Social Media and Press Freedom:
A Global Games Approach

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Abstract

The use of social media as a tool for spreading political information is accentuated when traditional media outlets are under pressure from governments. One such case was the 2013 protests in Turkey; largely ignored by mass media, protesters took to Twitter to get their voice heard, despite threats and attempts at suppression. We analyze this interaction on social media in a global game setting. Our results show that an increase in connectedness of a country serves to bring in line the information revealed by the mainstream and the alternative media. An increase in connectedness may free the mainstream media by making their capture more costly for the incumbent, thus allowing all media outlets to share relevant information with the public. Conversely, it may also lead the government to capture the alternative media outlets as well as the mainstream media, thus preventing dissemination of information in the country completely. The relationship between press freedom (as well as voter welfare) and social media usage rates depends on the incentives faced by the incumbent, who may either increase or decrease pressure on traditional media in response. Finally, we examine a cross-country dataset to test the predictions of our model. We show that our theoretical hypotheses are corroborated by data, and are robust to various specifications and empirical methods.

Key words: connectedness, global games, press freedom, social media.

JEL classification: D72, D73, D8, L82.

1 Introduction

June 2013 in Turkey was marked with violent clashes between the police and protesters who were trying to prevent the demolition of a park in the heart of Istanbul, known as Gezi Park. Many aspects of the events, such as the socio-economic diversity of the protesters, involvement of the very popular soccer fan clubs, the government's response to the protests, and the degree of violence used by the riot police were worth mentioning.[1] But, the way the Turkish mainstream media ignored the events took center stage instead. For example, while CNN International was broadcasting live the hundreds of thousands of protesters under brutal teargas and water cannon attacks by the police, CNN's Turkish version CNN Türk was broadcasting a documentary about penguins. One channel was showing a beauty pageant, yet another a show about ethnic food. The mainstream media; the TV channels, the newspapers and their websites, was remiss throughout the first few days of the protests. What brief coverage they had was mostly focused on the vandalism committed by the protesters, with little or no mention of the excessive use of police force (Turgut, 2013). The most accurate and extensive coverage of the events took place in social media,[2] and a few alternative media outlets whose anti-government stances were well established. People utilized social media to alert fellow citizens about the existence of a few TV stations and newspapers which reported the events more reliably than the mainstream media, channeling people to these sources for information. An example is Halk TV, a TV station that is owned by the main opposition party, CHP. During the Gezi protests, many Twitter users made references to its live feeds of the events, and the channel became a "Trending Topic" for the first time in the evening of May 31st, 2013, increasing its ratings from a mere 0.453% to 1.308%, an almost threefold increase within a few days. Similarly, the anti-government daily Sözcü, which was the fourth most popular newspaper in Turkey at the time, saw a 21% increase in sales during the week following the start of the protests.

In this paper, we provide a theoretical analysis of the effects of social media on the government's capture of the media industry, and thus, on government accountability. We construct and analyze a game theoretical model of political competition, the main actors of which are (i) an incumbent politician whose type (e.g. corrupt or clean) is unobservable, (ii) mainstream and alternative media outlets (e.g. CNN Türk and Halk TV in the above example), and (iii) two groups of voters, each following one of the two types of media outlets.

Our model follows the long and established political agency literature.[3] There is an incumbent whose

[1] These occupied headlines and columns in the international media; see for example Arango and Yeginsu (2013).

[2] According to data by NYU Social Media and Political Participation laboratory, during the first three days of the protests, 10 million tweets had been sent that included the most popular hashtags such as #occupygezi and #direngeziparki (Fitzpatrick, 2013).

[3] See (Barro, 1973; Ferejohn, 1986; Besley and Prat, 2006).

type is observed only by the media outlets. Voters want to overturn a bad incumbent, who wishes to remain in office. He may offer transfers to media outlets, in return for them suppressing information about his type. The media outlets' response determines what information the voters receive. Based on their information then, the voters vote between the incumbent and a challenger.

