Political Economy of Crisis Response

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Abstract

We offer a 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, the 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 the 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 public response to 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 in-place lockdowns (e.g., China and South Korea). Most governments, including the United States and countries across Europe, have initially adopted shelter-in-place policies, which mandate only minimal movement for essential activities.

Compliance with these policies, however, has been uneven. In the United States, compliance is 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 non-compliance 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 United Kingdom.

We offer a simple model of behavior during a crisis. To highlight the relevance of the model to the current pandemic, the exposition mirrors the specific language of the COVID-19 pandemic (i.e., social distancing, shelter-in-place). In our model, individuals are heterogeneous in their incomes and exposure to an exogenous threat from the pandemic, and have

[1] See https://bit.ly/2Z58xYT.
[2] See https://bbc.in/2STNyUX.

to decide whether or not to comply with the governments' ordinance. Our starting point is that compliance is costly in terms of foregone income, the costs of non-compliance are heterogeneous and 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, healthcare costs (Proposition 1) and population density (Proposition 5). 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. At the community (e.g., U.S. county) level, the share of complying individuals is increasing in average income, which lowers health risks for the population overall (Proposition 2). Then, we identify the conditions under which the share of complying individuals is increasing in income inequality (Proposition 3).

Next, we explain the economic rationale behind observable attitudes towards the lockdowns. In particular, high income individuals prefer a complete shutdown, with strict social distancing enforcement (Proposition 4). The presence of externalities influences the political preferences of agents. Without an externality, the level of enforcement preferred by an agent that does not comply is always zero. With a negative externality, it might be positive as this 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 (Proposition 6). The same mechanism works, in a more subtle form, with preferences over information: in the presence of externalities, an agent might prefer one level of media slant to base her compliance decision on and another level of slant if this information is provided to everyone.

We investigate the role of information in shaping compliance in Propositions 7-9. Posterior beliefs are influenced by public reports, yet the information obtained from such a report is valuable to the extent that it changes the behavior of an individual. An agent who is inclined to be non-compliant finds the reports 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 towards downplaying the risks.[3] In particular, low-income individuals prefer sources that downplay the risks of COVID-19 while high-income individuals prefer sources that exaggerate risks (Proposition 8). An increase in inequality is associated with individuals preferring the sources that exaggerate risks even further (Proposition 9).

The model provides a novel perspective on the findings of those who focus on the impact of slanted media coverage on COVID-19 deaths across the United States. Bursztyn et al. (2020) find that exposure to content that downplays the severity of the crisis significantly increases fatalities; Simonov et al. (2020) document the effect for social distancing. Our model suggests that endogenous demand over slant might be the channel that provides a feed-back loop: agents that chooses not to comply may rationally prefer everyone to receive information from more slanted sources.

In addition to providing a framework for studying compliance 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 non-compliance and a risky behavior. In Section 2 we describe early evidence on economic and informational factors of shelter-in-place compliance during the 2020 pandemic, which is consistent with our theoretical model.

As information acquisition plays the critical role in our theory, our paper is related to

[3] In 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 are 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).

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 commitment assumption and the associated 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 is a participation game with negative externalities: in our setup, both the payoff from participating *and* the payoff from taking the outside option are influenced by the actions of other players, but at different rates. There is a plethora of models where agents can fully isolate themselves from the externality by taking their outside options, such as market entry games, congestion games, tournaments, and contests. In our model, the particular form of externality induces an indirect utility that is single-dipped in entry costs, which results in highly-polarized preferences over enforcement levels (Propositions 4 and 6).

Models, in which 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) and Frank (1985); Ireland (1994); Hopkins and Kornienko (2004) are more recent treatments. In our model, beliefs about the severity of externalities is the object of interest and we consider information disclosure policies affecting such beliefs.

[4] Other models where media sources strategically choose their slants include Strömberg (2004); Bernhardt, Krasa 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.

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

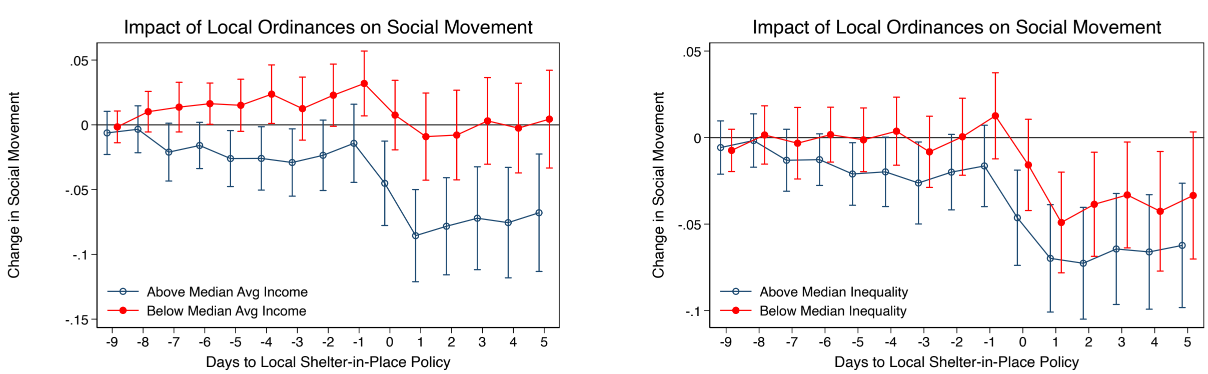
Finally, our model provides a theoretical framework for the emerging literature on heterogeneous effects on social distancing of income, partisanship, population density, political polarization, and distrust of authority that we briefly discuss in Section 2.

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 theoretical setup. Section 4 analyses basic factors of compliance. Section 5 discusses the impact of and demand for media slant, while Section 6 concludes.

2 Social Distancing and Media During COVID-19

In this section, we collect stylized facts that relate economic factors that affect behavior behavior and preferences such as income, inequality, and population density and 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.



(a) Income (median threshold). (b) Inequality (median threshold).

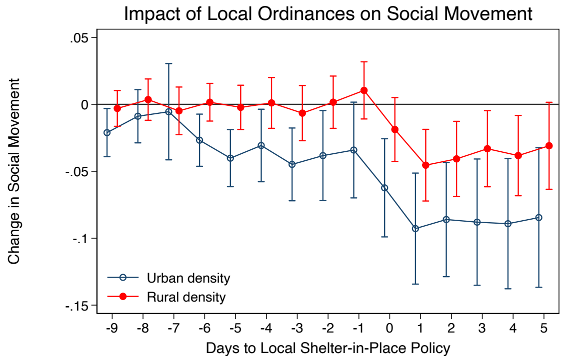
Notes: (a) and (b) Event study design plots showing heterogeneous effects on compliance with local shelter-in-place policies. For additional details on data and model specifications see Wright et al. (2020); data extended to May 1, 2020.

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 roll-out of local social distancing policies to estimate compliance and heterogeneous responses to policy onset via an income mechanism. We extend this data to May 1, and replicate 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 2 establish this result theoretically.

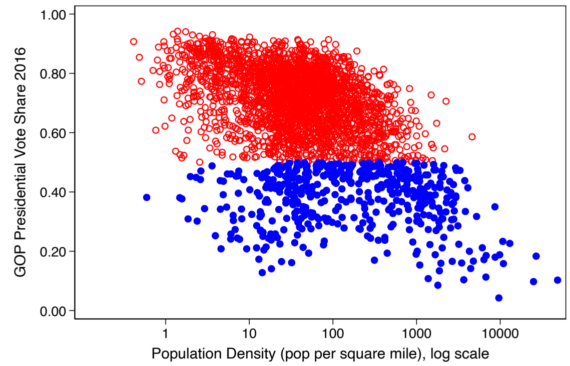
Second, using the cell-phone data as well as census-based measures of economic inequality (Gini index), we calculated the heterogeneous and marginal effects of inequality in Figures 1(b) and A-2(b). In Figure 1(b), we replicate the event study design using the median threshold for splitting inequality 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 plot 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 75^{th} percentile, consistent with the income mechanism. Proposition 3 works out the mechanics of this effect.

