Media Bias, Investment Costs and Firm Quality in the Market for News

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Abstract

We present a theoretical model that analyzes the interaction between government control or capture and bias in the context of firm quality and investment costs. We endogenously derive a threshold level of firm quality such that when the quality of the firm is equal to or above the threshold, capture leads to smaller bias and higher welfare than under private control when investments are sufficiently costly. Capture, however, always leads to greater bias and lower welfare when the cost of investment is sufficiently low. We also find that media bias obtained under capture and private control converge when investments are sufficiently costly and diverge when they are not. Finally, we show that media bias under capture declines as the cost of investment increases. These findings may explain why the measure of media freedom under capture and private control may diverge when countries are more democratic.

KEY WORDS: *Political economy; Media bias; Media Capture; Firm quality.*
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1 Introduction:

Mass media and extensive news consumption has been the hallmark of democracies and involves a significant portion of a country's population especially across key demographics. Firms that produce news, aside from providing entertainment, inform public opinion about critical issues affecting our world. However, do they provide information of sufficient accuracy to its readers for them to make meaningful decisions about the issues they care about? Evidence based on surveys seem to suggest that a large body of the public do not trust the media and moreover that trust is declining (See Ladd (2012)). Further, Gentzkow et al. (2016) note that different media outlets indeed report facts that align with their political sentiments and thus support one political aisle or the other. For example outlets like *USA Today*, *The Washington Times* etc., present news that align politically to conservatism. Similarly, news outlets like *The New York Times*, *The Washington Post*, *The Wall Street Journal* etc., provide narratives that align more to liberal politics. Since a significant fraction of metropolitan statistical areas are served by a single news outlet (George and Waldfogel (2006), George and Waldfogel (2000) Battaggion and Vaglio (2017)), biased reporting raises serious concerns about the role of media as a watchdog for democracy and fuels the debate about its ramification in politics. Our paper addresses this growing concern over media bias and welfare of the polity both under capture and private control by underlining the role of firm quality and investment costs.[1]

In this paper, we present a model of media freedom along its two dimensions, namely, the incidence of media capture and bias that exploits the role of firm quality. This allows us to contribute to the literature in the following ways: First, it offers a rationale as to why notions about media policy may be quite disparate across developed and developing countries. This is especially relevant in the context of the ongoing debate in current political climates among many developed and developing countries about what constitutes news and how to report it. Second, we endogenously determine a threshold level of firm quality and find that the interaction between capture and bias may change when the

[1] Media capture or simply capture, in our model, refers to the situation where the government bribes the private media to further its own objectives. Private control, on the other hand, refers to the situation where the media firm chooses an editorial policy that maximizes its own profits.

quality of the firm is above this threshold. This allows us to pin down the necessary and sufficient conditions for capture to lead to smaller and greater bias. Third, we explore how the difference between media bias across private control and capture evolves as firm quality changes and underline conditions under which media biases across these alternative regimes may converge and diverge. Our model generates two empirically testable implications: First, it predicts that media bias under capture should be greater relative to that under private control in situations where the cost of investment, or broadly speaking, the cost of taking an action is smaller. Second, it also predicts that the difference between media bias under capture and private control should diverge as countries become more and more democratic. Measures of media freedom across countries over time seem to support these predictions. For instance, consider Figure 1 in which the horizontal axis in Figure 1 measures *polity 2* variable from the Polity IV dataset for years 1993-2014 and ranges from -10 to 10 with higher scores pertaining to more democratic societies. The vertical axis measures media freedom from the Freedom House Press Freedom Score for years 1993-2014 reordered and ranges from 0-100 such that higher scores imply greater media freedom. A vertical line through the cluster plot gives us countries that have different levels of media freedom despite having the same level of democracy or political reality. We observe that the difference between measures of media freedom indeed becomes more pronounced when countries are more democratic.

We analyze a model that has four types of agents: a government, a single private media firm, a journalist and a continuum of citizens (whose size is normalized to one). The government wants citizens to invest in a project and derives a utility for every individual who invests. The state of the economy can be either good (G) or bad (B).[2] Citizens incur a cost to invest in the project and expect a positive return from the investment

[2] It is worthwhile to note that our results carry over if we label the states Y and Z instead of good (G) and bad (B) and citizens gained from investing or taking precautions in one of the states. The media firm, in that case, would carry a bias for the state in which citizens gain from investing or taking a precaution. For instance, if we analyze our model in the context of climate change, then the news media could exhibit a bias that claimed climate change is real and hazardous and citizens stand to gain by taking some precaution if it's true and lose if it's not. Since bias in our model is defined as the probability with which the media firm lies about its signal, our results would still go through regardless of whether the bias was pro-good news or pro-bad news.

only if the state of the economy is good (G). The project does not yield a return in the bad state (B) so citizens, who invest, lose. Agents do not observe the true state of the economy but know the likelihood of the good (G) and the bad (B) state which occur with probabilities θ and $1 - \theta$ respectively.

The media firm hires a journalist who receives a noisy signal about the state of the economy and makes a report.[3] Citizens, who subscribe to the media firm, read the report and update their beliefs about the state of the economy and decide whether or not to invest in the project. Since the government gains when citizens invest, it has an incentive to bribe the media firm to report the good state to influence investment. The media firm decides whether to accept or reject the bribe. If it accepts the bribe then the media firm is captured and its editorial policy furthers the interest of the government. However, if it rejects the bribe then it chooses an editorial policy that maximizes its own profits which we refer to as private control. Bias in the context of our model is defined by the extent to which the media firm lies about its true signal. We assume, without loss of generality, that the media firm never lies about a good signal.[4]

With this setup we analyze and compare the perfect Bayesian Nash equilibrium (PBNE) media bias in mixed strategies and the welfare obtained under capture and private control. Our main findings can be summarized as follows:

(a) First, we endogenously determine a threshold level of signal quality $q^0 \in (0, 1)$ such that for any signal quality equal to or above the threshold, media capture leads to a

[3]The quality of the firm is determined by the precision of the signal received by the journalist about the true state of the economy. We argue that a media firm that employs a journalist with lower signal precision will be less certain of the actual state of the economy and would be of low quality. Consequently, we use quality of the signal received by the journalist and the quality of the firm synonymously.

[4]Following Baron (2006) and Gelbach and Sonin (2014) we assume that the firm truthfully reports its signal $s = g$. Our assumption implies that the bias exhibited by the media firm is pro-good news and citizens potentially benefit from taking some action (investing in the project in the context of this paper) when the state is good. This assumption allows us to retain a key feature of the demand side analysis of media bias where the bias in equilibrium is aligned with citizens' priors.

smaller bias than under private control if the cost of investment is sufficiently high. Media bias under capture is higher otherwise.[5]

(b) Second, we show that media bias obtained under capture and private control converge (diverge) in response to an increase in signal quality when the cost of investment is sufficiently high (low).

(c) Third, we find that welfare under capture is greater than that under private control when the signal quality is above q^0 and the cost of investment is sufficiently high. Welfare under capture is smaller otherwise.

(d) Finally, we find that media bias under capture declines as the cost of investment increases.

