Social Media and Press Freedom

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Abstract

As internet penetration rapidly expanded throughout the world, press freedom and government accountability improved in some countries, while many others experienced a backslide. Combining political agency models with global games, we propose a formal model that provides a mechanism that explains the observed divergent paths of countries. We argue that increased access to social media made partial capture, where governments allow limited freedom of the press, an untenable strategy. By amplifying the influence of small traditional media outlets, higher internet access increases both the costs of capture and the risk that a critical mass of citizens will become informed and overturn the incumbent. Depending on the incentives to retain office, greater internet access thus either forces an autocrat to extend capture to small outlets, further undermining press freedom; or to relieve pressure from others. We relate our findings to the case of Turkey.

Keywords: internet, global games, press freedom, social media.

JEL classification: D72, D73, D8, L82.

The color revolutions and the Arab Spring resulted in the optimistic belief that social media might substitute for traditional media as a watchdog on government wrongdoing (Diamond, 2010; Howard and Hussain, 2013). Once exposed as crooked, citizens might hope to replace corrupt governments, and the prospect of exposure would preempt misconduct (Bennett and Segerberg, 2012; Shirky, 2009). In some democratic settings, this assertion prevailed: greater internet access is indeed associated with better government accountability (Andersen et al., 2011; Lio, Liu, and Ou, 2011). But in autocratic regimes, the internet has been no panacea. Whatever gains the internet helped achieve have been short-lived or far more limited than what earlier accounts suggested. Over the last decade, the hope that the internet would incite a sweeping wave that will overthrow corrupt, repressive autocracies across the world has dwindled (Aday et al., 2013). Many countries instead experienced a deterioration of basic freedoms, such as freedom of the press.

In this paper, we study an autocrat's strategic response to new information technologies that can be used to amplify small voices. Without such technologies, communication between citizens is minimal and an autocrat can confine information to a few independent media outlets and their consumers. The advent of information technologies, in particular social media, enables opponents of the autocrat to spread damaging information to a broad audience. Containment thus becomes futile. An autocrat must then either release control completely, or suppress all criticism. Our model suggests that increased internet access leads to either higher or lower press freedom under different conditions. This is because the internet makes it impossible for incumbents to ignore smaller media outlets.

The core of the argument made in this paper is as follows. Social media catalyze the transmission of information by acting as a conduit between citizens. This amplifies their voices, allowing them to reach much larger audiences at a fraction of the time and cost. The diffusion of the ability to distribute information makes control harder. This poses a threat to autocrats who rely on their control of the flow of information for their survival. In the context of government control of media, or media capture, social media make capture harder in two ways. First, they increase the costs of capture, by increasing the opportunity costs outlets face of suppressing news. The incumbent must then provide stronger incentives to capture media outlets, whether in the form of sticks or carrots. To the extent that these incentives are costly to provide, this pushes the incumbent towards releasing some pressure from media. Second, social media make containment harder. They increase the risk that damaging information will leak and reach a critical mass of citizens who may then overturn the incumbent. This pushes the incumbent towards intensifying pressure, suppressing smaller outlets he previously ignored so that there is no damaging information to spread on social media. Depending on which of these forces dominate, greater internet access may lead to more or less media capture.

This logic explains the pattern that high internet penetration is linked to more extreme press freedom outcomes. Data from 160 countries across 16 years shows that there are few observations of countries with high internet penetration and intermediate levels of press freedom. This is in line with our argument that greater internet access makes partial capture, where the government accommodates some independent media, an untenable strategy. Instead, as internet penetration rapidly rose across the world between 2000 and 2015, countries moved towards either extreme: some experienced an improvement in press freedom outcomes as the costs of pressuring media outlets went up, while in others press freedom deteriorated further as incumbents shut down independent outlets, fearing their news will spread on social media. Controlling for a host of variables and country and year fixed effects, we see that in countries that had a "Free" press at the start of this period, higher internet penetration is associated with more press freedom.[1] In contrast, among the countries that

[1]Freedom House denotes "Free" countries whose press freedom scores are less than 30, "Partly Free" those with scores between 31 and 60, and "Not Free" those with scores 61 and above. Throughout the paper we invert this scale so higher scores refer to more press freedom.

were “Partly Free” in 2000, internet penetration is associated with less press freedom.[2] This is consistent with the intuition that when incentives to stay in office are strong enough relative to the costs of capture, the risk of overturning eclipses higher costs, and greater internet access leads to more capture.

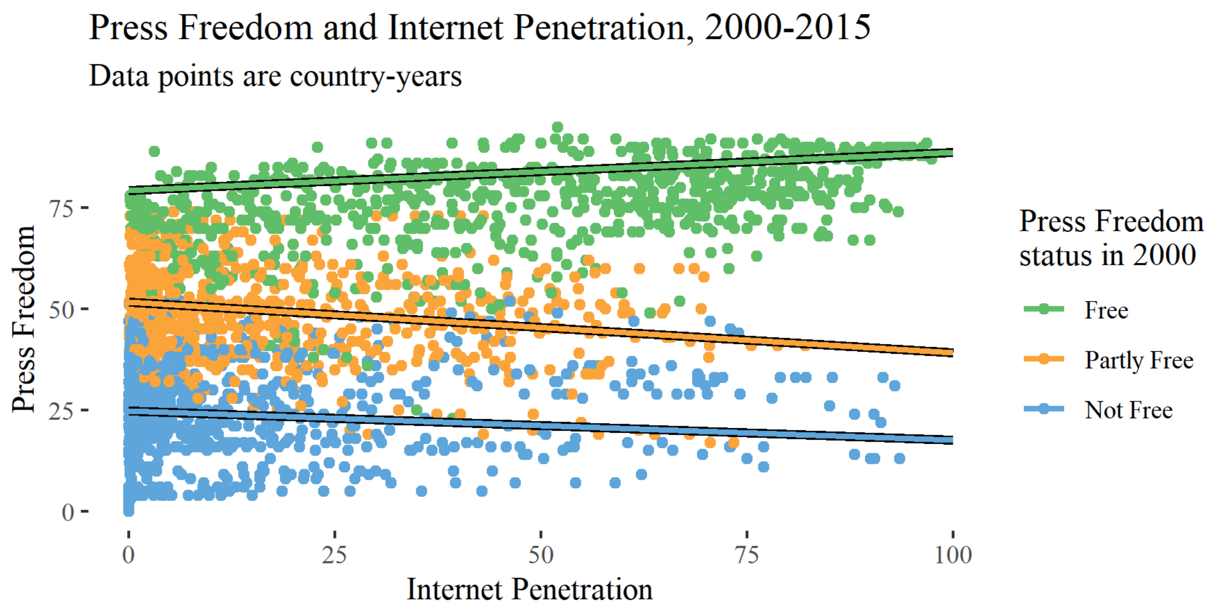

Figure 1: A scatterplot of internet penetration rates and press freedom scores in 160 countries over 16 years. Countries in green had a “Free” press in 2000, yellow “Partly Free”, and blue “Not Free.” Lines correspond to linear fits from regressions with controls and country and year fixed effects. The full set of regression results and details about datasets and empirical specifications can be found in Appendix C.

What explains this observed heterogeneity on the effects of the internet in different contexts? While we agree with the optimists’ premise that the internet is a medium through which information can diffuse, we argue that it also set off a cascade of counterbalancing forces. First, autocrats proved better able to respond to the new reality of the internet than anticipated. Much scholarly attention has focused on internet censorship (King, Pan, and Roberts, 2013; Tufekci, 2017). From blocking websites to deleting posts, incumbent autocrats devised a plethora of methods to subdue the revolutionary potential of social media

[2]The coefficient of internet penetration is negative for countries that were “Not Free” in 2000, but it is not statistically significant at conventional levels.

(Morozov, 2012; Zhuravskaya, Petrova, and Enikolopov, 2020). Second, the prevalence of misinformation resulted in an unprecedented lack of trust online (Invernizzi and Mohamed, 2019). Although less control over content did make it easier for critical news to spread, it also made it easier to transmit sketchy or completely made-up news. With low entry costs and little reputation concerns, many on the internet produced and propagated misinformation. This led to more skepticism, making it easier for incumbents to dismiss damaging information as fake news.

In this paper, we start from these observations and present a model that investigates how the advent of the internet influences the interaction between the incumbent and media. Our model follows the political agency literature (Barro, 1973; Besley and Prat, 2006; Ferejohn, 1986). There is an incumbent whose type is observed by the media outlets but not the voters. Voters want to overturn a bad incumbent, who wishes to remain in office. A bad incumbent may offer transfers to media outlets to suppress information about his type. Media outlets may accept or reject these offers, whose decisions determine what information their followers receive.

The novel contribution of our paper is to model how information can disperse among groups of voters with different signals. This allows us to offer a mechanism that explains the observed heterogeneity in press freedom outcomes. Our main focus is on the case where a minority of voters observe the incumbent's type. Then, the informed minority may choose to spread on social media the signal they received from the informative outlet. This mechanism is motivated by recent empirical work that shows social media are more effective at political persuasion when used to complement traditional media as a signal booster. For example, Reuter and Szakonyi (2015) find that the effect of social media on public awareness of electoral fraud in the 2011 Russian parliamentary election was larger in regions with more press freedom. State-run media—where a majority of Russians got their news from—avoided the issue entirely. Thus, coverage was exclusive to local news outlets with limited reach. Where they could, opposition activists fed more reliable information from these outlets into social media, magnifying their influence. Similarly, Aday et al. (2013) find that content generated by traditional news organizations dominated the online discourse during the Egyptian Uprising. More broadly, Druckman, Levendusky, and McLain (2017) find that "almost half the information that originates from the media passes to the masses indirectly via a diffuse intermediate layer of opinion leaders," consistent with the "two-step flow of communication" hypothesis which posits that media affects behavior mostly via personal influences of the intermediaries (Katz, 1957). We study the interaction of such activists or opinion leaders in a global games framework.