Figure 2(a) demonstrates the impact of the urban versus rural divide in the United States on compliance. As predicted by Proposition 5(a), the compliance in rural counties is lower. Also, political demand for stronger shelter-in-place restrictions in rural counties is lower – see Proposition 5(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

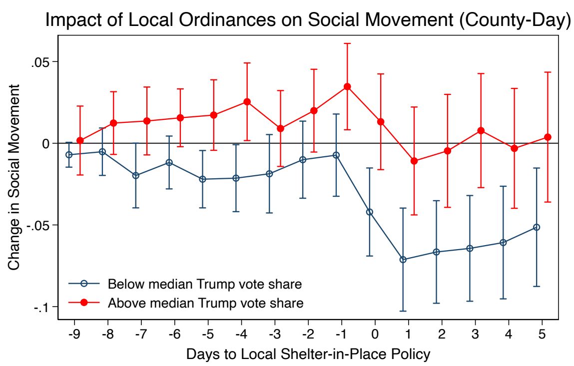
Figure 2: Impact of urban/rural status, partisanship, and media slant on compliance.



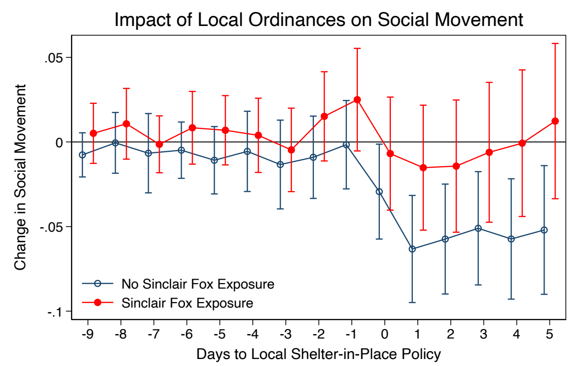
(a) Population density (census threshold).



(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 income 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(c), we extend the findings of Allcott et al. (2020) by demonstrating 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, Bursztyn 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 7 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 from April 20-26, 2020, includes information about perceived exaggeration of the COVID-19 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 related to the dangers of COVID-19.[6] This data is useful for assessing the impact of and demand for slanted information that we analyse in Propositions 7 and 8.

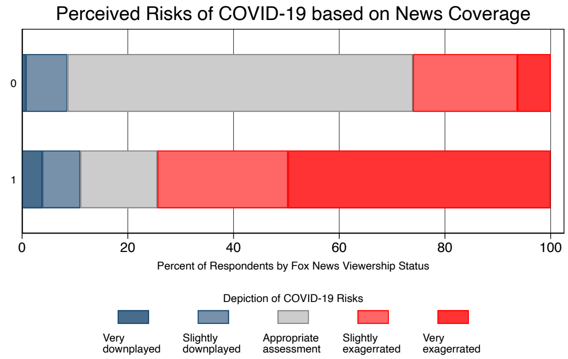
Fox News viewers are presented in the second horizontal bar (=1) of each plot.[7] Figures 3(a) and 3(b) suggest Fox News viewers are significantly more likely to think news coverage and public health statements about COVID-19 exaggerate the severity of the pandemic. These individuals are also more likely to believe news coverage of COVID-19 is inaccurate (Figure 3(c)). This is what predicted by a combination of our Propositions 1 and 8: 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 8 and 9). The optimal slant of information for personal usage (Proposition 5(b)) is higher than that of public information

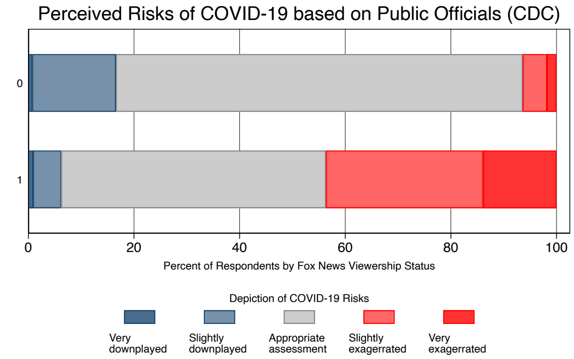
[6] Details about the data and detailed information about surveys questions are available here: `https://pewrsr.ch/2WXCd7i`.

[7] Regression-based evidence is presented in the Table A-1.

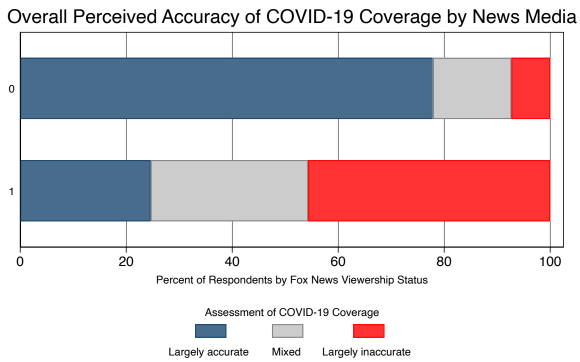
Figure 3: Viewers Assessment of News Coverage and Information Relevance



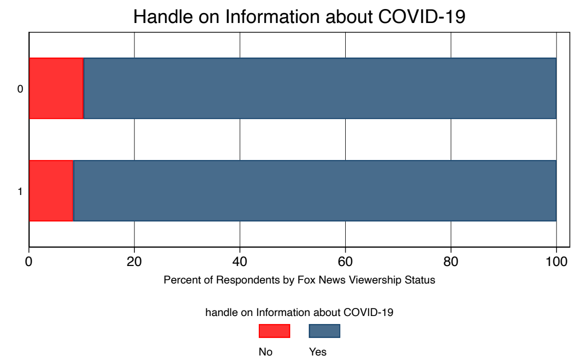
(a) News Media



(b) CDC



(c) Accuracy of News Coverage



(d) Grasp COVID-19 Information

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, New York Times). Data drawn from 2020 PEW Research Center's American Trends Panel, Wave 66 (Pathways & Trust in Media Survey). Survey was fielded from April 20-26, 2020.

(Proposition 8): 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 the agents face an 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 media sources that might be slanted towards 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 coronavirus threat is $\Pr(s = C) = \theta \in (0, 1)$. Throughout Section 4, we will fix the information $\mathcal{I}$ about the state. Let

$$q \equiv \Pr(s = C|\mathcal{I}) \in (0, 1)$$

denote the probability attached to coronavirus threat given the 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 $supp(F(\cdot)) \subseteq [0, \infty)$. We also consider an extension, in which agents are heterogeneous with respect to their exposure to health risks, e.g., because of the local population density.

Decision to comply 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 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 non-compliance, 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. $p : S \times A \times [0, 1] \to [0, 1]$ *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* $\Delta p : [0, 1] \to [0, 1]$ *defined as*

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

is increasing in $\gamma \in [0, 1]$*, 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 complies with the ordinance. Moreover, by (iv), such health risks are increasing in the number of people who do not comply. This captures the indirect effects of non-compliers on compliers through contact in public spaces, essential services, etc. Finally, (v) imposes a crucial supermodularity feature, which implies that the additional risk of non-compliance is decreasing in the share of compliers.

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

Example 1. One function that satisfies Assumption 1 is if the probability of catching the disease for a non-complier is proportional to the share of non-compliers:

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

Here, t is a measure of interdependency of non-compliance: 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.

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

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

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

$$v(r) > H. \tag{1}$$

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

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

Media Our definition of an equilibrium has agent receiving information $\mathcal{I}$ without specifying a source. To analyse the role of media exposure, in Section 5 we assume that agents receive information $\mathcal{I}$ from a media outlet, which operates as follows. It observes an informative signal $x \in [0, 1]$ about the state of the world s, where

$$x \sim G_s(\cdot), \quad s \in \{C, N\}$$

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 $\lim_{x\to 0} \frac{g_C(x)}{g_N(x)} = 0$ and $\lim_{x\to 1} \frac{g_C(x)}{g_N(x)} = \infty$. 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 $g_N(1) = 0$.

The media source commits to a cutoff $m \in [0, 1]$ and sends a public report $\widehat{s} \in \left\{\widehat{C}, \widehat{N}\right\}$

according to:

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

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

Note that a higher value of m means $\widehat{s} = \widehat{N}$ signal is sent less frequently. Therefore, a media source with higher cutoff downplays the coronavirus threat compared to a media source with lower m. We refer to m as the *slant* of the media source, and a media source with higher m is *more slanted* towards downplaying the coronavirus threat.

4 Determinants of Compliance

We start by analyzing individual behavior, which is a function of agent's income, information she has, and behavior of other agents via probability of catching the disease. 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 lower income than the threshold do not comply, whereas the agents with higher income shelter in place:*

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

and

$$\gamma^* = \int_{j \in I} \mathbb{I}_{a_j^*(q)=n} dj$$

is the measure of non-compliers. Moreover,

(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 non-compliance 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 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 non-compliance rises. Second, the same effect applies to every agent in the community, so that everyone has more incentives to comply. This in turn, makes non-compliance 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 increasing compliance.

