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Political Economy of Crisis Response

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The Political Economy of Crisis Response*

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Abstract

We offer a theoretical model in which heterogeneous agents make individual decisions with negative external effects such as the extent of social distancing during pandemics. Because of the externality, agents have different individual and political preferences over the policy response. Personally, they might prefer a low-level response, yet would vote for a higher one because it deters others. In particular, agents want one level of slant in the information they base their actions on and a different level of slant in public announcements. The model accounts for numerous empirical regularities of the early public response to COVID-19 in the U.S.

JEL Classification: D72, L82, H12, I18.

Keywords: Bayesian persuasion, public health externality, media slant, polarization, income inequality, COVID-19.

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1 Introduction

The spread of COVID-19 represents a major public health challenge. To slow the growth rate of infections, a number of governments have adopted policies that range in severity from voluntary social distancing (e.g., Sweden) to strict lockdowns (e.g., China and South Korea). Most governments have adopted shelter-in-place policies, which mandate only minimal movement for essential activities, or strongly encouraged social distancing.

Compliance with these policies, however, has been uneven. In the United States, compliance has been driven by local income (Chiou and Tucker, 2020; Wright et al., 2020), partisanship and polarization (Painter and Qiu, 2020; Gadarian, Goodman and Pepinsky, 2020; Allcott et al., 2020; Grossman et al., 2020), media slant (Simonov et al., 2020), and beliefs in science (Brzezinski et al., 2020; Sailer et al., 2020). In Europe, trust in government also influences changes in population movement after governments enact physical distancing policies (Bargain and Aminjonov, 2020; Brodeur, Grigoryeva and Kattan, 2020).

Shelter-in-place policies have also triggered a strong political reaction, including deliberate noncompliance and protests (Dyer, 2020). Local officials have amended mask requirements after store employees were threatened with physical violence.¹ Protests in more than a dozen US states have erupted as demands for relaxed standards have grown. In Michigan, protesters stormed the state capital to demand the governor revoke the state-wide shelter-in-place order.² Similar movements have emerged in Australia, Brazil, Canada, Germany, India, Italy, Pakistan, Poland, and the United Kingdom.

We offer a model of individual behavior and political attitudes during a crisis. To highlight the relevance of the model to the 2020 pandemic, the exposition mirrors the specific language of the COVID-19 disease and the U.S. policy response (i.e., social distancing or shelter-in-place ordinances, mask mandates, etc.), yet the model can be used to analyze the political response to any crisis in which individual behavior has significant external effects. In our

¹See <https://bit.ly/2Z58xYT>.

²See <https://bbc.in/2STNyUX>.

model, individuals are heterogeneous in their incomes and exposure to an exogenous threat from the pandemic, and have to decide whether or not to comply with the government ordinance. Our starting point is that compliance is costly in terms of foregone income, the costs of noncompliance depend on others' compliance behavior, and the information that agents choose to consume matters.

Our first results are that compliance is increasing in local health risks, household income, and healthcare costs (Proposition 1). For the impact of income, the intuition is straightforward: the marginal utility of income is diminishing, while the health risks depend, in equilibrium, on others' compliance. Later, we derive similar results at the community (e.g., U.S. county) level (Proposition 5) and identify the conditions under which the share of complying individuals is increasing in income inequality (Proposition 6). As we demonstrate in Section 2, which collects empirical facts, all these results are consistent with the evidence.

We investigate the role of information, the core focus of our study, in Propositions 2–4. For each agent, posterior beliefs are influenced by public reports, yet the information obtained from such a report is valuable to the extent that it changes the agent's behavior. We start with a straightforward result about each agent's demand for information when the only concern of the agent is her individual behavior (Proposition 2). Naturally, any agent finds information about the severity of threat valuable only if it leads to a strong adjustment of beliefs, causing her to change her behavior. As a result, individuals who are more likely to be non-compliant prefer information sources slanted toward downplaying the risks.³

The empirical evidence that we discuss in Section 2 suggests a strong correlation between the sources of information downplaying the coronavirus threat and less compliance with lockdowns or mask-wearing ordinances. What Proposition 2 shows is that some of this

³In political science, this is known as the “Nixon goes to China” phenomenon, in which individuals only trust a like-minded politician to implement a controversial reform because the information value of such actions is higher (Cukierman and Tommasi, 1998). The same force appears in Calvert (1985) and Suen (2004) where people prefer to receive advice from like-minded experts, in Burke (2008), Oliveros and Várdy (2015) and Yoon (2019) where people choose media sources, in Meyer (1991) when designing dynamic contests, and in Gill and Sgroi (2012) when designing tests for a product. For recent applications of this idea to dynamic decision making, see Che and Mierendorff (2019) and Zhong (2019).

correlation might not be a result of media persuasion. Instead, it might be a rational choice of agents who are unlikely to comply to consume information from a slanted source: a signal from a less slanted source would not be strong enough to alter the agent’s behavior. In particular, low-income individuals or those who live in rural, sparsely populated areas might rationally prefer sources that downplay the risks of COVID-19.

Agents’ political attitude toward the informational slant differs from their individual attitude. In the presence of a negative externality, each agent has two concerns about the slant in publicly provided information. First, as discussed above, she needs information to decide whether or not to stay at home. Second, she wants the signal to be designed so that it keeps others at home to reduce the external effect; this motive is relatively stronger for those who are not staying at home themselves. To calculate the optimal slant, each agent effectively solves the Bayesian persuasion problem (Kamenica and Gentzkow, 2011). The additional challenge is two combine this with the general equilibrium element of the model as, when eliciting political preferences, every agent is both a persuader and the subject of persuasion. Proposition 3 describes the equilibrium in the presence of a slanted source of information; Proposition 4 elicits individual political preferences over the slant.

Propositions 5–7 focus on the effect of income inequality, which is a major determinant of social distancing (see Figure 1 in Section 2). In particular, an increase in inequality is associated with individuals preferring the sources that exaggerate risks even further (Proposition 7). Next, we explain the economic rationale behind observable attitudes toward quarantines, mask mandates, lockdowns and other measures. Naturally, high-income individuals prefer strict social distancing enforcement (Proposition 8): they derive less marginal utility from additional income and are more likely to stay home. It is different for those who cannot afford staying home: without an externality, the level of enforcement preferred by them would be zero. With a negative externality, the preferred level of enforcement might be positive as each agent benefits from other agents’ compliance. Those who live in densely populated urban areas express demand for strict enforcement even if they do not comply themselves,

while rural voters prefer laxer rules. One consequence of this is extreme polarization: many polities are split into two groups with drastically different attitudes toward restrictive orders (Proposition 9.)

In addition to providing a framework for studying behavior during a health crisis and its relation to consumption of information in the presence of externalities, our model could also be extended to study how polarization and partisanship influence information acquisition about a broader class of community threats such as disinformation campaigns, foreign influence operations, fraudulent voting, etc. It provides a framework to study political dynamics of anti-government protests more broadly, where individuals make the joint decision to engage in risky actions with negative externalities.

As information acquisition plays the critical role in our theory, our paper is related to various studies of slanted media and biased information (Gentzkow and Shapiro, 2006, 2008; DellaVigna and Gentzkow, 2010). In the pioneering work of Mullainathan and Shleifer (2005) and Baron (2006), the heterogeneous demand for media slant is driven by exogenous factors.⁴ In our model, the demand is endogenous, as those who choose not to comply are interested in a higher slant due to its informative content. At the same time, they are interested in a greater emphasis of the threat to keep others at home. We use the geometric argument in the Bayesian persuasion literature (Kamenica and Gentzkow, 2011) to determine what amount of slant an agent prefers: in the presence of externalities, the agent's optimal choice is not only the source of information, but also the persuasion mechanism for others.⁵

Our model relates to the literature on Bayesian persuasion with multiple receivers. Alonso and Câmara (2016) and Laclau and Renou (2016) consider public messages by a sender to convince a group of heterogeneous receivers. Bardhi and Guo (2018) and Arieli and Babichenko (2019) consider private, possibly correlated, messages. Wang (2013), Chan et al. (2019) and Kerman, Herings and Karos (2020) compare private and public persuasion mecha-

⁴Other models where media sources strategically choose their slants include Strömberg (2004); Bernhardt, Krassa and Polborn (2008); Anderson and McLaren (2012); Chan and Suen (2008); Duggan and Martinelli (2011). Gentzkow, Shapiro and Stone (2015) provides a comprehensive summary of the literature.

⁵See Bergemann and Morris (2019) and Kamenica (2019) for recent surveys.

nisms. The general characterization of the set of implementable outcomes relies on modeling the persuasion problem as an information design problem (Bergemann and Morris, 2016a,b; Taneva, 2019; Mathevet, Perego and Taneva, 2020). Information design towards multiple receivers have been used in studying stress tests (Inostroza and Pavan, 2020), banking regulations (Inostroza, 2019) and contests (Zhang and Zhou, 2016). In our model, when we ask agents about their preferred slant in public information, every agent is treated as a sender in the Bayesian persuasion problem with all other agents, including this agent herself, as a receiver.

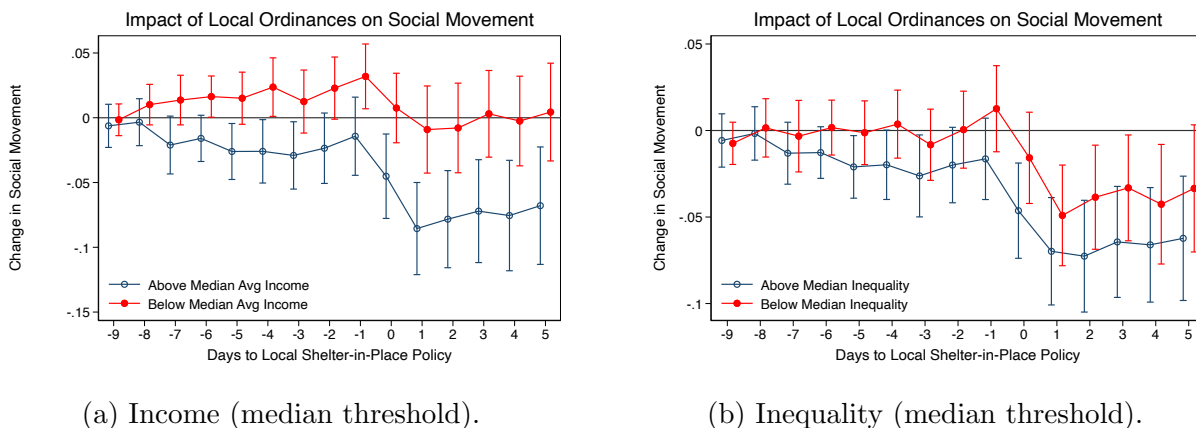
Models where both the payoffs from the activity *and* from non-activity are influenced by other players' actions are studied in the literature on status games (e.g., Robson, 1992). The most salient application is conspicuous consumption, where some goods are observable and individuals' payoffs depend on their relative position in the consumption of such goods. The idea originates from Veblen (1899); Frank (1985), Ireland (1994), and Hopkins and Kornienko (2004) are more recent treatments. In our model, beliefs about the severity of externalities are the object of interest and we consider information disclosure policies affecting such beliefs.

The rest of the paper is organized as follows. Section 2 collects the stylized facts relating to economic and informational determinants of shelter-in-place compliance. Section 3 presents the setup. Section 4 analyzes basic factors of compliance and political preferences over information provision. Section 5 discusses the impact of income inequality. Section 6 deals with attitudes toward policy enforcement and polarization, while Section 7 concludes.

2 Social Distancing and Media During COVID-19

In this section, we collect stylized facts that relate economic factors affecting behavior behavior and preferences such as income, inequality, and population density, as well as informational ones such as access to media. These facts help us assess the plausibility of the model's structure, its core assumptions, and predictions.

Figure 1: Income, Inequality, and Compliance with COVID-19 Local Shelter-in-Place Policies.



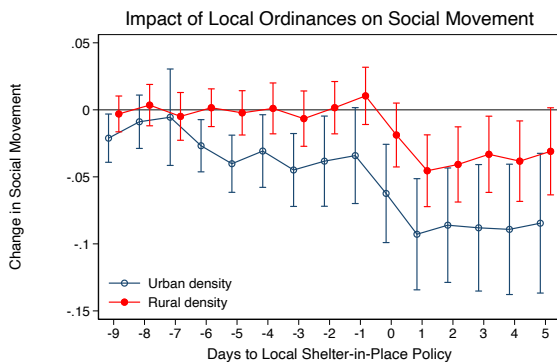
Notes: (a) and (b) Event study design plots showing heterogeneous effects on compliance with local shelter-in-place policies. For additional details on data and model specifications see [Wright et al. \(2020\)](#); data extended to May 1, 2020.

First, we observe that low-income communities and more unequal ones complied less with shelter-in-place policies. [Wright et al. \(2020\)](#) use county-day level data on population movement and the staggered rollout of local social distancing policies to estimate compliance and heterogeneous responses to policy onset via an income mechanism. We extended this data to May 1 and replicated the event study results in Figure 1(a). Notice that below-median counties do not engage in social distancing while above-median counties engage in substantial social distancing (reduction in physical movement) after the onset of a local policy. Figure A-2(a) shows the flexible marginal effects of residualized income using the approach introduced by [Hainmueller, Mummolo and Xu \(2019\)](#). [Chiou and Tucker \(2020\)](#) and [Lou and Shen \(2020\)](#) confirm the negative relationship between county-level average income and compliance using alternative data sources and methodology. Propositions 1 and 5 establish this result theoretically.

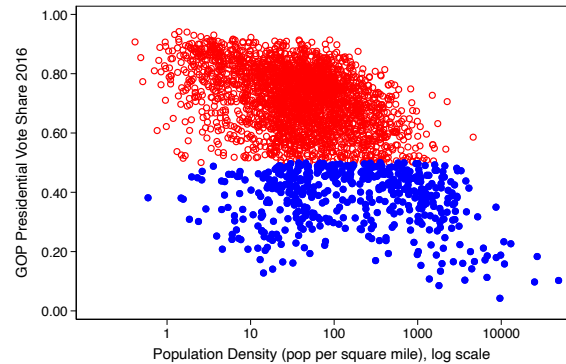
Second, using cell-phone data and census-based measures of economic inequality (Gini index), we calculated the heterogeneous and marginal effects of inequality in Figures 1(b) and A-2(b). In Figure 1(b), we replicate the event study design using the median threshold

for splitting the inequality distribution. Notice that compliance is relatively stronger in high-inequality counties (approximately 3%), though the distinction is not as sharp as the income channel. In Figure A-2(b), we residualized the Gini index and plotted the marginal effects. These results provide similar evidence, suggesting that compliance is increasing with within-county inequality. Across the inequality distribution, the shift in marginal effects is approximately five percent (similar to the flexible marginal effects of income). The marginal effect flattens above the 75th percentile, consistent with the income mechanism. Proposition 6 works out the mechanics of this effect.

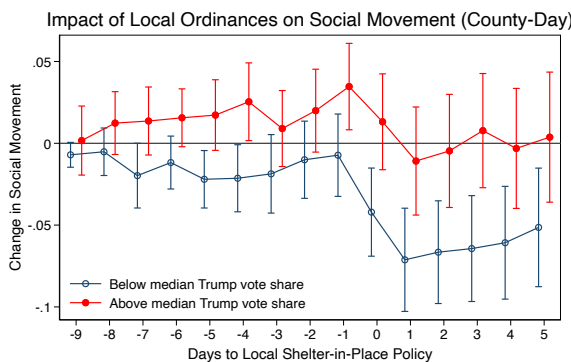
Figure 2: Impact of Urban/Rural Status, Partisanship, and Media Slant on Compliance.