We show that an important parameter in determining the outcome of social media interaction is the level of "connectedness" (Jackson and Yariv, 2007). We take the level of connectedness to be a measure of technological variables such as internet penetration, social media use, the prevalence of mobile devices or other telecommunication technologies; and sociological ones, such as social capital or political trust (Haciyakupoglu and Zhang, 2015). We find that an increase in the connectedness of a country serves to bring in line the information revealed by media outlets in equilibrium. Higher connectedness may free media because it makes capture more costly for the incumbent. When this is the case, all media outlets can publish critical news about the government. However, if rents from staying in office are sufficiently high relative to costs of capture, higher connectedness may instead lead the government to capture smaller media outlets too. This hinders the dissemination of information in the country completely. Thus, our model provides a novel explanation as to why censorship intensified in many autocracies as internet use spread over the last few decades.

The rest of the paper is organized as follows. Section 1 reviews related literature. In section 2, we present the model, and in section 3 we analyze the equilibria. In section 4, we discuss the Gezi Park protests in Turkey in 2013 as a case study for our analysis. Section 5 concludes.

1 Related Literature

This paper contributes to the political economy literature on media capture. In a highly influential paper on the topic, Besley and Prat (2006) assume that the incumbent can make transfers to media outlets to suppress a bad signal they may have about him. They find that plurality in the media can act as a safeguard against media capture.[3] Egorov, Guriev, and Sonin (2009) investigate the relationship between press freedom and resource endowment. They argue that dictators in resource-poor countries rely on an efficient bureaucracy to generate revenue and that free media—while hurting the incumbent's survival—can help the incumbent provide stronger incentives to the bureaucracy. They find strong and robust empirical support to their theory that oil reserves are associated with lower press freedom in non-democracies, whereas this relationship is flat for democracies. Trombetta (2017) studies a model with rationally ignorant voters and shows theoretically and empirically that greater competition in the media industry may make capture easier. Gehlbach and Sonin (2014) examine a setting in which capture can occur in two ways. The government can pay transfers to independent media or seize control. The authors find that controlling for media ownership, higher commercial revenues lead to greater press freedom. But because it can drive the government to nationalize media outlets to save on costs of capture, it may also cause a decline in press freedom. Edmond (2013) studies a noisy signaling model where the incumbent can take a costly action that manipulates the information provided by the media outlets to discourage dissent. He finds that the proliferation of new information technologies has offsetting effects on a bad regime's chances of survival. On one hand, a greater number of outlets that a regime may manipulate leads to public opinion becoming more precise. This makes it easier for the incumbent to induce coordination on the status quo. But this also means that the costly action the incumbent may take is now more costly because there

[3] Sheen (2019) finds that reputation concerns alone can induce the media to be uninformative in equilibrium, even in the absence of capture. Media plurality ameliorates this, but does not ensure truthful reporting.

are more outlets to capture. He argues that unless there are strong economies of scale in information control (*e.g.* radio propaganda in Nazi Germany) an increase in the number of signals makes the regime easier to overthrow, like in the case of social media.

In an early paper that studies the interaction between the internet and press freedom, Petrova (2008) presents a model which suggests that higher internet penetration leads to greater media freedom, and more so in democracies. Using panel data up to 2004, she finds support for her claims in democracies, but not in autocracies. Our results corroborate her findings for democracies but suggest that social media has an opposite, detrimental effect in autocracies. In a related model, Lorentzen (2014) explores the question of how increased access to the internet relates to press freedom in autocracies. In his model, incumbents may allow some degree of freedom to media outlets to keep subordinates in check. He finds that when media are used by the central government as a watchdog for local politicians, as in China, greater internet penetration may lead to lower press freedom under certain conditions. Little (2016) examines the influence of social media on social movements in two different dimensions. The first is the increased precision of beliefs about the level of anti-government sentiment among citizens. Depending on how the real value compares to citizens' priors, social media may increase or decrease protest activity. The latter is the increased ability of citizens to coordinate, which unambiguously increases protest activity. Empirical findings from Russia (Enikolopov, Makarin, and Petrova, 2019) to Egypt (Clarke and Kocak, 2020) support this latter mechanism: both papers find social media was used for coordination by citizens with preexisting grievances towards the government. Similarly, in our model citizens face a problem of coordination despite knowing others share their anti-government sentiments.

2 Model

In this section, we introduce a two-period voting model. Our model is a Bayesian game involving (i) an incumbent politician, I, whose type is private information, (ii) mainstream and the alternative media outlets M and A, and (iii) a unit mass of voters V, divided into two groups as (a) followers of the mainstream media (mainstream voters, V_M) and (b) followers of the alternative media (alternative voters, V_A).[4]

In the first period, the incumbent is exogenously in power, seeking reelection against a challenger. Both the incumbent and the challenger can be one of two types, 'good' or 'bad', denoted $\zeta \in \{g, b\}$. A good executive produces a payoff of one to voters, a bad executive a payoff of zero. The incumbent and the challenger are drawn independently from a common pool, and we denote by γ the prior probability that a politician is good. At the start of the game, the incumbent and media outlets observe the type of the incumbent. The voters can only learn about the incumbent's type before the election through the news reports of the media outlets.

The Mainstream and Alternative media outlets are identical in their strategy sets and preferences. They only differ in their audience size, denoted by σ_k for $k \in \{M, A\}$. At the start of the game, the mainstream outlet reaches a majority of voters $\sigma_M > \sigma_A$, and each voter follows exactly one outlet, $\sigma_M + \sigma_A = 1$. If the incumbent is good, the outlets have no news and publish the null signal, $s_k = \emptyset$ for $k \in \{M, A\}$. If the incumbent is bad, media outlets have a verifiable signal ($s_k = b$) that they can publish and inform their audience of the incumbent's type. Before they make their editorial decisions, however, the incumbent can try to influence them.

[4]Although we restrict attention to the case of two media outlets for ease of exposure, one may readily extend this assumption to any number of media outlets from which the incumbent determines M and A endogenously, as in Trombetta (2017). We could also allow for voters who follow multiple outlets or no outlets at all. Our substantive results would remain unchanged. We stick with this simpler setup for tractability.

Real-world incumbents have a broad set of tools to influence the editorial decisions of media outlets. These tools may be in the form of carrots to outlets who adopt editorial strategies in line with the incumbent's objectives (*e.g.* access, cash transfers, business contracts), and sticks against those who do not (*e.g.* fines, closures). To capture this wide range of possible strategies in a simple way, we model this interaction between the incumbent and the outlets as a bargaining game. After the outlets observe his type, the incumbent can make an offer of a transfer t_k to outlet k in exchange for them suppressing the verifiable signal. Here, a high t_k may correspond to larger monetary transfers paid out to outlets in the case of carrots, or to sparing them from shutting down in the case of sticks. For sake of generality, we impose no structure on the form of these transfers except requiring that stronger incentives to suppress are more costly for the incumbent to provide. This means that, for example, bigger bribes are more expensive to pay out, and shutting down a defiant outlet is more costly than fining it. The outlets observe the offers made to each. They then simultaneously decide whether to publish the news or to suppress them in exchange for transfers from the incumbent. The incumbent and the outlets observe what both outlets publish.

Voters initially only observe the news reported by the media outlets they follow. As in Prat (2018), we assume that there is some rigidity in the media market, and voters do not change the outlet they follow unless they have sufficient reason to believe the other is more informative (Simonov and Rao, 2020). This may be because of habit-formation or because voters consume media mainly for reasons other than informativeness, such as entertainment. Either way, we assume that voters do not seek out another media outlet upon observing the null signal on their own. But they may do so if they see the news shared on social media.

If there are voters who learn the incumbent's type from their outlet, they may share the news on social media, causing some fraction of the uninformative outlet's audience to switch to the informative outlet. This switch decreases the audience share of the uninformative outlet while increasing that of the informative outlet.[5] Thus, an outlet facing an uninformative competitor in equilibrium chooses between the opportunity to steal some market share versus transfers from the incumbent; whereas an outlet facing an informative competitor chooses between holding on to their market share versus receiving transfers but losing some audience to their competitor. The offers to two outlets are made simultaneously, and are unobserved by the voters, as are whether the outlets accept the incumbent's offers. We assume that when indifferent, outlets accept the incumbent's offer. When the audience share of outlet k remains unchanged, we normalize their audience related profits to zero for ease of notation.

If both outlets accept the offer, or if both reject, the game moves to the election stage. If one of the media outlets accepts the offer and the other does not, the followers of the informative outlet (informed voters, or IV) decide whether to share their signal via social media. In this decision, the expressive utility of sharing information about a bad incumbent is weighed against the potential costs of expressing political, anti-government opinions online. Upon receiving the verifiable signal the incumbent is bad, the IV can use social media to propagate it. Depending on the fraction of IV who share the signal, $v \in [0,1]$; and an exogenous parameter we call connectedness, $\theta \in \mathbb{R}$, some uninformed voters switch to the informative outlet, observe the verifiable signal about the incumbent's type, and become informed. The rest of the uninformed voters stay uninformed. We assume that as a result of the social media game the size of IV grows by $q(v,\theta) > 0$, where q is continuous and strictly increasing in both arguments.

