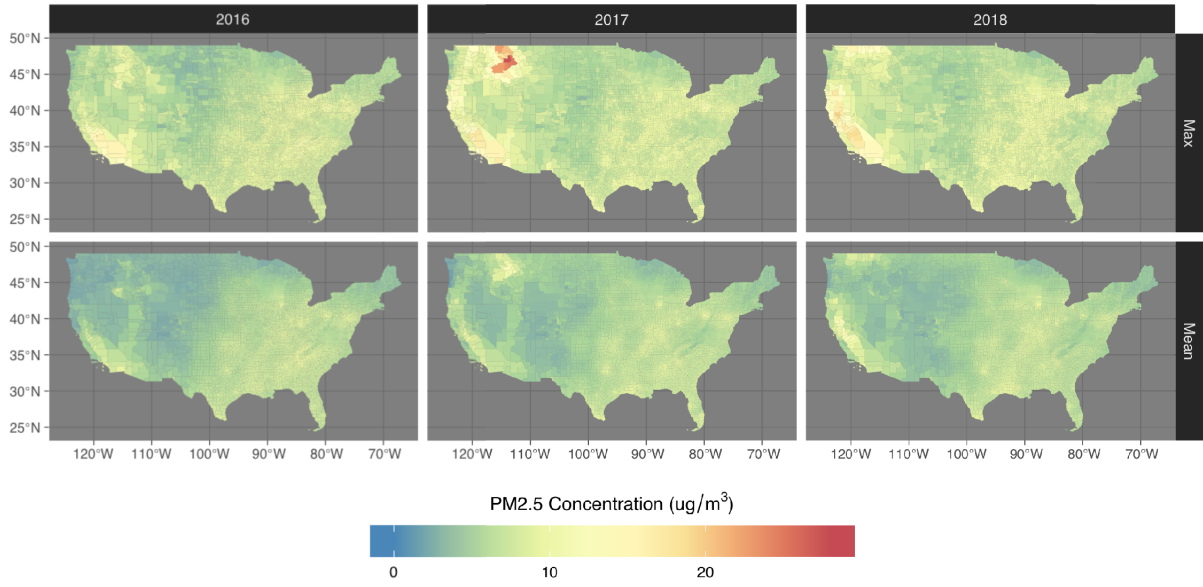




Figure C.7: Between-County Variation in Wind Speed Instrument, 2016-2018

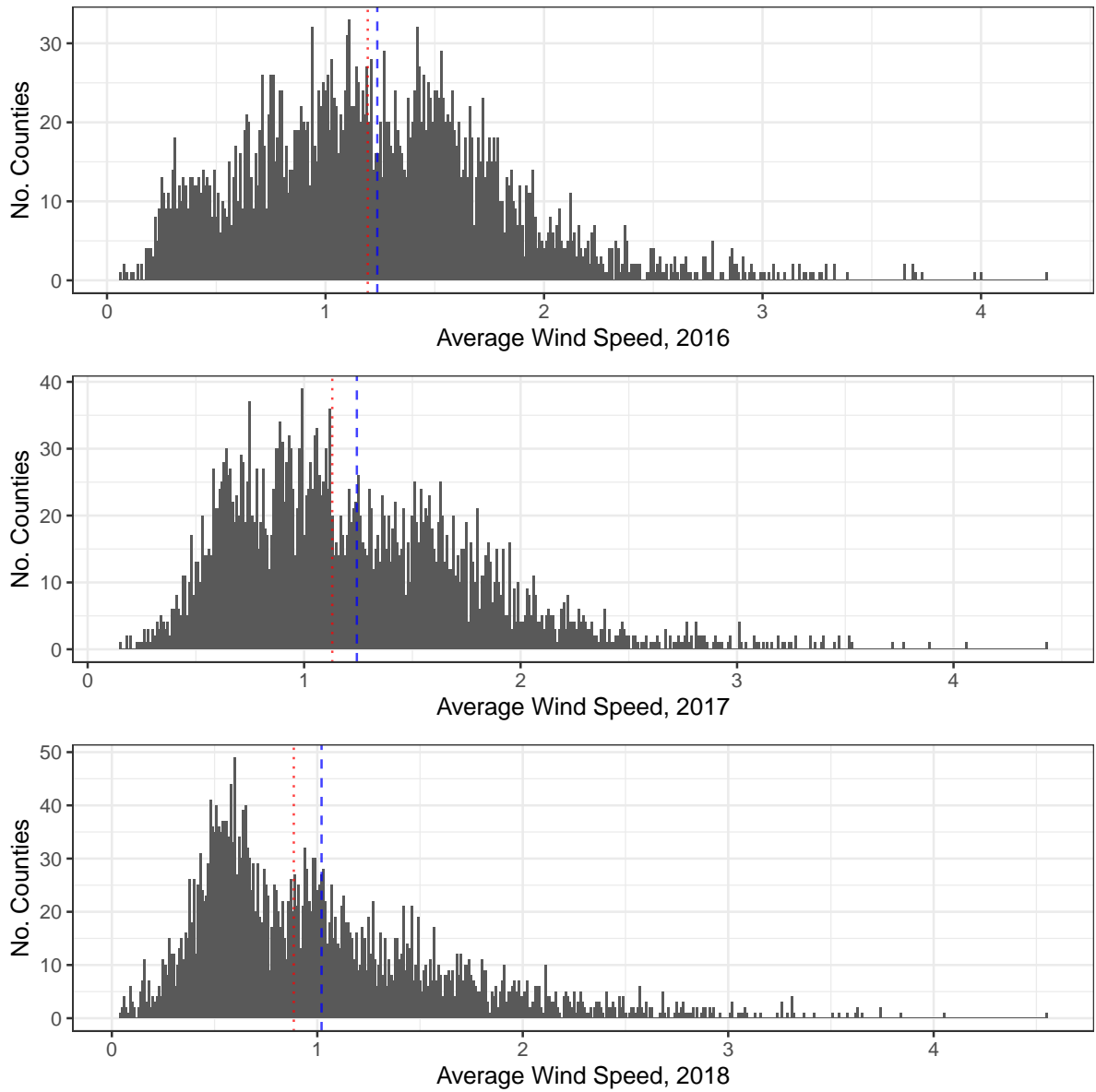


Figure C.8: \*

*Note:* Dashed blue/dotted red lines indicate the mean and median average annual wind speed among counties in our sample, respectively.