Although we cast our model of media bias in terms of pure economic or financial gains/loss that accrue to citizens from investing (depending on the state of the economy), our model remains wide in its scope and can admit many social issues such as the desirability of GMO foods, global climate change etc. Broadly interpreted, the cost of investment captures the cost citizens incur to take an action or a precaution in a given circumstance. The return, on the other hand, captures the benefits that accrue to citizens from taking an action or a precaution against some hazard. Consider the cost of investment or taking some precaution under two scenarios: climate change and GMO. Without loss of generality suppose that $S = G$ implies that man-made climate change and consuming GMO foods are potentially hazardous and $S = B$ implies that both of them are benign. It is worthwhile to note that nothing important hinges on which state is labeled 'good' and which state is labeled 'bad'. Now consider the cost of taking precautionary measures or making an 'investment' against both. Citizens can potentially guard against the hazards of GMO foods by switching to eating organic foods. The cost of guarding against man-made climate change, however, is much more costly because it involves switching to alternative sources of energy like installing solar panels, using electric cars for transportation etc. Evidently the cost of taking precautionary measures against climate change is

[5]In the paper the firm is said to be of high quality when the quality of the signal received by the journalist is equal to or above q^0.

significantly higher than that under GMO. In that context, our model implies that under capture, news pertaining to climate change would be less biased in comparison to news pertaining to GMO, holding everything else constant.[6]

Our model also carries another implication in the context of media freedom across countries. It may be reasonable to expect the cost of investment to decline as countries become more and more democratic. This may occur possibly because they afford a more favorable environment for investments or make it easier to take precautionary measures against potential hazards. Further, one may also expect the quality of the signal received by the journalist to become more precise as countries become more democratic. This may happen because it may be easier for a journalist to gather or verify information when countries are more democratic. Under these assumptions, our model implies that difference between measures of media freedom under capture and private control should be more pronounced as countries become more democratic as depicted in Figure 1.

In the next section we situate our model in the context of the literature on the political economy of media bias. Section 3 lays out the basic model and the payoffs. We explore the demand for news in section 4. Equilibrium bias under private control and capture in analyzed in section 5 and 6 respectively. We compare equilibrium media biases under capture and private control in section 7. Section 8 explores citizens welfare under capture and private control. Conclusions follow in section 9.

2 Related Literature:

The literature on the political economy of media bias is extensive and can be roughly classified along two broad lines; the demand side analysis of media bias and the supply side analysis of media bias. The demand side analysis explains media bias chiefly as the news outlets' response to consumer bias. The bias could arise exogenously as in Mullainathan and Shleifer (2005), Bernhardt et al. (2008) and Duggan and Martinelli (2011). It could also arise from media outlets purposefully biasing their reports in favor of consumer priors

[6]Bias, in this context, refers to the case where the media firm deliberately reports climate change or GMO to be potentially hazardous when they receive a signal to the contrary.

to enhance their reputation as in Gentzkow and Shapiro (2006). In this context they show that a media firm is deemed to be of higher quality when its reports are more consistent with the consumer's prior beliefs. Further, bias could also arise because demand for media varies across groups due to differences in ideological policy preferences as in Strömberg (2004), Dyck et al. (2008). On the supply side of the argument, media bias can arise because of intrinsic biases of newsmakers as in Gabszewicz et al. (2004), Baron (2006) and Puglisi (2011) or the purchase of journalists by special interest groups as in Corneo (2006) and Petrova (2008, 2012) or from the ownership or purchase of media outlets by the state as in Besley and Prat (2006) and Gelbach and Sonin (2014). Media control in dictatorships is examined by Debs (2010), Edmonds (2008), Lorentzen (2013), Egorov et al. (2009).

Our model contributes to the extant body of literature by combining elements of both supply-side and demand-side models of media bias. Media bias, in our model, arises from the perspective of newsmakers, both under private control and capture, but are biased in the direction of citizens' prior beliefs. Following Baron (2006), bias, in our model under private control, arises because the media firm allows the journalist to exercise some bias in her reports in order to pay lower wages. The journalist, on the other hand, biases her report in favor citizens' priors because it allows her to further her career prospects should her reports turn out to be correct. Bias under capture, in our model, arises because the government has an incentive to influence citizens to invest in the project which happens if the reports align with their prior beliefs. Thus the news, both under capture and private control, tend to reinforce what citizens believe. Further, following Baron (2006) and Gelbach and Sonin (2014), we also assume that citizens are Bayesian and update their beliefs about the state of the economy after reading the news. Baron (2006) shows that the media bias under private control is non-trivial and not driven out by the presence of a rival media firm or by a media firm with an opposing bias. Further, he shows that media bias under monopoly may be lower than under competition. Our model is closest to Baron (2006) but differs from his in two important ways: First, we endogenize the role of firm quality and analyze how that affects optimal media bias and welfare under capture and private control which is not investigated in his model. Further, we also underline conditions under which the difference in media bias between capture and private control may converge or diverge which is not explored in his model.

Our model also shares some similarities with Gelbach and Sonin (2014). They highlight the difference in media bias associated with state ownership and indirect state control and show that state ownership of a media firm, directly or indirectly, generally leads to greater bias than under private control. In that context, we underline conditions under which indirect control or capture may lead to smaller bias and higher welfare. Finally, Gelbach and Sonin (2014) show that media bias decreases as countries become more and more democratic because governments care more about its citizens' payoff or the externalities associated with investment as they become more democratic. In that context, we show that media bias under capture decreases when the cost associated with investment increases. Finally, we explore how the difference in optimal media bias under capture and private control may diverge or converge in response to an increase in quality depending on the cost of investment. This line of enquiry may offer a novel explanation as to why the difference between measures of media freedom under capture and private control may be larger when countries are more democratic. We lay out the model in the next section.

3 Model:

We consider an economy with the following set of players: a government, a private media firm, a journalist and a continuum of citizens of size one. The economy can either be in a good (G) or a bad (B) state which is unobservable. We represent the state of the economy by the index $S \in \{G, B\}$. The private media firm hires the journalist to report about the state of the economy. The journalist is assumed to receive an imperfect signal about the state of the economy which is denoted by $s \in \{g, b\}$ where $s = g$ indicates that the state of the economy is good while $s = b$ indicates that the state of the economy is bad. The government wants citizens to invest in a project and receives a utility of φ units for every individual who invests. Citizens are assumed to incur a fixed cost 'c' to invest.

The return on the investment depends on the state of the economy. In the good state, citizens get a return of $X \sim U(0, 2m)$ where m is the average return. In the bad state, the investment yields a return of zero, so that citizens lose c.[7] We assume that citizens only know the likelihood of each state given by $\Pr[S = G] = \theta$ and $\Pr[S = B] = 1 - \theta$. Since no one observes the true state and the government wants citizens to invest, it offers a bribe to the private media firm to capture it. The media firm decides whether or not to accept the bribe and makes a report $r \in \{g, b\}$ indicating the likely state of the economy. Citizens who subscribe to the media firm, after receiving the news about the economy, update their beliefs and decide whether or not to invest. The timeline of the game is as follows:

1. The state of the economy $S \in \{G, B\}$ is realized.
2. The government makes a transfer offer $T \in [0, \infty)$.
3. The media firm accepts or rejects the offer and announces its editorial policy given by: $\Pr[r = g|\ s = b] = \sigma$ and a subscription price p.[8]
4. Citizens subscribe to the media firm.
5. The journalist receives a signal $s \in \{g, b\}$. The quality of the signal is represented by $q = \Pr[s = g|S = G] = \Pr[s = b|S = B] \in (\frac{1}{2}, 1)$ and is assumed to be common knowledge.
6. The media firm reports $r \in \{g, b\}$.
7. Citizens update their beliefs and make investments.
8. Pay-offs are realized.

We lay out the payoff functions of the media firm, the government and the journalist under private control (P) and capture (Gov) represented by the index $i \in \{P, Gov\}$ as

[7]We assume $m > c$ to imply that more than half the population would invest in the project if the good state were certain.