We use the term connectedness to refer to both technological factors such as internet penetration, and to social factors that influence the likelihood with which messages reach voters

[5] For example, in Fujimori's Peru, after one small TV channel started broadcasting a video documenting corruption around the clock, many consumers switched to this more informative outlet. Larger media outlets on the government's payroll soon followed suit to stem the loss of their market share (McMillan and Zoido, 2004).

with different political leanings on a network, such as political trust and the prevalence of fake news. We take connectedness to be a random variable of the form $\theta = \mu + \varepsilon$.[6] Since technological variables are measured relatively precisely, we can interpret the expected level of connectedness, $\mu \in [0,1]$, to be equal to the level of internet penetration. The error term, drawn from a normal distribution with mean zero and precision α (*i.e.* variance $1/\alpha$), can be interpreted as the uncertainty regarding social factors that influence information flows through the social network. Furthermore, to capture the different online experiences individuals have depending on their social networks, we assume that each IV i receives a private signal regarding the level of connectedness. This can be interpreted as the volume and content of activity they observe on their social media feeds and the inferences they make from them about overall connectedness in the society. This signal is of the form $x_i = \theta + \epsilon_i$, where ϵ_i is a random draw from a normal distribution with mean zero and precision β. Conditional on θ, the signals are independent and identically distributed across voters, and μ, α, and β are all common knowledge. We assume that the incumbent and the media outlets rely on the common prior when they make decisions.[7]

The fraction of IV who shares the news is determined in equilibrium. There are costs associated with sharing the bad signal about the incumbent, given by the expression $c(1-\nu)$. This refers to punishments imposed by the government, such as fines or imprisonment. We assume that the costs are decreasing in the ratio of IV who share the news. This is because the probability that any given user is singled out for punishment falls as more people take an action. The non-negative constant c captures the severity of the punishment and might range from zero (*e.g.* no punishment), to relatively low (*e.g.* getting fired from public service)

[6]See Kim, Londregan, and Ratkovic (2019) for a microfoundation of θ.

[7]This assumption is sufficient to avoid the multiplicity of equilibria that would arise because of the informativeness of equilibrium strategies of the incumbent and media outlets if they had information that voters do not. See Angeletos, Hellwig, and Pavan (2006) for a discussion on signaling in global games.

to extremely high (*e.g.* death).

There is also a benefit that informed voters derive from sharing information via social media, which we assume to be linearly increasing in connectedness for the sake of simplicity. This benefit may be in the form of material gain where more clicks correspond to larger advertisement revenue. It may also be in the form of expressive or glow utility derived from sharing one's political opinion with an audience. Regardless, when connectedness increases, an informed voter can reach a larger audience and therefore derives a larger utility (Manacorda and Tesei, 2020). The utility of sharing is thus $\theta - c(1-v)$, and the utility of refraining is normalized to zero.

At the final stage of the game, voters vote either for the incumbent or a challenger of unknown type. The candidate who receives more than half of the votes wins. Reelection yields a profit of $r > 0$ to both types of incumbents. Thus the payoff of the incumbent is $r - \sum_{k \in K} t_k$ if he is reelected, and $-\sum_{k \in K} t_k$ if he is not, where K is the set of media outlets who accept the incumbent's offer.

3 Analysis

In this section, we solve the game step by step. Our solution concept is perfect Bayesian equilibrium in undominated strategies. Section 3.1 solves for optimal voting behavior as a function of beliefs, section 3.2 solves for optimal sharing on social media, section 3.3 solves for the interaction between the incumbent and the media outlets, section 3.4 summarizes the unique equilibrium of the game, and section 3.5 presents comparative statics.

3.1 Equilibrium Voting Behavior

For a voter who observes that the incumbent is bad (*i.e.* $s_i = b$), the expected utility of reelecting the incumbent is zero; bad signals are verifiable and all voters who observe them believe that the incumbent is bad with probability one. The expected utility of electing a challenger of unknown type is equal to the probability that the challenger is good, γ, regardless of the signal observed. Because we are looking at equilibria in undominated strategies, any voter who receives the signal that the incumbent is bad votes against the incumbent. On the other hand, if a voter observes no signal (*i.e.* $s_i = \emptyset$), she believes that the incumbent is good with probability weakly greater than γ. This is because observing the null signal is never *more* likely when the incumbent is bad. Thus, a voter who receives the null signal votes for the incumbent.[8]

Therefore, any voter who observes the signal that the incumbent is bad votes for the challenger, and any voter who does not observe any signal votes for the incumbent. The only means by which the voters can observe the incumbent's type is through the media outlets. Because $\sigma_M > \sigma_A$, when they vote together, the votes of V_M are decisive in an election. Hence, the outcome of the elections ultimately boils down to whether V_M receive any signal about the type of the incumbent.

If the mainstream outlet publishes the news that the incumbent is bad, the incumbent loses the election with certainty. If neither M nor A publishes, then all voters vote for the incumbent and he wins the election. If only the alternative outlet publishes and the mainstream outlet suppresses, then the outcome of the elections depends on the outcome of the social media game. This is summarized in Table 1.

[8]That the voter votes for the incumbent when the posterior belief after observing the null signal is strictly greater than γ is obvious. To see why in equilibrium she must also vote for the incumbent when the posterior on the incumbent is equal to the prior on the challenger, suppose that she votes for the challenger. Then the incumbent would have no incentive to offer positive transfers to the media outlets, which would mean that outlets would always publish the bad signal. Then, observing the null signal implies the incumbent must be the good type with probability $1 > \gamma$, a contradiction.

	A publishes	A does not publish
M publishes	Challenger elected	Challenger elected
M does not publish	Social media game	Incumbent reelected

Table 1: Media outlets' strategies result in different electoral outcomes.

3.2 Equilibrium Information Sharing on Social Media

If only the voters who follow the mainstream outlet are informed, then whether news spread through social media does not affect the outcome of the elections. This is because the challenger always wins when a majority of voters know the incumbent is bad. Thus, it is never optimal for the bad incumbent to only capture the alternative outlet, as this would mean paying transfers to the alternative outlet and losing the election. It follows that in equilibrium, it cannot be the case that V_M are informed and V_A are not. Therefore, we restrict attention to the inverse case where V_A are informed and V_M are not.

Consider an informed voter $i \in V_A$ who has learned via the alternative outlet that the incumbent is bad. Given the prior distribution of connectedness, the distribution of private signals, and the signal x_i informed voter i has received, her posterior belief is such that θ is distributed normally with mean: $\rho_i = \mathbb{E}[\theta|x_i] = \frac{\alpha\mu+\beta x_i}{\alpha+\beta}$ and precision $\alpha+\beta$ (DeGroot, 2005).

The informed voters' decision on whether to share the news or not depends on the relative payoffs of the two. Within the social media game, the expected utility gain of sharing for an IV is $\text{EU}_i(\text{share}|x_i) - \text{EU}_i(\text{refrain}|x_i) = \rho_i - c(1-\nu)$.[9]

There are three intervals in which we examine the best response of an informed voter:

- When $\rho_i < 0$, the expected utility of sharing is negative regardless of the actions of the other IV. Thus, refraining is a strictly dominant strategy.

- When $\rho_i \in [0, c]$, neither strategy is strictly dominant. The optimal strategy depends

[9] We assume that the informed voters who share the signal on social media incur the costs of sharing before the election. Assuming that costs are incurred after the election and only if the incumbent stays in power would complicate the algebra but not qualitatively change any of our results.

on players' beliefs on the value of connectedness and other players' strategies.

- When $\rho_i > c$, the expected benefit of sharing is always greater than its cost regardless of what the other IV do. Thus, sharing is a strictly dominant strategy.

A pure strategy for an IV in the social media game is a function specifying an action for each possible posterior, that is to say, $s_i(\rho_i) \in \{\text{share, refrain}\}$ for all ρ_i. Because the benefit of sharing is monotonic in the posterior on connectedness, threshold strategies are natural candidates for equilibrium. Here, if an IV shares the news at posterior expectation $\hat{\rho}$, she should share it at any $\rho \geq \hat{\rho}$. As shown below, in equilibrium each informed voter shares when their posterior expectation of connectedness is higher than some threshold ρ^* and refrains when it is lower.

Because the preferences of informed voters are identical, when they use a threshold strategy their thresholds must be equal. We show this is indeed the case, and that such a strategy profile is the only profile that survives iterated elimination of strictly dominated strategies. Consider an IV whose posterior expectation is exactly equal to ρ^*, the threshold. This means that she must be indifferent between sharing and refraining. This holds only when the expected benefit of sharing equals its expected cost, and so $\rho_i = c(1-\nu)$. To find the threshold, we must first calculate the expected value of ν in equilibrium: the expected proportion of IV who share the news on social media conditional on the posterior expectation ρ^*.

Lemma 1. *An IV i with posterior ρ_i believes that a fraction $1-\Phi\left(\sqrt{\eta}(\rho_i-\mu)\right)$ of other IVs share the news on social media in equilibrium, where Φ denotes the cumulative distribution function of the standard normal distribution and $\eta = \frac{\alpha^2(\alpha+\beta)}{\beta(\alpha+2\beta)}$.*

Proof. All proofs are in Appendix B. □

By the above lemma, for an IV whose posterior is equal to the threshold ρ^*, it must be that $\mathbb{E}[\nu] = 1-\Phi\left(\sqrt{\eta}(\rho^*-\mu)\right)$. This means that the equilibrium threshold must satisfy

$\rho^* = c\left(1 - \left[1 - \Phi\left(\sqrt{\eta}(\rho^* - \mu)\right)\right]\right)$, or equivalently:

$$\rho^* = c\Phi\left(\sqrt{\eta}(\rho^* - \mu)\right). \tag{1}$$

Note that both sides of the above equation are increasing in ρ^*. For there to be a unique threshold where the IV choose to share if and only if their posterior is greater, the two sides of the above equation must cross exactly once. The slope of the left-hand side is one. The slope of the cumulative distribution function of the standard normal distribution is maximized when the probability distribution function is evaluated at its mean, at $\frac{1}{\sqrt{2\pi}}$. Thus, the slope of the right-hand side is at most $\frac{c\sqrt{\eta}}{\sqrt{2\pi}}$. We henceforth assume this is less than one, a sufficient condition for the uniqueness of ρ^*.