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

In addition to results about individual decisions as a function of income, *ex ante* expectations, and expected costs of disease, one can do comparative statics with respect to the aggregate income distribution. The next result, Proposition 2, compares two communities with one community wealthier than the other one. For example, 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 2. *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 non-compliers 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 2 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 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.[8] That is, $\mathbb{E}_{w\sim F_1}[w] = \mathbb{E}_{w\sim F_2}[w]$ and there exists a $z > 0$ such that

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

Intuitively, $F_2(\cdot)$ is a "spread out" version of $F_1(\cdot)$, and thus $F_2(\cdot)$ describes a "more unequal" community than $F_1(\cdot)$.

Proposition 3. *Take two distributions $F_2(\cdot)$ and $F_1(\cdot)$ such that $F_2(\cdot)$ is a mean-preserving*

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

spread of $F_1(\cdot)$. *Then, there exists a* $q^* \in [0,1]$ *such that*

$$\gamma_2^* \leq \gamma_1^* \textit{ if } q \leq q^*, \qquad \textit{and} \qquad \gamma_2^* \geq \gamma_1^* \textit{ if } q \geq q^*$$

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 3 demonstrates that non-compliance is higher in counties with more inequality only when the beliefs about the severity of coronavirus threat are high enough. By part (i) of Proposition 1, an increase in q unambiguously increases 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.

In the rest of this subsection, we focus on a specific example with a closed-form solution to illustrate the economic intuition behind the second part of Proposition 3.

Take $F_1(\cdot)$ such that

$$w_i \sim F_1(\cdot) \implies w_i = \begin{cases} \underline{w}_1, & \text{w.p. } \alpha \\ \overline{w}_1, & \text{w.p. } 1-\alpha \end{cases} \qquad \alpha \in (0,1) \tag{3}$$

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

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

and let

$$\underline{q}_1 \equiv \frac{v(\overline{w}_1 + r) - v(\overline{w}_1)}{\Delta p(1) \cdot H}$$
$$\overline{q}_1 \equiv \frac{v(\overline{w}_1 + r) - v(\overline{w}_1)}{\Delta p(\alpha) \cdot H}$$

When $\underline{w_1} < \underline{z}$, the measure of non-compliers in equilibrium is

$$\gamma_1^* = \begin{cases} 1, & \text{if } q \leq \underline{q}_1, \\ \Delta p^{-1}\left(\frac{v(\overline{w}_1+r)-v(\overline{w}_1)}{q \cdot H}\right), & \text{if } q \in [\underline{q}_1, \overline{q}_1], \\ \alpha, & \text{if } q \geq \overline{q}_1 \end{cases} \tag{4}$$

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, the high-income agents are indifferent between complying and non-complying. Note that in any equilibrium under any q, low-income agents always non-comply. This is ensured by $\underline{w_1} < \underline{z}$: their income levels are low enough so that they always have strong incentives to obtain the extra income r.

Now, take a mean-preserving spread of $F_1(\cdot)$. Consider $F_2(\cdot)$ such that

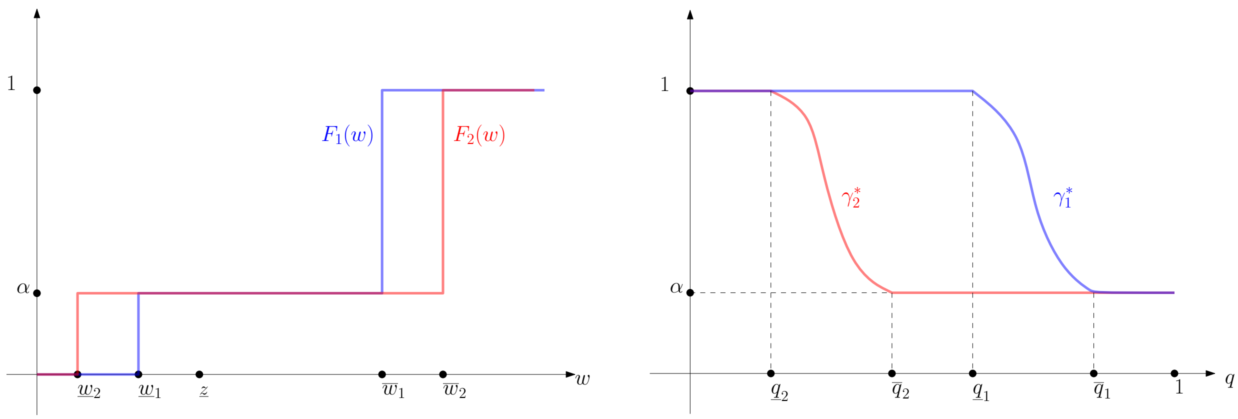
$$w_i \sim F_2(\cdot) \implies w_i = \begin{cases} \underline{w}_2, & \text{w.p. } \alpha \\ \overline{w}_2, & \text{w.p. } 1 - \alpha \end{cases}$$

with $\alpha \cdot \underline{w}_1 + (1-\alpha) \cdot \overline{w}_1 = \alpha \cdot \underline{w}_2 + (1-\alpha) \cdot \overline{w}_2$, and $\underline{w}_2 < \underline{w}_1 < \overline{w}_1 < \overline{w}_2$.

Note that $\underline{w}_2 < \underline{w}_1 < \underline{z}$. The measure of non-compliers under $F_2(\cdot)$ is therefore given by (4), with the substitution of subscripts. Moreover, $\overline{w}_2 > \overline{w}_1$ implies that $\underline{q}_2 < \underline{q}_1$, $\overline{q}_2 < \overline{q}_1$, and $\gamma_2^* \leq \gamma_1^*$. Figure 4 illustrates the effect of inequality on compliance.

Panel (a) of Figure 4 shows that the second part of Proposition 3 applies to this case. As long as the income of low-income agents is below $\underline{z}$, such agents never comply. $\overline{w}_2 > \overline{w}_1$ means that a lower value of q is sufficient to convince agents with income $\overline{w}_2$ for compliance.

Figure 4: The effect of inequality on compliance.



(a) Income distributions, $\underline{w}_2 < \underline{w}_1 < \overline{w}_1 < \overline{w}_2$.

(b) The measure of non-compliers.

This is the reason why $\gamma_2^* < \gamma_1^*$ for intermediate values of q, as shown in Panel (b) of Figure 4. Intuitively, the mean-preserving spread removes some agents who do not comply and replaces them with the agents 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 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.

Preferences over Enforcement Level A policy tool available for the government is increasing the enforcement of the order or the fines for not complying with the order. This corresponds to a decrease in r. To study potential effects of such a policy, let us consider the following modification of the basic setup. Fix the beliefs about the state of the world, $q = \Pr(s = C|\mathcal{I}) \in (0,1)$. 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 non-compliance without any enforcement by the government. Any $\hat{r} < r$ corresponds to some level of enforcement, whose equilibria is 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.

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. We state our results in terms of agents' preferences over policy; the application of the pivotal voter approach (e.g., Persson and Tabellini, 2002) is straightforward.

Proposition 4. *Suppose $F(\cdot)$ is continuous. 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 4 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 non-compliers. 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 non-compliance, and (ii) the indirect negative effect of having more non-compliers. The direct effect always dominates, 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 the fact that utility function is concave in income, 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, we use another dimension of heterogeneity. Suppose that the probability to catch the disease is as in Example 1:

$$p(s, a_i, \gamma) = \mathbb{I}_{s=C} \cdot \left((1-\bar{t}) + t_i \cdot \mathbb{I}_{a_i=n}\right) \cdot \gamma \tag{5}$$

where $\bar{t} \in (0,1)$ and $t_i \in [0, \bar{t}]$. A higher value of t_i indicates that the relative risk of non-compliance is highly dependent on the overall non-compliance of population. This captures the effect of living in an area with high population density: for an overall non-compliance rate, when an individual in a city non-complies, she is exposed to a higher risk compared to a non-complying individual in a rural area. Since individuals living in an urban counties are far more likely to identify as Democrats, we expect high values of t_i to be affiliated with being a Democrat.[9] Conversely, low values of t_i capture individuals living in rural counties, who are far more likely to identify as Republicans. Figure 2(b) illustrates these trends.