[8]We implicitly assume that citizens do not observe whether the media firm accepts or rejects the bribe.

the case maybe. The media firm maximizes its profit which is given by:

$$\pi^i = (p^i + a)\hat{S}^i - \tilde{w} - K + T \tag{1}$$

where p^i denotes the subscription price and a is the advertising revenue per copy of the newspaper. $\hat{S}^i$ denotes the size of the subscription. Following Rosse and Dertouzos (1978), Strömberg (2004) and Thompson (1989), we assume that the cost of news production is fixed and roughly constant in the long run because the bulk of the cost of making news is involved in producing the first copy. In this context, $\tilde{w}$ captures the net wage paid out to the journalist while K represents other fixed costs associated with producing the first copy.[9] Finally, T^i captures the transfer payment it receives from the government when it is captured. Note that $T = 0$ when the media firm rejects the bribe. Next, we lay out the pay-off function of the government. The government maximizes the following:

$$V^i = \varphi \sum_{j \in \{g,b\}} \Pr[r^i = j] I^i_j - T \tag{2}$$

where φ is the utility it derives for each citizen who invests. Let I^i_j denote the expected number of citizens who invest in the project following a report $r^i = j$ where $j \in \{g, b\}$ under private control (P) and capture (Gov) denoted by or $i \in \{P, Gov\}$. Finally, we lay out the pay-off of the journalist which is given by:

$$\tilde{w} + \Pr[r^i = g]R \geq w_0 \tag{3}$$

The left hand side of inequality (3) represents the payoff from journalism which includes the wage paid by the media firm $\tilde{w}$ and the expected reward from journalism which is represented by $\Pr[r^i = g]R$.[10] The right hand side of the inequality denotes the reservation wage she could have earned elsewhere. Note that a citizen may receive a good report

[9] We assume the cost of journalism is fixed, i.e., independent of number of subscribers. Our results, however, go through even if we relax that assumption.

[10] We assume that $\tilde{w} = w - b_0$ where $b_0 > 0$ represents some basic pay. This assumption ensures that the media firm pays a positive net wage in equilibrium. Our results go through even if $b_0 = 0$.

because of three possibilities: first, the journalist correctly receives a good signal and reports her signal truthfully; second, the journalist incorrectly receives a good signal and reports it truthfully and finally, the journalist receives the correct signal that the state of the economy is bad but lies about her signal.i.e, biases her report. The media firm allows the journalist to exercise some bias in her reports in order to pay lower wages. The journalist, on the other hand, may benefit from biasing her reports in the form of awards, cash prizes, fame, book contracts etc, the monetary value of which is captured by R, should her reports turn out to be true. Since the media firm does not have any incentive to pay the journalist anything over her reservation wage, equation (3) holds with strict equality, i.e., $\tilde{w} = w_0 - \Pr[r^i = g]R$. We now turn to analyze subscription decision from the perspective of citizens.

4 The Demand for News:

In this section, we analyze the subscription decisions made by citizens. Citizens, upon receiving a report $r^i = g$, infer the probability of the state, G, using Bayes' Rule as follows where $i \in \{P, Gov\}$:

$$\begin{aligned} \Pr[S = G|r^i = g] =& \frac{\Pr[r^i = g|S = G] \Pr[S = G]}{\Pr[r^i = g]}, \\ =& \frac{\theta\{q + (1-q)\sigma^i\}}{\theta\{q + (1-q)\sigma^i\} + (1-\theta)\{(1-q) + q\sigma^i\}}. \end{aligned} \tag{4}$$

After reading the report $r^i = g$ and calculating the probability of the true state, citizens invest in the project only if the expected return from the project is greater than the cost of investment 'c'. Let $\bar{X}_g^i$ denote the minimum return that justifies investment for $i \in \{P, Gov\}$ when the media firm reports $r^i = g$. Then $\bar{X}_g^i$ is given by:

$$\begin{aligned} \bar{X}_g^i \Pr[S = G|r^i = g] = c \Rightarrow \bar{X}_g^i =& \frac{c}{\Pr[S = G|r^i = g]}, \\ \Rightarrow \bar{X}_g^i =& c\left[1 + \left(\frac{1-\theta}{\theta}\right) \frac{(1-q) + q\sigma^i}{q + (1-q)\,\sigma^i}\right]. \end{aligned} \tag{5}$$

Similarly, upon hearing a report $r^i = b$, citizens infer the probability of the true state, G, as follows:

$$\begin{aligned} \Pr[S = G|r^i = b] =& \frac{\Pr[r^i = b|S = G]\,\Pr[S = G]}{\Pr[r^i = b]}, \\ =& \frac{\theta(1-q)}{\theta(1-q) + (1-\theta)q} > 0. \end{aligned} \tag{6}$$

Let $\bar{X}_b^i$ be the return that justifies investment following a report $r^i = b$. Then $\bar{X}_b^i$ is given by:

$$\begin{aligned} \bar{X}_b^i \Pr[S = G|r^i = b] = c \Rightarrow \bar{X}_b^i =& \frac{c}{\Pr[S = G|r^i = b]}, \\ \Rightarrow \bar{X}_b^i =& c\left[1 + \left(\frac{1-\theta}{\theta}\right)\frac{q}{(1-q)}\right]. \end{aligned} \tag{7}$$

Note that any citizen with an expected return below $\bar{X}_g^i$ does not invest in the project even following a good report and hence does not have any need for the news. Similarly, citizens with an expected return above $\bar{X}_b^i$ always invest in the project regardless of the news report and therefore also have no need for the news. Now let us turn to analyzing investment decisions in the absence of the news. Without the news, citizens make investment decisions based on their priors. Let $\bar{X}$ be the minimum return that justifies investment in the project. Clearly, $\bar{X} = \frac{c}{\theta}$. Therefore, based on the priors, citizens do not invest in the project if their expected return is below $\bar{X}$. However, citizens with an expected return above $\bar{X}$ always invest. As a consequence, only citizens in the intervals $[\bar{X}_g^i, \bar{X}]$ and $[\bar{X}, \bar{X}_b^i]$ are interested in subscribing to the news.[11] In the interval $[\bar{X}_g^i, \bar{X}]$, citizens invest only if $r^i = g$, therefore the net benefit from subscription, ϕ_g^i, is given by:

$$\phi_g^i = \Pr[r^i = g]\,\Pr[S = G|r^i = g](X - c) - \Pr[r^i = g]\,\Pr[S = B|r^i = g]c - (p^i + d). \tag{8}$$

Recall that citizens do not invest in the project based on the prior in the interval $[\bar{X}_g^i, \bar{X}]$ and therefore do not earn a return. The first two terms in equation (8) represent the

[11] It is easy to check that $\bar{X}_g^i \leq \bar{X} \leq \bar{X}_b^i$.

net return from investing following the news whereas the last two terms within brackets represent the net cost of subscribing to the news (where p^i is the price of the newspaper and d is the cost of delivery). Consequently, a citizen subscribes to the news only if

$$\begin{aligned}\phi_g^i =& \Pr[r^i = g] \Pr[S = G|r^i = g](X - c) - \Pr[r^i = g] \Pr[S = B|r^i = g]c - (p^i + d), \\ \geq& 0.\end{aligned} \tag{9}$$

Therefore, the minimum return required by a citizen to subscribe to the news in the interval $(\bar{X}_g^i, \bar{X})$ is given by:

$$\tilde{X}_g^i = c\left\{1 + \left(\frac{1-\theta}{\theta}\right)\frac{(1-q) + q\sigma^i}{q + (1-q)\sigma^i}\right\} + \frac{p^i + d}{\theta(q + (1-q)\sigma^i)}. \tag{10}$$

It is easy to check that $\tilde{X}_g^i > \bar{X}_g$ for any non-trivial net price of the newspaper which implies that the return from the project needs to be higher to cover for the cost of newspaper subscription. Now let us consider subscription decisions in the interval $[\bar{X}, \bar{X}_b^i]$. Recall that in this interval citizens invest based on the prior and hence citizens get a net return of $\theta X - c$. In this interval, citizens do not invest in the project following a bad report. Therefore, the return from subscription ϕ_b^i in the interval $[\bar{X}, \bar{X}_b^i]$ is captured by:

$$\phi_b^i = \Pr[r^i = g] \Pr[S = G|r^i = g](X - c) - \Pr[r^i = g] \Pr[S = B|r^i = g]c - (p^i + d). \tag{11}$$