Proposition 1. *There is a unique equilibrium of the social media game. In this equilibrium, every IV shares the information on social media if and only if their posterior is greater than the threshold ρ^* that solves the indifference condition in Equation (1).*

In the unique equilibrium of the social media game, every IV whose posterior is greater than ρ^* share the news on social media, and every IV whose posterior is below refrain from sharing. It is clear from Equation (1) that ρ^* is increasing in c, meaning that greater the costs associated with sharing anti-government news on social media, fewer informed voters do so. This is not very surprising. The more important observation from Equation (1) for our purposes is that ρ^* is decreasing in μ. This means that a larger fraction of informed voters share the news on social media as internet penetration goes up, holding everything else constant. Thus, in addition to the first-order effect of increasing the value of sharing for each informed voter, higher connectedness has a positive second-order effect on sharing due to strategic complementarity (Granovetter, 1978; Jackson and Yariv, 2007).[10]

Given the level of internet penetration, μ, we denote by $p(\mu) = \Pr(\sigma_A(1 + q(\theta)) > 1/2|\mu)$,

[10]Because q is increasing in both μ and ν, and ν is increasing in μ, we note that q is increasing in μ and henceforth suppress the ν in q and write $q(\mu) \equiv \mathbb{E}[q(\nu(\theta), \theta)|\mu]$.

the probability that a subset of V_M large enough to overturn the bad incumbent is convinced to switch to the informative outlet and become informed themselves. Since θ is distributed normally with mean μ and precision α, we can write this as:

$$p(\mu) = 1 - \Phi\left(\left(q^{-1}\left(\frac{1/2 - \sigma_A}{1 - \sigma_A}\right) - \mu\right)\alpha\right). \tag{2}$$

This is the probability of overturning if the game reaches the social media stage. It can be seen from Equation (2) that this probability is increasing in internet penetration. In the next subsection, we study the implications of this finding for press freedom.

3.3 Equilibrium Media Capture

The payoff of a media outlet depends not only on its action but also on whether the other outlet publishes or not. When both outlets publish, they receive a normalized payoff of zero. When one publishes and the other suppresses, the former's audience share grows by fraction $q(\theta)$ as a subset of the latter switch to it after being convinced on social media. The payoff of an outlet k that publishes is thus:

$$\mathrm{EU}_k(\text{publish}) = \begin{cases} 0, & \text{if } -k \text{ publishes} \\ \sigma_k q(\mu), & \text{if } -k \text{ suppresses} \end{cases}$$

When instead an outlet suppresses, its payoff is the transfer offered by the incumbent minus some audience share lost if the other outlet publishes the news:

$$\mathrm{EU}_k(\text{suppress}) = \begin{cases} t_k - \sigma_{-k} q(\mu), & \text{if } -k \text{ publishes} \\ t_k, & \text{if } -k \text{ suppresses} \end{cases}$$

In equilibrium, when a media outlet is indifferent between accepting or rejecting an offer by the incumbent, it accepts. Thus, making an offer to an outlet that is strictly greater than its opportunity cost is strictly dominated for the incumbent. Moreover, capturing A only is a dominated strategy because it would lead to the bad incumbent paying transfers and still losing the election. Thus, the incumbent never makes such an offer in equilibrium. Finally, making an offer that an outlet would reject in equilibrium is equivalent to offering zero. These are summarized in the following lemma:

Lemma 2. *The incumbent's equilibrium strategy is equivalent to one of the following:*

1. *Offer* $t_M = \sigma_M q(\mu)$ *and* $t_A = \sigma_A q(\mu)$ *(complete capture)*
2. *Offer* $t_M = \sigma_A q(\mu)$ *and* $t_A = 0$ *(partial capture)*
3. *Offer* $t_M = 0$ *and* $t_A = 0$ *(no capture)*

When both media outlets are captured, the bad incumbent is reelected for certain, but he has to pay transfers to both outlets. When only M is captured, the transfers are lower and the incumbent is reelected with probability $1 - p(\mu)$. And when neither outlet is captured, the bad incumbent does not pay any transfers but is certainly overturned.

Lemma 3. *The expected payoff of the bad incumbent from the strategies described in Lemma 2 are:*

$$\begin{aligned}
\mathrm{EU}_I(\textit{complete capture}) &= r - q(\mu) \\
\mathrm{EU}_I(\textit{partial capture}) &= r(1 - p(\mu)) - \sigma_A q(\mu) \\
\mathrm{EU}_I(\textit{no capture}) &= 0
\end{aligned}$$

3.4 Equilibrium

The equilibrium of the game is summarized here. We state it formally in Appendix A.

Any voter who learns the incumbent is bad believes that the incumbent is bad, and votes for the challenger. Any voter who does not observe a signal about the incumbent's type believes that the incumbent is at least as likely to be good as a challenger, and votes for the incumbent. Voters who observe that the incumbent is bad may share their signal on social media. The informed voters whose posterior beliefs on connectedness are higher than the threshold in Equation (1) share and others refrain. The level of connectedness thus determines the costs of capture and the probability of overturning. Given these, the incumbent chooses which outlets to capture, if any, maximizing his expected utility as described in Lemma 3. The media outlets accept any offer from the incumbent that is at least as high as the expected change in commercial revenues.

3.5 Comparative Statics

The equilibrium level of press freedom depends on the incumbent's strategies summarized in Lemma 3. When the probability $p(\mu)$ that the signal about the incumbent's type spreads to a critical mass of voters is zero, complete capture is never optimal. Substantively, if the incumbent has little reason to fear his supporters switching to an antagonistic outlet, our model suggests that he prefers to confine pressure to the mainstream outlet only. This would be true when there are few means of communication between citizens or when such communications are often dismissed due to a lack of trust. Here, partial capture allows the incumbent to keep a greater share of extracted rents for himself. In contrast, when $p(\mu) \geq \sigma_M$, partial capture is never optimal because the risk of overturning is too high. When this is the case the incumbent effectively chooses between no capture and complete capture.

In between these two extremes, when $0 < p(\mu) < \sigma_M$ all three strategies are viable. The incumbent's optimal strategy then depends on the relative costs of capture, $q(\mu)$; the probability of overturning under partial capture, $p(\mu)$; and office rents, r. Specifically, for sufficiently low rents from office, $r < \frac{\sigma_A q(\mu)}{1-p(\mu)}$, no capture is optimal for the incumbent, because the payoff of holding office does not cover the costs of capture. For sufficiently high rents, $r > \frac{\sigma_M q(\mu)}{p(\mu)}$, the incumbent prefers complete capture, because the payoff of holding office is too high to risk overturn. For intermediate values of rent, the incumbent prefers partial capture. Figure 2 shows these different regions of the incumbent's optimal strategies as a function of office rent.

Given the incumbent's equilibrium strategies, we can derive the primary comparative statics of our model: the effect of internet penetration on press freedom. It can be seen from Lemma 3 that the incumbent's payoffs from both complete and partial capture are decreasing in internet penetration. Intuitively, this is because the probability of news spreading via social media goes up when internet penetration rises, which increases both the risk of overturning and the costs of capture. This means that when rents from staying in office are low, an increase in internet penetration may free the media by making capture too costly for the incumbent.

The effect of a rise in internet penetration on the relative payoffs of complete capture versus partial capture is less obvious. On one hand, greater internet penetration pushes the incumbent towards complete capture because it increases the risk of overturning if the social media game is played. But it also makes complete capture less attractive because outlets' opportunity cost of suppressing increases as their potential market gain grows. Thus, it becomes more costly for the incumbent to capture both outlets. Whether the risk effect or the cost effect dominates depends on the following condition:

Condition 1. $\frac{d\frac{p(\mu)}{q(\mu)}}{d\mu} > 0$.

Condition 1 implies that the risk of overturning increases faster than the cost of capture as connectedness goes up. When this is the case, an incumbent who prefers partial capture may switch to complete capture as internet penetration increases. Thus, the set of rents for which the incumbent chooses partial capture shrinks as μ goes up, forcing an incumbent who previously preferred partial capture to either switch to complete or no capture. Figure 2 provides a visual representation of these forces at work.

When Condition 1 holds, the effect of social media on press freedom is ambiguous. Increased internet penetration may improve press freedom, as the risk of overturn becomes too high, and capture too expensive, for the incumbent to continue pressuring the mainstream outlet. But it may also have the opposite effect: It may induce incumbents to increase their hold on media by capturing alternative outlets too to ensure news cannot spread via social media. Figure 3 presents a simulation that captures the relationship between internet pen-