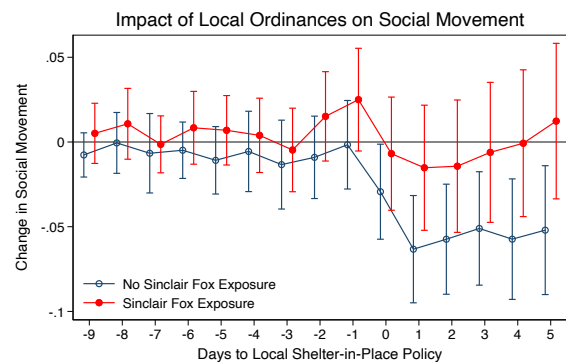
(a) Population density (census threshold).



(b) Population density and partisan voting.



(c) Partisanship (median threshold).



(d) Media slant (Sinclair Fox exposure).

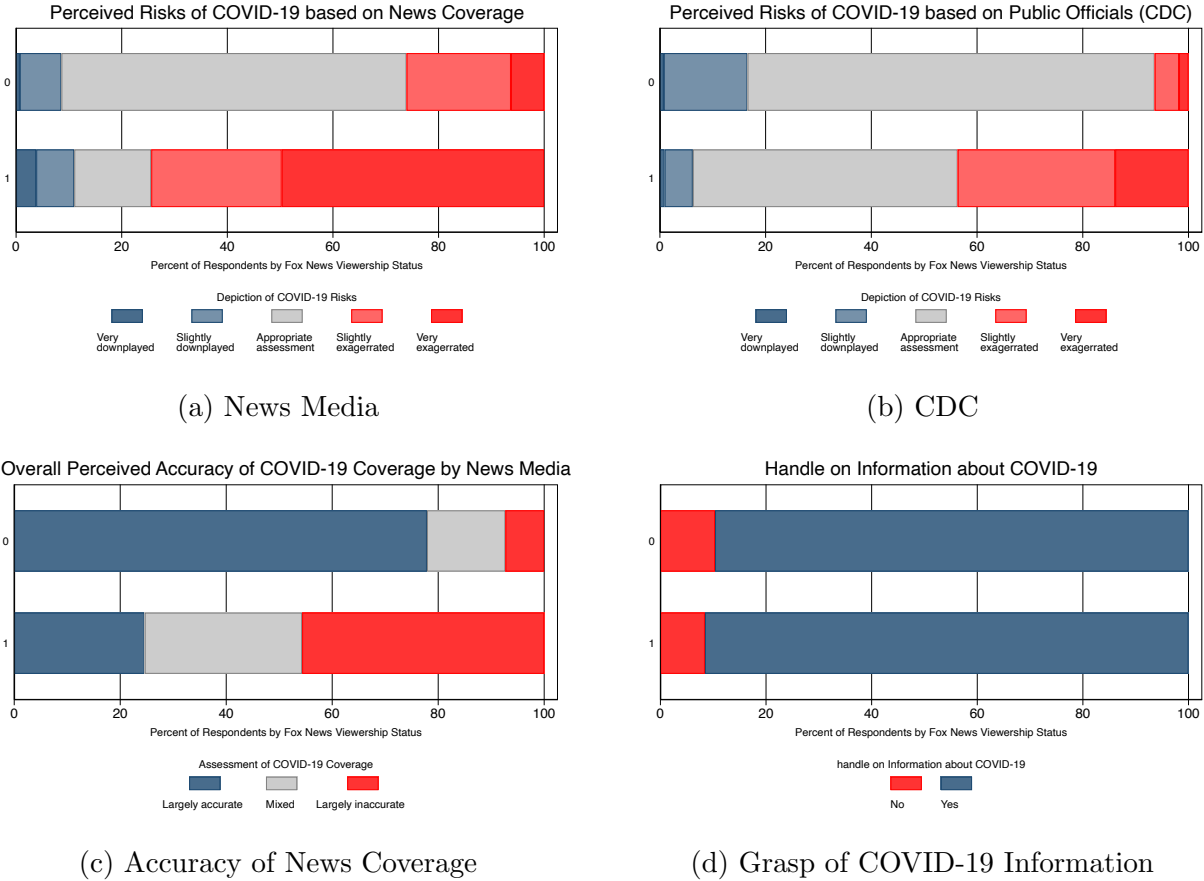
Notes: (a), (c), and (d): Event study design plots showing heterogeneous effects of factors on compliance with local shelter-in-place policies. For additional details on data and model specifications see [Wright et al. \(2020\)](#). Data extended to May 1, 2020. (b): Correlation between population density and Republican vote share in 2016 presidential elections.

Figure 2(a) demonstrates the impact of the urban versus rural divide in the United States on compliance. As predicted by Proposition 9(a), the compliance in rural counties is lower. Also, political demand for stronger shelter-in-place restrictions in rural counties is lower – see Proposition 9(b). As there is a strong and significant correlation between population density and Republican vote (see Figure 2(b)), these results correspond to those presented in Allcott et al. (2020) on the impact of partisanship on COVID-19 shelter-in-place compliance. In Figure 2(c), we extend the findings of Allcott et al. (2020) by demonstrating that compliance with shelter-in-place policies is influenced by partisanship (consistent with Painter and Qiu, 2020, as well).

A number of studies reported effects of heterogeneous access to media and media slant on compliance. Wright et al. (2020) and Chiou and Tucker (2020) demonstrated that access and exposure to different media sources has a significant impact on compliance. Using a novel IV approach, Bursztyrn et al. (2020) documented the downstream health effect of exposure to differently slanted Fox News prime-time programs (i.e., increased COVID-related mortality). Figure 2(d) demonstrates that exposure to slanted media significantly reduces compliance. Communities where this source of slanted media is not present see a significant decline in population movement starting the first day after the onset of a local shelter-in-place policy. There are no meaningful changes in social distancing in exposed communities. Proposition 3 shows formally that exposure to reports that downplay the coronavirus threat reduces compliance.

Figure 3 is based on survey data collected as part of the Pew Research Center’s American Trends Panel to assess the association between Fox News viewership and public attitudes related to the COVID-19 pandemic. Wave 66, collected April 20–26, 2020, includes information about perceived exaggeration of the COVID-19 threat by news outlets and public health officials (e.g., the Centers for Disease Control and Prevention, CDC). In particular, respondents were asked to give information about how closely they are following developments related to COVID-19 and whether they have a (self-reported) firm grasp on information

Figure 3: Viewers' Assessment of News Coverage and Information Relevance



Notes: Fox News Viewership status depicted as binary (primary news source). Base category (=0) is respondents that rely on cable news that is not Fox News or mainstream non-televised sources (i.e., National Public Radio, The New York Times). Data drawn from the 2020 PEW Research Center's American Trends Panel, Wave 66 (Pathways & Trust in Media Survey). The survey was fielded April 20–26, 2020.

related to the dangers of COVID-19.⁶ This data is useful for assessing the impact of and demand for slanted information that we analyze in Propositions 3 and 4.

Fox News viewers are presented in the second horizontal bar (=1) of each plot.⁷ Figures 3(a) and 3(b) suggest that Fox News viewers are significantly more likely to think news coverage and public health statements about COVID-19 exaggerate the severity of the pandemic. These individuals are also more likely to believe that news coverage of COVID-19 is

⁶Details about the data and detailed information about the survey's questions are available here: <https://pewrsr.ch/2WXcd7i>.

⁷Our reversion-based evidence is presented in Table A-1.

inaccurate (Figure 3(c)). This is predicted by a combination of our Propositions 1 and 4: those who are the least likely to comply with the policy, either because their income is low or their *ex ante* perception of the threat is low, express demand for more slanted news.

Importantly, the fact that an agent has lower incentives to comply makes her rationally more interested in a higher information slant (Propositions 4 and 7). The optimal slant of information for personal use (Proposition 9(b)) is higher than that of public information (Proposition 4): the demand for the latter incorporates the externality effect. Note that not only are Fox News viewers more skeptical of the severity of the threat and how it is being depicted by news organizations and public officials, they also self-report a particularly strong grasp of information about the pandemic (Figure 3(d)), which is consistent with the result that those who are not complying for economic, geographical, or partisan reasons rationally demand more slanted information than those who comply.

3 Setup

Our model considers an environment in which agents face uncertainty about the existing threat and make a decision that affects the risks they face. For example, it might be a situation in which a shelter-in-place ordinance is issued, and agents decide whether to comply with the order. Agents are heterogeneous in their incomes and receive information about the health risks associated with not complying with the order. The health risks depend on the exogenous state of the world and the share of population who do not comply with the order. The information about the state of the world is provided by a source (e.g., media, politician, or public official) that might be slanted toward downplaying or exaggerating the extent of health risks.

Coronavirus Threat. There are two possible states of the world $s \in S = \{C, N\}$, where $s = C$ stands for *coronavirus threat* and $s = N$ stands for *no threat*. The *ex ante* probability of a coronavirus threat is $\Pr(s = C) = \theta \in (0, 1)$. Let $q \equiv \Pr(s = C|\mathcal{I}) \in (0, 1)$ denote the

probability attached to the coronavirus threat given information \mathcal{I} .

Heterogeneous Agents. There is a continuum of agents, denoted by I ; the measure of I is normalized to one. Agent $i \in I$ has income w_i , distributed according to $w_i \sim_{iid} F(\cdot)$, where $\text{supp}(F(\cdot)) \subseteq [0, \infty)$.

Decision to Stay Home. Each agent $i \in I$ makes a decision on whether or not to comply with the ordinance, denoted by $a_i \in A = \{c, n\}$, where $a_i = c$ corresponds to social distancing (complying) and $a_i = n$ corresponds to not complying. If agent i complies, she consumes her income w_i . If she does not comply, she receives an additional income of $r > 0$, but she subjects herself to the increased risk of catching the disease. Parameter r incorporates, in addition to benefits of noncompliance, the expected costs, e.g., fines.

Agent i 's probability of catching the disease $p(s, a_i, \gamma)$ depends on the state of the world s , i 's action a_i , and the measure of agents who do not comply with the order $\gamma = \int_{j \in I} \mathbb{I}_{a_j=n} dj$. If the agent catches the disease, she incurs a health cost $H > 0$.

The following assumption summarizes the structure we impose on $p(\cdot, \cdot, \cdot)$, the function that describes the individual's probability of catching the disease as a function of the underlying risk, her personal compliance behavior, and the number of others who comply.

Assumption 1. $p : S \times A \times [0, 1] \rightarrow [0, 1]$ satisfies the following:

- (i) $p(N, a_i, \gamma) = 0$ for all $a_i \times \gamma \in A \times [0, 1]$, i.e., there are no health risks when there is no coronavirus threat.
- (ii) $p(C, a_i, \gamma) > 0$ for all $a_i \times \gamma \in A \times (0, 1]$, i.e., agents are subject to health risks when there is coronavirus threat, regardless of their actions.
- (iii) $p(C, n, \gamma) > p(C, c, \gamma)$ for all $\gamma \in (0, 1]$, i.e., the health risks are higher when the agent does not comply.

(iv) $p(C, a_i, \gamma)$ is strictly increasing in $\gamma \in [0, 1]$ for all $a_i \in A$, i.e., health risks are higher when more agents do not comply.

(v) The function $\Delta p : [0, 1] \rightarrow [0, 1]$ defined as

$$\Delta p(\gamma) \equiv p(C, n, \gamma) - p(C, c, \gamma)$$

is increasing in γ , i.e., the relative health risk of not complying is higher when more agents do not comply.

Every element of Assumption 1 is a natural condition for function p . By (ii), an agent is subject to health risks even when she maintains social distancing. By (iv), such health risks are increasing in the number of people who do not distance. This captures the indirect effects of noncompliers on compliers through contact in public spaces, essential services, etc. Finally, (v) imposes a crucial supermodularity feature, which implies that the additional risk of noncompliance is decreasing in the share of those who maintain social distancing.

Assumption 1 imposes a novel form of externality. An agent can reduce the risk of catching the disease by social distancing yet she cannot fully isolate herself from the externality. Our theoretical setup therefore combines features of congestion games and market entry games (where not participating yields a fixed payoff independent of externalities), as well as status games (where agents are fully exposed to externalities, regardless of their behavior).

Example 1. Let the probability of catching the disease for a noncomplier be proportional to the share of noncompliers:

$$p(s, a_i, \gamma) = \mathbb{I}_{s=C} \cdot (\underline{t} + t \cdot \mathbb{I}_{a_i=n}) \cdot \gamma, \quad t \in (0, 1 - \underline{t}). \quad (1)$$

Here, $\underline{t} > 0$, and t is a measure of interdependency of social distancing: a higher t indicates that $\Delta p(\gamma)$ is rapidly increasing in γ . For example, a sparsely populated rural community has a small t , while an urban community has a high t . This function satisfies Assumption 1.

Utility Functions. The utility function of agent i is quasilinear and is given by

$$u_i(s, \{a_j\}_{j \in I}) = v(w_i + \mathbb{I}_{a_i=n} \cdot r) - p\left(s, a_i, \int_{j \in I} \mathbb{I}_{a_j=n} dj\right) \cdot H$$

We assume that $v(\cdot) : \mathbb{R}^+ \rightarrow \mathbb{R}^+$ is strictly increasing, strictly concave, and satisfies the Inada conditions: $\lim_{x \rightarrow 0} v'(x) = \infty$ and $\lim_{x \rightarrow \infty} v'(x) = 0$. Functions $v(x) = \ln x$ and $v(x) = \sqrt{x}$ are standard examples. To guarantee an interior solution, we also assume that $v(r) > H$.

The agents are expected utility maximizers. Given information \mathcal{I} that induces beliefs $q = \Pr(s = C|\mathcal{I})$, agent i 's expected utility is

$$\mathbb{E}_s[u_i(s, \{a_j\}_{j \in I})] = \begin{cases} v(w_i) - q \cdot p\left(C, c, \int_{j \in I} \mathbb{I}_{a_j=n} dj\right) \cdot H, & \text{if } a_i = c, \\ v(w_i + r) - q \cdot p\left(C, n, \int_{j \in I} \mathbb{I}_{a_j=n} dj\right) \cdot H & \text{if } a_i = n \end{cases}$$

Equilibrium. Given information \mathcal{I} that induces beliefs $q = \Pr(s = C|\mathcal{I})$, an **equilibrium** is an action profile $\{a_i^*(q)\}_{i \in I}$ such that

$$a_i^*(q) \in \arg \max_{a \in A} \mathbb{E}_s[u_i(s, (a, \{a_j^*(q)\}_{j \in I \setminus \{i\}}))] \quad \text{for all } i \in I \quad (2)$$

Information Source. Our definition of an equilibrium has an agent receiving information \mathcal{I} without specifying the source. To analyze the role of information and preferences over the content of this information, in Section 4 we consider the case where agents receive information \mathcal{I} from an outlet that operates as follows. It observes an informative signal $x \in [0, 1]$ about the state of the world s , where $x \sim G_s(\cdot)$, $s \in \{C, N\}$. We assume that both c.d.f.s $G_C(\cdot)$ and $G_N(\cdot)$ are differentiable, have full support on $[0, 1]$, and their densities satisfy the strict monotone likelihood ratio property:

$$\frac{g_C(x)}{g_N(x)} \text{ is increasing in } x \in [0, 1].$$

That is, higher values of x indicate a higher likelihood of $s = C$. To ensure an interior solution, we also assume that $\lim_{x \rightarrow 0} \frac{g_C(x)}{g_N(x)} = 0$ and $\lim_{x \rightarrow 1} \frac{g_C(x)}{g_N(x)} = \infty$. This is satisfied, for instance, when $g_C(x)$ is strictly increasing with $g_C(0) = 0$ and $g_N(x)$ is strictly decreasing with $g_N(1) = 0$.