Citizens subscribe to the news in the interval $[\bar{X}, \bar{X}_b^i]$ if and only if $\phi_b^i \geq (\theta X - c)$. Note that a rise in the expected return induces citizens to invest in the project regardless of the news report. Let $\tilde{X}_b^i$ be the return for which the citizen is indifferent between subscribing and not subscribing. Algebraically, $\tilde{X}_b^i$ is given by:

$$\begin{aligned}\tilde{X}_b^i =& c\left\{1 + \left(\frac{1-\theta}{\theta}\right)\frac{q}{1-q}\right\} - \frac{p^i + d}{\theta(1-q)(1-\sigma^i)}, \\ =& c\left\{1 + \left(\frac{1-\theta}{\theta}\right)\frac{q}{1-q}\left(1 - \frac{p^i + d}{c(1-\theta)q(1-\sigma^i)}\right)\right\}.\end{aligned} \tag{12}$$

Since $\lim_{q \to 1} \dfrac{q}{1-q} \to \infty$, $\exists$ a $q^0 \in \mathbb{R}$ such that $\tilde{X}^i_b = 2m$ provided $\lambda = \dfrac{p^i + d}{c(1-\theta)q(1-\sigma^i)} < 1$ which holds for a sufficiently large $d \in \mathbb{R}$ for every $a \in \mathbb{R}$.[12] To illustrate, we use a numerical example where $\theta = 0.1$, $m = 10$, $c = 2$, $a = 4$, $d = 4$, $q = 0.6$, $w = 6$ and $R = 10$. In that case $\lambda = 0.17$ and q^0 turns out to be equal to 0.54. Note that $\forall$ $q \in [q^0, 1]$ citizens with an expected return of at least $\tilde{X}^i_g$ subscribe to the news. Therefore, the number of subscribers, $\hat{S}^i$, is given by $\Pr[\tilde{X}^i_g \leq X \leq 2m]$. Further, $\forall q \in [q^0, 1]$ no one invests in the project following $r^i = b$. To see this note that a citizen will invest in the project only if the state is G. As a result, upon receiving a report $r^i = b$, citizens calculate the probability of a good state to be $\Pr[S = G | r^i = b]$. Therefore, a citizen can only make a positive expected return if $Pr[S = G|r^i = b](X - c) - Pr[S = B|r^i = b]c > 0$ which implies that the minimum return that justifies investment following $r^i = b$ is at least $\bar{X}^i_b = c\left\{1 + \left(\dfrac{1-\theta}{\theta}\right)\dfrac{q}{1-q}\right\}$. It is easy to see that $\forall q \geq q^0$, $\bar{X}^i_b > 2m$ which implies that no one invests in the project following $r^i = b$. In essence, when the signal quality is above q^0, the probability that the journalist receives an incorrect signal is so low that citizens cannot gain by investing in the project following a bad report. In other words, citizens take the report $r^i = b$ to be completely credible when $q \geq q^0$. In the context of this paper, we will deem the media firm to be of high quality if its report $r^i = b$ is completely credible. We turn to the supply of news under private control in the next section.

5 The Supply of News under Private Control:

In this section, we formalize the media bias obtained in equilibrium under private control. The media firm chooses an editorial policy that maximizes its profit. Recall from equation (1) we have:

$$\pi^P = (p^P + a)\hat{S}^P - \tilde{w} - K.$$

[12]Note that citizens make subscription decisions taking $p^i + d$, c, q and σ^i as given. Further, it is easy to check that $q^0 = \dfrac{(\frac{2m-c}{c})(\frac{\theta}{1-\theta})(\frac{1}{1-\lambda})}{1 + (\frac{2m-c}{c})(\frac{\theta}{1-\theta})(\frac{1}{1-\lambda})}$.

where

$$\begin{aligned}\hat{S}^P &= \Pr[\tilde{X}_g^P \leq X \leq 2m], \\ &= \left(1 - \frac{c}{2m}\right) - \frac{c}{2m}\left(\frac{1-\theta}{\theta}\right)\frac{(1-q)+q\sigma^P}{q+(1-q)\sigma^P} - \frac{p^P + d}{2\theta m(q+(1-q)\sigma^P)}.\end{aligned} \tag{13}$$

We observe that $\frac{\partial \hat{S}^P}{\partial p^P} = -\frac{1}{2\theta m(q+(1-q)\sigma^P)} < 0$ which implies that a rise in price reduces the expected number of subscribers. Differentiating equation (1) with respect to p^P yields:

$$\frac{\partial \pi^P}{\partial p^P} = \hat{S}^P - \frac{p^P + a}{2\theta m(q+(1-q)\sigma^P)} = 0. \tag{14}$$

Therefore, in equilibrium,

$$\hat{S}^P = \frac{p^P + a}{2\theta m(q+(1-q)\sigma^P)}. \tag{15}$$

It is straightforward to check that $\frac{\partial^2 \pi^P}{\partial {p^P}^2} < 0$. Further, substituting equation (13) in equation (15) and solving for p^P in equilibrium yields:

$$p^{P_*} + d = \frac{1}{2}\left\{2\theta m(q+(1-q)\sigma^P) - cn(\sigma^P) - (a-d)\right\}. \tag{16}$$

where $n(\sigma^P) = \Pr[r^P = g] = \theta\{q+(1-q)\sigma^P\} + (1-\theta)\{(1-q)+q\sigma^P\}$.[13] Plugging equation (15) in equation (1) and using $\tilde{w} = w_0 - n(\sigma^P)R$, we get:

$$\pi^P = \frac{(p^{P_*} + a)^2}{2\theta m(q+(1-q)\sigma^P)} - w_0 + n(\sigma^P)R - K. \tag{17}$$

Let $\nu(\sigma^P) = p^{P_*} + a$ and let $h(\sigma^P) = (q+(1-q)\sigma^P)^{-1}$ Therefore, equation (17) can be rewritten as:

$$\pi^P = \frac{1}{2\theta m} h(\sigma^P)\nu(\sigma^P)^2 - w_0 + n(\sigma^P)R - K. \tag{18}$$

Maximizing π^P with respect to σ^P yields:

$$\frac{\partial \pi^P}{\partial \sigma^P} = \frac{1}{2\theta m}\nu(\sigma^P)\left\{2h(\sigma^P)\nu'(\sigma^P) + \nu(\sigma^P)h'(\sigma^P)\right\} + n'(\sigma^P)R. \tag{19}$$

[13] Going forward, we will restrict our attention to the class of parameter values such that $p^{P_*} + d > 0$.

Further, we find that $\dfrac{\partial^2 \pi^P}{\partial \sigma^{P2}} > 0$. We assume that R is sufficiently large such that $\left.\dfrac{\partial \pi^P}{\partial \sigma^P}\right|_{\sigma^P=0} > 0$. To have a sense of how large the reward from journalism, R, must be, consider the following numerical example where the relevant parameter values are the following: $\theta = 0.1$, $m = 10$, $c = 2$, $a = 4$, $d = 4$, $w_0 = 6$, $q = 0.6$. In that case we find $\left.\dfrac{\partial \pi^P}{\partial \sigma^P}\right|_{\sigma^P=0} > 0$ for any $R > 0.1$ which is reasonable considering that her reservation wage is equal to 6. For our analysis, we will assume that $R > w_0$ which implies that the reward from journalism is larger than her reservation wage. Note that $\left.n(\sigma^P)\right|_{\sigma^P=1} = 1$ which implies that $\left.\tilde{w}\right|_{\sigma^P=1} = w_0 - R < 0$. Since, $\tilde{w} \nless 0$, the firm allows the journalist the maximum allowable discretion given by $\bar{\sigma}$ such that $n(\bar{\sigma}) = \dfrac{w_0}{R}$. Therefore, under private control, the journalist chooses the maximum bias allowed by the media firm which is given by: $\sigma^P = \bar{\sigma} = \dfrac{\frac{w_0}{R} - \{\theta q + (1-\theta)(1-q)\}}{\{\theta(1-q) + (1-\theta)q\}}$. We analyze the supply of news under capture in the next section.