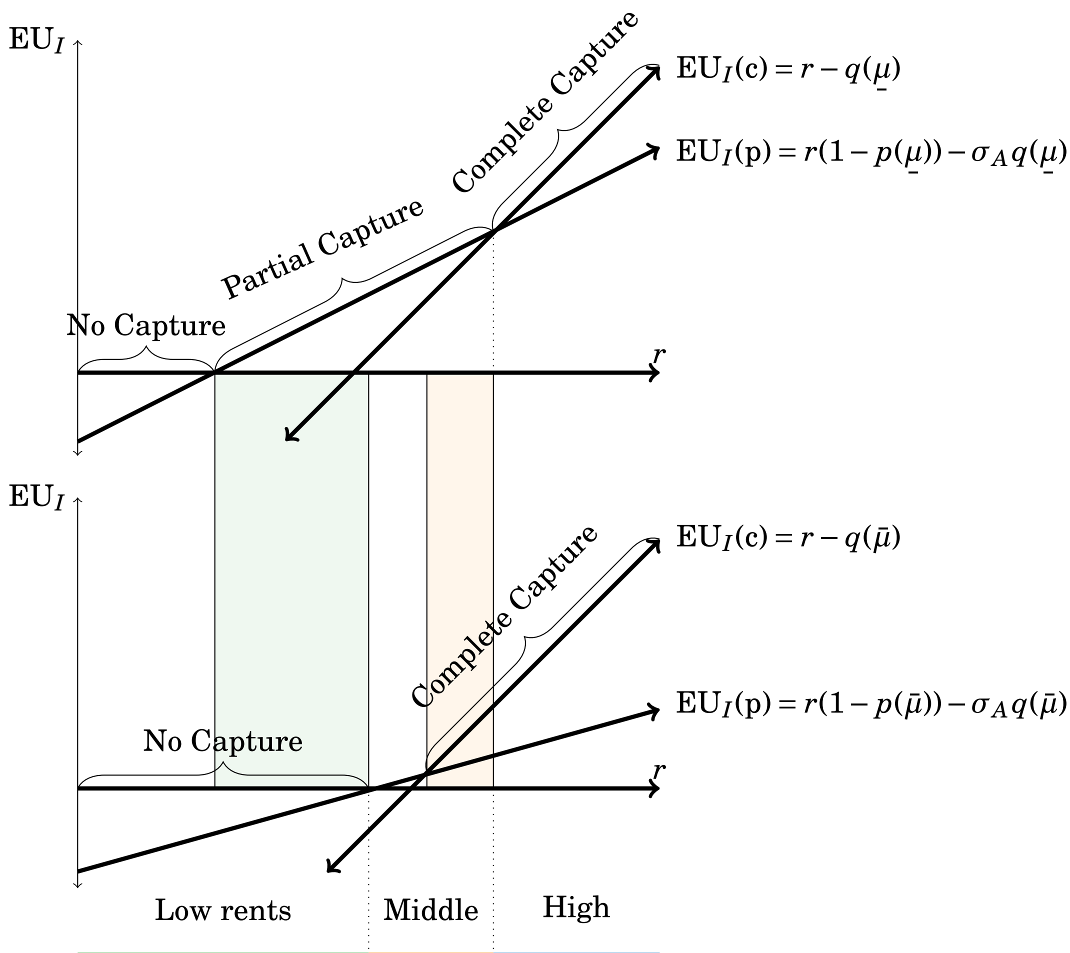

Figure 2: For two different levels of connectedness $\bar{\mu} > \underline{\mu}$, the expected utilities of the incumbent from his three equilibrium strategies are plotted against low, middle, and high office rents, when Condition 1 holds and $0 < p(\mu) < \sigma_M$. The best response of the incumbent is the upper envelope in each plot. The green (yellow) shaded region indicates levels of office rents such that the incumbent switches from partial capture to no (complete) capture when connectedness goes up.

etration and press freedom when Condition 1 holds.[11] Here, the equilibrium level of press freedom on the vertical axis is plotted against randomly drawn internet penetration μ on the horizontal axis. Colors capture the tertiles of office rents, r: blue refers to countries with high office rents, yellow to intermediate office rents, and green to low office rents. As internet penetration increases, most low rent countries switch from partial capture to no capture. In contrast, most countries with intermediate levels of rent switch from partial capture to complete capture. Countries with high office rents remain in complete capture.

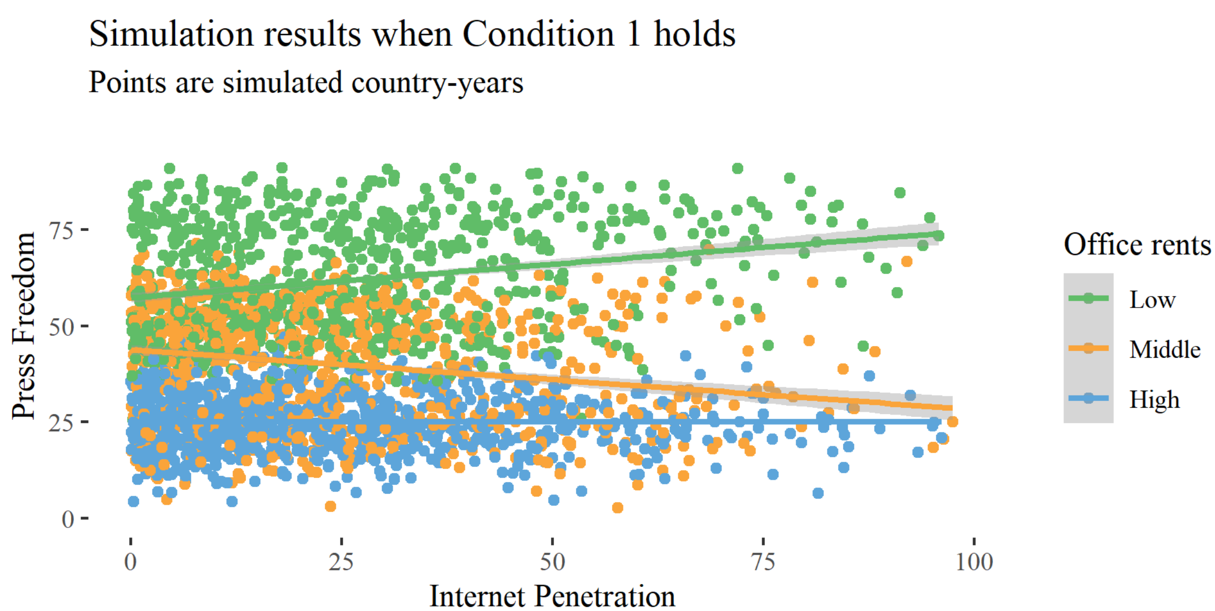

Figure 3: When Condition 1 holds, higher internet penetration may improve press freedom by making partial capture too costly and inducing incumbents to release mainstream outlets in low rent countries (green), or may hurt it by making partial capture too risky and inducing incumbents to capture alternative outlets in medium rent countries (yellow). High rent countries (blue) remain in complete capture.

In contrast, when Condition 1 fails, the cost of capturing both outlets grows faster than the risk of overturning. Then, internet penetration has the unambiguous effect of improving press freedom. This is because the transfers required to capture media outlets grows faster than the risk that a sufficiently high fraction of uninformed voters become informed and overturn the incumbent. Here, greater internet penetration cannot induce an incumbent to

[11]The details of our simulations can be found in Appendix D.

switch from partial to complete capture. The only possible change is that countries move towards more press freedom. Figure 4 presents a simulation of the relationship between internet penetration and press freedom when Condition 1 fails.

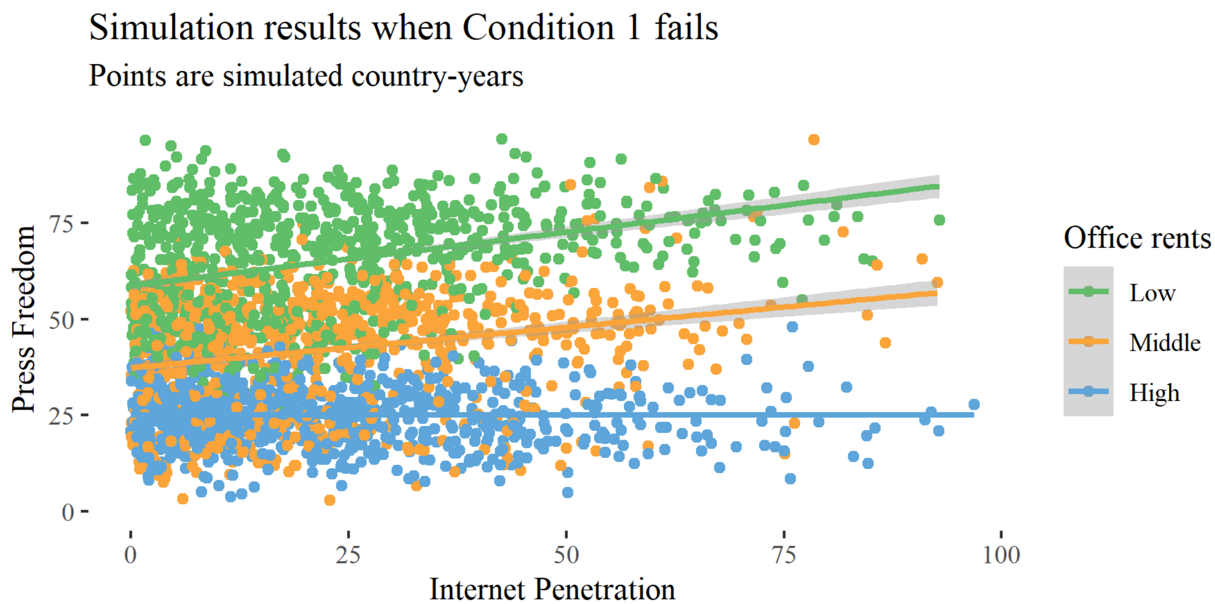

Figure 4: When Condition 1 fails, higher internet penetration improves press freedom by making both partial and complete capture too costly and inducing incumbents to move from partial to no capture (green), or move from complete to partial or no capture (yellow). High rent countries (blue) remain in complete capture.

One way to differentiate between these two scenarios of whether Condition 1 holds or not is to look at actual data. As can be seen in Figure 1 in the introduction, countries with higher internet penetration have either high press freedom or low press freedom, with few intermediate cases. Moreover, the fits in Figure 1 reveal a pattern similar to that in Figure 3: that internet penetration improves press freedom in low rent countries while hurting it in others. Overall, Condition 1 is consistent with the observed data because higher internet penetration is associated with better or worse press freedom depending on their status in 2000, rather than an unambiguous improvement as a failure of Condition 1 would suggest.

Thus, we expect media in countries with high penetration to be generally either very free or not free at all. In contrast, media in countries with low penetration should have smaller cross-country variance. As internet penetration increases, countries that have intermediate levels of press freedom should move towards either extreme.

Greater press freedom leads to bad incumbents being identified and overturned more often. Therefore, voter welfare increases as press freedom goes up. These points are summarized in the following proposition:

Proposition 2. *When Condition 1 holds, an increase in internet penetration improves press freedom in some countries while deteriorating it in others, depending on rents for holding office. Voter welfare is increasing in press freedom.*

4 The Case of Turkey

In this section, we relate the assumptions and findings of our model to the case of Turkey. We argue that before June 2013, when internet penetration was low, there was partial capture in Turkey. Then incumbent prime minister Erdoğan focused his efforts on capturing mainstream media, overlooking smaller media outlets. As a result, a series of events damaging to the incumbent were covered solely by alternative media outlets with limited reach. Their market share surged after social media users started discussing and referring others to them. Erdoğan's government survived this tumultuous episode and subsequently extended capture to alternative media outlets, thus switching from partial to complete capture in response to rising connectedness. In their 2014 report, Freedom House moved Turkey from the "Partly Free" to "Not Free."