To keep matters simple, assume that income distribution is homogeneous: every agent has income $w > 0$. We assume that $t_i \sim_{iid} \Phi(\cdot)$, where $supp(\Phi(\cdot)) = [0, \bar{t}]$ and its pdf $\phi(\cdot)$ is differentiable. Moreover, we impose the following condition on $\Phi(\cdot)$:

$$\frac{\Phi(w)}{\phi(w)} + w \quad \text{is increasing in } w. \tag{6}$$

Condition (6) is a simple regularity condition. It is satisfied when function $\Phi(\cdot)$ is log-concave, i.e., when $\log \Phi(w)$ is concave.[10]

Our first result characterizes the behavior of agents in this setup, and plays the same role as Propositions 1 and 2, which described equilibria with income heterogeneity.

Proposition 5. *Given $q = \Pr(s = C|\mathcal{I}) \in (0,1)$, the equilibrium is characterized by a unique*

[9] In 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 more likely to be a Republican. See `https://pewrsr.ch/2AVrpiJ`.

[10] Bagnoli and Bergstrom (2005) demonstrate that many standard distributions satisfy this condition.

threshold t^* :

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

and $\Phi(t^*)$ *is the measure of non-compliers. Furthermore, consider two distributions* $\Phi_1(\cdot)$ *and* $\Phi_2(\cdot)$ *such that* $\Phi_1(\cdot)$ *first-order stochastically dominates* $\Phi_2(\cdot)$, *and let* t_1^* *and* t_2^* *be the corresponding thresholds. Then* $\Phi_1(t_1^*) \leq \Phi_2(t_2^*)$; *that is, there is a larger share of sheltering in urban communities.*

The results of Proposition 5 are intuitive: conditional on the number of people non-complying, the additional risk of non-compliance in a rural (low-t) area is lower than than 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. Now, we can use this characterization to investigate the agents' most preferred levels of enforcement and sources of information.

Proposition 6. **(i)** *There exists a threshold* $\hat{t} = \hat{t}(q, r) > 0$ *such that for* $t_i < \hat{t}$, *the most preferred enforcement level 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., agents living in urban counties prefer a complete shutdown.*

(ii) *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* $m^*(t_i)$ *is decreasing in* t_i.[11] *That is, agents living in rural counties prefer information sources with a higher slant.*

[11] In the proof, we show that there is a continuum of agents with sufficiently low t_i who are indifferent among any media sources. We pick such agents' preferred media sources to be $m^*(t_i) = 1$. This is consistent with their behavior: these agents do not comply under any belief, so they prefer the media sources that send $\widehat{s} = \widehat{N}$ with probability one. This assumption can be microfounded by imposing the obedience constraint (Bergemann and Morris, 2019; Kolotilin et al., 2017).

Preferences over the level of enforcement (part (i) in Proposition 6) incorporate the externality effect. Take $r > 0$, and consider the marginal agent, i.e., the one that has t^* of Proposition 5, who is indifferent between compliance and non-compliance. Even though this agent weakly prefers non-complying in equilibrium, she indeed votes for a strict enforcement level that leaves no benefit of non-compliance to the agents. This is because under strict enforcement the non-compliance is zero, so she does not suffer from the externalities imposed by non-compliers. Therefore, there are agents who do not comply themselves, yet in voting would support strict enforcement.

Part (ii) of Proposition 6 deals with the preferred slant of agents. Suppose an agent observes the compliance behavior of others and chooses an information source from the full range 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 action. This is akin to the problem of choosing a possibly biased advisor (Calvert, 1985; Suen, 2004). Since agents face different probabilities of catching the disease, they prefer different slants in their information. For example, if an agent has a low probability of catching the disease 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.

The result in part (ii) underlines one of the essential forces in our model. Still, the argument relies on 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. In Section 5, 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 non-complier might benefit from a media that overstates the threat as this induces others to stay home.

5 The Role of Information

Evidence reported in Bursztyn et al. (2020); Painter and Qiu (2020); Wright et al. (2020); Anderson et al. (2020) demonstrates that sources of information played an important role determining the compliance behavior during the COVID-19 pandemics. In Section 2 we provided additional survey-based evidence about media consumption and attitudes towards sources of information during the crisis. In this section, we analyze the mechanism that relate behavior and political preferences to decisions about media consumption and use of information.

Equilibrium with Slanted Media We now consider the equilibria when information is provided by a media source with a cutoff $m \in [0,1]$. Agents receive the report from the media outlet before deciding on their actions. Given a cutoff m, the beliefs induced by report $\widehat{s}$, $q^m(\widehat{s})$, are given by the Bayes' Rule:

$$q^m(\widehat{C}) \equiv \Pr\left(s = C|\widehat{s} = \widehat{C}\right) = \frac{\theta(1 - G_C(m))}{\theta(1 - G_C(m)) + (1 - \theta)(1 - G_N(m))} \tag{7}$$

$$q^m(\widehat{N}) \equiv \Pr\left(s = C|\widehat{s} = \widehat{N}\right) = \frac{\theta G_C(m)}{\theta G_C(m) + (1 - \theta)G_N(m)} \tag{8}$$

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 7 provides some preliminary findings about the equilibrium. They directly follow from the comparative statics results discussed in Proposition 1.

Proposition 7. *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 non-compliers:* $\gamma^*(\widehat{C})$ *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 towards downplaying the threat.*

A discussion about Part (iii) of Proposition 7 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 (7), 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 (8), 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 occurence of such an event. As a result, the non-compliance following $\widehat{s} = \widehat{N}$ is lower when such a report comes from a more slanted media source.

More crucially, part (iii) of Proposition 7 does *not* claim that the *expected* compliance is higher when the media is more slanted. A media source with a higher m sends the $\widehat{s} = \widehat{N}$ report more frequently. Because $\gamma^*(\widehat{N}) \geq \gamma^*(\widehat{C})$, 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

$$w_i = \begin{cases} \underline{w}, & \text{w.p. } \alpha \\ \overline{w}, & \text{w.p. } 1-\alpha \end{cases} \qquad \alpha \in (0,1) \tag{9}$$

Moreover, assume that

$$\frac{v(\underline{w}+r)-v(\underline{w})}{\Delta p(\alpha)\cdot H} > 1 \tag{10}$$

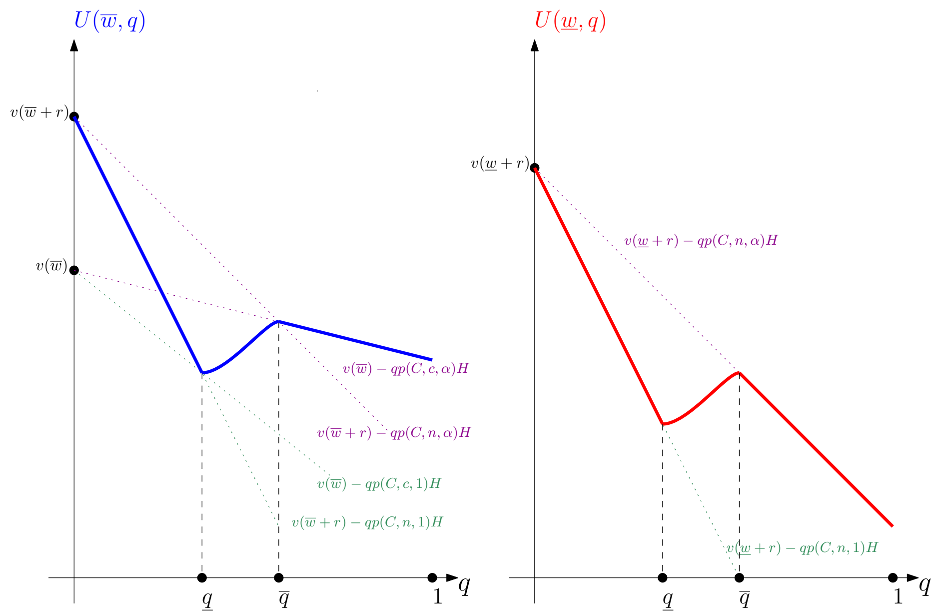
$$\frac{v(\overline{w}+r)-v(\overline{w})}{\Delta p(\alpha)\cdot H} < \theta \tag{11}$$

Note that (10) is the same condition as in $\underline{w} < \underline{z}$ in Example 4: it holds when $\underline{w}$ is low enough. Under this condition, the measure of non-compliers in equilibrium has an analytical solution, given in (4): low-income agents never comply, and high-income agents comply when q is high enough. The inequality in (11) holds when $\overline{w}$ is sufficiently high. This condition ensures $\overline{q} < \theta$; that is, in the absence of any information (i.e. when $q = \theta$), high-income agents comply with the order.