6 The Supply of News under Capture:

In what follows, we analyze the optimal bias under capture. We begin with the investment decisions. Recall that in the interval $[\tilde{X}_g^{Gov}, \bar{X}]$, citizens with an expected return of at least $\tilde{X}_g^{Gov}$ invest in the project only if the media firm reports the economy to be in the good state. Further, in the interval $[\bar{X}, \tilde{X}_b^{Gov}]$, citizens do not invest in the project if the state of the economy is reported to be in a bad state. We have already established that $\tilde{X}_b^{Gov} \geq 2m$ for $q \in [q^0, 1]$, therefore no one in the interval $[\tilde{X}_g^{Gov}, 2m]$ invest following a bad report. As a result, the objective function of the government reduces to the following:

$$V^{Gov} = \varphi n(\sigma^{Gov}) I_g^{Gov} - T. \tag{20}$$

The term $n(\sigma^{Gov})$ in equation (20) is the likelihood of a good report while $I_g^{Gov} = \Pr[\tilde{X}_g^{Gov} \leq X \leq 2m]$ gives the number of citizens who invest in the project following a good report. Recall that the government receives a utility of φ for each citizen who invests in the project. As a result, it is in the interest of the government to maximize expected number of investors. However, since no one invests in the project following a bad report the government pays a bribe, T, to the private media firm to report a good state. Note that citizens who do not subscribe to the news cannot be pursued to invest in the project. We, therefore, turn to subscription decisions. Recall that only citizens with an expected return in the interval $[\tilde{X}_g^{Gov}, \tilde{X}_b^{Gov}]$ subscribe to the news. Since $\tilde{X}_b^{Gov} \geq 2m$, we note that $\hat{S}^{Gov} = I_g^{Gov}$ which is given by:

$$\begin{aligned}\hat{S}^{Gov} =& \Pr[\tilde{X}_g^{Gov} \leq X \leq 2m], \\ =& \left(1 - \frac{c}{2m}\right) - \frac{c}{2m}\left(\frac{1-\theta}{\theta}\right)\frac{(1-q)+q\sigma^{Gov}}{q+(1-q)\sigma^{Gov}} - \frac{p^{Gov}+d}{2\theta m(q+(1-q)\sigma^{Gov})}.\end{aligned} \tag{21}$$

Note that a rise in bias affects the expected number of subscribers in a two of ways. First, a rise in bias, ceteris paribus, makes the news less informative which increases the minimum return required to justify investment. As a consequence, the expected number of subscribers/investors decrease. On the other hand, a rise in bias also reduces the price (by reducing the reliability of the report) which results in an increase in the number of subscribers (by making it more affordable at the margin). The net result depends on relative magnitude of these two effects. As a result, the government first solves for the equilibrium price as a function of bias which yields:

$$\frac{\partial \pi^{Gov}}{\partial p^{Gov}} = \hat{S}^{Gov} - \frac{p^{Gov*}+a}{2\theta m(q+(1-q)\sigma^{Gov})} = 0. \tag{22}$$

The net revenue per subscriber $\nu(\sigma^{Gov})$ given by:

$$\begin{aligned}\nu(\sigma^{Gov}) =& p^{Gov*} + a, \\ =& \frac{1}{2}\left\{2\theta m(q+(1-q)\sigma^{Gov}) - cn(\sigma^{Gov}) + (a-d)\right\}.\end{aligned}$$

As before, let $h(\sigma^{Gov}) = (q + (1-q)\sigma^{Gov})^{-1}$. Consequently, the number of subscribers is given by:

$$\begin{aligned}\hat{S}^{Gov} =& \frac{p^{Gov*} + a}{2\theta m(q + (1-q)\sigma^{Gov})}, \\ =& \frac{1}{2\theta m}\nu(\sigma^{Gov})h(\sigma^{Gov}).\end{aligned} \tag{23}$$

Plugging equation (23) in equation (20) we obtain: Therefore, the optimal bias under capture σ^{Gov*} is obtained by:

$$\sigma^{Gov*} = \underset{\sigma^{Gov}}{\operatorname{argmax}} \left[\frac{\varphi}{2\theta m} n(\sigma^{Gov})\nu(\sigma^{Gov})h(\sigma^{Gov}) - T\right]. \tag{24}$$

A change in bias has two effects. First, it changes the likelihood of a good report which directly impacts the expected number of investors. We call this the 'optimism or pessimism effect' depending on whether the expected number of investors increase or decrease respectively. Second, a change in bias also alters the reliability of the news which we call the 'reliability effect'. A change in reliability alters the expected number of investors in two ways: first, it directly affects the minimum return required to justify investment. Second, it also changes the minimum return by altering the subscription price of the newspaper. The net effect of an increase in bias on the expected number of subscribers depends on the magnitude of the cost of investment. Note that the number of expected subscribers is given by $\nu(\sigma^{Gov})h(\sigma^{Gov})$. It is easy to check that V^{Gov} is strictly concave with respect to σ^{Gov}, therefore, an interior optimum exists and is unique.[14] In the next section we compare media biases across private control and capture and analyze how the spread between the two change in response to increase in the quality of the firm.

[14]Clearly, $\sigma^{Gov} \neq 1$ because if it were so the news would become completely uninformative. As a consequence, citizens will not subscribe to the news which implies that the government loses its instrument with which to pursue citizens to invest.

7 Media Bias under Private Control and Capture:

In this section we compare media biases between private control and capture. We state our results in terms of proposition 1 and 2 below.

Proposition 1: For every $m, a, d \in \mathbb{R}$ and a sufficiently large $R \in \mathbb{R}$, $\exists$ a $\underline{c} \in \mathbb{R}$ such that

(a) $\forall\ c < \underline{c}$, $\sigma^{Gov*} > \bar{\sigma}$ and $\forall\ c \in (\underline{c}, c_0)$, $\sigma^{Gov*} < \bar{\sigma}$,

(b) $\dfrac{d\sigma^{Gov*}}{dc} < 0$ ■

Proof: See Appendix ■

Discussion: Consider the situation where the government is contemplating an increase in bias given that the current magnitude of bias is at the same level as under private control. A rise in bias affects the expected number of investors in two ways: first, it makes a good report more likely which increases the expected number of investors due to the 'optimism effect'. However, recall that a rise in bias also makes the news less reliable which may increase or decrease the expected number of investors depending on the whether the required minimum return increases or decreases. We find that when the investment is sufficiently costly, the minimum return required to justify investment increases which decreases the expected number of investors. Further, we find that the decrease in the expected number of investors due to the 'reliability effect' outweighs the increase in the expected number of investors due to the 'optimism effect'. Essentially, investors are much more sensitive to bias when investments are costly. Consequently, there is a net decrease in the expected number of investors. Since the government utility increases with the expected number of investors, the government reduces its bias in the margin. The exact opposite effect comes into play when the cost of investment is sufficiently low. To put the results into perspective, consider the following examples:

Example 1: Suppose that climate change is man-made and potentially hazardous with some probability. Suppose that under private control, the journalist would bias her report, with some probability, warning citizens against the perils of climate change even when she receives a signal to the contrary. If the cost of taking precautions is not too large, the government may want citizens to undertake precautions to protect them against potential hazards and may err on the side of caution and bribe the private media to claim that climate change is man-made and hazardous. This would represent the case under capture where $\sigma^{Gov} > \bar{\sigma}$. Now consider the situation where the cost of taking precautions is substantial. In this case, the government may bribe the media firm to decrease its bias when there is not sufficient evidence to warrant it. This could represent the case under capture where $\sigma^{Gov} < \bar{\sigma}$.

Example 2: Now consider a scenario where $S = G$ implies that climate change is benign and $S = B$ implies that climate change is real and potentially hazardous. Citizens could potentially gain from using or investing in technologies that rely heavily on fossil fuels which yield a return only if climate change is benign. In this case, if the cost of investing in technologies associated with fossil fuels is sufficiently low the government bribes the private media firm to bias its report and claim that climate change is benign. This scenario would represent the case under capture where $\sigma^{Gov} > \bar{\sigma}$. However, if the cost of investment is sufficiently high then the government could bribe the media firm to reduce its bias which could represent the case where $\sigma^{Gov} < \bar{\sigma}$.