June 2013 was marked by violent clashes between the police and protesters trying to prevent the demolition of a park in the heart of Istanbul. Propelled by widespread anger towards the then prime minister Erdoğan's authoritarian style, the so called "Gezi Park" protests multiplied across the country. The number and the broad scope of protesters, the government's response, and the use of extreme force by the riot police were unprecedented. The protests made headlines all around the world. But in Turkey, the way mainstream media ignored the events took center stage instead. For example, while CNN International was live-streaming the hundreds of thousands of protesters in a mist of teargas, CNN's Turkish version, CNN Türk, was broadcasting a documentary about penguins. One channel was showing a beauty pageant, another a show about ethnic food. The mainstream media; TV stations, newspapers, and their websites, was remiss throughout the first few days of the protests.

The most accurate and extensive coverage of the events took place in social media, and a few alternative media outlets (Chrona and Bee, 2017). People used social media to alert fellow citizens about a few TV stations and newspapers which reported on the events, channeling people to these sources for reliable information. An example of this is the Halk TV, an obscure TV station that streamed the protests live with commentary in Turkish. Twitter users in Turkey soon started referring to the channel and Halk TV became a "trending topic." Soon, others flocked to the news channel to find out about the protests, tripling its audience size (Bonini, 2017; Farro and Demirhisar, 2014). Similarly, the anti-government daily Sözcü saw a 21% increase in sales during the week following the start of the protests.

A probe into Turkish media yields why some outlets chose to cover these protests, whereas most others did not. Both Halk TV and Sözcü were universally acknowledged to be anti-government. Many of Sözcü's editors moved there when fired from their previous outlets, allegedly due to government pressure.[12] Most of Sözcü's readers also switched to the anti-government daily after their newspapers changed their stances to accommodate the government.[13] Eventually, Sözcü became a haven for the disillusioned secularists in an increas-

[12]One editor at Sözcü was forced to resign from his position as editor-in-chief at one of the highest circulating dailies in Turkey, Hürriyet, when he refused to fire a columnist in defiance of requests from the incumbent. Soon after he started writing for Sözcü, he was elected as a member of parliament for the main opposition party and subsequently sentenced to 25 years in prison for his journalism.

[13]Durante and Knight (2012) report a similar shift in Italy after Berlusconi's election in 2001, as voters changed their TV consumption habits in response to changes in outlets' coverage of news.

ingly polarized society. Its staunch adherence to old Kemalist principles made it unlikely to appeal to anybody else. It was not a government target for capture, precisely because it only reached a substantial minority who would never vote for Erdoğan or his Justice and Development Party (Corke et al., 2014). Instead, the government focused its attention and pressure on mainstream media outlets that can reach people whose votes can be influenced by the news they consume (Corke et al., 2014). Throughout his tenure, Erdoğan used a variety of sticks and carrots to capture these mainstream outlets.

One carrot is preferential treatment in public procurement in Turkey's centralized economy. Most media outlets in Turkey are owned by large holding companies. Often, these companies earn the bulk of their profits from other interests, such as energy or construction. They buy media outlets, not for commercial revenues—which are very limited in Turkey—but for a means to show their loyalty to the incumbent. Erdoğan was in charge of both the Privatization High Council (ÖİB), which gives the privatization approvals; and the Housing Development Administration (TOKİ), which distributes billions of dollars each year through construction contracts, as well as several other institutions that tender public sector contracts. Staying on good terms with the government was key to getting lucrative business contracts, and owning a sycophantic media outlet helped.

In contrast, critical mainstream media outlets were disproportionately subject to tax inspections. In one case, the government fined a media company a record $2.5 billion over tax irregularities. This equaled about four-fifths of the valuation of the entire parent holding. To settle its bill, its owner sold two of the highest circulating newspapers in Turkey to another holding company with strong ties to the government. Tax authorities promptly agreed to restructure the fine (Esen and Gumuscu, 2016).

In the backdrop of these developments and concurrently with the rest of the developing world, internet penetration was rising in Turkey. Household surveys show that internet access went from about 30% in 2009 to about 50% in 2013 to just under 90% in 2019 (TurkStat, 2019). In terms of our model, the prior expectation of connectedness in Turkey was not high enough to induce complete capture before 2013. Under partial capture, people who consumed alternative media had a chance to take the news of widespread protests to social media, and try to convince those who followed mainstream media to switch. Citizens flocked to social media to draw attention to what was happening in Taksim and elsewhere (Chrona and Bee, 2017). During the first three days of the protests, Twitter saw 10 million tweets that included the protest hashtags such as `#occupygezi` and `#direngeziparki` (Barbera, Metzger, and Tucker, 2013). An overwhelming majority of these tweets came from inside the country, with about half from Istanbul.

From hiring online commentators to spread pro-government messages to blocking access to social media platforms, the government took many steps to stem citizens' ability to inform one another via social media (Esen and Gumuscu, 2016). Soon after Erdoğan called Twitter a "menace to society," pro-government media outlets started targeting public figures for tweeting in support of the protests. More directly related to our model was the government's escalation of media capture. For example, Halk TV was fined for "harming the physical, moral and mental development of children and young people" by broadcasting coverage of the Gezi Park protests (Hürriyet Daily News, 2013). Journalists were assaulted, jailed, and fired from their outlets after government henchmen—and sometimes Erdoğan himself—called their owners to complain about a piece they wrote (Hürriyet Daily News, 2014). 143 journalists lost their jobs in 2013 alone, followed by 339 more in 2014.

5 Conclusion

While Turkey is an interesting case, it is not an exception. The recent proliferation of social media altered the way people across the world receive and share the news. People increasingly go online to follow news and organize. Politicians have caught up with this trend and are trying to find ways of discouraging the public from sharing news on social media. Autocrats censor websites, arrest social media users for critical posts, imprison bloggers, spread fake news, and hire pro-government commentators to manipulate online discussions. As such, while information technologies continue to spread across the globe, the rise in connectedness lags behind.

Previous research has mostly focused on these trends to explain the internet's failure to bring about a new wave of democratization. Instead, in this paper, we focus on autocrats' efforts to expand control over traditional media as a direct result of the internet. Our main contribution to the literature is the study of social media and its relation to press freedom within a global games framework. Our model reiterates that press freedom is a significant tool for political accountability; and suggests that social media may serve as a complement to traditional media. However, contrary to earlier accounts, we find that press freedom and political accountability do not necessarily improve as a result of increased access to the internet. Governments whose survival depends on their control of information find means to counteract its spread. Indeed, despite initial optimism about the wave of democratization social media might bring, many autocratic regimes thrived after the advent of the internet.

We propose a model of political agency where a subset of voters who follow independent media outlets can spread verifiable information via social media to other voters who follow captured media outlets. Consumers who learn their outlet is captured switch to an independent media outlet and become informed. This results in revenue loss for captured media and revenue gain for independent media. Thus, the prevalence of social media increases both the compensation the incumbent must provide for capture, and the risk independent media pose to the incumbent. If the costs of capture are high relative to office rents, the cost effect dominates, and greater internet access leads to more press freedom. Otherwise, the increased risk induces the incumbent to extend capture to outlets he previously ignored, and greater internet access leads to less press freedom. Thus, our model provides a mechanism that explains the divergence in press freedom outcomes over the last two decades as internet penetration rose rapidly across the world.

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Appendix A Formal Statement of the Equilibrium

Before we present the formal proposition summarized in the analysis section, we first define the following to simplify the notation. Let us denote by $r_{pn}(\mu)$ the critical value of r at which the incumbent is indifferent between partial capture, and no capture given μ. Formally:

$$r_{pn}(\mu) = \frac{\sigma_A q(\mu)}{1 - p(\mu)} \tag{3}$$

Further denote by $r_{cp}(\mu)$ the critical value of r at which the incumbent is indifferent between complete capture and partial capture. Formally:

$$r_{cp}(\mu) = \frac{\sigma_M q(\mu)}{p(\mu)} \tag{4}$$

Finally, denote by $r_{cn}(\mu)$ the critical value of r at which the incumbent is indifferent between complete capture and no capture:

$$r_{cn}(\mu) = q(\mu). \tag{5}$$

Note that $r_{pn}(\mu) > r_{cp}(\mu)$ if and only if the probability of overturn is large, in particular $p(\mu) > \sigma_M$. When this is the case for all μ, partial capture is never optimal for the incumbent. Throughout, we assume that $p(\mu) < \sigma_M$ for some μ so that all three strategies are optimal for some values of connectedness.

With that, we are ready to formally state the main proposition of the paper.

Proposition A1. *The following constitutes an equilibrium:*

a) Beliefs of Voters:

The audience of M believe:

$$\Pr(\zeta = g | s_M) = \begin{cases} 0 & \textit{if } s_M = b \\ \hat{\gamma}_M & \textit{if } s_M = \varnothing \end{cases}$$

where

$$\hat{\gamma}_M = \begin{cases} \gamma & \text{if } r \geq \max\{r_{pn}(\mu), r_{cp}(\mu)\} \\ \frac{\gamma}{\gamma+(1-\gamma)(1-\mathbb{E}[q(\nu,\theta)|\rho])} & \text{if } r_{cp}(\mu) > r \geq r_{pn}(\mu) \\ 1 & \text{if } r < r_{pn}(\mu), \end{cases}$$

and the audience of A believe:

$$\Pr(\zeta = g|s_A) = \begin{cases} 0 & \text{if } s_A = b \\ \hat{\gamma}_A & \text{if } s_A = \varnothing \end{cases}, \qquad \text{where } \hat{\gamma}_A = \begin{cases} \gamma & \text{if } r \geq \max\{r_{pn}(\mu), r_{cp}(\mu)\} \\ 1 & \text{if } r < \max\{r_{pn}(\mu), r_{cp}(\mu)\}. \end{cases}$$

b) Strategies of Informed Voters:

Each informed voter i shares if $\rho_i > \rho^*$, and refrain otherwise, where ρ^* is the unique solution to:

$$\rho^* = c\Phi\left(\sqrt{\eta}(\rho^* - \mu)\right).$$

c) Strategies of Voters:

Voter i votes for the challenger if and only if she observes the signal the incumbent is bad. Otherwise she voters for the incumbent.

d) Strategies of the Incumbent:

Incumbent offers:

$$(t_M, t_A) = \begin{cases} t_M = \sigma_A q(\mu) \text{ and } t_A = \sigma_M q(\mu) & \text{if } r \geq \max\{r_{cn}(\mu), r_{cp}(\mu)\} \\ t_M = \sigma_M q(\mu) \text{ and } t_A = 0 & \text{if } r_{cp}(\mu) > r \geq r_{pn}(\mu) \\ t_M = 0 \text{ and } t_A = 0 & \text{if } r < r_{pn}(\mu). \end{cases}$$

e) Strategies of Media Outlets:

Outlet k accepts offer t_k if $t_k \geq \sigma_{-k} q(\mu)$ and $-k$ suppresses, or if $t_k \geq \sigma_k q(\mu)$ and $-k$ publishes. Otherwise it rejects.