Given the equilibrium behavior of agents, the expected utility of an agent with income $w_i = \overline{w}$ in equilibrium when beliefs are q is

$$U(\overline{w},q) \equiv \begin{cases} v(\overline{w}+r) - q\cdot p\,(C,n,1)\cdot H, & \text{if } q \le \underline{q}, \\ v(\overline{w}) - q\cdot p\left(C,c,\Delta p^{-1}\left(\frac{v(\overline{w}+r)-v(\overline{w})}{q\cdot H}\right)\right)\cdot H, & \text{if } q \in [\underline{q},\overline{q}], \\ v(\overline{w}) - q\cdot p\,(C,c,\alpha)\cdot H, & \text{if } q \ge \overline{q} \end{cases} \tag{12}$$

Figure 5: Utility functions for two types of agents.



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

$$U(\underline{w}, q) \equiv \begin{cases} v(\underline{w}+r) - q \cdot p\,(C, n, 1) \cdot H, & \text{if } q \leq \underline{q}, \\ v(\underline{w}+r) - q \cdot p\left(C, n, \Delta p^{-1}\left(\frac{v(\overline{w}+r)-v(\overline{w})}{q \cdot H}\right)\right) \cdot H, & \text{if } q \in [\underline{q}, \overline{q}], \\ v(\underline{w}+r) - q \cdot p\,(C, n, \alpha) \cdot H, & \text{if } q \geq \overline{q} \end{cases} \tag{13}$$

Figure 5 illustrates the utility functions.

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 $\{q^m(\widehat{C}), q^m(\widehat{N})\}$:

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

Note that, 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

$$\lim_{m\to 0} q^m(\widehat{N}) = 0, \qquad \lim_{m\to 0} q^m(\widehat{C}) = \theta$$
$$\lim_{m\to 1} q^m(\widehat{N}) = \theta, \qquad \lim_{m\to 1} q^m(\widehat{C}) = 1$$

An agent with income w_i chooses from the family of distributions $\{H^m\}_{m\in(0,1)}$.[12] So, for each agent i, the problem reduces to a restricted version of Kamenica and Gentzkow (2011), in which the sender can commit to only a family of disclosure rules. The optimization problem defines the agent's most-preferred cutoff:

$$m^*(w_i) = \arg\max_{m\in(0,1)} \mathbb{E}_{q\sim H^m}[U(w_i, q)] \tag{14}$$

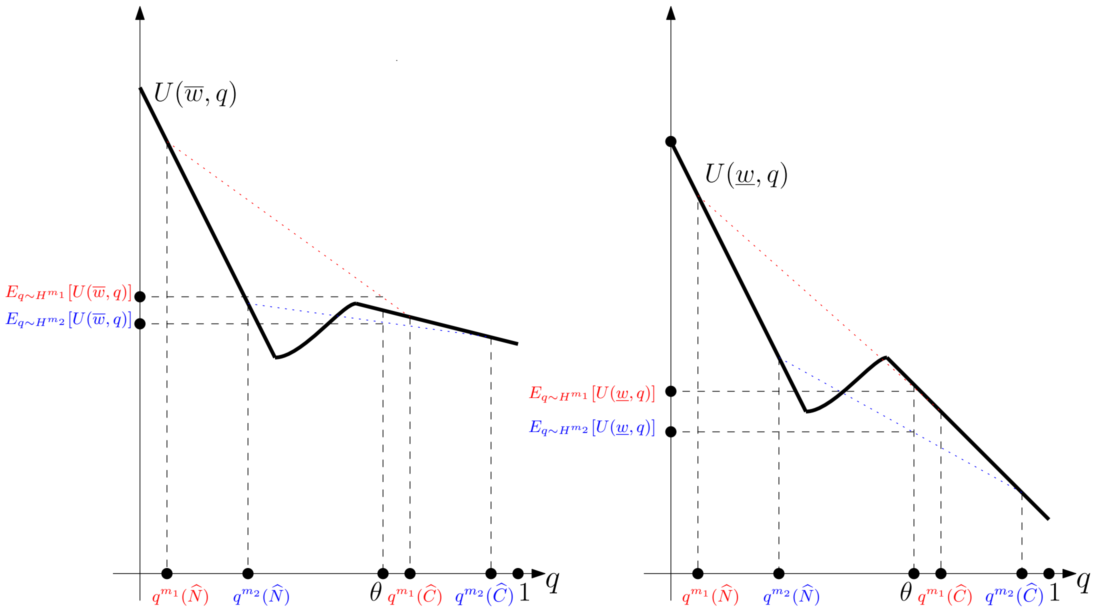
The fact that each agent i that optimizes the media slant has to deal with the families of distributions over potential posteriors (and thus solve the Kamenica and Gentzkow problem) is a direct consequence of the presence of externalities. The agent simultaneously chooses the source of information to base the own compliance decision on and the persuasion mechanism that will keep others at home. Figure 6 illustrates a representative choice for agents between two media cutoffs m_1 and m_2, with $m_1 < m_2$. In this particular figure, both agents prefer m_1 over m_2.

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

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

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

Figure 6: Agents' choices between m_1 and m_2, for $m_1 < m_2$.



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 8 shows that agents' preferences towards a media source's slant is inversely related to their income levels.

Proposition 8. *Suppose the income distribution is given by (9), and (10)-(11) are satisfied. Then,*

(i) $m^*(\underline{w}) \geq_S m^*(\overline{w})$. *That is, low-income agents prefer more slanted media sources compared to high-income agents.*

(ii) $m^*(\overline{w})$ *is decreasing in* $\overline{w}$ *in the strong set order. That is, as the high-income agents' income increases, these agents prefer less slanted media sources.*

Part (i) of Proposition 8 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 $\widehat{s} = \widehat{N}$ 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 $\widehat{s} = \widehat{N}$ report. This is achieved only when $\widehat{s} = \widehat{N}$ 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 non-compliers, low-income agents prefer a media that minimizes the probability of high-income agents not complying. This is achieved only when the $\widehat{s} = \widehat{N}$ 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 8 is reminiscent of Proposition 1 of Suen (2004), and uses a similar proof technique that relies on the submodularity of expected utility in $\overline{w}$ and m. Intuitively, as an agent becomes wealthier, she requires even stronger $\widehat{s} = \widehat{N}$ report not to comply. This translates into a media source with lower m, i.e. one that overstates the coronavirus threat even further.

The proof of Proposition 8 also establishes that $m^*(w_i)$ is independent of $\underline{w}$. Moreover, $m^*(\underline{w}) = [\overline{m}, 1)$ with $\overline{m}$ strictly decreasing in $\overline{w}$. This suggests an easy comparison between the two economies whose income distributions are ranked in the sense of second-order stochastic dominance. In our context, this corresponds to comparing two communities with the same average income, with one income distribution being more unequal than the other.

Proposition 9. *Take two distributions of income $F_1(\cdot)$ and $F_2(\cdot)$ that both satisfy (10) and (11). Suppose $F_1(.)$ second-order stochastically dominates $F_2(\cdot)$: $\alpha \cdot \underline{w}_1 + (1-\alpha) \cdot \overline{w}_1 = \alpha \cdot \underline{w}_2 + (1-\alpha) \cdot \overline{w}_2$, and $\underline{w}_2 < \underline{w}_1 < \overline{w}_1 < \overline{w}_2$. Then,*

$$m_1^*(\overline{w}_1) \geq_S m_2^*(\overline{w}_2) \qquad m_1^*(\underline{w}_1) \geq_S m_2^*(\underline{w}_2)$$

That is, if community 2 has more inequality 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 9 implies that as the distribution of income becomes more unequal, the local media adopts a policy that the "overstates" the coronavirus threat, which implies a higher frequency of $\widehat{s} = \widehat{C}$ reports. This results in $\widehat{s} = \widehat{N}$ reports being sent rarely, but convincingly – convincing enough so that high-income agents do not comply after such reports.

An implication of this reasoning is the following. Suppose the media source chooses some $m \in m^*(\overline{w})$.[13] Then, the occurrence of $\widehat{s} = \widehat{N}$ reports are lower, and the expected non-compliance 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 towards less slanted media may be a driver of this empirical regularity.