Our paper diverges from the existing literature in terms of how information is dispersed among the voters. The closest model to ours is by Besley and Prat (2006), where it is assumed that if all outlets suppress the news, voters learn nothing; but even if a single outlet rejects the incumbent's offer and publishes the news, all voters learn incumbent's type. In this paper, we relax this assumption by studying the possibility that news do not spread immediately to the whole population from a small fraction of "informed voters", who may only disseminate the news via social media. Existing empirical work on social media, in particular Twitter, shows that "almost half the information that originates from the media passes to the masses indirectly via a diffuse intermediate layer of opinion leaders" (Wu et al., 2011), providing strong support for the "two-step flow of communication" hypothesis which posits that media affects voting behavior mostly indirectly, via personal influences of the intermediaries, who are found to be more exposed to mass media than average citizen. (Katz, 1957) We study the interaction of such opinion leaders, or in our terminology, the informed voters, in a global game framework. This is fitting because while a single informed voter cannot do much to propagate information, many informed voters revealing the same information may have a sizable effect. Moreover, payoffs from using the social media depends on how many other informed voters are also using it.

We argue that an important parameter in determining the outcome of the social media interaction is the "level of connectedness" in a country. We take the level of connectedness to be a measure of both technological and economic variables (such as the internet penetration rate, social media usage rates, prevalence of mobile devices or other telecommunication technologies) as well as sociological ones (such as social capital or political trust). Improvements in access to communication technologies as well as building up trust between the members of the society increases the level of connectedness in a country.

Our results show that an increase in connectedness of a country serves to bring in line the information revealed by the mainstream and the alternative media. An increase in connectedness may free the mainstream media by making their capture more costly for the incumbent, thus allowing all media outlets to share relevant information with the public. Conversely, if rents from staying in office are sufficiently high it may also lead the government to capture the alternative media outlets as well as the mainstream media, thus preventing dissemination of information in the country completely. These results predict that, as the world becomes more connected, we should generally observe a decline in the likelihood of media capture; but among those countries that still have captured media, we should observe more media outlets captured.

We test our results empirically and find that our hypotheses are supported by a cross-country dataset. Using internet penetration rate as a proxy for connectedness, our study of the data reveals that countries with greater connectedness on average have significantly greater press freedom. However, these countries also have significantly greater cross-country variance, suggesting that increased connectedness may lead governments to further suppress media freedom in high rent countries.

This paper is part of a recent literature on the question of media bias and how it relates to politics. There have been various attempts to explain why media bias exists. Baron (2006) examines a model where media bias is rooted in the supply side. In their setting, the media outlets have the option to hire journalists for lower wages if they allow them to publish biased news, who might prefer to slant the news if this may help them further their careers. Gentzkow and Shapiro (2006), on the other hand, focus on the demand side. They argue that if customers believe that the quality of a news report is proportional to how well it conforms to their prior expectations, then media outlets will have an incentive to slant the news towards their audience's priors to build a reputation of high quality. In a behavioral model, Mullainathan and Shleifer (2005) assume that customers derive utility from consuming news that confirm their beliefs. Studying the interaction between media and elections, Duggan and Martinelli (2011) assume that media outlets can slant the news depending on which candidate they support. Besley and Prat (2006) focus instead on the political pressure on media, and examine a model where the head of state in a democratic setting can make transfers to media outlets in order to suppress a bad signal they may have about him, where the state space is binary. Shadmehr and Bernhardt (2015) generalize the state to a continuum, and show that the ruler uses a cutoff strategy in equilibrium. They find that in their model, introduction of new technologies that raise censorship costs may benefit the ruler.

Gehlbach and Sonin (2014) examine a setting in which the government has an incentive to have citizens believe the world is in a particular state, even when indeed it is not. The government can do that by (direct or indirect) control of the media, which slants the news in a direction favorable to the government. Their model differs from that of Besley and Prat (2006) in that instead of censorship, the news are biased, so that they are still somewhat informative; and media consumption as well as ownership (state or private) is endogenous. The authors find that, controlling for media ownership, higher commercial revenues for media outlets lead to greater press freedom; however it may also drive the government to nationalize media outlets in order to save on costs of capture.