Appendix B Proofs

Proof of Lemma 1. Note that the proportion of IV who share is equal to the probability that any individual shares. Since each IV uses ρ^* as the cutoff rule, the probability that any one of them shares is equal to the probability that she has a posterior greater than ρ^*.

Recall that voter i believes that θ is distributed normally with mean ρ_i and precision $\alpha+\beta$. Symmetrically, voter j has posterior:

$$\rho_j = \frac{\alpha\mu + \beta x_j}{\alpha+\beta}$$

where $x_j = \theta + \epsilon_j$. Voter i's expectation of x_j is then normally distributed with mean ρ_i, and variance $\frac{1}{\alpha+\beta} + \frac{1}{\beta}$. Hence we write:

$$\rho_j > \rho_i \iff \frac{\alpha\mu + \beta x_j}{\alpha+\beta} > \rho_i \iff x_j > \rho_i + \frac{\alpha}{\beta}(\rho_i - \mu)$$

Voter i believes that voter j has a posterior expectation ρ_j greater than ρ_i with probability:

$$1 - \Phi\left(\sqrt{\frac{\beta(\alpha+\beta)}{\alpha+2\beta}}\left(\rho_i + \frac{\alpha}{\beta}(\rho_i - \mu) - \rho_i\right)\right) = 1 - \Phi\left(\frac{\alpha}{\beta}\sqrt{\frac{\beta(\alpha+\beta)}{\alpha+2\beta}}(\rho_i - \mu)\right)$$

where Φ denotes the cumulative distribution function of the standard normal distribution. Defining $\eta = \frac{\alpha^2(\alpha+\beta)}{\beta(\alpha+2\beta)}$ we can rewrite the expression above as:

$$1 - \Phi\left(\sqrt{\eta}(\rho_i - \mu)\right)$$

□

Proof of Proposition 1. Denote by $u(\rho, \hat{\rho})$ the expected utility of an informed voter with the posterior expectation ρ of sharing when all other informed voters use the cutoff $\hat{\rho}$. The expected proportion of informed voters who refrain is equal to:

$$\Phi\left(\sqrt{\eta}\left(\hat{\rho}+\frac{\alpha}{\beta}(\hat{\rho}-\mu)-\rho\right)\right)=\Phi\left(\sqrt{\frac{\alpha(\alpha+\beta)}{(\alpha+2\beta)}}\left(\hat{\rho}-\mu+\frac{\beta}{\alpha}(\hat{\rho}-\rho)\right)\right)$$

Hence:

$$u(\rho,\hat{\rho})=\rho-c\Phi\left(\sqrt{\frac{\alpha(\alpha+\beta)}{(\alpha+2\beta)}}\left(\hat{\rho}-\mu+\frac{\beta}{\alpha}(\hat{\rho}-\rho)\right)\right)$$

When $\theta \leq 0$, sharing is weakly dominated. Let $\rho_1 = 0$. Then, any IV with $\rho \leq \rho_1$ refrains since $u(\rho_1,\rho_1) = c\Phi\left(\sqrt{\frac{\alpha(\alpha+\beta)}{(\alpha+2\beta)}}\left(\rho_1-\mu\right)\right) < 0$. This gives us the first round of elimination of dominated strategies for low values of ρ. But notice that if everyone who has posteriors lower than ρ_1 refrain, sharing can never be optimal for an IV whose posterior is lower than ρ_2, where ρ_2 solves $u(\rho_2,\rho_1)=0$.

The above equality implies that ρ_2 is the best response threshold strategy to ρ_1. Since u is increasing in its first argument and decreasing in the second, and $u(\rho_1,\rho_1)<0$, it must be that $\rho_2 > \rho_1$. This and the fact that payoffs are symmetric means that the proportion of IV who refrain is higher than that implied by the cutoff strategy at ρ_1. The expected utility of sharing decreases in the expected proportion of IV who refrain, hence for any value $\rho < \rho_2$, sharing is dominated. This gives us the second round of elimination of dominated strategies for low values of ρ. By iterating, we have a sequence:

$$\rho_1 \leq \rho_2 \leq \ldots \leq \rho_k \leq \ldots$$

where sharing is eliminated for values of posterior $\rho < \rho_k$ in period k of iterated elimination of dominated strategies. The lowest posterior ρ_m which solves $u(\rho_m,\rho_m) = 0$ is the least upper bound of this sequence.

A symmetric argument for high values of ρ establishes a similar sequence:

$$\rho^1 \geq \rho^2 \geq \ldots \geq \rho^k \geq \ldots$$

where refraining is eliminated for values of posterior $\rho > \rho_k$ in period k of iterated elimination of dominated strategies. The largest posterior ρ^m which solves $u(\rho^m, \rho^m) = 0$ is the greatest lower bound of this sequence.

Finally, our assumption $\eta \leq \frac{2\pi}{c^2}$ ensures that there is a unique value of ρ such that $u(\rho, \rho) = 0$, and therefore $\rho_m = \rho^m$. The discussion in the paper following Lemma 1 shows that this unique cutoff must satisfy $\rho^* = c\Phi\left(\sqrt{\eta}(\rho^* - \mu)\right)$, which concludes our proof. □

Proof of Lemma 2. The first strategy ($t_M = \sigma_M q(\mu)$ and $t_A = \sigma_A q(\mu)$) leads to the capture of both outlets. This is because when one outlet suppresses the news, the other chooses between publishing and taking some audience share from its competitor and repressing and receiving transfers from the incumbent. The incumbent's offers in this strategy exactly correspond to the expected increase in audience related revenues if an outlet were to publish while its competitor suppresses. Because we assumed that when indifferent outlets accept the offer from the incumbent, here both outlets accept their offers and suppress the news. More precisely, if A suppresses but M were to deviate and publish, its audience would grow by $\sigma_M q(\mu)$. The incumbent must transfer an equal amount in equilibrium in order to capture M. Symmetrically, if A deviates and publishes while M suppresses, A's audience would grow by fraction $q(\mu)$ of its audience, and the incumbent must transfer an equal amount to A to capture it as well. Note that any larger offer is dominated by $\{\sigma_M q(\mu), \sigma_A q(\mu)\}$, as they are also accepted but more expensive.

The second strategy ($t_M = \sigma_A q(\mu)$ and $t_A = 0$) leads to M's capture, but since $t_A = 0$, A rejects the offer and publish the bad signal. In this case the mainstream outlet loses some fraction of its audience to the alternative outlet, and the incumbent must compensate M for the lost audience share, which is equal to $\sigma_A q(\mu)$. Note that these offers lead to the same outcome as any other offer that A rejects, but we focus on this one for ease of notation.

In the third strategy ($t_M = 0$ and $t_A = 0$) the expected payoff of publishing is normalized to zero for both outlets; this is when both publish and keep their respective audiences. This is strictly greater than the payoff of accepting the incumbent's offer of zero and losing some audience to the other outlet. Again, this is in effect the same as any offer that is rejected by both outlets, but for ease of exposition we suppose that the incumbent offers zero whenever he does not intend to capture an outlet.

Note that the strategy $t_M = 0$, $t_A = \sigma_M q(\mu)$ is dominated by $t_M = 0$, $t_A = 0$. When only A is captured the audience of M still learn the incumbent's type, and their votes are enough to overturn the incumbent. □

Proof of Lemma 3. Since the voters can base their votes only on the information they have, and we have that $\sigma_M > \sigma_A$, the strategy of V_M are decisive on the outcome of the election. Hence, whenever the mainstream outlet is not captured and publishes the bad signal about the incumbent, the incumbent is overturned with certainty. In this case the expected utility of the incumbent is zero.

If the incumbent chooses to capture both outlets by offering $t_M = \sigma_M q(\mu)$ and $t_A = \sigma_A q(\mu)$, then there is complete capture, and the incumbent is reelected for sure. His expected utility in this case is $r - q(\mu)$. Finally, if only the mainstream outlet is captured, the incumbent is reelected with probability $1 - p(\mu)$, and therefore his expected utility is equal to $r(1 - p(\mu)) - \sigma_A q(\mu)$. □

Proof of Proposition A1. **a)** Any voter who observes the bad signal believes that the incumbent is good with probability zero because bad signals are verifiable. A voter who observes the null signal believes that the incumbent is good with probability one if the outlet she follows is never captured in equilibrium, with probability γ if her outlet is always captured in equilibrium and she has no chance of being informed via social media, or with some intermediate probability if her outlet is captured in equilibrium but there is a positive probability that she is informed via social media. In any case, her posterior belief that the incumbent is good is at least as high as her belief that the challenger is good when she observes no signal.

b) Follows from Proposition 1.

c) We assume that voters use undominated pure strategies. If a voter observes $s = b$ and therefore deduces that the incumbent is good with probability zero, then the expected payoff of reelection is also zero, whereas the expected utility when a new challenger wins the election is γ. Therefore a voter who observes $s = b$ strictly prefers the challenger and votes against the incumbent.