Further, we find that media bias under capture declines as the cost of investment increases. This happens because, holding other things constant, a rise in the cost of investment increases the minimum return required to justify investment. As a consequence, it decreases the expected number of investors. The government counters the fall in the expected number of investors by making the news more reliable, i.e., by reducing bias.

Proposition 2: For a sufficiently large $R \in \mathbb{R}$, $\frac{d\sigma^{Gov*}}{dq} > \frac{d\bar{\sigma}}{dq} \implies \forall c < \underline{c}$, $\sigma^{Gov*} - \bar{\sigma}$ diverges and $\forall c \in (\underline{c}, c_0)$ $\sigma^{Gov*} - \bar{\sigma}$ converges as q increases ■[15]

Proof: See Appendix ■

Discussion: First, consider how a rise in q affects bias under private control. Note that in equilibrium $\tilde{w} = 0$. Further, as q rises, news reports become more reliable which, ceteris paribus, increases the wage $\tilde{w}$ received by the journalist. A higher wage reduces the profit of the firm. As a result, the firm responds by allowing greater discretion to the journalist in order to keep $\tilde{w} = 0$. Now consider what happens when q increases under capture.

In this case, a rise in q affects the expected number of investors in the followings ways; First, a rise in q, ceteris paribus, decreases the probability of receiving a good report which decreases the expected number of investors due to the 'pessimism effect'. Therefore, to counter this the government has an incentive to increase bias. Second, holding everything else constant, a rise in q makes the news more reliable. An increase in reliability affects the expected number of subscribers in two ways: first, it directly decreases the minimum return required to justify investment thereby increasing the expected number of subscribers. This reduces the incentive of the government to increase bias. However, a rise in q also increases the price of the newspaper. As a consequence, there is a decrease in the expected number of investors.[16] The fall in the expected number of subscribers following a price increase prompts the government to increase bias. In the net, we find that the fall in the expected number of subscribers due to the 'pessimism effect' and the rise in price outweighs the increase in the expected number of subscribers because of a rise in q. As a result, the government ends up increasing its bias in equilibrium following a rise in q. Further, we find that if the return to journalism is sufficiently large, then the media firm only needs to increase bias by a small margin to restore $\tilde{w} = 0$ under private control. As a consequence, the increase in bias in response to a rise in quality is greater under capture than under private control.

Recall that when the cost of investment is sufficiently low then bias under capture is

[15] Requiring R to be large is not necessary but sufficient.
[16] Recall that any potential subscriber is also a potential investor.

greater than that under private control. Since bias under capture increases with respect to q, the difference between the bias under capture and private control diverges. However, if the cost of investment is sufficiently high then the difference between the two converges (since $\sigma^{Gov} < \bar{\sigma}$ and the increase in σ^{Gov} in response to q is greater under capture).

As mentioned before, it may be reasonable to expect the cost of investment to decline as countries become more democratic. Further, the quality of the signal received by the journalist may also become more precise as countries become more democratic. In that context, proposition 1 and 2 together imply that the difference between the measure of media freedom under capture and private control should become larger as countries become more and more democratic. This prediction seems to be supported by the data on media freedom and democracy as evidenced by Figure 1. Next, we turn to compare welfare obtained under capture and private control.

8 Welfare:

In this section, we analyze citizens' welfare under private control and capture.[17] We first analyze citizens' welfare under private control. Note that whenever the media firm announces $r^P = g$, citizens with expected returns of $\tilde{X}_g^P$ or above invest in the project. Recall that no one invests following a news report of $r^P = b$ since $\tilde{X}_b^P \geq 2m$. The likelihood of receiving $r^P = g$, given that the actual state is G, is given by $\Pr[r^P = g|S = G]\Pr[S = G]$. Similarly, the likelihood of receiving the same report, given that the actual state is B, is given by $\Pr[r^P = g|S = B]\Pr[S = B]$. Recall that a citizen who invests with an expected return of $X \geq \tilde{X}_g^P$ makes a net gain of $X - c$, following a good report

[17]In the context of the present model, it is worthwhile to note that the government will only compensate the private media firm to the extent of the loss it incurs by not following its profit-maximizing editorial policy which implies that the media firm makes the same amount of profit in both scenarios. As a consequence, welfare comparisons can be carried out by just focusing on citizens' welfare. We assume that the government has all the bargaining power, which maybe appropriate because governments make the laws. Our results, however, would carry over even if that's not the case because of two reasons: first, the division of surplus would not affect equilibrium media bias under capture or private control. Second, the loss in citizens' welfare due to higher bias would outweigh the larger bribe obtained by the media firm. Since the bargaining solution between the media firm and the government does not alter our results, we do not analyze it explicitly in the paper.

$(r^P = g)$, when the actual state is G and a loss of c when the actual state is B. Let W^P denote citizens' expected welfare under private control which is given by:

$$\begin{aligned} W^P =& \Bigg[\Pr[r^P = g|S = G] \Pr[S = G] \int_{\tilde{X}_g^P}^{2m} \frac{X - c}{2m} dX \\ & - \Pr[r^P = g|S = B] \Pr[S = B] \int_{\tilde{X}_g^P}^{2m} \frac{c}{2m} dX \\ & - (p^{P*} + d) \int_{\tilde{X}_g^P}^{2m} \frac{1}{2m} dX \Bigg], \\ =& \frac{\theta}{4m}(q + (1 - q)\bar{\sigma})(2m - \tilde{X}_g^P)^2. \end{aligned} \tag{25}$$

The first term within the square brackets in equation (25) is the expected gains received by citizens who invest following a good report when the actual state is G. The second term, on the other hand, captures losses incurred by citizens who invest following a good report when the actual state is B. The last term represents the welfare cost of subscribing to the news. Similarly, under capture a citizens' expected welfare under capture is given by:

$$\begin{aligned} W^{Gov} =& \Bigg[\Pr[r^{Gov} = g|S = G] \Pr[S = G] \int_{\tilde{X}_g^{Gov}}^{2m} \frac{X - c}{2m} dX \\ & - \Pr[r^{Gov} = g|S = B] \Pr[S = B] \int_{\tilde{X}_g^{Gov}}^{2m} \frac{c}{2m} dX \\ & - (p^{Gov*} + d) \int_{\tilde{X}_g^{Gov}}^{2m} \frac{1}{2m} dX \Bigg], \\ =& \frac{\theta}{4m}(q + (1 - q)\sigma^{Gov*})(2m - \tilde{X}_g^{Gov})^2. \end{aligned} \tag{26}$$

Given the expressions for welfare under private control and capture, we compare welfare between the two scenarios and state our result in proposition 3.

Proposition 3: For every $m, a, d \in \mathbb{R}$ and a sufficiently large $R \in \mathbb{R}$, $\exists$ a $\underline{c} \in \mathbb{R}$ such that $\forall\ c < \underline{c}$, $W^{Gov} < W^P$ and $\forall\ c \in (\underline{c}, c_0)$, $W^{Gov} > W^P$ ■

Proof: See Appendix ■

Discussion: Consider the situation where the cost of investment is sufficiently high. In that case, we observe that the bias under capture is smaller than under private control which implies that citizens are less likely to receive a good report when the actual state is bad which increases the expected return from investment. Further, since the news is more reliable the expected number of investors also increases. As a result, welfare under capture is higher. The exact opposite result is obtained when the cost of investment is lower than the threshold.

9 Conclusion:

We offer a theoretical model to study the interaction between the two aspects of media freedom, namely media capture and bias in the context of a single media firm. We explore how firm quality and the cost of investment impacts the nature of this interaction. Specifically, we endogenously determine a threshold level of signal quality such that for a firm with signal quality above or equal to the threshold, capture may lead to smaller bias and greater welfare if the cost of investment is sufficiently high. However, private control always leads to smaller bias and greater welfare when the cost of investment is sufficiently low. We also find that media bias under capture decreases as the cost of investment increases. This finding generates an empirically testable hypothesis that media bias under capture should be lower in situations where the cost of taking an action or precaution against a potential hazard is higher. Finally, we show that the difference between media bias across capture converges when the cost of investment is sufficiently high and diverges when it is sufficiently low. These findings may explain why the difference between measures of media freedom under capture and private control may diverge when countries are more democratic.