Figure C.9: Within-County Variation in Wind Speed Instrument, 2016-2018

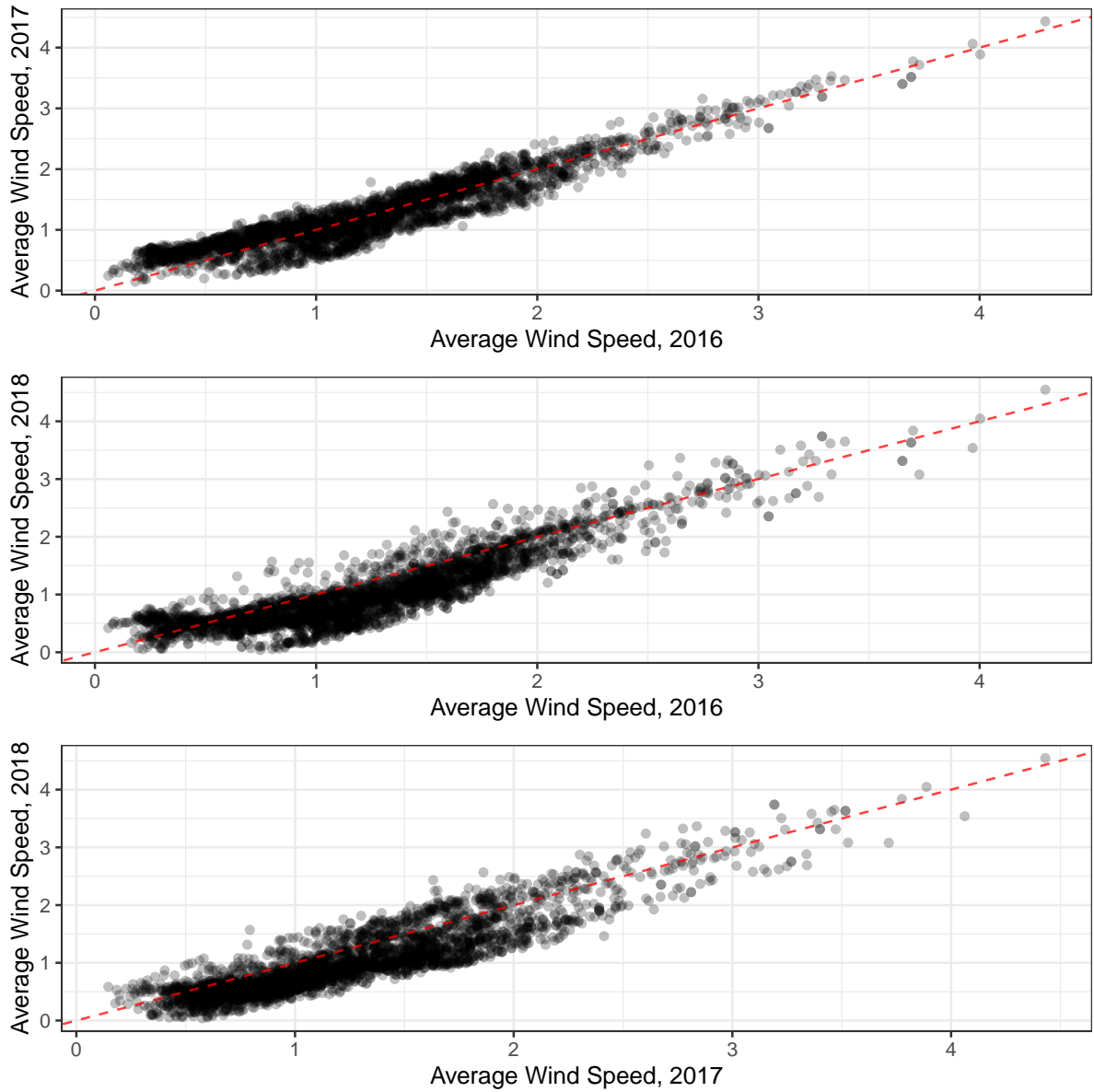


Figure C.10: \*

*Note:* Dashed blue/dotted red lines indicate the mean and median average annual wind speed among counties in our sample, respectively.

Figure C.11: Average Monthly PM2.5 Concentration (2016, 2017, 2018) v. Commitments per 1000 residents (2019-2021)