We model the information slant as follows. The source commits to a cutoff $m \in [0, 1]$ and sends a public report $\hat{s} \in \{\hat{C}, \hat{N}\}$ according to:

$$\hat{s} = \begin{cases} \hat{C}, & \text{if } x > m, \\ \hat{N}, & \text{if } x \leq m \end{cases}$$

Agents receive the report from the source and update their beliefs about the probability of the threat before deciding on their actions. Given cutoff m , the belief $q^m(\hat{s})$ induced by report $\hat{s} \in \{\hat{C}, \hat{N}\}$ is calculated according to the Bayes' Rule. Now, an **equilibrium** is an action profile $\{a_i^*(q^m(\hat{s}))\}_{i \in I}$ that satisfies (2) for each $\hat{s} \in \{\hat{C}, \hat{N}\}$.

Our information source is not strategic: we analyze the impact of changing the slant parameter m , as well as agents' preferences, both individual and political, over m . Thus, this source can be interpreted, depending on context, either as a media that an agent prefers to individually consume or as a public official whose signal is observed by all agents. A higher value of m means $\hat{s} = \hat{N}$ signal is sent more frequently. Therefore, an information source with a higher cutoff downplays the coronavirus threat compared to a source with lower m .

4 Determinants of Social Distancing

We start by analyzing individual behavior, which is a function of agent's income, the information she has, and the behavior of other agents via probability of catching the disease. Next, we focus on the impact of information provided by a slanted source and preferences over the level of slant.

The Basic Equilibrium. Proposition 1 describes the equilibrium in our model. All proofs are relegated to the Appendix.

Proposition 1. *Given $q = \Pr(s = C|\mathcal{I}) \in (0, 1)$, the equilibrium is characterized by a unique pair (w^*, γ^*) . w^* is the threshold income such that agents with income lower than the threshold do not comply with shelter-in-place ordinances, whereas agents with higher income stay home:*

$$a_i^*(q) = \begin{cases} n, & \text{if } w_i < w^*, \\ c, & \text{if } w_i > w^*. \end{cases}$$

and $\gamma^* = \int_{j \in I} \mathbb{I}_{a_j^*(q)=n} dj$ is the measure of noncompliers. Furthermore,

- (i) γ^* is decreasing in q , i.e., more people shelter in place when the coronavirus threat is more likely.
- (ii) γ^* is increasing in r , i.e., fewer people shelter in place when noncompliance generates higher additional income.
- (iii) γ^* is decreasing in H , i.e., more people shelter in place when health costs are higher.

By Proposition 1, agents are split into two groups by income: those who have income above the critical threshold w^* comply with the shelter-in-place policy, while those with income below w^* do not. An increase in the expected probability that there is a coronavirus threat, q , or the cost of catching the disease, H , has two consequences. First, agent i 's incentives to comply increase as the expected cost of noncompliance rises. Second, the same effect applies to every agent in the community, so that everyone has more incentives to comply. This in turn, makes noncompliance more attractive, as with other agents marginally more compliant the probability of catching the disease decreases. However, the individual effect dominates, so the net result of an increase in q or H is increased social distancing.⁸

⁸In an alternative setup, one might assume a negative externality of social distancing; e.g., as a result

The effect of an increase in r , the additional income from noncompliance, also has a general equilibrium component. When r rises, every agent’s incentives not to comply increase, thereby increasing the probability of catching the disease for everyone. Still, the direct effect dominates: a higher r leads to lower compliance. Conversely, increased fines or other punishments for noncompliance, which correspond to a lower r in the model, result in higher compliance.

Demand for Information. The evidence reported in [Bursztyn et al. \(2020\)](#); [Painter and Qiu \(2020\)](#); [Wright et al. \(2020\)](#), and [Anderson et al. \(2020\)](#) demonstrates that sources of information played an important role in determining the compliance behavior during the COVID-19 pandemic. In Section 2, we provided additional survey-based evidence about media consumption and attitudes toward sources of information during the crisis. Here, we analyze the theoretical mechanism that relates behavior and political preferences to decisions about media consumption and use of information.

We start with a simple result that answers the question: if an agent is able to choose between information sources of all possible slants, what slant would she choose for the information she will base her compliance decision on?

Proposition 2. *Suppose that there is a continuum of information sources with all possible slants $m \in [0, 1]$, and each agent i chooses a single source to follow. Fixing the behavior of other agents, agent i ’s choice $m^*(w_i)$ is decreasing in w_i .⁹ That is, poorer agents prefer information sources that downplay the pandemic’s threat.*

Proposition 2 deals with the preferred slant of agents. Suppose an agent observes the social distancing behavior of others and chooses an information source from the full range

of diminishing, in times of pandemics, positive externalities in production. Such a setup would result in high-income agents more likely to go to work, which is incompatible with the existing empirical evidence; see Section 2.

⁹In the proof, we show that there is a continuum of agents with sufficiently low w_i who are indifferent among any media sources. We pick such agents’ preferred media sources to be $m^*(w_i) = 1$. This is consistent with their behavior: these agents comply under any belief, so they prefer the media sources that send $\hat{s} = \hat{N}$ with probability one. This assumption can be microfounded by imposing the obedience constraint ([Bergemann and Morris, 2019](#); [Kolotilin et al., 2017](#)).

of all possible slants. Because the behavior of other agents is fixed, the only thing that she cares about is the direct effect of obtained information on the agent’s actions.¹⁰ Since agents have different marginal benefits of social distancing, they prefer different slants in their information. For example, if an agent has high marginal benefit of noncompliance and thus does not comply in equilibrium, she optimally chooses to rely on a very slanted information source, which would warn her about the threat if and only if the situation is really dire.

Proposition 2 underlines one of the essential forces in our model. Still, the argument relies on an overly simplified model of information acquisition. First, it assumes that an agent takes the behavior of others as given. Because other agents receive their information from media sources as well, one would expect their information content to be correlated, and agents to act accordingly. Second, it assumes that there is a continuum of sources with exogenously given slants. One would expect the media sources to form their slants based on agents’ demands. Below we relax these simplifying assumptions and analyze the *political* preferences over the information provision by a single source of information. When agents vote for the level of slant, they take into account the external effect: a noncomplier might benefit from a media that overstates the threat as it induces others to stay home.

Equilibrium with Slanted Media. We now consider the case where agents choose their most preferred slant m for the media source that provides information to the whole population. Given a cutoff m , the beliefs induced by report \hat{s} , $q^m(\hat{s})$, are given by the Bayes’ Rule:

$$q^m(\hat{C}) \equiv \Pr(s = C | \hat{s} = \hat{C}) = \frac{\theta(1 - G_C(m))}{\theta(1 - G_C(m)) + (1 - \theta)(1 - G_N(m))} \quad (3)$$

$$q^m(\hat{N}) \equiv \Pr(s = C | \hat{s} = \hat{N}) = \frac{\theta G_C(m)}{\theta G_C(m) + (1 - \theta)G_N(m)} \quad (4)$$

¹⁰In a theoretical literature, a similar problem arises, e.g., with choosing a possibly biased advisor (Calvert, 1985; Suen, 2004).

The monotone likelihood ratio property implies first-order stochastic dominance, so that $G_C(m) \leq G_N(m)$. This in turn yields

$$q^m(\widehat{C}) \geq \theta \geq q^m(\widehat{N})$$

Therefore, upon hearing report $\widehat{s} = \widehat{C}$, agents adjust their beliefs about the coronavirus threat upwards. Similarly, $\widehat{s} = \widehat{N}$ makes people adjust their beliefs downwards.

Proposition 3 provides some observations about the equilibrium under different reports. They directly follow from the comparative statics results discussed in Proposition 1.

Proposition 3. *Suppose that agents get their information from a media with a reporting threshold $m \in [0, 1]$. Each message $\widehat{s} \in \{\widehat{C}, \widehat{N}\}$ induces a measure of noncompliers: $\gamma^*(\widehat{C})$ and $\gamma^*(\widehat{N})$. Moreover,*

- (i) $\gamma^*(\widehat{C}) \leq \gamma^*(\widehat{N})$, *i.e., more people shelter in place when the media report is \widehat{C} .*
- (ii) $\gamma^*(\widehat{C})$ and $\gamma^*(\widehat{N})$ *are decreasing in θ , i.e., more people shelter in place when the coronavirus threat is ex ante more likely.*
- (iii) $\gamma^*(\widehat{C})$ and $\gamma^*(\widehat{N})$ *are decreasing in m , i.e., following a given report, more people shelter in place when the media source is more slanted toward downplaying the threat.*

A discussion about Part (iii) of Proposition 3 is in order. At first, it may seem puzzling that a more slanted media source generates more compliance, fixing the report. This is indeed a very natural consequence of agents being Bayesian updaters. By (3), a higher m means that $q^m(\widehat{C})$ is larger: when a slanted media source sends a report about the severity of the coronavirus threat, it is a convincing signal in favor of $s = C$. Consequently, agents respond more and compliance is higher. Moreover, by (4), a higher m means that $q^m(\widehat{N})$ is larger as well. Individuals expect a slanted media source to send a reports downplaying the coronavirus threat anyway, so beliefs do not adjust strongly following the occurrence of such

an event. As a result, the noncompliance following $\hat{s} = \hat{N}$ is lower when such a report comes from a more slanted media source.

More crucially, part (iii) of Proposition 3 does *not* claim that the *expected* compliance is higher when the media is more slanted. A media source with a higher m sends the $\hat{s} = \hat{N}$ report more frequently. Because $\gamma^*(\hat{N}) \geq \gamma^*(\hat{C})$, the expected compliance may still be lower. Indeed, the empirical findings reported in Figure 2(d), as well as in Bursztyn et al. (2020) and Painter and Qiu (2020), suggest that the frequency effect dominates: in U.S. counties with a higher share of viewership of media slanted against the coronavirus threat, the compliance is lower.

Demand for Slanted Media. To analyze the expected impact of a change in media exposure, we will focus on an income distribution with two mass points. Take $F(\cdot)$ such that

$$w_i = \begin{cases} \underline{w}, & \text{with probability } \alpha, \\ \bar{w}, & \text{with probability } 1 - \alpha, \end{cases} \quad \alpha \in (0, 1). \quad (5)$$

We will maintain two additional technical assumptions:

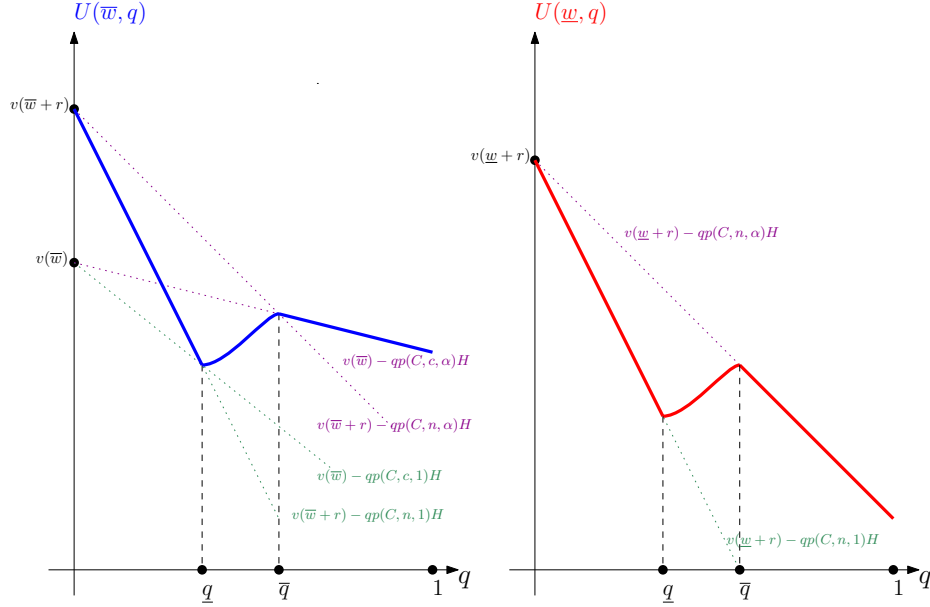
$$\frac{v(\underline{w} + r) - v(\underline{w})}{\Delta p(\alpha) \cdot H} > 1 \quad (6)$$

$$\frac{v(\bar{w} + r) - v(\bar{w})}{\Delta p(\alpha) \cdot H} < \theta \quad (7)$$

Condition (6) holds when \underline{w} is sufficiently low, and (7) holds when \bar{w} is sufficiently high. Condition (7) ensures that, in the absence of any information (i.e. when $q = \theta$), high-income agents comply with the order. Under (6) and (7), the measure of noncompliers in equilibrium has an analytical solution: low-income agents do not comply, and high-income agents comply when the perceived probability of the threat q is high enough.

We provide a full description of the equilibrium for the case of two types of agents and analyze the impact of changing inequality on agents' behavior in Section 5. Here, we look

Figure 4: Utility Functions for Two Types of Agents, High-Income (left) and Low-Income (right).



at the impact of information. The expected utility of an agent with income $w_i = \bar{w}$ in equilibrium when beliefs are q is

$$U(\bar{w}, q) \equiv \begin{cases} v(\bar{w} + r) - q \cdot p(C, n, 1) \cdot H, & \text{if } q \leq \underline{q}, \\ v(\bar{w}) - q \cdot p\left(C, c, \Delta p^{-1}\left(\frac{v(\bar{w}+r)-v(\bar{w})}{q \cdot H}\right)\right) \cdot H, & \text{if } q \in [\underline{q}, \bar{q}], \\ v(\bar{w}) - q \cdot p(C, c, \alpha) \cdot H, & \text{if } q \geq \bar{q}. \end{cases} \quad (8)$$

The expected utility of an agent with income $w_i = \underline{w}$ in equilibrium is

$$U(\underline{w}, q) \equiv \begin{cases} v(\underline{w} + r) - q \cdot p(C, n, 1) \cdot H, & \text{if } q \leq \underline{q}, \\ v(\underline{w} + r) - q \cdot p\left(C, n, \Delta p^{-1}\left(\frac{v(\bar{w}+r)-v(\bar{w})}{q \cdot H}\right)\right) \cdot H, & \text{if } q \in [\underline{q}, \bar{q}], \\ v(\underline{w} + r) - q \cdot p(C, n, \alpha) \cdot H, & \text{if } q \geq \bar{q} \end{cases} \quad (9)$$

Figure 4 illustrates the utility functions. The threshold \underline{q} is the minimum perceived probability of the threat such that some of the high-income agents start to socially distance. If the probability reaches the threshold $\bar{q} > \underline{q}$, then all high-income agents shelter-in-place.

Although low-income agents never comply, their utility is affected by the behavior of high-income agents.

Any level of slant $m \in [0, 1]$ generates a distribution of q , which we denote by $q \sim H^m$. Then, the possible values of q are $\{q^m(\widehat{C}), q^m(\widehat{N})\}$:

$$q = \begin{cases} q^m(\widehat{C}), & \text{w.p. } \theta(1 - G_C(m)) + (1 - \theta)(1 - G_N(m)) \\ q^m(\widehat{N}), & \text{w.p. } \theta G_C(m) + (1 - \theta)G_N(m) \end{cases}$$

By Bayes' Rule, $\mathbb{E}_{q \sim H^m}[q] = \theta$ for all m . Moreover, $q^m(\widehat{N})$ and $q^m(\widehat{C})$ are increasing in m and

$$\begin{aligned} \lim_{m \rightarrow 0} q^m(\widehat{N}) &= 0, & \lim_{m \rightarrow 0} q^m(\widehat{C}) &= \theta, \\ \lim_{m \rightarrow 1} q^m(\widehat{N}) &= \theta, & \lim_{m \rightarrow 1} q^m(\widehat{C}) &= 1. \end{aligned}$$

An agent with income w_i chooses from the family of distributions $\{H^m\}_{m \in (0,1)}$.¹¹ So, for each agent i , the problem reduces to a restricted version of [Kamenica and Gentzkow \(2011\)](#), in which the sender can commit to a family of disclosure rules. The optimization problem defines the agent's most-preferred cutoff:

$$m^*(w_i) = \arg \max_{m \in (0,1)} \mathbb{E}_{q \sim H^m}[U(w_i, q)] \quad (10)$$

When choosing her most preferred media slant, an agent i deals with the families of distributions over potential posteriors (and thus solves a version the Kamenica and Gentzkow problem). The presence of externalities play a crucial role in the choice: the agent simultaneously chooses the source of information to base the own compliance decision on and the persuasion mechanism that will keep others at home.