6 Conclusion

We present a simple 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. Preferences for non-compliance, which is marginally decreasing with income, influences endogenous media consumption. Individuals for whom non-compliance 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

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

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, 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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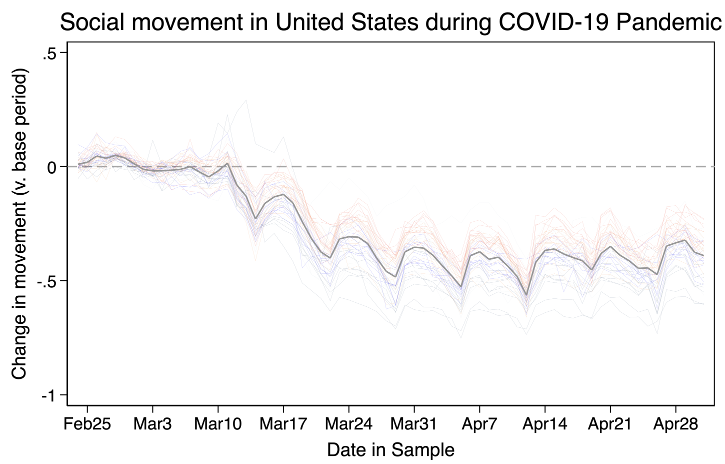
Appendix

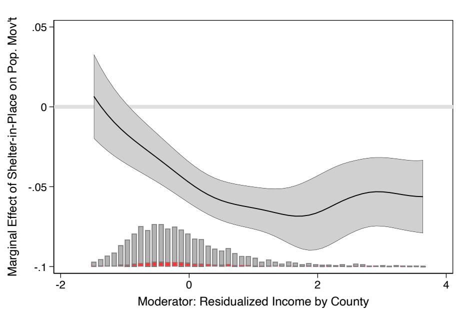
A1 Additional Figures

Figure A-1: Variation in social distancing during COVID-19 pandemic associated with income

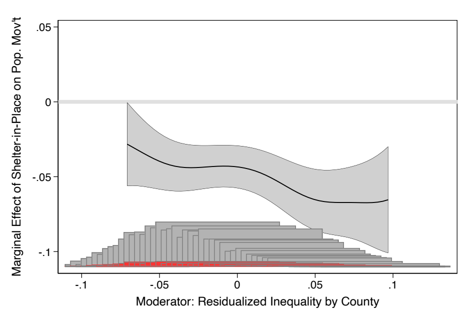


Notes: Trends in social distancing by administrative state plotted for quintiles of the income distribution. Red and orange-red indicate bottom two quintiles of income distribution. Blue and navy indicate top two quintiles. Grey line indicates the grand mean of reduced movement in a given day. Compiled using the 'group_lines' command in Stata. For additional details on data and 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.



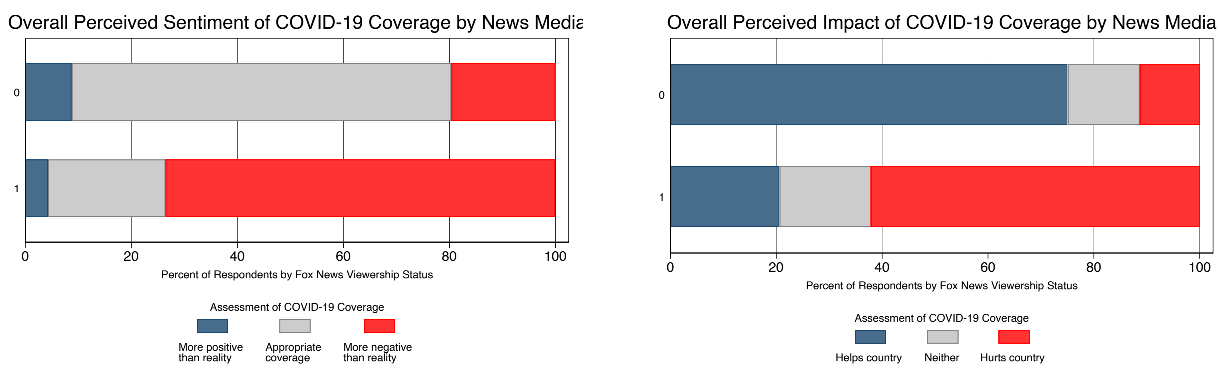
(b) Flexible marginal effects of residualized inequality.

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 from April 20-26, 2020, is particularly useful as it includes information about perceived exaggeration of the COVID-19 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 news coverage is too negative sentiment, inaccurate, or hurts the country. Respondents were asked to given 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 surveys questions are available here: https://pewrsr.ch/2WXCd7i. This data is most useful in assessing the descriptive association between viewership and attitudes towards news coverage of the pandemic. We extend the main figure 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



(a) Sentiment of News Coverage

(b) Impact of News Coverage

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, New York Times). Data drawn from 2020 PEW Research Center's American Trends Panel, Wave 66 (Pathways & Trust in Media Survey). Survey was fielded from 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):

$$\begin{aligned} y_i = \alpha + \beta_1 fox\_news_i + \omega rural_i + \phi region_i + \lambda age_i + \theta sex_i + \kappa educ_i + \delta ethnic_i \\ + \zeta citizen_i + \eta martial\_status_i + \nu religion_i + \epsilon_i \end{aligned} \tag{A1}$$

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 towards 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) News Exaggerates	(2) CDC Exaggerates	(3) Threat Exaggerated	(4) Coverage Too Negative	(5) Coverage Inaccurate	(6) Coverage Hurts Country	(7) Follow COVID Closely	(8) Grasp on COVID Info.
Fox News Viewership	0.811***	0.553***	0.677***	0.571***	0.884***	1.027***	-0.0847***	0.0167*
	(0.0327)	(0.0254)	(0.0219)	(0.0191)	(0.0255)	(0.0267)	(0.0204)	(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 1-4. 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, New York Times). Data drawn from 2020 PEW Research Center's American Trends Panel, Wave 66 (Pathways & Trust in Media Survey). Survey was fielded from April 20-26, 2020. Stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

A3 Proofs

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

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

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 $v(r) > H$ by (1), $q \cdot \Delta p(\gamma^*) \cdot H < v(0 + r) - v(0)$. Since $\lim_{x \to \infty} v'(x) = 0$, $v(w_i + r) - v(w_i)$ converges to zero as $w_i \to \infty$. Then,

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

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

  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,

$$\gamma^* \in [\lim_{w \to w^*-} F(w), \lim_{w \to w^*+} F(w)] \tag{A4}$$

Therefore, in any equilibrium the following must be satisfied:

$$w^* \in [\lim_{w \to w^*+} \omega(q, F(w)), \lim_{w \to w^*-} \omega(q, F(w))] \tag{A5}$$

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 $\lim_{x \to \infty} \omega(q, F(x)) - x < \omega(q, 1) - \lim_{x \to \infty} x < 0$. Therefore, for any $q \in (0,1)$, there is a unique w^* that satisfies

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

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

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

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

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

$$w_1^* = \omega(q_1, \gamma_1^*)$$
$$w_2^* = \omega(q_2, \gamma_2^*)$$

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, towards a contradiction, that $\gamma_1^* > \gamma_2^*$. By (A3):

$$q \cdot \Delta p(\gamma_1^*) \cdot H = v(w_1^* + r_1) - v(w_1^*)$$
$$q \cdot \Delta p(\gamma_2^*) \cdot H = v(w_2^* + r_2) - v(w_2^*)$$

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, towards a contradiction, that $\gamma_1^* < \gamma_2^*$. By (A3) :

$$q \cdot \Delta p(\gamma_1^*) \cdot H_1 = v(w_1^* + r) - v(w_1^*)$$
$$q \cdot \Delta p(\gamma_2^*) \cdot H_2 = v(w_2^* + r) - v(w_2^*)$$

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

$$w_1^* = \omega(q, \gamma_1^*)$$
$$w_2^* = \omega(q, \gamma_2^*)$$

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. □

Proof of Proposition 3. 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),

$$q \cdot \Delta p(\gamma_1^*(q)) \cdot H = v(w_1^*(q) + r) - v(w_1^*(q)) \tag{A6}$$
$$\gamma_1^*(q) \in [\lim_{x \to w_1^*(q)-} F_1(x), \lim_{x \to w_1^*(q)+} F_1(x)] \tag{A7}$$

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

$$q \cdot \Delta p(\gamma_2^*(q)) \cdot H = v(w_2^*(q) + r) - v(w_2^*(q)) \tag{A8}$$
$$\gamma_2^*(q) \in [\lim_{x \to w_2^*(q)-} F_2(x), \lim_{x \to w_2^*(q)+} F_2(x)] \tag{A9}$$

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

$$\hat{\gamma} \equiv \lim_{x \to z-} F_2(x) \tag{A10}$$

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

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

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

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

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

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

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

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

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

   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: $w_1^*(q) \geq z$. By the same argument, (A9) and (A10) imply: $w_2^*(q) \geq z$.