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Appendix:

Proposition 1: For every $m, a, d \in \mathbb{R}$ and a sufficiently large $R \in \mathbb{R}$, $\exists$ a $\underline{c} \in \mathbb{R}$ such that

(a) $\forall\ c < \underline{c}$, $\sigma^{Gov*} > \bar{\sigma}$ and $\forall\ c \in (\underline{c}, c_0)$, $\sigma^{Gov*} < \bar{\sigma}$,

(b) $\dfrac{d\sigma^{Gov*}}{dc} < 0$ ■

Proof (a): Note that using equations (20) and (23) we get that

$$V^{Gov} = \frac{\varphi}{2\theta m} n(\sigma^{Gov})\nu(\sigma^{Gov})h(\sigma^{Gov}) - T. \tag{27}$$

Differentiating equation (27) with respect to σ^{Gov} and evaluating it at $\sigma^{Gov} = \bar{\sigma}$ yields:

$$\left.\frac{\partial V^{Gov}}{\partial \sigma^{Gov}}\right|_{\sigma^{Gov*}=\bar{\sigma}} = \frac{\varphi}{2\theta m}\frac{\lambda_c - \gamma_c}{2(q + (1-q)\bar{\sigma})}. \tag{28}$$

where

$$\lambda_c = \{2\theta m(q + (1-q)\bar{\sigma}) - cn(\bar{\sigma}) + (a-d)\}\, n'(\bar{\sigma}). \tag{29}$$

and

$$\gamma_c = n(\bar{\sigma})\left\{\frac{c(1-\theta)(2q-1)}{q + (1-q)\bar{\sigma}} + \frac{(a-d)(1-q)}{q + (1-q)\bar{\sigma}}\right\}. \tag{30}$$

Now consider λ_c, for every $m, a, d \in \mathbb{R}$ $\exists c_0 \in \mathbb{R}$ such that $\lambda_c = 0 \implies \left.(\lambda_c - \gamma_c)\right|_{c=c_0} < 0$. Since γ_c is increasing in c, $\exists \underline{c} < c_o \in \mathbb{R}$ such that $\lambda_c - \gamma_c = 0$. Therefore, $\forall c < \underline{c}$, $\lambda_c - \gamma_c > 0$ and $\forall c \in (\underline{c}, c_0)$, $\lambda_c - \gamma_c < 0$. Since V^{Gov} is concave in σ^{Gov}, $\lambda_c - \gamma_c > 0 \implies \sigma^{Gov*} > \bar{\sigma}$ and $\lambda_c - \gamma_c < 0 \implies \sigma^{Gov*} < \bar{\sigma}$ ■

Proof (b): Differentiating equation (27) with respect to σ^{Gov} yields:

$$\begin{aligned} D(\sigma^{Gov}) =& n'(\sigma^{Gov})\nu(\sigma^{Gov})h(\sigma^{Gov}) + n(\sigma^{Gov})\left[\nu'(\sigma^{Gov})h(\sigma^{Gov}) + \nu(\sigma^{Gov})h'(\sigma^{Gov})\right], \\ =& 0. \end{aligned} \tag{31}$$

It is easy to check that V^{Gov} is strictly concave with respect to σ^{Gov}. Differentiating equation (31) with respect to c using the implicit function rule gives us the following:

$$D_c dc + D_{\sigma^{Gov}} d\sigma^{Gov} = 0$$

Since V^{Gov} is strictly concave in σ^{Gov}, $D_{\sigma^{Gov}} < 0$. Further, with a little algebra we can show that $D_c < 0$ which yields our desired result■

Proposition 2: For a sufficiently large $R \in \mathbb{R}$, $\frac{d\sigma^{Gov*}}{dq} > \frac{d\bar{\sigma}}{dq} \implies \forall c < \underline{c}$, $\sigma^{Gov*} - \bar{\sigma}$ diverges and $\forall c \in (\underline{c}, c_0)$ $\sigma^{Gov*} - \bar{\sigma}$ converges as q increases ■

Proof: First consider private control. Recall that under private control we have $n(\bar{\sigma}) = \frac{w_0}{R}$ which yields $\bar{\sigma} = \frac{\frac{w_0}{R} - (\theta q + (1-\theta)(1-q))}{(\theta(1-q) + (1-\theta)q)}$. It is easy to check that $\frac{d\bar{\sigma}}{dq} > 0$. Now consider the first order conditions for maximizing V^{Gov} given by equation (31):

$$\begin{aligned} D(\sigma^{Gov}) =& n'(\sigma^{Gov})\nu(\sigma^{Gov})h(\sigma^{Gov}) + n(\sigma^{Gov})\left[\nu'(\sigma^{Gov})h(\sigma^{Gov}) + \nu(\sigma^{Gov})h'(\sigma^{Gov})\right], \\ =& 0. \end{aligned}$$

Dividing equation (31) sides by $n(\sigma^{Gov})\nu(\sigma^{Gov})h(\sigma^{Gov})$ we get:

$$\begin{aligned} D(\sigma^{Gov}) =& \frac{n'(\sigma^{Gov})}{n(\sigma^{Gov})} + \frac{\nu'(\sigma^{Gov})}{\nu(\sigma^{Gov})} + \frac{h'(\sigma^{Gov})}{h(\sigma^{Gov})}, \\ =& 0. \end{aligned} \tag{32}$$

Using the implicit function theorem on equation (31) we get

$$D_{\sigma^{Gov}} d\sigma^{Gov} + D_q dq = 0. \tag{33}$$

which yields $\frac{d\sigma^{Gov}}{dq} = \frac{D_q}{-D_{\sigma^{Gov}}}$. Since V^{Gov} is strictly concave with respect to σ^{Gov}, $-D_{\sigma^{Gov}} > 0$. Therefore, the sign of $\frac{d\sigma^{Gov}}{dq}$ depends on the sign of D_q which is given by:

$$D_q = \frac{d}{dq}\left[\frac{n'(\sigma^{Gov*})}{n(\sigma^{Gov*})} + \frac{\nu'(\sigma^{Gov*})}{\nu(\sigma^{Gov*})} + \frac{h'(\sigma^{Gov*})}{h(\sigma^{Gov*})}\right]. \tag{34}$$

It is easy to check that $\frac{d}{dq}\left(\frac{n'(\sigma^{Gov*})}{n(\sigma^{Gov*})}\right)$ and $\frac{d}{dq}\left(\frac{h'(\sigma^{Gov*})}{h(\sigma^{Gov*})}\right)$ are positive. For a sufficiently large R, with a little algebra we can show that $\frac{1}{-D_{\sigma^{Gov}}}D_q > \frac{d\bar{\sigma}}{dq}$. To see this note that

$$\frac{1}{-D_{\sigma^{Gov}}}D_q = \frac{1}{-D_{\sigma^{Gov}}}Z_0 \tag{35}$$

where

$$\begin{aligned}
Z_0 =& \frac{1}{(q+(1-q)\sigma^{Gov*})^2} - \frac{\theta m + \frac{c}{2}(1-2\theta)}{\nu(\sigma^{Gov*})} \\
&- (\theta m + \frac{c}{2}(1-2\theta))(1-\sigma^{Gov*})\frac{\nu'(\sigma^{Gov*})}{\nu(\sigma^{Gov*})^2} \\
&+ \frac{(1-2\theta)}{w_0}R\frac{n(\bar{\sigma})}{n(\sigma^{Gov*})} \\
&+ \frac{d\bar{\sigma}}{dq}R^2\left(\frac{1-\sigma^{Gov*}}{1-\bar{\sigma}}\right)\left(\frac{n'(\bar{\sigma})}{w_0}\right)^2\left\{\frac{n(\bar{\sigma})}{n(\sigma^{Gov*})}\right\}^2
\end{aligned}$$