¹¹We rule out $m \in \{0, 1\}$ to get rid of potential equilibrium multiplicity: both $m = 0$ and $m = 1$ correspond to fully uninformative messages. Given the assumption that $\lim_{x \rightarrow 0} \frac{g_C(x)}{g_N(x)} = 0$ and $\lim_{x \rightarrow 1} \frac{g_C(x)}{g_N(x)} = \infty$, there is always an interior solution.

Figure 5: Agents' Choices Between Slants m_1 and m_2 , for $m_1 < m_2$; High Income (left) and Low Income (right).

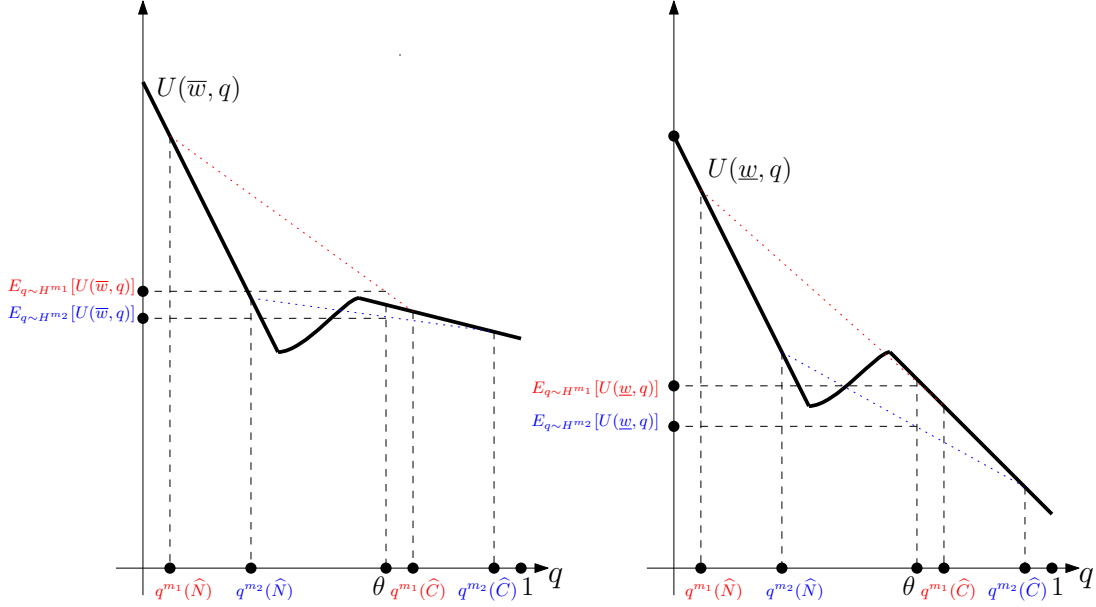


Figure 5 illustrates a choice for agents between two media cutoffs m_1 and m_2 , with $m_1 < m_2$. The expected utilities from m_1 and m_2 lie on the dotted lines (the red line and the blue line, respectively). In this particular example, m_1 yields a higher expected utility, so both agents prefer m_1 over m_2 .

It is possible for the maximizer to be multi-valued. In general, the most-preferred cutoff is a set-valued correspondence $m^* : \text{supp}(F(\cdot)) \rightrightarrows (0, 1)$. Whenever we compare two set-valued objects, we use the natural generalization of greater-than order, the *strong set order*. Formally, for any two subsets $A, B \subseteq (0, 1)$,

$$A \geq_S B \quad \text{if for any } a \in A, b \in B, \quad \min\{a, b\} \in B \text{ and } \max\{a, b\} \in A.$$

For singleton sets, this reduces to the usual order on real numbers. For intervals, this is equivalent to both upper and lower bounds of A being greater than the respective bounds of B .

Proposition 4 shows that agents' preferences toward a media source's slant are inversely related to their income levels.

Proposition 4. *Suppose that the income distribution is given by (5), and (6)-(7) are satisfied. Then*

- (i) $m^*(\underline{w}) \geq_S m^*(\bar{w})$. *That is, low-income agents prefer more slanted media sources compared to high-income agents.*
- (ii) $m^*(\bar{w})$ *is decreasing in* \bar{w} *in the strong set order. That is, as high-income agents' income increases, these agents prefer less slanted media sources.*

Part (i) of Proposition 4 suggests that there is a disparity among agents' preferred slant levels. Low-income agents prefer a media sources with higher m . These media sources send $\hat{s} = \hat{N}$ more frequently compared to the preferred media sources of high-income agents. Therefore, these media sources downplay the coronavirus threat compared to the preferred media sources of high-income agents.

Intuitively, the preferred slant of high-income agents reflects their desire for an informative media: they want a report that changes their behavior in equilibrium. Because their optimal choice without any information is compliance, they prefer a media source that sends a convincing $\hat{s} = \hat{N}$ report. This is achieved only when $\hat{s} = \hat{N}$ is sent infrequently, which requires a low value of m . In contrast, low-income agents do not comply in any equilibrium, so they only care about the behavior of high-income agents. Due to the externalities generated by noncompliers, low-income agents prefer media that minimizes the probability of high-income agents not complying. This is achieved only when the $\hat{s} = \hat{N}$ report is not convincing enough to change the behavior of high-income agents, which requires a high value of m .

Technically, the second part of Proposition 4 is reminiscent of Proposition 1 in Suen (2004) and uses a similar proof technique that relies on the submodularity of expected utility in \bar{w} and m . Intuitively, as an agent becomes wealthier, she requires even stronger $\hat{s} = \hat{N}$ report not to comply. This translates into a media source with lower m , i.e. one that overstates the coronavirus threat even further.

5 Inequality and Crisis Response

In addition to results about individual decisions as a function of income, information, and the expected cost of disease, it is possible to conduct comparative statics exercises with respect to the aggregate income distribution. The next result, Proposition 5, compares two communities with one community wealthier than the other. Suppose that community 1 is wealthier than community 2; — e.g., community 2 has lower baseline income or is more affected by a local economic shock. Mathematically, this corresponds to the distribution of income with c.d.f. $F_1(\cdot)$ first-order stochastically dominating the distribution with c.d.f. $F_2(\cdot)$: for any w , $F_1(w) \leq F_2(w)$.

Proposition 5. *Take two distributions of income $F_1(\cdot)$ and $F_2(\cdot)$ such that $F_1(\cdot)$ first-order stochastically dominates $F_2(\cdot)$, and let γ_i^* denote the measure of noncompliers when the income distribution is $F_i(\cdot)$, $i \in \{1, 2\}$. Then $\gamma_1^* \leq \gamma_2^*$. That is, if community 1 is wealthier than community 2, then there is a larger share of sheltering in place in community 1, and the health risks imposed on the population are lower in community 1.*

The results of Proposition 5 are consistent with the evidence based on difference-in-difference estimation of the effect of income on compliance in the U.S. This is reported in Figure 1(a) in Section 2: counties with above median income comply with shelter-in-place policies by reducing movement by an additional 72% relative to the baseline policy impact.

To obtain comparative statics with respect to income inequality, we consider two income distributions $F_2(\cdot)$ and $F_1(\cdot)$ where the former is a mean-preserving spread of the latter.¹² That is, $\mathbb{E}_{w \sim F_1}[w] = \mathbb{E}_{w \sim F_2}[w]$ and there exists $z > 0$ such that

$$F_2(w) \geq F_1(w) \text{ if } w \leq z, \quad \text{and} \quad F_2(w) \leq F_1(w) \text{ if } w \geq z$$

Intuitively, $F_2(\cdot)$ is a “spread out” version of $F_1(\cdot)$, and thus $F_2(\cdot)$ describes a “more unequal”

¹²This is a sufficient condition for $F_1(\cdot)$ to second-order stochastically dominate $F_2(\cdot)$ (Rothschild and Stiglitz, 1970).

community than $F_1(\cdot)$.

Proposition 6. *Take two distributions $F_2(\cdot)$ and $F_1(\cdot)$ such that $F_2(\cdot)$ is a mean-preserving spread of $F_1(\cdot)$. Then, there exists a $q^* \in [0, 1]$ such that*

$$\gamma_2^* \leq \gamma_1^* \text{ if } q \leq q^*, \quad \text{and} \quad \gamma_2^* \geq \gamma_1^* \text{ if } q \geq q^*$$

For a given $F_1(\cdot)$, q^ rises with z . Moreover, there exists a $\underline{z} > 0$ such that, if $z < \underline{z}$, $q^* = 1$.*

Proposition 6 demonstrates that noncompliance is higher in counties with more inequality only when the beliefs about the severity of the coronavirus threat are high enough. By part (i) of Proposition 1, an increase in q unambiguously increases the compliance rate. The magnitude of the effect, however, depends on the income distribution. In particular, an increase in q from some $q_0 < q^*$ to $q_1 > q^*$ has a larger effect on the compliance rate of the more equal county. Intuitively, this is because the more equal county has more agents with incomes close to the mean income, so there is a stronger response to an increase in q for intermediate values of q . Therefore, following such an increase in q , agents in the more unequal county are subject to higher health risks compared to agents in the more equal county.

To illustrate the economic intuition behind Proposition 6, let us again consider the case with two levels of income. Let two income distributions $F_k(\cdot)$, $k \in \{1, 2\}$ satisfy (5), so that the income of each agent $i \in I$ is

$$w_i \sim F_k(\cdot) \implies w_i = \begin{cases} \underline{w}_k, & \text{with probability } \alpha \\ \bar{w}_k, & \text{with probability } 1 - \alpha \end{cases} \quad \alpha \in (0, 1). \quad (11)$$

Furthermore, assume that $\alpha \cdot \underline{w}_1 + (1 - \alpha) \cdot \bar{w}_1 = \alpha \cdot \underline{w}_2 + (1 - \alpha) \cdot \bar{w}_2$, and $\underline{w}_2 < \underline{w}_1 < \bar{w}_1 < \bar{w}_2$, which means that $F_2(\cdot)$ is a mean-preserving spread of $F_1(\cdot)$.

Define $\underline{z} > 0$ such that

$$\frac{v(\underline{z} + r) - v(\underline{z})}{\Delta p(\alpha) \cdot H} = 1$$

and let

$$\begin{aligned} \underline{q}_k &\equiv \frac{v(\bar{w}_k + r) - v(\bar{w}_k)}{\Delta p(1) \cdot H} \\ \bar{q}_k &\equiv \frac{v(\bar{w}_k + r) - v(\bar{w}_k)}{\Delta p(\alpha) \cdot H} \end{aligned}$$

Whenever $\underline{w}_k < \underline{z}$, the measure of noncompliers in equilibrium is

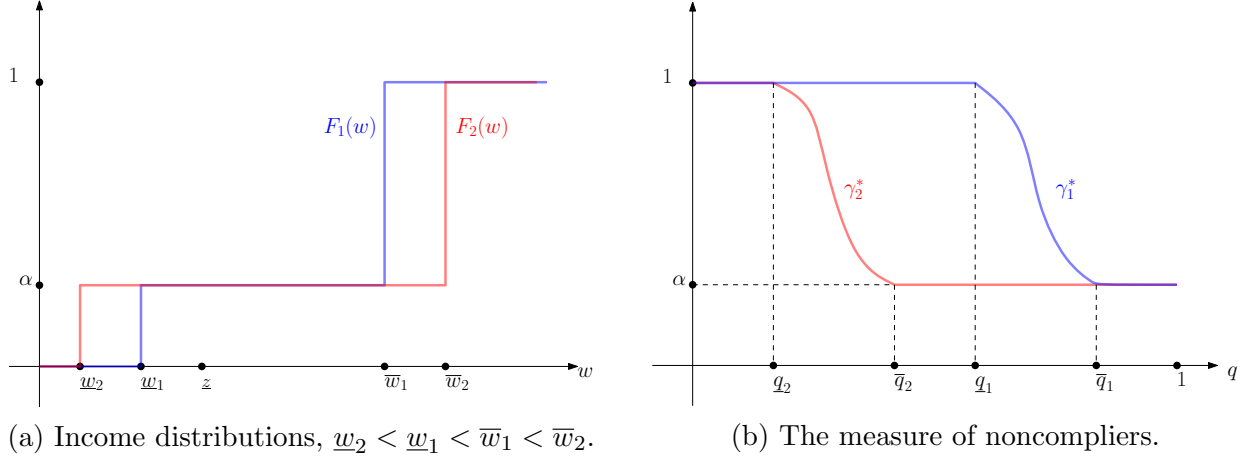
$$\gamma_k^* = \begin{cases} 1, & \text{if } q \leq \underline{q}_k, \\ \Delta p^{-1} \left(\frac{v(\bar{w}_k + r) - v(\bar{w}_k)}{q \cdot H} \right), & \text{if } q \in [\underline{q}_k, \bar{q}_k], \\ \alpha, & \text{if } q \geq \bar{q}_k \end{cases} \quad (12)$$

For sufficiently low values of q , no one complies and for sufficiently high values of q only high-income agents comply. For intermediate values of q , high-income agents are indifferent between complying and non-complying. Note that in any equilibrium under any q , low-income agents never comply. This is ensured by $\underline{w}_k < \underline{z}$: their income levels are low enough so that they always have strong incentives to obtain the extra income r .

Figure 6 illustrates the effect of inequality on compliance.

Panel (a) of Figure 6 shows that the second part of Proposition 6 applies to this case. As long as the income of low-income agents is below \underline{z} , such agents never comply. $\bar{w}_2 > \bar{w}_1$ means that a lower value of q is sufficient to convince agents with income \bar{w}_2 to comply. This is the reason why $\gamma_2^* < \gamma_1^*$ for intermediate values of q , as shown in Panel (b) of Figure 6. Intuitively, the mean-preserving spread removes some agents who do not comply and replaces them with lower-income agents, who still do not comply. It also takes some high-income agents and replaces them with higher-income agents, who are more inclined to

Figure 6: The Effect of Inequality on Compliance.



comply. The net effect is an increase in compliance rate. This is consistent with the empirical findings illustrated in Figure 1(b) in Section 2.

Inequality and Information. The proof of Proposition 4 established that $m^*(w_i)$, the set of preferred slants of agent i , is independent of \underline{w} . Furthermore, $m^*(\underline{w}) = [\bar{m}, 1)$ with \bar{m} strictly decreasing in \bar{w} . This suggests that it is possible to compare the two communities with income distributions ranked in the sense of second-order stochastic dominance (which is equivalent to the generalized Lorentz-curve domination). In our context, this corresponds to comparing two communities with the same average income, with one income distribution being more unequal than the other. The following result comes in as a corollary of Proposition 4.