     Our claim is that $\gamma_1^*(q) \geq \gamma_2^*(q)$. Suppose, towards 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: $w_1^*(q) \leq z$. By the same argument, (A9) and (A10) imply: $w_2^*(q) \leq z$.

  Our claim is that $\gamma_1^*(q) \leq \gamma_2^*(q)$. Suppose, towards 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 $\lim_{q\to 1} \gamma_1^*(q) \geq \hat{\gamma}$ and $\lim_{q\to 1} \gamma_2^*(q) \geq \hat{\gamma}$. 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: $w_1^*(q) \geq z$. 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, towards 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 $\lim_{q\to 1} \gamma_1^*(q) \geq \hat{\gamma}$ and $\lim_{q\to 1} \gamma_2^*(q) < \hat{\gamma}$. 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: $w_2^*(q) \geq z$.

     Our claim is that $\gamma_1^*(q) \geq \gamma_2^*(q)$. Suppose, towards 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 $\lim_{q\to 1} \gamma_1^*(q) < \hat{\gamma}$ and $\lim_{q\to 1} \gamma_2^*(q) \geq \hat{\gamma}$. 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: $w_1^*(q) \geq z$.

     Our claim is that $\gamma_1^*(q) \geq \gamma_2^*(q)$. Suppose, towards 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 $q \geq q_1^*$. 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 $v(r) > H$ by (1), 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, $\lim_{q \to 1} \gamma_1^*(q) > F_1(z)$. By the same argument, $\lim_{q \to 1} \gamma_2^*(q) > F_2(z)$. This corresponds to case 2 above, where $q^* = 1$. □

Proof of Proposition 4. 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 non-compliers in equilibrium. To emphasize its dependence on r, denote this threshold by $w^*(r)$. It is given by the indifference condition:

$$v\left(w^*(r) + r\right) - v\left(w^*(r)\right) = q \cdot \Delta p\left(F(w^*(r))\right) \cdot H \tag{A13}$$

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 an agent i in equilibrium is

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

Now,

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

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

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

$$\frac{\partial \mathbb{E}[u_i]}{\partial r} = v'(w_i + r) - q \cdot p_3\left(C, n, F(w^*(r))\right) \cdot H \cdot f(w^*(r)) \cdot \frac{\partial w^*(r)}{\partial r} \tag{A15}$$

Taking the derivative of (A13) with respect to r:

$$v'\left(w^*(r) + r\right) \cdot \left(\frac{\partial w^*(r)}{\partial r} + 1\right) - v'\left(w^*(r)\right) \frac{\partial w^*(r)}{\partial r} = q \cdot \Delta p'\left(F(w^*(r))\right) \cdot H \cdot f(w^*(r) \cdot \frac{\partial w^*(r)}{\partial r} \tag{A16}$$

Recall that $p(C,n,\gamma) = p(C,c,\gamma) + \Delta p(\gamma)$, and therefore

$$p_3(C,n,\gamma) = \underbrace{p_3(C,c,\gamma)}_{\geq 0 \text{ by Assumption 1}} + \Delta p'(\gamma) \geq \Delta p'(\gamma)$$

(A15) then implies:

$$\frac{\partial \mathbb{E}[u_i]}{\partial r} \geq v'(w_i + r) - q \cdot \Delta p'\left(F(w^*(r))\right) \cdot H \cdot f(w^*(r)) \cdot \frac{\partial w^*(r)}{\partial r}$$

Substituting this into (A16):

$$\begin{aligned}\frac{\partial \mathbb{E}[u_i]}{\partial r} &\geq v'(w_i + r) - \left(v'\left(w^*(r) + r\right) \cdot \left(\frac{\partial w^*(r)}{\partial r} + 1\right) - v'\left(w^*(r)\right)\frac{\partial w^*(r)}{\partial r}\right) \\ &= \underbrace{v'(w_i + r) - v'\left(w^*(r) + r\right)}_{>0 \text{ because } w_i < w^*(r)} - \underbrace{\left(v'\left(w^*(r) + r\right) - v'\left(w^*(r)\right)\right)}_{<0} \underbrace{\frac{\partial w^*(r)}{\partial r}}_{>0 \text{ by Proposition 1}} > 0\end{aligned}$$

If w_i is high enough so 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 the 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 the 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

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

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

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

By (1), $v(r) > H$ so that 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 $w_i < \hat{w}$. □

Proof of Proposition 5. Given $q \in (0,1)$, by substituting (5) into the expected utility and using (2),

$$\begin{aligned}a_i^* = n &\iff v(w) - q \cdot (1 - \bar{t}) \cdot \gamma^* \cdot H \leq v(w + r) - q \cdot (1 - \bar{t} + t_i) \cdot \gamma^* \cdot H \\ &\iff t_i \leq \frac{v(w + r) - v(w)}{q \cdot \gamma^* \cdot H}\end{aligned}$$

which implies that in any equilibrium, only the agents with t_i below a threshold t^* non-comply. Therefore, in equilibrium,

$$\gamma^* = \Phi(t^*)$$

and t^* satisfies:

$$q \cdot t^* \cdot \Phi(t^*) \cdot H = v(w+r) - v(w) \tag{A17}$$

Because the left-hand side is strictly increasing in t^*, there is a unique t^* that satisfies (A17) with equality.

To prove the second part, assume towards a contradiction that $\Phi_1(t_1^*) > \Phi_2(t_2^*)$. By (A17),

$$q \cdot t_1^* \cdot \Phi_1(t_1^*) \cdot H = v(w+r) - v(w)$$
$$q \cdot t_2^* \cdot \Phi_2(t_2^*) \cdot H = v(w+r) - v(w)$$

which imply $t_1^* < t_2^*$. But then $\Phi_1(t_1^*) \leq \Phi_2(t_1^*) < \Phi_2(t_2^*)$, a contradiction. □

Proof of Proposition 6. **(i)** As in the proof of Proposition 4, we begin by showing that the preferences over r are single-dipped. Fix $q \in (0,1)$. For any r, by Proposition 5, there is a threshold t^* that distinguishes compliers and non-compliers in equilibrium, given by (A17). Since the left-hand side of (A17) is strictly increasing in t^* and the right hand-side is strictly increasing in r, t^* is strictly increasing in r. Therefore, it has an inverse function $\tau(t)$, which is strictly increasing in t. $\tau(t)$ is the value of r that leaves an agent with $t_i = t$ indifferent between complying and non-complying. If $r > \tau(t)$ the agent does not comply in equilibrium, if $r < \tau(t)$ she complies.

The expected utility of an agent i in equilibrium is

$$\mathbb{E}[u_i] = \begin{cases} v(w) - q \cdot (1-\bar{t}) \cdot \Phi(t^*) \cdot H, & \text{if } r < \tau(t_i) \\ v(w+r) - q \cdot \big((1-\bar{t}) + t_i\big) \cdot \Phi(t^*) \cdot H, & \text{if } r \geq \tau(t_i) \end{cases} \tag{A18}$$

Note that $\mathbb{E}[u_i]$ is continuous in r by Berge's maximum theorem. Now,

- If $r < \tau(t_i)$,

$$\frac{\partial \mathbb{E}[u_i]}{\partial r} = -q \cdot (1-\bar{t}) \cdot \phi(t^*) \cdot \underbrace{\frac{\partial t^*}{\partial r}}_{>0} \cdot H < 0$$

- If $r \geq \tau(t_i)$,

$$\frac{\partial \mathbb{E}[u_i]}{\partial r} = v'(w+r) - q \cdot \big((1-\bar{t}) + t_i\big) \cdot \phi(t^*) \cdot \frac{\partial t^*}{\partial r} \cdot H \tag{A19}$$

Taking the derivative of (A17) with respect to r:

$$v'(w+r) = q \cdot \frac{\partial t^*}{\partial r} \cdot (\Phi(t^*) + t^* \cdot \phi(t^*)) \cdot H$$