It is easy to check that for a sufficiently large $R \in \mathbb{R}$, $\frac{1}{-D_{\sigma^{Gov*}}}Z_0 > \frac{d\bar{\sigma}}{dq}$.[18] Recall from proposition 1 that $\forall c < \underline{c}$, $\sigma^{Gov*} > \bar{\sigma}$ and $\forall c \in (\underline{c}, c_0)$, $\sigma^{Gov*} < \bar{\sigma}$. Therefore $\sigma^{Gov*} - \bar{\sigma}$ decreases (increases) and to the left (right) of $\underline{c}$ ■

Proposition 3: For every $m, a, d \in \mathbb{R}$ and a sufficiently large $R \in \mathbb{R}$, $\exists$ a $\underline{c} \in \mathbb{R}$ such that $\forall\ c < \underline{c}$, $W^{Gov} < W^P$ and $\forall\ c \in (\underline{c}, c_0)$, $W^{Gov} > W^P$ ■

Proof: From equations (25) and (26) we see that

$$W^{Gov} - W^P = \frac{\theta}{4m}\left[(q+(1-q)\sigma^{Gov*})(2m - \tilde{X}_g^{Gov})^2 - (q+(1-q)\bar{\sigma})(2m - \tilde{X}_g^P)^2\right]. \tag{36}$$

Recall that

$$\begin{aligned}
\hat{S}^G =& \Pr[\tilde{X}_g^{Gov} \leq X \leq 2m], \\
=& \Pr[X \leq 2m] - \Pr[X \leq \tilde{X}_g^{Gov}], \\
=& 1 - \frac{\tilde{X}_g^{Gov}}{2m}.
\end{aligned} \tag{37}$$

[18] Note that $q \in [q^0, 1] \implies \nu'(\sigma^{Gov*}) = \frac{1}{2}\left(2\theta m(1-q) - cn'(\sigma^{Gov*})\right) \leq 0$.

Further note that $\hat{S}^{Gov} = \dfrac{p^{Gov*}+a}{2\theta m(q+(1-q)\sigma^{Gov*})}$. As a result we must have:

$2m - \tilde{X}_g^{Gov} = \dfrac{p^{Gov*}+a}{\theta(q+(1-q)\sigma^{Gov*})}$. Further recall that $\dfrac{p^{Gov*}+a}{\theta(q+(1-q)\sigma^{Gov*})} = \dfrac{1}{\theta}\nu(\sigma^{Gov*})h(\sigma^{Gov*})$. After a little algebra we see that equation (27) reduces to:

$$W^{Gov} - W^P = \frac{1}{4\theta m}\nu(\sigma^{Gov*})^2 h(\sigma^{Gov*}) - \frac{\theta}{4m}(q+(1-q)\bar{\sigma})(2m - \tilde{X}_g^P)^2. \qquad (38)$$

Differentiating $W^{Gov} - W^P$ with respect to σ^{Gov*} yields:

$$\begin{aligned}\frac{\partial(W^{Gov}-W^P)}{\partial\sigma^{Gov*}} &= \frac{1}{4\theta m}\nu(\sigma^{Gov*})\left[\nu(\sigma^{Gov*})h'(\sigma^{Gov*}) + 2\nu'(\sigma^{Gov*})h(\sigma^{Gov*})\right], \\ &< 0.\end{aligned} \qquad (39)$$

Since $\nu'(\sigma^{Gov*}) \leq 0$ and $h'(\sigma^{Gov*})$ is decreasing in σ^{Gov*}. Note that $W^{Gov}|_{\sigma^{Gov*}=\bar{\sigma}} = W^P$. Since $\dfrac{\partial(W^{Gov}-W^P)}{\partial\sigma^{Gov*}} < 0$, using proposition 1 we obtain our result ■

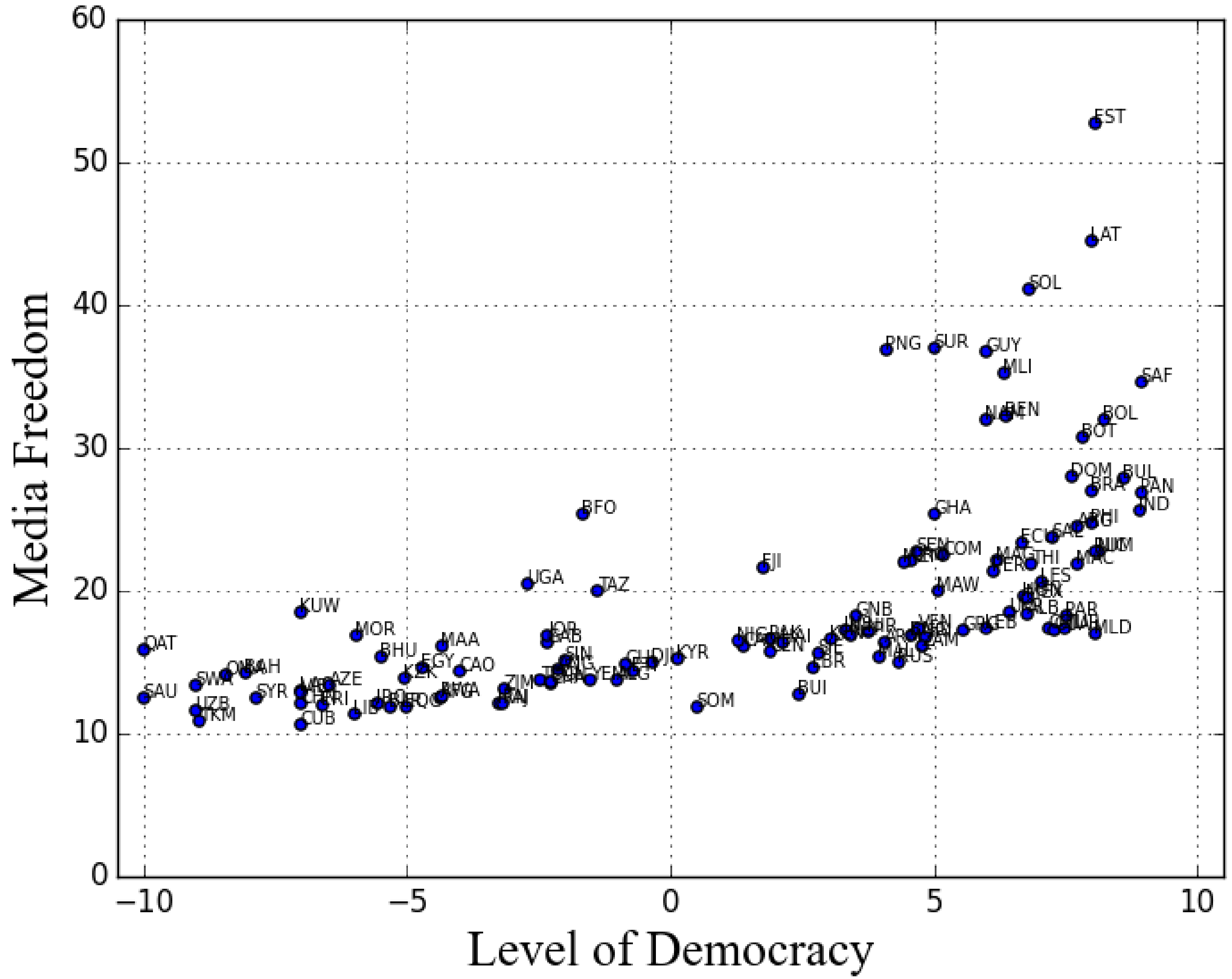

Figure 1: Media Freedom vs Democracy:
The vertical axis measures media freedom reordered such that higher values correspond to higher media freedom (Data on media freedom is obtained from Freedom House Press Freedom Score Data 1993-2014). The horizontal axis measures democracy or the polity score with higher scores representing more democratic societies (Democracy or polity score variable is obtained from Polity IV dataset; years 1993-2014). Following Gelbach and Sonin (2014) we omit countries that have an average polity score of 10 from the graph.