Proposition 7. *Take two distributions of income $F_1(\cdot)$ and $F_2(\cdot)$ that both satisfy (6) and (7). Suppose $F_1(\cdot)$ second-order stochastically dominates $F_2(\cdot)$: $\alpha \cdot \underline{w}_1 + (1 - \alpha) \cdot \bar{w}_1 = \alpha \cdot \underline{w}_2 + (1 - \alpha) \cdot \bar{w}_2$, and $\underline{w}_2 < \underline{w}_1 < \bar{w}_1 < \bar{w}_2$. Then*

$$m_1^*(\bar{w}_1) \geq_S m_2^*(\bar{w}_2) \quad \text{and} \quad m_1^*(\underline{w}_1) \geq_S m_2^*(\underline{w}_2)$$

That is, if community 2 is more unequal than community 1, then individuals in community

2 prefer less slanted media sources compared to individuals in community 1.

Consider a local media source that responds to the distribution of agents’ most preferred media policies (e.g. by choosing the median or some weighted average of preferred policies). Proposition 7 implies that as the distribution of income becomes more unequal, the local media adopts a policy that “overstates” the coronavirus threat, which implies a higher frequency of $\hat{s} = \hat{C}$ reports. This results in $\hat{s} = \hat{N}$ reports being sent rarely, but convincingly – convincingly enough that high-income agents do not comply after such reports.

An implication of this reasoning is the following. Suppose the media source chooses some $m \in m^*(\bar{w})$.¹³ Then, in more unequal communities, the occurrence of $\hat{s} = \hat{N}$ reports is lower, and the expected noncompliance is lower. This is consistent with the findings reported in Figures 1(b) and A-2(b): higher income inequality is associated with higher compliance rates. Our theory suggests that endogenous preferences toward less slanted media may be a driver of this empirical regularity.

6 Enforcement Level and the Political Divide

One of the most visible political reactions to lockdown policies was protests in many U.S. states and around the world. A number of empirical studies have recorded that the reaction was highly polarized. In this section, we analyze the public response to government’s efforts to enforce lockdowns.

The policy tools available for governments vary across the globe, ranging from public reprimands to significant fines to imprisonment. In our exercise, we will focus on the government’s control of parameter r , the additional income of noncompliance. Thus, a higher level of enforcement corresponds to a decrease in r .

To study potential effects of manipulating r , let us consider the following modification of the basic setup. Fix the beliefs about the state of the world, $q = \Pr(s = C|\mathcal{I}) \in (0, 1)$.

¹³This will be true, for instance, when the media source chooses the median demand and $\alpha < \frac{1}{2}$.

The government chooses a level of enforcement, which translates into an $\hat{r} \in [0, r]$. As in the basic model, r is the additional income from noncompliance without any enforcement by the government. Any $\hat{r} < r$ corresponds to some level of enforcement, whose equilibria are analyzed above. Lower values of \hat{r} correspond to higher enforcement levels. $\hat{r} = 0$ is the case where the government orders a complete lockdown and fully enforces it. Each agent $i \in I$ has preferences over \hat{r} , with their most preferred enforcement level being the $\hat{r} \in [0, r]$ that maximizes the agent's expected utility in equilibrium.

Political Polarization Over the Enforcement Level. The next result suggests that there is substantial polarization in agents' most preferred enforcement level. For analytical convenience in proving the proposition, we present the result assuming that $F(\cdot)$ is continuous. This in particular implies that $\gamma^* = F(w^*)$ in equilibrium.

For this particular result, we also need the following condition on the preliminaries of the model.

Assumption 2. *The rate of increase of $p(C, n, \gamma)$ in its third argument is bounded from above by:*

$$\frac{\partial}{\partial \gamma} p(C, c, \gamma) \leq \bar{p}_3(\gamma) \equiv \frac{v'(F^{-1}(\gamma)) - v'(v^{-1}(v(F^{-1}(\gamma)) + q\Delta p(\gamma)H))}{qf(F^{-1}(\gamma))H}.$$

Though Assumption 2 hardly provides any intuition, when $p(C, a_i, \gamma)$ has the functional form in Example 1, $v(x) = \ln(x)$ and $w_i \sim \mathcal{U}[0, 1]$, it boils down to assuming that $\underline{t} < \kappa(q, H)t$, where κ is a constant that depends on parameters q and H . Effectively, compliance with shelter-in-place policies needs to be protecting individuals from the disease sufficiently: when an individual complies, the risk of catching the disease is *not too responsive* to the noncompliance rate. If this natural assumption about the risk response to the ratio of people not sheltering in place is fulfilled, the result is a stark polarization in preferences over the extent of lockdown enforcement.

Proposition 8. *Suppose $F(\cdot)$ is continuous and Assumption 2 holds. Given $q \in (0, 1)$ and $r > 0$, there exists some $\hat{w} > 0$ such that for $w_i < \hat{w}$, the most preferred enforcement level is $r_i^* = r$, i.e. low-income agents prefer no enforcement. For $w_i > \hat{w}$, the most preferred enforcement level is $r_i^* = 0$, i.e. high-income agents prefer a complete shutdown.*

The proof of Proposition 8 goes through showing that an individual’s preferences over r are single-dipped. By part (ii) of Proposition 1, w^* is increasing in r . This means, for every individual i , there is an r_i^* such that if $r < r_i^*$ she complies with the order in equilibrium, and if $r > r_i^*$ she does not comply. Whenever an individual complies with the order, she prefers an r that is as low as possible to minimize the number of noncompliers. On the contrary, when an individual does not comply with the order, a local increase in r has two effects: (i) the direct positive effect of increased income from noncompliance, and (ii) the indirect negative effect of having more noncompliers. Under Assumption 2, the direct effect dominates,¹⁴ so an increase in r leaves the individual better off. This results in single-dipped preferences, with the expected utility being minimized at r_i^* . Therefore, individuals have extreme preferences over r : their most preferred enforcement levels are either $\hat{r} = 0$ or $\hat{r} = r$. Due to concavity of $v(\cdot)$, individuals with lower wealth levels, i.e., those are the least likely to comply, tend to prefer $\hat{r} = r$ over $\hat{r} = 0$.

The Impact of Rural vs. Urban Divide and Partisanship. To investigate the effect of partisanship on policy preferences and media consumption, let the probability of catching the disease be given by (1) in Example 1:

$$p(s, a_i, \gamma) = \mathbb{I}_{s=C} \cdot (\underline{t} + t \cdot \mathbb{I}_{a_i=n}) \cdot \gamma, \quad t \in (0, 1).$$

¹⁴To elaborate, the direct positive effect is an increase in $v(w_i + \hat{r})$: this is bounded below by the numerator in the right-hand side of the inequality in 2. The indirect negative effect is caused by an increase in γ^* , and is reflected in an increase in $p(C, n, \gamma^*)$. Since $p(C, n, \gamma^*) = p(C, c, \gamma^*) + \Delta p(\gamma^*)$, the indirect effect can be decomposed into two parts. The latter part, the increase in $\Delta p(\gamma^*)$, is “priced out” by the direct positive effect of the marginal agent. As long as the part that is not “priced out”, the increase in $p(C, c, \gamma^*)$, is small enough, the negative effect stays below the lower bound of the direct positive effect.

where $t \in (0, 1 - \underline{t})$. A higher value of t indicates that the relative risk of noncompliance is highly dependent on the overall noncompliance of the population. This captures the effect of living in an area with high population density: for an overall noncompliance rate, when an individual in a city fails to comply, she is exposed to a higher risk compared to a non-complying individual in a rural area. Since individuals living in U.S. urban counties are far more likely to identify as Democrats, we expect high values of t to be correlated with a Democratic-voting county.¹⁵ Conversely, low values of t capture individuals living in rural counties, who are far more likely to identify as Republicans. Figure 2(b) illustrates these trends.

Proposition 9 is a political corollary of Proposition 8: urban counties are more likely to impose lockdowns than rural ones.

Proposition 9. *Suppose $F(\cdot)$ is continuous and \underline{t} is low enough that Assumption 2 is satisfied. Suppose that the decisions about the level of enforcement are made by majority voting. There exists a threshold $\hat{t} > 0$ such that for $t < \hat{t}$, the political choice is $r_i^* = r$, i.e., agents living in rural counties would vote for no enforcement. For $t_i > \hat{t}$, the most preferred enforcement level is $r_i^* = 0$, i.e., the majority of agents living in urban counties prefer a strict shutdown.*

The results of Proposition 9 are intuitive: conditional on the number of people non-complying, the additional risk of noncompliance in a rural (low- t) area is lower than that in an urban (high- t) community. So, if a county has a large share of people living in a densely populated city (or cities), the level of compliance is higher.

Preferences over the level of enforcement incorporate the externality effect. Take $r > 0$, and consider the marginal agent, i.e., the one that has $w^*(r)$, who is indifferent between compliance and noncompliance. Even though this agent weakly prefers non-complying in

¹⁵In a year-long Pew Research Center survey of partisanship in 2016, the difference in shares of Democrats and Republicans is statistically insignificant in 6 income categories out of 7; in one category, < \$30,000, there is twice as many Democrats as Republicans. In contrast, the urban-rural divide is significant: while an urban citizen is twice as likely to be Democrat, a rural one is 1.5 times more likely to be a Republican. See <https://pewrsr.ch/2AVrpiJ> and Section 2 for additional evidence.

equilibrium, she indeed votes for a strict enforcement level that leaves no benefit of noncompliance to agents. This is because under strict enforcement the noncompliance is zero, so she does not suffer from the externalities imposed by noncompliers. Therefore, there are agents who do not comply themselves, yet in voting would support strict enforcement.

7 Conclusion

We present a model of the political economy of compliance with government policies during a pandemic. The model is introduced in the context of the current COVID-19 crisis, where compliance with social distancing policies (shelter-in-place) is essential to limit interpersonal viral spread. We study how such characteristics as income, inequality, and population density influence compliance. The preferences for noncompliance, which is marginally decreasing with income, influences endogenous media consumption. Individuals for whom noncompliance is economically beneficial on the margin have a preference for information sources that downplay the severity of the pandemic threat. These results are consistent with empirical evidence which suggests that compliance is increasing with income and decreasing with exposure to slanted media. Results also highlight how meso-level factors, such as community income in levels or regional economic inequality, may influence compliance and, as a consequence, risks of transmission.

The model produces a more general set of results relevant to work on disinformation and slanted media. These results suggest endogenous preferences may partially explain the strong correlation between partisanship, polarization, and disbelief of science and risky behaviors that may cause growth in COVID-19 exposure that is difficult to track (i.e., in low income communities where the ability to engage in active testing or contact tracing is lacking). Our model provides a theoretical microfoundation for this research agenda and could be extended to a range of alternative settings where political or economic factors impact risky behaviors and, in turn, the acquisition of information that reinforces these decisions.

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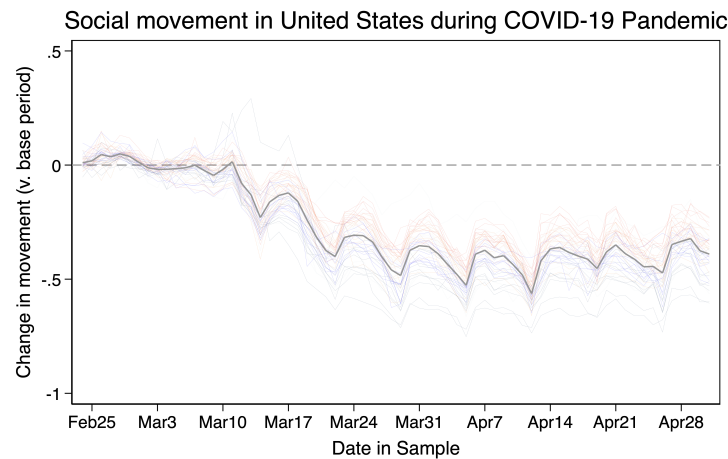
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Appendix

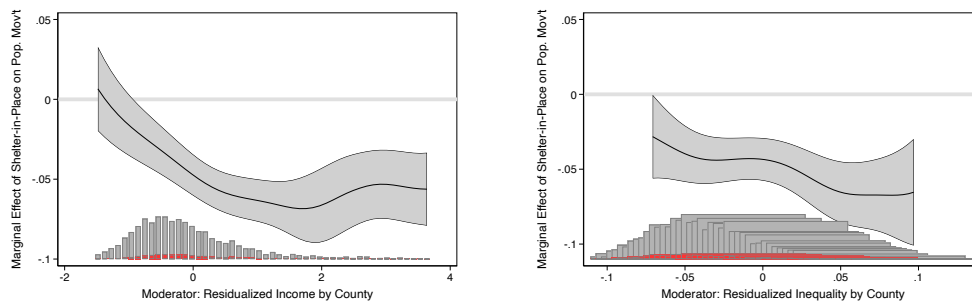
A1 Additional Figures

Figure A-1: Variation in Social Distancing During the COVID-19 Pandemic Associated With Income



Notes: Trends in social distancing by administrative state plotted for quintiles of the income distribution. Red and orange-red indicate the bottom two quintiles of the income distribution. Blue and navy indicate the top two quintiles. The grey line indicates the grand mean of reduced movement in a given day. Compiled using the 'group_lines' command in Stata. For additional details on the data and the model specifications see [Wright et al. \(2020\)](#). Data extended to May 1, 2020.

Figure A-2: Income, Inequality, and Compliance with COVID-19 Local Shelter-in-Place Policies (flexible marginal effects)



(a) Flexible Marginal Effects of Residualized Income

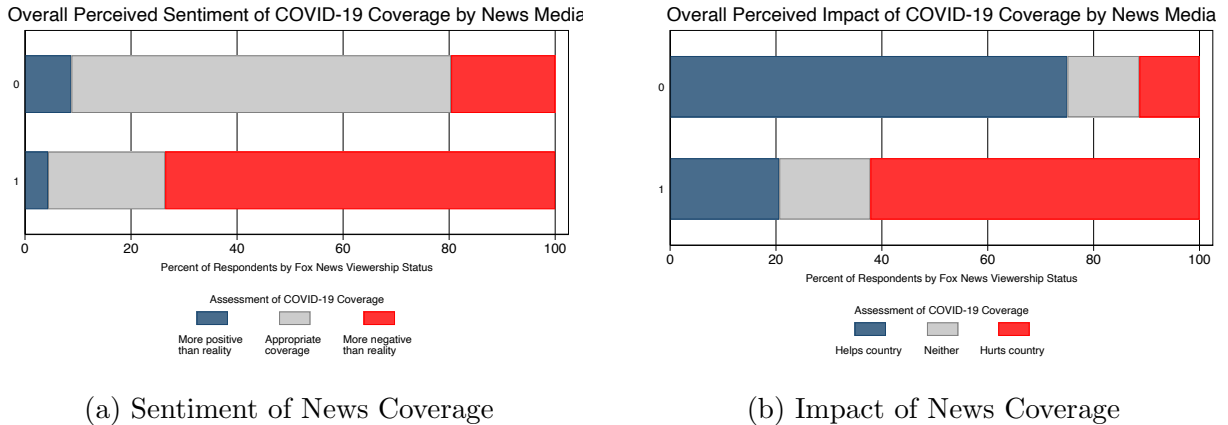
(b) Flexible Marginal Effects of Residualized Inequality

Notes: Underlying data described in [Wright et al. \(2020\)](#). For methodology, see [Hainmueller, Mummolo and Xu \(2019\)](#).