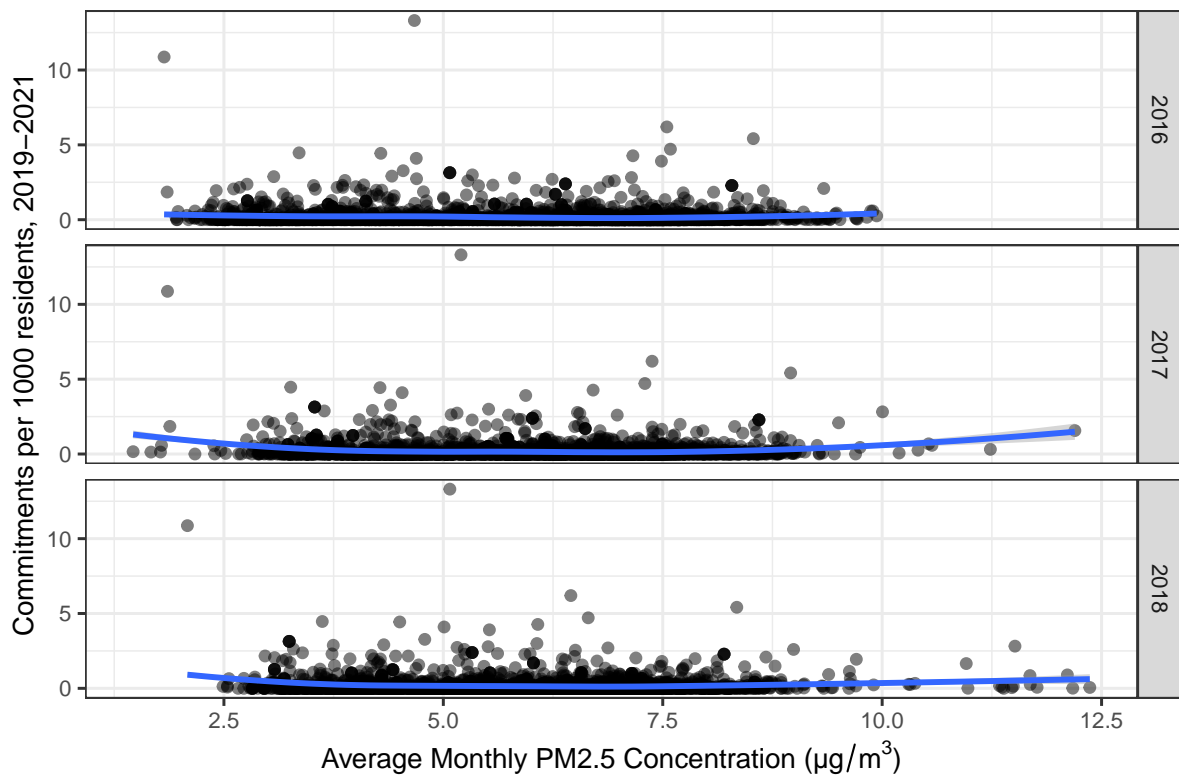


Figure C.12: \*

*Note: finish me, and make my title more informative!*

Figure C.13: Exposure to PM<sub>2.5</sub> pollution reduces political participation.

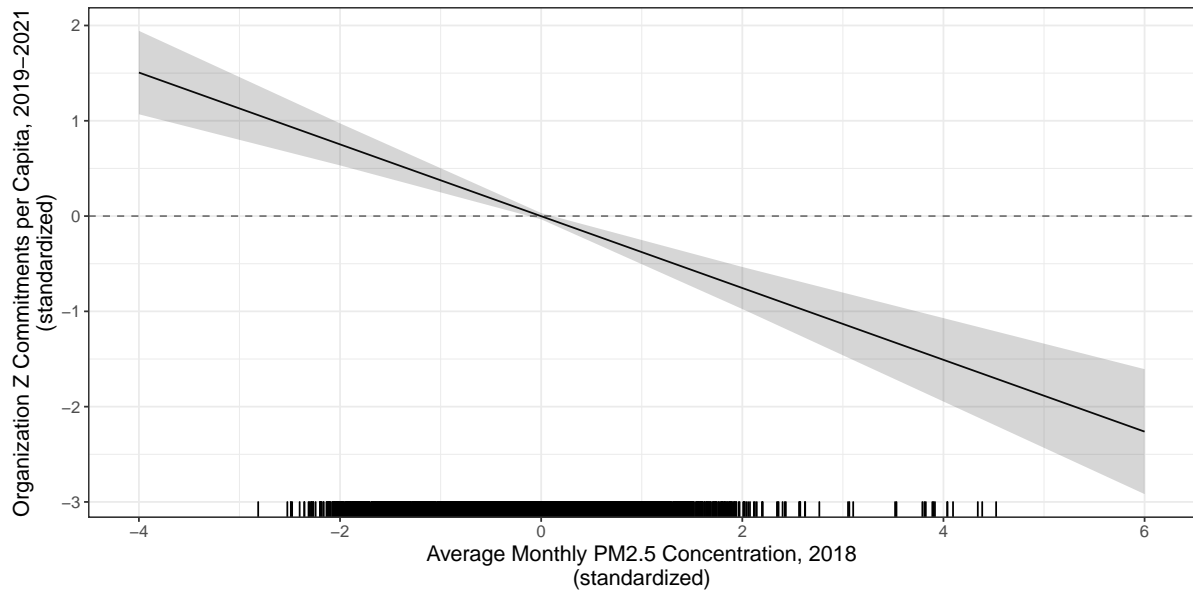


Figure C.14: Leave-One-Out Analysis: Average Monthly PM<sub>2.5</sub> (2018) v. Political Participation