If a voter observes $s_k = \varnothing$ for $k \in \{M, A\}$, she believes that the incumbent is good with probability $\hat{\gamma}_k \geq \gamma$. If $\hat{\gamma}_k$ is strictly greater than γ, then the expected utility of voting for the incumbent is also $\hat{\gamma}_k > \gamma$, and the voter votes for the incumbent.

To see why a voter who observes $s_k = \varnothing$ votes for the incumbent when $\hat{\gamma}_k = \gamma$, assume for a contradiction that she votes against. Then the bad incumbent has no incentive to pay a transfer to media outlet k, because the audience of k vote against the incumbent even when the signal $s_k = \varnothing$. Therefore the incumbent offers $t_k = 0$ and the outlet k publishes the bad signal whenever the incumbent is bad. But then, outlet k is never captured in equilibrium, and it must be that $\hat{\gamma}_k = 1$, a contradiction.

It follows that all voters vote for the incumbent if and only if their posteriors of the incumbent are at least as high as their priors on the challenger, γ. Then, every voter who observes the signal that the incumbent is bad votes for the challenger and every voter who does not observe any signal votes for the incumbent.

d) Recall that the incumbent must choose from one of the three strategies in Lemma 3.

When rents are sufficiently high so that $r \geq \max\{r_{cp}, r_{cn}\}$, the incumbent's expected utility is maximized when there is complete capture. If rents are in an intermediate range, namely $r_{cp}(\mu) > r > r_{pn}(\mu)$, then the incumbent's expected utility is maximized when only M

is captured. This happens when the probability of overturning the incumbent via the social media game is sufficiently small and rents are not high enough to justify capturing both outlets. On the other hand, when $r < r_{pn}$, the incumbent's optimal strategy is to capture neither outlet because the rents from office are not high enough to cover the expenses of capture.

e) If $-k$ publishes, k receives zero if it publishes, and $t_k - \sigma_{-k} q(\mu)$ if it suppresses. Therefore, k accepts any offer $t_k \geq \sigma_{-k} q(\mu)$ whenever $-k$ publishes, and rejects any offer below.

If $-k$ suppresses, k receives $\sigma_k q(\mu)$ if it publishes, and t_k if it suppresses. Therefore, k accepts any offer $t_k \geq \sigma_k q(\mu)$ whenever $-k$ suppresses, and rejects any offer below.

□

Proof of Proposition 2. Suppose $p(\mu) < \sigma_M$ so that partial capture is optimal for some μ. Recall Condition 1: $\frac{d\frac{p(\mu)}{q(\mu)}}{d\mu} > 0$. When this is true, it follows from Equation 4 that $\frac{\partial r_{cp}(\mu)}{\partial \mu} < 0$. Thus, the level of office $r_{cp}(\mu)$ that leaves the incumbent indifferent between complete and partial capture is decreasing in internet penetration. This means that for some levels of office rent, increased internet penetration causes incumbents to switch from partial capture to complete capture.

Note also from Equation 3 that $\frac{\partial r_{pn}(\mu)}{\partial \mu} > 0$. Thus, the level of office $r_{cp}(\mu)$ that leaves the incumbent indifferent between partial and no capture is increasing in internet penetration. Thus, for some levels of office rent, as internet penetration goes up incumbents switch from partial capture to no capture.

It follows that for a fixed value of office rents r, an increase in μ can change the incumbent's optimal strategy from partial capture to complete capture, leading to less press freedom; or from partial capture to no capture, leading to more press freedom.

More press freedom allows voters to recognize bad incumbents and overturn them more often. Specifically, the voter's expected payoff is γ under complete capture, $\gamma(1 + p(\mu))$ under partial capture, and $\gamma + 1$ under no capture. Thus, voter welfare is higher, more press freedom there is. □

Appendix C Empirics

In this section we describe our data and empirical specifications. Our dependent variable is the Freedom of the Press index by Freedom House (`freedomhouse.org`). This index was first published in 1980. Each year every country is given a score from 0 (best) to 100 (worst) according to various questions and indicators. We invert this scale so that higher values correspond to more press freedom. After our inversion, countries that have scores between 70 and 100 are regarded to have Free press; 40 to 69, Partly Free press; and 0 to 39, Not Free press. We believe this is a good measure for this analysis because the scores are based on a range of factors, including indirect forms of repression.

Our main independent variable is internet penetration data provided by International Telecommunication Union (`itu.int`). For our controls, we use the number of checks on the executive from the Database of Political Institutions by the World Bank (Beck et al., 2001), Polity IV scores (Marshall, Gurr, and Jaggers, 2016), and GDP per capita and population data from the World Bank (`data.worldbank.org`).

Our empirical specification is

$$PressFreedom_{it} = \delta_i + \delta_t + \beta InternetPenetration_{it} + X'_{it}\gamma + \varepsilon_{it} \tag{6}$$

where $PressFreedom_{it}$ is the press freedom score of country i in year t. δ_i and δ_t correspond to country and year fixed effects respectively. $InternetPenetration_{it}$ is our independent variable of interest and is equal to internet penetration in country i in year t. The time varying controls X'_{it} are the number of checks on the executive, logarithm of GDP, and logarithm of population. Standard errors are clustered at the country level.

As can be seen in Table 2, in our baseline specification with country and year fixed effects and without controls, the coefficient of internet penetration is negative and statistically significant. The same holds when controls are added but year fixed effects are removed. When controls and both fixed effects are included in the specification, the coefficient is still negative but no longer statistically significant.

In columns 4-6, we run the full specification with controls and country and year fixed effects on the subsamples of countries' with different press freedom status in 2000. Column 4 shows that among the countries that had a "Free" press (i.e. press freedom scores between 70-100) in 2000, internet penetration is associated with more press freedom. In contrast, internet penetration has the opposite effect in countries that had a "Partly Free" press in 2000 (i.e. scores between 40-69). Finally, column 6 shows that internet penetration is associated with less press freedom in countries that had a "Not Free" press in 2000, but the relationship is not statistically significant at the conventional levels.

In the last two columns we split the dataset by countries' Polity scores. Polity scores are a composite indicator that measures where a country in a given year falls on a scale between +10 (strongly democratic) to -10 (strongly autocratic). Out of concerns about reverse causality, we use Polity scores in 2000, the start of our dataset.[14] We split the dataset by countries whose polity scores are below and above 6. This is the standard cutoff for democracies in the Polity dataset. Sub-sample analysis shows that for countries whose Polity scores were above 6 in 2000 the coefficient of internet penetration is positive and statistically significant. The opposite holds for countries whose Polity scores were below 6 in 2000. There, the coefficient of internet penetration is negative and statistically significant.

[14]Because internet penetration was very low in almost all countries in 2000, internet penetration is unlikely to have driven Polity scores in 2000. Our results are unchanged when we use Polity scores in each year instead.

Table 2: Internet penetration is associated with more or less press freedom in countries, depending on the Press Freedom Status or Polity2 scores in 2000.

				Freedom of the Press score				
		All countries		Free	Partly Free	Not Free	Polity > 6	Polity ≤ 6
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Internet penetration	−0.059**	−0.070***	−0.040	0.094**	−0.125*	−0.072	0.105**	−0.090***
	(0.029)	(0.023)	(0.029)	(0.044)	(0.072)	(0.051)	(0.052)	(0.034)
Checks		0.829***	0.858***	0.661	0.707**	1.197	0.420*	1.294**
		(0.307)	(0.308)	(0.425)	(0.321)	(0.822)	(0.220)	(0.515)
ln(GDP per capita)		−0.828	0.637	0.503	6.724***	−4.611**	2.765	−2.334
		(0.765)	(1.240)	(1.569)	(2.581)	(2.293)	(1.719)	(1.841)
ln(Population)		−0.879	2.094	0.515	−11.921	−1.061	−17.302*	−0.915
		(2.691)	(2.662)	(7.752)	(8.578)	(4.184)	(9.266)	(3.601)
Country FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓		✓	✓	✓	✓	✓	✓
Observations	2,521	2,406	2,406	826	743	837	1,021	1,361
R^2	0.010	0.097	0.035	0.063	0.109	0.085	0.124	0.076
Adjusted R^2	−0.064	0.031	−0.042	−0.025	0.023	−0.006	0.047	−0.006

Note: *p<0.1; **p<0.05; ***p<0.01
Standard errors are clustered at the country level.

Appendix D Simulations

For our simulations, we assume that the fraction of uninformed voters who switch to the informative outlet is drawn from the inverse logit function: $q(\mu) = \frac{e^{\mu}}{1+e^{\mu}}$. We set $\sigma_A = 1/4$. Office rents r are drawn from the standard uniform distribution and internet penetration μ across observations come from a beta distribution with shape parameters 1 and 5. We draw $160 * 16 = 2560$ values of μ, corresponding to 160 countries over 16 years. We draw 160 values of r; one for each simulated country.

For Figure 2, to ensure Condition 1 holds for all μ, we assume the precision of beliefs of connectedness, $\alpha = 2$; and we shift internet penetration so that $\mu \in [-0.8, -0.2]$. That is, we let $\mu \sim B(1,5) * 0.6 - 0.8$. To ensure Condition 1 fails for all μ for Figure 3, we assume $\alpha = 1/2$, and we let $\mu \sim (B(1,5) - 0.4) * 2$ so that $\mu \in [-0.8, 0.6]$.

Given parameter values α, σ_A, and randomly drawn values of r and μ, we calculate the incumbent's optimal strategy for capture. We order observations in increasing press freedom: 0 refers low press freedom or complete capture, 1 is intermediate press freedom or partial capture, and high press freedom/no capture is denoted by 2. We add jitter drawn from a normal distribution with mean zero and standard deviation 0.3 to enhance readability. Our simulated plots have μ on the horizontal axis and press freedom on the vertical axis. We color observations by which tercile of r they fall in: green for high office rents, blue for intermediate office rents, and red for low office rents.

References

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