A2 Regression-Based Assessment of Exposure to Slanted Media

Research Design. We leverage survey data collected as part of the Pew Research Center’s American Trends Panel to assess the association between Fox News viewership and public attitudes related to the COVID-19 pandemic. Wave 66, collected April 20–26, 2020, is particularly useful, as it includes information about perceived exaggeration of the COVID-19 threat by news outlets and public health officials (e.g., the Centers for Disease Control). The survey also asks respondents about their overall assessment of whether COVID-19 has been exaggerated or downplayed. Respondents are also asked whether the news coverage is too negative, inaccurate, or hurts the country. Respondents are asked to give information about how closely they are following developments related to COVID and whether they have a firm grasp on information related to the dangers of COVID-19. Details about the data and detailed information about the survey’s questions are available here: <https://pewrsr.ch/2WXCd7i>. This data is most useful in assessing the descriptive association between viewership and attitudes toward news coverage of the pandemic. We extend the main graphic in Figure A-3, which supplements the finding in 3(d) (regarding in accuracy).

Figure A-3: Fox News Viewers Believe News Coverage of COVID-19 is Too Negative and Hurts Country



Notes: Fox News Viewership status depicted as binary (primary news source). Base category (=0) is respondents that rely on cable news that is not Fox News or mainstream non-televised sources (i.e., National Public Radio, The New York Times). Data drawn from the 2020 PEW Research Center’s American Trends Panel, Wave 66 (Pathways & Trust in Media Survey). The survey was fielded April 20–26, 2020.

However, to rule out a set of confounding factors, we introduce regression-based evidence to clarify the results presented visually in the main text as Figure 3.

Our benchmark specification battery of demographic fixed effects, including urban/rural residence, region of residence, age, sex, education, ethnicity, citizenship, marital status, and religious affiliation. We study equation (A1):

$$y_i = \alpha + \beta_1 fox_news_i + \omega rural_i + \phi region_i + \lambda age_i + \theta sex_i + \kappa educ_i + \delta ethnic_i + \zeta citizen_i + \eta marital_status_i + \nu religion_i + \epsilon_i, \quad (A1)$$

where y_i is a model-specific outcome variable that measures respondent attitudes. The specific parameter of interest is noted in the column headings of Table A-1, where we present the descriptive results. fox_news_i indicates whether a respondent reported Fox News as their primary source of political information in Wave 57 of the panel survey. This is the primary quantity of interest. The fixed effects are reported in the parameters between ω and ν . Heteroskedasticity-robust standard errors are reported.

Regression-Based Descriptive Results. Fox News viewership is associated with significantly higher level of skepticism toward news coverage of the pandemic overall. The results estimated using equation (A1) are reported in Table A-1. These results align closely with the descriptive patterns in Figures 3 and A-3. Columns 1 and 2 suggest Fox News viewers are significantly more likely to report that news coverage and public health officials have exaggerated the threat of COVID-19. They also report that the overall threat has been largely overstated (Column 3). Fox News viewers also believe news coverage of COVID-19 is too negative in tone, inaccurate in its assessment of COVID-19, and hurts the country as a whole (Columns 4–6). Fox News viewers report following developments related to the pandemic slightly less closely than respondents getting their information from other sources (Column 7). Fox News viewers also state that they have a firmer grasp of information related to the threat posed by COVID-19 (Column 8). Taken together, these regression-based results suggest the visual descriptive evidence presented in the main text is robust to accounting for a battery of confounding factors. We emphasize interpreting these findings with care. These results illustrate robust descriptive patterns, not causal effects.

Table A-1: Association Between Fox News Viewership and Perceptions of COVID-19 Risks and News Consumption/Comprehension

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	News Exaggerates	CDC Exaggerates	Threat Exaggerated	Coverage Too Negative	Coverage Inaccurate	Coverage Hurts Country	Follow COVID Closely	Grasp on COVID Info.
Fox News Viewership	0.811*** (0.0327)	0.553*** (0.0254)	0.677*** (0.0219)	0.571*** (0.0191)	0.884*** (0.0255)	1.027*** (0.0267)	-0.0847*** (0.0204)	0.0167* (0.0101)
SUMMARY STATISTICS								
Outcome Mean	0.539	0.122	-0.0543	0.318	-0.377	-0.260	3.549	0.903
Outcome SD	0.973	0.720	0.720	0.600	0.810	0.885	0.610	0.295
MODEL FIXED EFFECTS								
Urban/Rural	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
US Region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age Category	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sex	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education Category	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ethnic Identity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Citizenship	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Marital Status	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Religion	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MODEL STATISTICS								
No. of Observations	4700	4706	4693	4689	4696	4697	4714	4701
R ²	0.203	0.169	0.252	0.236	0.316	0.348	0.0868	0.0263

Notes: Outcome of interest varies by column and is noted in each column heading. Columns 1 and 2 are five-point scales centered at zero. Columns 3 through 6 are three-point scales centered at zero. Column 7 is a four-point scale from 1 to 4. Column 8 is a binary outcome. Fox News viewership is the quantity of interest. Results in Columns 1–6 correspond to Figure 3(a,b). Results in Columns 7–8 correspond to Figure 3(c,d). Additional parameters included in models indicated in table notes (included as fixed effects). Heteroskedasticity-robust standard errors are reported in parentheses. Fox News viewership status depicted as binary (primary news source). Base category (=0) is respondents that rely on cable news that is not Fox News or mainstream non-televised sources (i.e., National Public Radio, The New York Times). Data drawn from the 2020 PEW Research Center’s American Trends Panel, Wave 66 (Pathways & Trust in Media Survey). The survey was fielded April 20–26, 2020. Stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

A3 Proofs

Proof of Proposition 1. Given $q \in (0, 1)$, by (2), in any equilibrium,

$$a_i^*(q) = \begin{cases} n, & \text{if } q \cdot \Delta p(\gamma^*) \cdot H < v(w_i + r) - v(w_i) \\ c, & \text{if } q \cdot \Delta p(\gamma^*) \cdot H > v(w_i + r) - v(w_i). \end{cases} \quad (\text{A2})$$

Note that any equilibrium defines a unique γ^* . We first show that for any (q, γ^*) pair, there is a unique $\omega(q, \gamma^*) \geq 0$ such that

$$a_i^* = \begin{cases} n, & \text{if } w_i < \omega(q, \gamma^*) \\ c, & \text{if } w_i > \omega(q, \gamma^*). \end{cases}$$

Since $v(\cdot)$ is strictly concave, $v(w_i + r) - v(w_i)$ is strictly decreasing in w_i . Since $v(r) > H$, $q \cdot \Delta p(\gamma^*) \cdot H < v(0 + r) - v(0)$. Since $\lim_{x \rightarrow \infty} v'(x) = 0$, $v(w_i + r) - v(w_i)$ converges to zero as $w_i \rightarrow \infty$. Then

- If $q \cdot \Delta p(\gamma^*) \cdot H > 0$, there is a unique $w^* > 0$ that satisfies

$$q \cdot \Delta p(\gamma^*) \cdot H = v(w^* + r) - v(w^*). \quad (\text{A3})$$

Let this quantity be defined as $\omega(q, \gamma^*) > 0$.

- If $q \cdot \Delta p(\gamma^*) \cdot H = 0$, then

$$q \cdot \Delta p(\gamma^*) \cdot H < v(w_i + r) - v(w_i)$$

for all w_i , and every agent finds it optimal not to comply. In this case, $\omega(q, \gamma^*) = \infty$.

Note that since the right-hand side of (A3) is continuous and strictly decreasing, $\omega(q, \gamma^*)$ is continuous and strictly decreasing in q and γ^* .

By (A2), $a_i^* = n$ if $w_i < \omega(q, \gamma^*)$ and $a_i^* = c$ if $w_i > \omega(q, \gamma^*)$. Therefore, in any equilibrium there is a threshold w^* such that those with wealth below w^* do not comply, whereas those with wealth above w^* comply. Then

$$\gamma^* \in \left[\lim_{w \rightarrow w^* -} F(w), \lim_{w \rightarrow w^* +} F(w) \right]. \quad (\text{A4})$$

Therefore, in any equilibrium the following must be satisfied:

$$w^* \in \left[\lim_{w \rightarrow w^* +} \omega(q, F(w)), \lim_{w \rightarrow w^* -} \omega(q, F(w)) \right]. \quad (\text{A5})$$

Also, since $\omega(q, \gamma) > 0$ for any γ , $w^* > 0$ in any equilibrium.

Finally, we show that the equilibrium is unique for any $q \in (0, 1)$. Since $\omega(\cdot, \cdot)$ is strictly decreasing in its second argument, $\omega(q, F(x)) - x$ is strictly decreasing in x . Also, $\omega(q, F(0)) - 0 > 0$ and $\lim_{x \rightarrow \infty} \omega(q, F(x)) - x < \omega(q, 1) - \lim_{x \rightarrow \infty} x < 0$. Therefore, for any $q \in (0, 1)$, there is a unique w^* that satisfies

$$\lim_{w \rightarrow w^* +} \omega(q, F(w)) - w^* \leq 0 \leq \lim_{w \rightarrow w^* -} \omega(q, F(w)) - w^*.$$

By (A5), this is the unique threshold given q .

The final step is proving the uniqueness of γ^* . If $\lim_{w \rightarrow w^*+} F(w) = \lim_{w \rightarrow w^*-} F(w)$, by (A4), $\gamma^* = F(w^*)$, and the uniqueness of the equilibrium directly follows. Otherwise, there is a unique $\hat{\gamma} \in [\lim_{w \rightarrow w^*-} F(w), \lim_{w \rightarrow w^*+} F(x)]$ such that $q \cdot \Delta p(\hat{\gamma}) \cdot H = v(w^* + r) - v(w^*)$. It must be that $\gamma^* = \hat{\gamma}$ in equilibrium:

- If $\gamma^* < \hat{\gamma}$, $q \cdot \Delta p(\gamma^*) \cdot H < v(w^* + r) - v(w^*)$. By continuity of $v(\cdot)$, there exists some $w_i > w^*$ such that $a_i = n$, which contradicts w^* being the threshold wealth.
- If $\gamma^* > \hat{\gamma}$, $q \cdot \Delta p(\gamma^*) \cdot H > v(w^* + r) - v(w^*)$. By continuity of $v(\cdot)$, there exists some $w_i < w^*$ such that $a_i = c$, which contradicts w^* being the threshold wealth.

Therefore, given q , the appropriate share of agents with threshold wealth comply, so that the share of noncompliers is γ^* .

- (i) To prove (i), take q_1, q_2 with $q_1 < q_2$ and assume, toward a contradiction, that $\gamma_1^* < \gamma_2^*$. By (A5), the following equalities must hold:

$$\begin{aligned} w_1^* &= \omega(q_1, \gamma_1^*) \\ w_2^* &= \omega(q_2, \gamma_2^*). \end{aligned}$$

Because $q_2 > q_1$ and $\gamma_2^* > \gamma_1^*$, and because $\omega(\cdot, \cdot)$ is strictly decreasing in its arguments, $\omega(q_2, \gamma_2^*) < \omega(q_1, \gamma_1^*)$. Then $w_2^* < w_1^*$. By (A4), this implies $\gamma_2^* \leq \gamma_1^*$, a contradiction.

- (ii) To prove (ii), take r_1, r_2 with $r_1 < r_2$ and assume, toward a contradiction, that $\gamma_1^* > \gamma_2^*$. By (A3):

$$\begin{aligned} q \cdot \Delta p(\gamma_1^*) \cdot H &= v(w_1^* + r_1) - v(w_1^*) \\ q \cdot \Delta p(\gamma_2^*) \cdot H &= v(w_2^* + r_2) - v(w_2^*). \end{aligned}$$

Since $\gamma_1^* > \gamma_2^*$, $\Delta p(\gamma_1^*) \geq \Delta p(\gamma_2^*)$. Because $v(\cdot)$ is strictly concave, $w_1^* < w_2^*$. By (A4), this implies $\gamma_1^* \leq \gamma_2^*$, a contradiction.

- (iii) To prove (iii), take H_1, H_2 with $H_1 < H_2$ and assume, toward a contradiction, that $\gamma_1^* < \gamma_2^*$. By (A3):

$$\begin{aligned} q \cdot \Delta p(\gamma_1^*) \cdot H_1 &= v(w_1^* + r) - v(w_1^*) \\ q \cdot \Delta p(\gamma_2^*) \cdot H_2 &= v(w_2^* + r) - v(w_2^*) \end{aligned}$$

$\gamma_1^* < \gamma_2^*$ and $H_1 < H_2$ implies $q \cdot \Delta p(\gamma_1^*) \cdot H_1 < q \cdot \Delta p(\gamma_2^*) \cdot H_2$. Because $v(\cdot)$ is strictly concave, $w_1^* > w_2^*$. By (A4), this implies $\gamma_1^* \geq \gamma_2^*$, a contradiction.

□

Proof of Proposition 2. Let $m^*(w_i) \in [0, 1]$ denote the consumption choice of agent $i \in I$. In equilibrium, the agent's actions depend on the message sent by the media source: let $a_i^*(\hat{s})$, $\hat{s} \in \{\hat{C}, \hat{N}\}$ denote these actions.

Throughout the proof, we assume that $a_i^*(\widehat{C}) = c$ and $a_i^*(\widehat{N}) = n$. This is without loss of generality, because if the agent was to have $a_i^*(\widehat{C}) = a_i^*(\widehat{N}) = c$, she can equivalently choose $m^*(w_i) = 0$, which produces $\widehat{s} = \widehat{C}$ with probability one. Similarly, if $a_i^*(\widehat{C}) = a_i^*(\widehat{N}) = n$, she can choose $m^*(w_i) = 1$.

Consider an agent $i \in I$, and fix the behavior of other agents. This gives a measure of noncompliers $\gamma \in [0, 1]$. Therefore, given $q \in (0, 1)$, the agent's expected utility is:

$$U(w_i, q) = \begin{cases} v(w_i + r) - q \cdot p(C, n, \gamma) \cdot H, & \text{if } q \leq q_i^* \\ v(w_i) - q \cdot p(C, c, \gamma) \cdot H, & \text{if } q > q_i^*, \end{cases}$$

where q_i^* satisfies:

$$q_i^* \cdot \Delta p(\gamma) \cdot H = v(w_i + r) - v(w_i).$$

Note that q_i^* is strictly decreasing in w_i . Agent i chooses the media source to follow by solving the following optimization problem:

$$m^*(w_i) = \arg \max_{m \in [0, 1]} \mathbb{E}_{q \sim H^m} [U(w_i, q)].$$

Our first claim is that if $q_i^* > 1$, then $m^*(w_i) = 1$. For such an agent, for any $m \in [0, 1]$,

$$\begin{aligned} \mathbb{E}_{q \sim H^m} [U(w_i, q)] &= \mathbb{E}_{q \sim H^m} [v(w_i + r) - q \cdot p(C, n, \gamma) \cdot H] \\ &= v(w_i + r) - \mathbb{E}_{q \sim H^m} [q] \cdot p(C, n, \gamma) \cdot H \\ &= v(w_i + r) - \theta \cdot p(C, n, \gamma) \cdot H. \end{aligned}$$

Therefore, this agent is indifferent among any media source. Because $a_i^* = n$ for such an agent, her optimal media source to consume is $m^* = 1$. Since q_i^* is strictly decreasing in w_i , the condition $q_i^* > 1$ is equivalent to $w_i < w^*$ for some $w^* > 0$.