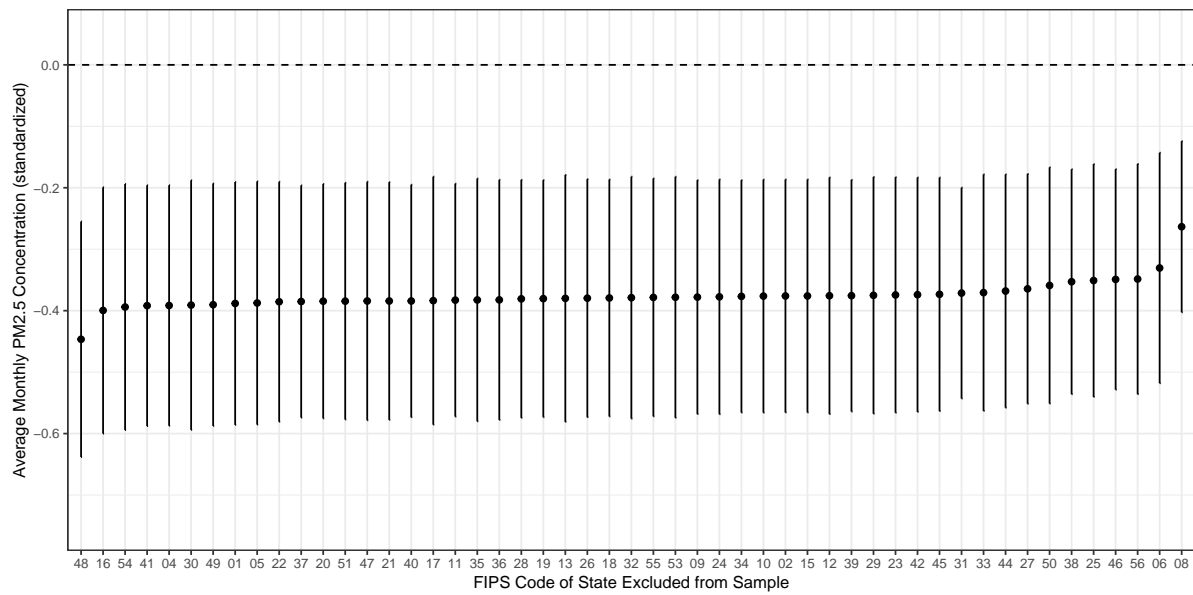
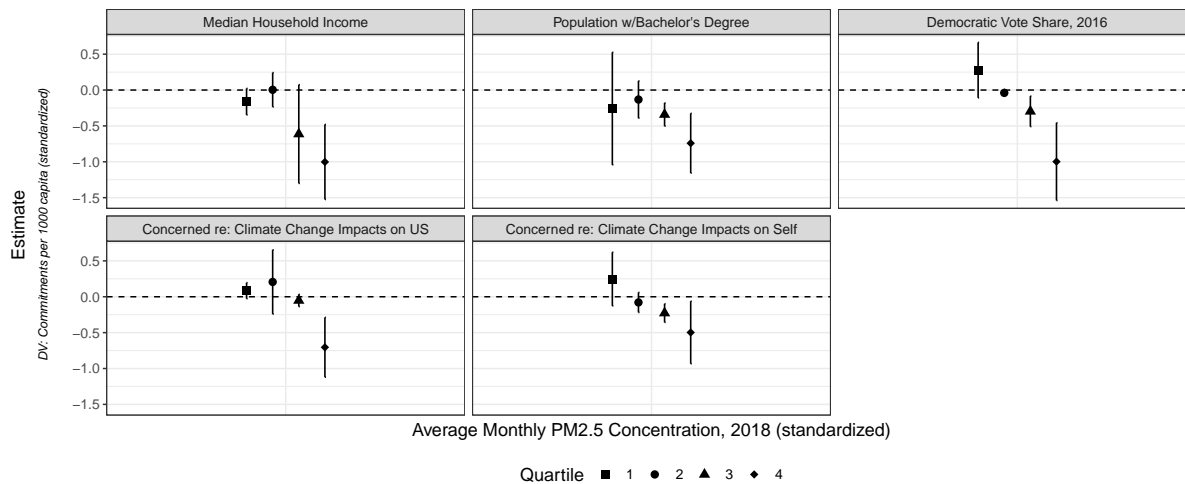


Figure C.15: Exposure to PM<sub>2.5</sub> pollution reduces political participation, especially within relatively well-educated, high-income, majority Democrat, and environmental-concerned counties.



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