Substituting into (A19):

$$\begin{aligned} \frac{\partial \mathbb{E}[u_i]}{\partial r} &= q \cdot \frac{\partial t^*}{\partial r} \cdot (\Phi(t^*) + t^* \cdot \phi(t^*)) \cdot H - q \cdot \big((1-\bar{t}) + t_i\big) \cdot \phi(t^*) \cdot \frac{\partial t^*}{\partial r} \cdot H \\ &= q \cdot \underbrace{\frac{\partial t^*}{\partial r}}_{>0} \cdot \Big(\Phi(t^*) + t^* \cdot \phi(t^*) - \big((1-\bar{t}) + t_i\big) \cdot \phi(t^*)\Big) \cdot H \end{aligned}$$

Therefore,

$$\frac{\partial \mathbb{E}[u_i]}{\partial r} \geq 0 \iff \Phi(t^*) + t^* \cdot \phi(t^*) - \big((1-\bar{t}) + t_i\big) \cdot \phi(t^*) \geq 0$$
$$\iff t_i + (1-\bar{t}) \leq \frac{\Phi(t^*)}{\phi(t^*)} + t^*$$

Since t^* is increasing in r, and since $\Phi(\cdot)$ satisfies (6), the right-hand side is increasing in r. We conclude that $\mathbb{E}[u_i]$ is v-shaped in r: it is first decreasing and then increasing.

Overall, for $r < \tau(t_i)$ $\mathbb{E}[u_i]$ is decreasing in r, and for $r \geq \tau(t_i)$ $\mathbb{E}[u_i]$ is v-shaped in r. Combined with the fact that $\mathbb{E}[u_i]$ is continuous, we conclude that $\mathbb{E}[u_i]$ is single-dipped in r. An agent with t_i then compares her utilities in equilibrium under two extreme cases, $\hat{r} = 0$ and $\hat{r} = r$. When $\hat{r} = 0$, $t^* = 0$ and the utility is $v(w)$. When $\hat{r} = r$, the utility is decreasing in t_i. Therefore, if an agent i with t_i prefers $\hat{r} = r$, then any agent j with $t_j < t_i$ also prefers $\hat{r} = r$. The proof follows.

(ii) The proof of the second part uses notation introduced in Section 5.

For $i \in I$ with t_i, let $m^*(t_i) \in [0,1]$ denote the consumption choice of agent i. In equilibrium, the agent's actions depend on the message sent by the media source: let $a_j^*(\widehat{s})$, $\widehat{s} \in \{\widehat{C}, \widehat{N}\}$ denote these actions.

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

Consider an agent i with t_i, and fix the behavior of other agents. This gives a measure of non-compliers $\bar{\Phi} \in [0,1]$. Therefore, given $q \in (0,1)$, the agent's expected utility is:

$$U(t_i, q) = \begin{cases} v(w+r) - q \cdot ((1-\bar{t}) + t_i) \cdot \bar{\Phi} \cdot H, & \text{if } q \leq q_i^* \\ v(w) - q \cdot (1-\bar{t}) \cdot \bar{\Phi} \cdot H, & \text{if } q > q_i^* \end{cases}$$

where q_i^* satisfies:

$$q_i^* \cdot t_i \cdot \bar{\Phi}(\cdot H = v(w+r) - v(w)$$

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

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

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

$$\begin{aligned} \mathbb{E}_{q \sim H^m}[U(t_i, q)] &= \mathbb{E}_{q \sim H^m}[v(w+r) - q \cdot ((1-\bar{t}) + t_i) \cdot \bar{\Phi} \cdot H] \\ &= v(w+r) - \mathbb{E}_{q \sim H^m}[q] \cdot ((1-\bar{t}) + t_i) \cdot \bar{\Phi} \cdot H \\ &= v(w+r) - \theta \cdot ((1-\bar{t}) + t_i) \cdot \bar{\Phi} \cdot H \end{aligned}$$

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 t_i, the condition $q_i^* > 1$ is equivalent to $t_i < t^*$ for some $t^* > 0$.

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

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

Towards a contradiction, first suppose that $q_i^* < q^{m^*(t_i)}(\widehat{N}) < q^{m^*(t_i)}(\widehat{C})$. Then, repeating the argument above, the agent's expected utility is $\mathbb{E}_{q\sim H^{m^*(t_i)}}[U(t_i, q)] = v(w) - \theta \cdot (1 - \bar{t}) \cdot \bar{\Phi} \cdot H$. But the agent can choose an $m > 0$ small enough such that $q^{m^*(t_i)}(\widehat{N}) < q_i^*$ and obtain an expected payoff of

$$\begin{aligned}
\mathbb{E}_{q\sim H^m}[U(t_i, q)] &= \Pr(q = q^m(\widehat{N})) \cdot [v(w + r) - q \cdot ((1 - \bar{t}) + t_i) \cdot \bar{\Phi} \cdot H] \\
&\quad + \Pr(q = q^m(\widehat{C})) \cdot [v(w) - q^m(\widehat{C})) \cdot (1 - \bar{t}) \cdot \bar{\Phi} \cdot H] \\
&> \Pr(q = q^m(\widehat{N})) \cdot [v(w) - q \cdot (1 - \bar{t}) \cdot \bar{\Phi} \cdot H] \\
&\quad + \Pr(q = q^m(\widehat{C})) \cdot [v(w) - q^m(\widehat{C})) \cdot (1 - \bar{t}) \cdot \bar{\Phi} \cdot H] \\
&= v(w) - \mathbb{E}_{q\sim H^m}[q] \cdot (1 - \bar{t}) \cdot \bar{\Phi} \cdot H \\
&= v(w) - \theta \cdot (1 - \bar{t}) \cdot \bar{\Phi} \cdot H
\end{aligned}$$

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

$$\begin{aligned}
m^*(t_i) = \arg\max_{m\in[0,1]} &(\theta G_C(m) + (1 - \theta)G_N(m)) \cdot \Big(v(w + r) - q^m(\widehat{N})) \cdot ((1 - \bar{t}) + t_i) \cdot \bar{\Phi} \cdot H\Big) \\
&+ (\theta(1 - G_C(m)) + (1 - \theta)(1 - G_N(m))) \Big(v(w) - q^m(\widehat{C})) \cdot (1 - \bar{t}) \cdot \bar{\Phi} \cdot H\Big)
\end{aligned}$$

The first-order condition for this optimization problem yields:

$$t_i \cdot \bar{\Phi} \cdot H = \left(1 + \frac{1 - \theta}{\theta} \frac{g_N(m^*(t_i))}{g_C(m^*(t_i))}\right) (v(w + r) - v(w))$$

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

□

Proof of Proposition 7. 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 (7) and (8), $q^m(\widehat{s})$ 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 (7),

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

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 (8),

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

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 $\frac{\partial q^m(\widehat{N})}{\partial m} \geq 0$.

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

□

Proof of Proposition 8. We start with the most-preferred cutoff of agents with $w_i = \underline{w}$. Define $\overline{m} \in (0,1)$ such that $q^{\overline{m}}(\widehat{N}) = \overline{q}$, i.e.

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

Take any $m \geq \overline{m}$. By monotonicity of $q^m(\widehat{N})$ in m, for all such m, $q^m(\widehat{N}) \geq \overline{q}$. Since $q^m(\widehat{C}) \geq q^m(\widehat{N})$, we also have $q^m(\widehat{C}) \geq \overline{q}$ for all such m. By (13),

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

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

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

which is independent of m. Now, take any $m < \overline{m}$. Once again, by monotonicity of $q^m(\widehat{N})$, $q^m(\widehat{N}) < \overline{q}$ for all such m. Since $q^m(\widehat{C}) > \theta > \overline{q}$, we have $q^m(\widehat{C}) \geq \overline{q}$ for all such m. By (13),

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

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

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

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

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

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

This implies that information obtained under media policy m does not have any value for an agent with $w_i = \overline{w}$, 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 $\sup m^*(\overline{w}) \leq \overline{m}$.

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

$$q^m(\widehat{N}) < \overline{q} < q^m(\widehat{C})$$

Thus, for an agent with $w_i = \overline{w}$, under the media policy $m \in m^*(\overline{w})$, $n \in a_i^*(q^m(\widehat{N}))$ and $a_i^*(q^m(\widehat{C})) = c$. The optimization problem in (14) can then be written as:

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

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

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

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