We now consider agents with $w_i \geq w^*$, i.e., those with $q_i^* \in (0, 1)$. We first show that

$$q^{m^*(w_i)}(\widehat{N}) < q_i^* < q^{m^*(w_i)}(\widehat{C}).$$

Toward a contradiction, first suppose that $q_i^* < q^{m^*(w_i)}(\widehat{N}) < q^{m^*(w_i)}(\widehat{C})$. Then, repeating the argument above, the agent's expected utility is $\mathbb{E}_{q \sim H^{m^*(w_i)}} [U(w_i, q)] = v(w_i) - \theta \cdot p(C, c, \gamma) \cdot H$. But the agent can choose an $m > 0$ small enough that $q^{m^*(w_i)}(\widehat{N}) < q_i^*$ and obtain an expected payoff of

$$\begin{aligned} \mathbb{E}_{q \sim H^m} [U(w_i, q)] &= \Pr(q = q^m(\widehat{N})) \cdot [v(w_i + r) - q^m(\widehat{N}) \cdot p(C, n, \gamma) \cdot H] \\ &\quad + \Pr(q = q^m(\widehat{C})) \cdot [v(w_i) - q^m(\widehat{C}) \cdot p(C, c, \gamma) \cdot H] \\ &> \Pr(q = q^m(\widehat{N})) \cdot [v(w_i) - \Pr(q = q^m(\widehat{N})) \cdot p(C, c, \gamma) \cdot H] \\ &\quad + \Pr(q = q^m(\widehat{C})) \cdot [v(w) - q^m(\widehat{C}) \cdot p(C, c, \gamma) \cdot H] \\ &= v(w) - \mathbb{E}_{q \sim H^m} [q] \cdot p(C, c, \gamma) \cdot H \\ &= v(w) - \theta \cdot p(C, c, \gamma) \cdot H. \end{aligned}$$

For the case $q^{m^*(w_i)}(\widehat{N}) < q^{m^*(w_i)}(\widehat{C}) < q_i^*$, a similar argument applies. By choosing $m < 1$ large enough that $q_i^* < q^{m^*(w_i)}(\widehat{C})$, the agent can receive a strictly higher payoff. We conclude that $q^{m^*(w_i)}(\widehat{N}) < q_i^* < q^{m^*(w_i)}(\widehat{C})$. The optimization problem can then be written as:

$$m^*(t_i) = \arg \max_{m \in [0,1]} (\theta G_C(m) + (1 - \theta)G_N(m)) \cdot \left(v(w_i + r) - q^m(\widehat{N}) \cdot p(C, n, \gamma) \cdot H \right) \\ + (\theta(1 - G_C(m)) + (1 - \theta)(1 - G_N(m))) \left(v(w_i) - q^m(\widehat{C}) \cdot p(C, c, \gamma) \cdot H \right).$$

The first-order condition for this optimization problem yields:

$$v(w_i + r) - v(w_i) = \frac{\frac{\theta}{1-\theta} \frac{g_C(m^*(w_i))}{g_N(m^*(w_i))}}{1 + \frac{\theta}{1-\theta} \frac{g_C(m^*(w_i))}{g_N(m^*(w_i))}} \cdot \Delta p(\gamma) \cdot H.$$

By the monotone likelihood ratio property, the right-hand side is increasing in $m^*(w_i)$, so there is a unique solution. Moreover, since the left-hand-side is decreasing in w_i , $m^*(w_i)$ is decreasing in w_i . \square

Proof of Proposition 3. The equilibrium description follows from Proposition 1.

- (i) Part (i) follows from the fact that $q^m(\widehat{N}) \leq q^m(\widehat{C})$, and part (i) of Proposition 1.
- (ii) By (3) and (4), $q^m(\widehat{s})$ is strictly increasing in θ for $\widehat{s} \in \{\widehat{C}, \widehat{N}\}$. Thus, by part (i) of Proposition 1, $\gamma^*(\widehat{s})$ is decreasing in θ .
- (iii) We first show that $q^m(\widehat{s})$ is increasing in m for $\widehat{s} \in \{\widehat{C}, \widehat{N}\}$. By (3),

$$\frac{\partial q^m(\widehat{C})}{\partial m} = \frac{\theta(1 - \theta)}{\underbrace{(\theta(1 - G_c(m)) + (1 - \theta)(1 - G_N(m)))^2}_{>0}} (g_N(m)(1 - G_C(m)) - g_C(m)(1 - G_N(m))).$$

Since $g_C(\cdot)$ and $g_N(\cdot)$ satisfy the monotone likelihood ratio property, for any $m' \geq m$,

$$\begin{aligned} \frac{g_C(m')}{g_N(m')} \geq \frac{g_C(m)}{g_N(m)} &\implies g_C(m')g_N(m) \geq g_C(m)g_N(m') \\ &\implies \int_m^1 g_C(m')g_N(m)dm' \geq \int_m^1 g_C(m)g_N(m')dm' \\ &\implies g_N(m)(1 - G_C(m)) \geq g_C(m)(1 - G_N(m)) \\ &\implies g_N(m)(1 - G_C(m)) - g_C(m)(1 - G_N(m)) \geq 0. \end{aligned}$$

Substituting, we conclude that $\frac{\partial q^m(\widehat{C})}{\partial m} \geq 0$. Similarly, by (4),

$$\frac{\partial q^m(\widehat{N})}{\partial m} = \frac{\theta(1 - \theta)}{\underbrace{(\theta G_c(m) + (1 - \theta)G_N(m))^2}_{>0}} (g_C(m)G_N(m) - g_N(m)G_C(m)).$$

By the monotone likelihood ratio property, for any $m \geq m'$,

$$\begin{aligned}
\frac{g_C(m)}{g_N(m)} \geq \frac{g_C(m')}{g_N(m')} &\implies g_C(m)g_N(m') \geq g_C(m')g_N(m) \\
&\implies \int_0^m g_C(m)g_N(m')dm' \geq \int_0^m g_C(m')g_N(m)dm' \\
&\implies g_C(m)G_N(m) \geq g_N(m)G_C(m) \\
&\implies g_C(m)G_N(m) - g_N(m)G_C(m) \geq 0.
\end{aligned}$$

Substituting, we conclude that $\frac{\partial q^m(\hat{N})}{\partial m} \geq 0$.

Since $q^m(\hat{s})$ is increasing in m for $\hat{s} \in \{\hat{C}, \hat{N}\}$, by part (i) of Proposition 1, $\gamma^*(\hat{s})$ is decreasing in m . □

Proof of Proposition 4. We start with the most-preferred cutoff of agents with $w_i = \underline{w}$. Define $\bar{m} \in (0, 1)$ such that $q^{\bar{m}}(\hat{N}) = \bar{q}$, i.e.

$$\frac{\theta G_C(\bar{m})}{\theta G_C(\bar{m}) + (1 - \theta)G_N(\bar{m})} = \frac{v(\bar{w} + r) - v(\bar{w})}{\Delta p(\alpha) \cdot H}.$$

Take any $m \geq \bar{m}$. By monotonicity of $q^m(\hat{N})$ in m , for all such m , $q^m(\hat{N}) \geq \bar{q}$. Since $q^m(\hat{C}) \geq q^m(\hat{N})$, we also have $q^m(\hat{C}) \geq \bar{q}$ for all such m . By (9),

$$U(\underline{w}, q) = v(\underline{w} + r) - q \cdot p(C, c, \alpha) \cdot H, \quad \text{for } q \in \{q^m(\hat{N}), q^m(\hat{C})\} \text{ with } m \geq \bar{m}.$$

Then, for any $m \geq \bar{m}$,

$$\begin{aligned}
\mathbb{E}_{q \sim H^m}[U(\underline{w}, q)] &= \mathbb{E}_{q \sim H^m}[v(\underline{w} + r) - q \cdot p(C, c, \alpha) \cdot H] \\
&= v(\underline{w} + r) - \mathbb{E}_{q \sim H^m}[q] \cdot p(C, c, \alpha) \cdot H \\
&= v(\underline{w} + r) - \theta \cdot p(C, c, \alpha) \cdot H,
\end{aligned}$$

which is independent of m . Now, take any $m < \bar{m}$. Once again, by monotonicity of $q^m(\hat{N})$, $q^m(\hat{N}) < \bar{q}$ for all such m . Since $q^m(\hat{C}) > \theta > \bar{q}$, we have $q^m(\hat{C}) \geq \bar{q}$ for all such m . By (9),

$$U(\underline{w}, q) = \begin{cases} v(\underline{w} + r) - q_0^m \cdot p(C, c, \gamma) \cdot H, & \text{for } q = q^m(\hat{N}), \\ v(\underline{w} + r) - q_1^m \cdot p(C, c, \alpha) \cdot H, & \text{for } q = q^m(\hat{C}). \end{cases} \quad \text{with } \gamma > \alpha$$

Then, for any $m < \bar{m}$,

$$\begin{aligned}
\mathbb{E}_{q \sim H^m}[U(\underline{w}, q)] &= v(\underline{w} + r) - \left(\Pr(q = q^m(\hat{N})) \cdot q^m(\hat{N}) \cdot p(C, c, \gamma) + \Pr(q = q^m(\hat{C})) \cdot q^m(\hat{C}) \cdot p(C, c, \alpha) \right) \cdot H \\
&< v(\underline{w} + r) - \left(\Pr(q = q^m(\hat{N})) \cdot q^m(\hat{N}) \cdot p(C, c, \alpha) + \Pr(q = q^m(\hat{C})) \cdot q^m(\hat{C}) \cdot p(C, c, \alpha) \right) \cdot H \\
&= v(\underline{w} + r) - \left(\Pr(q = q^m(\hat{N})) \cdot q^m(\hat{N}) + \Pr(q = q^m(\hat{C})) \cdot q^m(\hat{C}) \right) \cdot p(C, c, \alpha) \cdot H \\
&= v(\underline{w} + r) - \mathbb{E}_{q \sim H^m}[q] \cdot p(C, c, \alpha) \cdot H \\
&= v(\underline{w} + r) - \theta \cdot p(C, c, \alpha) \cdot H.
\end{aligned}$$

This argument establishes that $\mathbb{E}_{q \sim H^{m'}}[U(\underline{w}, q)] < \mathbb{E}_{q \sim H^{m''}}[U(\underline{w}, q)]$ for any $m' < \bar{m} \leq m''$, and $\mathbb{E}_{q \sim H^{m''}}[U(\underline{w}, q)] = \mathbb{E}_{q \sim H^{m'''}}[U(\underline{w}, q)]$ for any $m'', m''' \geq \bar{m}$. We conclude that $m^*(\underline{w}) = [\bar{m}, 1)$.

Now, consider the most-preferred cutoff of agents with $w_i = \bar{w}$. Our claim is that $\sup m^*(\bar{w}) \leq \bar{m}$. To see this, suppose, toward a contradiction, that $\sup m^*(\bar{w}) > \bar{m}$. Take $m \in m^*(\bar{w}) \setminus (0, \bar{m})$. Using the same argument as above, one can show that

$$\mathbb{E}_{q \sim H^m}[U(\bar{w}, q)] = v(\bar{w} + r) - \theta \cdot p(C, c, \alpha) \cdot H.$$

This implies that information obtained under media policy m does not have any value for an agent with $w_i = \bar{w}$, as she receives the payoff she would receive absent any information. But the agent can receive a strictly higher payoff by choosing $m' = \epsilon > 0$ small enough, a contradiction. We conclude that $\sup m^*(\bar{w}) \leq \bar{m}$.

This argument establishes that any $m \in m^*(\bar{w})$ satisfies:

$$q^m(\hat{N}) < \bar{q} < q^m(\hat{C}).$$

Thus, for an agent with $w_i = \bar{w}$, under the media policy $m \in m^*(\bar{w})$, $n \in a_i^*(q^m(\hat{N}))$ and $a_i^*(q^m(\hat{C})) = c$. The optimization problem in (10) can then be written as:

$$\begin{aligned} \max_{m \in (0, 1)} & (\theta G_C(m) + (1 - \theta)G_N(m)) \cdot \left(v(w + r) - q^m(\hat{N}) \cdot p(C, n, \gamma^*(q^m(\hat{N}))) \cdot H \right) \\ & + (\theta(1 - G_C(m)) + (1 - \theta)(1 - G_N(m))) \left(v(w) - q^m(\hat{N}) \cdot p(C, c, \alpha) \cdot H \right). \end{aligned}$$

Note that the objective function is submodular in (w, m) :

$$\frac{\partial^2}{\partial \bar{w} \partial m} \mathbb{E}_{q \sim H^m}[U(\bar{w}, q)] = \underbrace{(v'(\bar{w} + r) - v'(\bar{w}))}_{< 0} \cdot (\theta g_C(m) + (1 - \theta)g_N(m)) < 0.$$

By [Topkis \(1998\)](#), $m^*(\bar{w})$ is decreasing in \bar{w} in the strong set order. \square

Proof of Proposition 5. Take $F_1(\cdot)$ and $F_2(\cdot)$ such that $F_1(x) \leq F_2(x)$ for all $x \geq 0$. Suppose, toward a contradiction, that $\gamma_1^* > \gamma_2^*$. By (A5):

$$\begin{aligned} w_1^* &= \omega(q, \gamma_1^*) \\ w_2^* &= \omega(q, \gamma_2^*). \end{aligned}$$

Since $\omega(\cdot, \cdot)$ is strictly decreasing in its second argument, $w_1^* < w_2^*$. But then, $F_1(w_1^*) \leq F_2(w_1^*) < F_2(w_2^*)$. By (A4), this implies $\gamma_1^* \leq \gamma_2^*$, a contradiction. \square

Proof of Proposition 6. To highlight the dependence of equilibrium on q , we will use the notation $w^*(q)$ and $\gamma^*(q)$. Given any $q \in (0, 1)$, the equilibrium under distribution $F_1(\cdot)$ is characterized by $(w_1^*(q), \gamma_1^*(q))$. By (A3) and (A4),

$$q \cdot \Delta p(\gamma_1^*(q)) \cdot H = v(w_1^*(q) + r) - v(w_1^*(q)) \tag{A6}$$

$$\gamma_1^*(q) \in \left[\lim_{x \rightarrow w_1^*(q)^-} F_1(x), \lim_{x \rightarrow w_1^*(q)^+} F_1(x) \right]. \tag{A7}$$

Similarly, the equilibrium under distribution $F_2(\cdot)$ is characterized by $(w_2^*(q), \gamma_2^*(q))$, which satisfy:

$$q \cdot \Delta p(\gamma_2^*(q)) \cdot H = v(w_2^*(q) + r) - v(w_2^*(q)) \quad (\text{A8})$$

$$\gamma_2^*(q) \in \left[\lim_{x \rightarrow w_2^*(q)-} F_2(x), \lim_{x \rightarrow w_2^*(q)+} F_2(x) \right]. \quad (\text{A9})$$

Define $\hat{\gamma} \in (0, 1)$ such that

$$\hat{\gamma} \equiv \lim_{x \rightarrow z-} F_2(x). \quad (\text{A10})$$

By part (i) of Proposition 1, $\gamma_1^*(q)$ and $\gamma_2^*(q)$ are decreasing in q , with $\lim_{q \rightarrow 0} \gamma_1^*(q) = \lim_{q \rightarrow 0} \gamma_2^*(q) = 1$. Consider four exhaustive cases:

1. Suppose that $\lim_{q \rightarrow 1} \gamma_1^*(q) < \hat{\gamma}$ and $\lim_{q \rightarrow 1} \gamma_2^*(q) < \hat{\gamma}$. Then there exists some $q_1^* \in (0, 1)$ such that

$$\gamma_1^*(q_1^*) = \hat{\gamma}.$$

Since $\lim_{x \rightarrow z-} F_2(x) \geq \lim_{x \rightarrow z-} F_1(x)$, $\hat{\gamma} \in [\lim_{x \rightarrow z-} F_1(x), \lim_{x \rightarrow z+} F_1(x)]$. By (A6), then q_1^* satisfies:

$$q_1^* \cdot \Delta p(\hat{\gamma}) \cdot H = v(z + r) - v(z). \quad (\text{A11})$$

Similarly, there exists some $q_2^* \in (0, 1)$ such that

$$\gamma_2^*(q_2^*) = \hat{\gamma}.$$

By construction, $\hat{\gamma} \in [\lim_{x \rightarrow z-} F_2(x), \lim_{x \rightarrow z+} F_2(x)]$. By (A8), q_2^* satisfies:

$$q_2^* \cdot \Delta p(\hat{\gamma}) \cdot H = v(z + r) - v(z). \quad (\text{A12})$$

By (A11) and (A12), $q_1^* = q_2^*$. Let

$$q^* \equiv q_1^* = q_2^* \in (0, 1).$$

- Take any $q \leq q^*$. Note that since $\gamma_1^*(q)$ is decreasing in q , $\gamma_1^*(q) \geq \gamma_1^*(q^*) = \hat{\gamma}$. Then, (A7) and (A10) imply that $w_1^*(q) \geq z$. By the same argument, (A9) and (A10) imply that $w_2^*(q) \geq z$.

Our claim is that $\gamma_1^*(q) \geq \gamma_2^*(q)$. Suppose, toward a contradiction, that $\gamma_1^*(q) < \gamma_2^*(q)$. By (A6) and (A8), $w_1^*(q) > w_2^*(q)$. Because $w_1^*(q) \geq z$ and $w_2^*(q) \geq z$, then $F_1(w_1^*(q)) \geq F_2(w_2^*(q))$. By (A7) and (A9), $\gamma_1^*(q) \geq \gamma_2^*(q)$, a contradiction.

- Take any $q \geq q^*$. Note that since $\gamma_1^*(q)$ is decreasing in q , $\gamma_1^*(q) \leq \gamma_1^*(q^*) = \hat{\gamma}$. Then (A7) and (A10) imply that $w_1^*(q) \leq z$. By the same argument, (A9) and (A10) imply that $w_2^*(q) \leq z$.

Our claim is that $\gamma_1^*(q) \leq \gamma_2^*(q)$. Suppose, toward a contradiction, that $\gamma_1^*(q) > \gamma_2^*(q)$. By (A6) and (A8), $w_1^*(q) < w_2^*(q)$. Because $w_1^*(q) \leq z$ and $w_2^*(q) \leq z$, then $F_1(w_1^*(q)) \leq F_2(w_2^*(q))$. By (A7) and (A9), $\gamma_1^*(q) \leq \gamma_2^*(q)$, a contradiction.

2. Suppose $\lim_{q \rightarrow 1} \gamma_1^*(q) \geq \hat{\gamma}$ and $\lim_{q \rightarrow 1} \gamma_2^*(q) \geq \hat{\gamma}$. Then for all $q \in (0, 1)$, $\gamma_1^*(q) \geq \hat{\gamma}$. By (A7) and (A10), $F_1(w_1^*(q)) \geq F_1(z)$, which implies that $w_1^*(q) \geq z$. Similarly, by (A9) and (A10), $w_2^*(q) \geq z$ for all q .

Our claim is that $\gamma_1^*(q) \geq \gamma_2^*(q)$ for all $q \in (0, 1)$. Suppose, toward a contradiction, that $\gamma_1^*(q) < \gamma_2^*(q)$ for some q . By (A6) and (A8), $w_1^*(q) > w_2^*(q)$. Because $w_1^*(q) \geq z$ and $w_2^*(q) \geq z$, then $F_1(w_1^*(q)) \geq F_2(w_2^*(q))$. By (A7) and (A9), $\gamma_1^*(q) \geq \gamma_2^*(q)$, a contradiction. In this case, setting $q^* = 1$ yields the result.

3. Suppose $\lim_{q \rightarrow 1} \gamma_1^*(q) \geq \hat{\gamma}$ and $\lim_{q \rightarrow 1} \gamma_2^*(q) < \hat{\gamma}$. Then, for all $q \in (0, 1)$, $\gamma_1^*(q) \geq \hat{\gamma}$. By (A7) and (A10), $F_1(w_1^*(q)) \geq F_1(z)$. Thus, $w_1^*(q) \geq z$. Also, there exists some $q_2^* \in (0, 1)$ such that

$$\gamma_2^*(q_2^*) = \hat{\gamma}.$$

- Take any $q \leq q_2^*$. Since $\gamma_2^*(q)$ is decreasing in q , $\gamma_2^*(q) \geq \hat{\gamma}$. (A9) and (A10) imply that $w_2^*(q) \geq z$.

Our claim is that $\gamma_1^*(q) \geq \gamma_2^*(q)$. Suppose, toward a contradiction, that $\gamma_1^*(q) < \gamma_2^*(q)$. By (A6) and (A8), $w_1^*(q) > w_2^*(q)$. Because $w_1^*(q) \geq z$ and $w_2^*(q) \geq z$, then $F_1(w_1^*(q)) \geq F_2(w_2^*(q))$. By (A7) and (A9), $\gamma_1^*(q) \geq \gamma_2^*(q)$, a contradiction.

- Take any $q \geq q_2^*$. Since $\gamma_2^*(q)$ is decreasing in q , $\gamma_2^*(q) \leq \hat{\gamma}$. Therefore, $\gamma_1^*(q) \geq \hat{\gamma} \geq \gamma_2^*(q)$.

Since $\gamma_1^*(q) \geq \gamma_2^*(q)$ for all $q \in (0, 1)$, setting $q^* = 1$ yields the result.

4. Suppose $\lim_{q \rightarrow 1} \gamma_1^*(q) < \hat{\gamma}$ and $\lim_{q \rightarrow 1} \gamma_2^*(q) \geq \hat{\gamma}$. There exists some $q^* \in (0, 1)$ such that

$$\gamma_1^*(q^*) = \hat{\gamma}.$$

Also, for all $q \in (0, 1)$, $\gamma_2^*(q) \geq \hat{\gamma}$. By (A9) and (A10), $F_2(w_2^*(q)) \geq F_2(z)$. Thus, $w_2^*(q) \geq z$.

- Take any $q \leq q^*$. Since $\gamma_1^*(q)$ is decreasing in q , $\gamma_1^*(q) \geq \hat{\gamma}$. (A7) and (A10) imply that $w_1^*(q) \geq z$.

Our claim is that $\gamma_1^*(q) \geq \gamma_2^*(q)$. Suppose, toward a contradiction, that $\gamma_1^*(q) < \gamma_2^*(q)$. By (A6) and (A8), $w_1^*(q) > w_2^*(q)$. Because $w_1^*(q) \geq z$ and $w_2^*(q) \geq z$, then $F_1(w_1^*(q)) \geq F_2(w_2^*(q))$. By (A7) and (A9), $\gamma_1^*(q) \geq \gamma_2^*(q)$, a contradiction.

- Take any $q \geq q^*$. Since $\gamma_1^*(q)$ is decreasing in q , $\gamma_1^*(q) \leq \hat{\gamma}$. Therefore, $\gamma_2^*(q) \geq \hat{\gamma} \geq \gamma_1^*(q)$.

Since the four cases are exhaustive, the proof of the first part follows. For the second part, note that by (A10), a lower value of z corresponds to a lower value of $\hat{\gamma}$. In cases 1 and 4, this results in a higher value of q^* . In cases 2 and 3, $q^* = 1$ does not change.

Finally, set \underline{z} such that

$$v(\underline{z} + r) - v(\underline{z}) = \Delta p(1) \cdot H.$$

Since $v(r) > H$, this equality is satisfied for some $\underline{z} > 0$.

Take any $z < \underline{z}$. For any agent with $w_i \leq z$,

$$v(w_i + r) - v(w_i) > q \cdot \Delta p(\gamma_1^*(q)) \cdot H$$

for any $q \in (0, 1)$. By (A2), $a_i^* = n$ in any equilibrium. Therefore, $\lim_{q \rightarrow 1} \gamma_1^*(q) > F_1(z)$. By the same argument, $\lim_{q \rightarrow 1} \gamma_2^*(q) > F_2(z)$. This corresponds to case 2 above, where $q^* = 1$. \square

Proof of Proposition 8. As discussed in the main text, we begin by showing that the preferences over r are single-dipped. Fix $q \in (0, 1)$. For any r , by Proposition 1, there is a threshold income that distinguishes compliers and noncompliers in equilibrium. To emphasize its dependence on r , denote this threshold by $w^*(r)$. When $F(\cdot)$ is continuous, it is uniquely pinned down by the indifference condition:

$$v(w^*(r) + r) - v(w^*(r)) = q \cdot \Delta p(F(w^*(r))) \cdot H. \quad (\text{A13})$$

By part (ii) of Proposition 1, $w^*(r)$ is strictly increasing in r with $w^*(0) = 0$. Therefore, it has an inverse function $\rho(w)$, which is strictly increasing in w with $\rho(0) = 0$. $\rho(w)$ is the value of r that leaves an agent with income w indifferent between complying and non-complying. If $r > \rho(w)$, the agent does not comply in equilibrium; if $r < \rho(w)$, she complies.

The expected utility of agent i in equilibrium is

$$\mathbb{E}[u_i] = \begin{cases} v(w_i) - q \cdot p(C, c, F(w^*(r))) \cdot H, & \text{if } r < \rho(w_i) \\ v(w_i + r) - q \cdot p(C, n, F(w^*(r))) \cdot H, & \text{if } r > \rho(w_i). \end{cases} \quad (\text{A14})$$

Now,

- If $r < \rho(w_i)$,

$$\frac{\partial \mathbb{E}[u_i]}{\partial r} = -q \cdot \underbrace{p_3(C, c, F(w^*(r))) \cdot H \cdot f(w^*(r))}_{>0 \text{ by Assumption 1}} \cdot \underbrace{\frac{\partial w^*(r)}{\partial r}}_{>0 \text{ by Proposition 1}} < 0.$$

- If $r \geq \rho(w_i)$,

$$\frac{\partial \mathbb{E}[u_i]}{\partial r} = v'(w_i + r) - q \cdot p_3(C, n, F(w^*(r))) \cdot H \cdot f(w^*(r)) \cdot \frac{\partial w^*(r)}{\partial r}.$$

Since $r \geq \rho(w_i)$, $w_i \leq w^*(r)$ and $v'(w_i + r) \geq v'(w^*(r) + r)$. Therefore,

$$\frac{\partial \mathbb{E}[u_i]}{\partial r} \geq v'(w^*(r) + r) - q \cdot p_3(C, n, F(w^*(r))) \cdot H \cdot f(w^*(r)) \cdot \frac{\partial w^*(r)}{\partial r}. \quad (\text{A15})$$

Implicitly differentiating (A13) with respect to r gives:

$$\frac{\partial w^*(r)}{\partial r} = \frac{v'(w^*(r) + r)}{v'(w^*(r)) - v'(w^*(r) + r) + q \cdot \Delta p'(F(w^*(r))) \cdot H \cdot f(w^*(r))}. \quad (\text{A16})$$

Substituting this into (A15):

$$\frac{\partial \mathbb{E}[u_i]}{\partial r} \geq v'(w^*(r) + r) \cdot \frac{v'(w^*(r)) - v'(w^*(r) + r) - q \cdot p_3(C, c, F(w^*(r))) \cdot H \cdot f(w^*(r))}{v'(w^*(r)) - v'(w^*(r) + r) + q \cdot \Delta p'(F(w^*(r))) \cdot H \cdot f(w^*(r))}.$$

By concavity of $v(\cdot)$ and by Assumption 1, the denominator is always positive. Thus, $\frac{\partial \mathbb{E}[u_i]}{\partial r} \geq 0$ if:

$$v'(w^*(r)) - v'(w^*(r) + r) \geq q \cdot p_3(C, c, F(w^*(r))) \cdot H \cdot f(w^*(r)). \quad (\text{A17})$$

By (A13),

$$w^*(r) + r = v^{-1}(v(w^*(r)) + q \cdot \Delta p(F(w^*(r))) \cdot H).$$

Substituting this into (A18), $\frac{\partial \mathbb{E}[u_i]}{\partial r} \geq 0$ if:

$$v'(w^*(r)) - v'(v^{-1}(v(w^*(r)) + q \cdot \Delta p(F(w^*(r))) \cdot H)) \geq q \cdot p_3(C, c, F(w^*(r))) \cdot H \cdot f(w^*(r)), \quad (\text{A18})$$

which is guaranteed by Assumption 2 (taking $\gamma = F(w^*)$ in the statement of Assumption 2 suffices).

If w_i is high enough that $\rho(w_i) > r$, $\mathbb{E}[u_i]$ is decreasing in $\hat{r} \in [0, r]$, so the agent's most preferred enforcement level is $\hat{r} = 0$. Otherwise, since utility is decreasing in \hat{r} for $\hat{r} < \rho(w_i)$ and increasing in \hat{r} for $\hat{r} > \rho(w_i)$, the value of $\hat{r} \in [0, r]$ that maximizes utility is either $\hat{r} = 0$ or $\hat{r} = r$. An agent with income w_i then compares:

$$v(w_i) - q \cdot p(C, c, 0) \cdot H$$

and

$$v(w_i + r) - q \cdot p(C, n, F(w^*(r))) \cdot H.$$

Agent i prefers $\hat{r} = r$ over $\hat{r} = 0$ if and only if:

$$v(w_i + r) - v(w_i) > q \cdot (p(C, n, F(w^*(r))) - p(C, c, 0)) \cdot H.$$

Since $v(r) > H$, the inequality holds for $w_i = 0$. Since $v(\cdot)$ is concave, the left-hand side is decreasing in w_i . Therefore, there is a threshold $\hat{w} > 0$ such that this inequality holds if and only if $w_i < \hat{w}$. \square

Proof of Proposition 9. Under (1) and when $F(\cdot)$ is continuous, in equilibrium,

$$\gamma^* = F(w^*(t, r)),$$

and $w^*(t, r)$ satisfies:

$$v(w^*(t, r) + r) - v(w^*(t, r)) = q \cdot t \cdot F(w^*(t, r)) \cdot H. \quad (\text{A19})$$

Because Assumption 2 is satisfied, Proposition 8 holds and there is a threshold $\hat{w}(t, r)$ such that agent i votes for $\hat{r} = r$ if and only if $w_i \leq \hat{w}(t, r)$. $\hat{w}(t, r)$ is uniquely pinned down by:

$$v(\hat{w}(t, r) + r) - v(\hat{w}(t, r)) = q \cdot (\bar{t} + t) \cdot F(w^*(t, r)) \cdot H. \quad (\text{A20})$$

Implicitly differentiating (A19) with respect to t and rearranging gives:

$$\frac{\partial w^*(t, r)}{\partial t} = - \frac{qF(w^*(t, r))H}{v'(w^*(t, r)) - v'(w^*(t, r) + r) + qt f(w^*(t, r))H}.$$

We now claim that $(\underline{t} + t) \cdot F(w^*(t, r))$ is increasing in t . To see this,

$$\begin{aligned} \frac{\partial}{\partial t}(\bar{t} + t) \cdot F(w^*(t, r)) &= F(w^*(t, r)) + (\bar{t} + t)f(w^*(t, r)) \frac{\partial w^*(t, r)}{\partial t} \\ &= F(w^*(t, r)) - (\underline{t} + t)f(w^*(t, r)) \frac{qF(w^*(t, r))H}{v'(w^*(t, r)) - v'(w^*(t, r) + r) + qt f(w^*(t, r))H} \\ &= F(w^*(t, r)) \frac{v'(w^*(t, r)) - v'(w^*(t, r) + r) - q\underline{t}f(w^*(t, r))H}{v'(w^*(t, r)) - v'(w^*(t, r) + r) + qt f(w^*(t, r))H}. \end{aligned}$$

Since \bar{t} satisfies Assumption 2, the numerator is positive, so that $(\underline{t} + t) \cdot F(w^*(t, r))$ is increasing in t . But then, by (A20), $\hat{w}(t, r)$ is decreasing in t . Therefore, the share of citizens supporting $\hat{r} = r$ is decreasing in t . The result follows. \square