Finally, there is a recent and growing strand of literature that studies regime change in global games settings. Angeletos et al. (2007) consider a dynamic version of global games of regime change. Bueno De Mesquita (2010) examines the extent to which extremists can influence the citizens' beliefs regarding the overall level of anti-government sentiment. Edmond (2013) studies a noisy signaling model where the incumbent can take a costly action that manipulates the information provided by the media outlets in order to discourage dissent. Employing a global games framework, he finds that proliferation of new information technologies have offsetting effects on a bad regime's chances of survival. On the downside, a greater number of outlets that a regime may manipulate leads to public opinion becoming more precise, and in this case coordination on status quo can be induced relatively easily. However, this also means that the costly action the incumbent may take is now more costly, because there are more outlets to capture. Edmond 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. The primary question Edmond tries to answer is how a bad incumbent can utilize propaganda to fake strength and therefore discourage attacks by citizens who know that the incumbent is bad. The theoretical findings are then evaluated under different media structures. In this sense, mass media and social media are interpreted as substitutes in Edmond's paper, and he finds that social media, because of its decentralized nature, proves less susceptible to government propaganda than does traditional media. In contrast, mass media and social media are complements in our model, and we study how information about the type of the incumbent may disseminate via a collaboration of the two.

In a related paper, Little (2015) examines the influence of social media on social movements on two different dimensions about which there is uncertainty using global games framework. The first is the precision of the signal about the level of anti-government sentiment among citizens, which may increase or decrease levels of protest activity depending on how the actual value compares to the prior. The latter is the signal about protest tactics (i.e. logistics of protests, like when and where to meet) which also become more precise upon the introduction of social media. This leads to higher protest activity unless most citizens would protest already in the absence of social media. In his model, the incumbent is not a strategic actor, and analysis is restricted to coordination among citizens who all know the incumbent is bad, but vary in their degrees of their anti-government sentiments and preferred tactics.

The rest of the paper is organized as follows: In Section 2 we present the benchmark model and in Section 3 we analyze the equilibria. In Section 4 we evaluate our findings empirically. In Section 5, we discuss the Gezi park protests in Turkey in 2013 as a case study for our analysis. Section 6 concludes the paper. Finally, we present the proofs and an extension of our baseline model in the Appendix.

2 Model

2.1 Preliminaries

In this section, we introduce a two-period retrospective voting model. Technically, our model is a Bayesian game involving (i) an **incumbent** politician, **I**, whose type (good or bad) is private information, (ii) **mainstream** and the **alternative** media outlets **M** and **A** (e.g. CNN Türk and Halk TV respectively in the example above), and (iii) a set **V** of voters, divided into two groups as (a) followers of the mainstream media (**mainstream voters, $\mathbf{V_M}$**) and (b) followers of the alternative media (**alternative voters, $\mathbf{V_A}$**).

In the first period, the incumbent is exogenously in power. He can be one of two types, $\zeta \in \{b, g\}$, where b stands for "bad" and g stands for "good". At the start of the game, the incumbent and media outlets observe the type of the incumbent, and the voters believe the incumbent is good with probability γ, and bad with probability $1 - \gamma$. A good incumbent produces a payoff of one to voters, whereas a bad incumbent generates zero payoff. The voters cannot observe these payoffs until the end of the game and thus cannot learn from them before they vote.

For simplicity, we assume that there are two media outlets. We call them M (for mainstream) and A (for alternative).[4] We denote by σ_i the audience share of outlet i. Without loss of generality, we assume that the audience share of the mainstream outlet is strictly larger than the audience share of the alternative outlet, that is, $\sigma_M > \sigma_A$ and $\sigma_M + \sigma_A = 1$. The media outlets are identical in their strategy sets and preferences. They have two types of profit, audience related and policy related. The former includes subscription fees and advertisements etc., whereas the latter may be in the form of direct bribes from the incumbent, or favorable policies for the groups or individuals associated with the outlet.

The media outlets observe the type of the incumbent. If the incumbent is good, we say that the outlets have no informative news and normalize their payoffs to zero. If the incumbent is bad, media outlet i can either publish the signal ($s = b$) for the audience related profit of at least σ_i; or it can suppress the bad signal ($s = \varnothing$) in exchange for a transfer t_i from the incumbent. The transfers are offered by the incumbent in exchange for the suppression of bad news about them. The offers to both outlets are made simultaneously, and are unobserved by the voters.

Next, the voters observe the news reported by the media outlets they follow. Voters who observe the news that the incumbent is bad also observe whether the other media outlet published or suppressed the

[4]One may extend on this assumption and think of M and A as two distinct groups of media outlets. Our results are not driven by exogenous differences in the media. As will be clear, a sheer difference in the audience shares will be sufficient. The two outlets additionally having different policy preferences does not change our findings qualitatively.

signal.[5] If one of the media outlets accept the offer whereas the other does not, the followers of the informative outlet (**informed voters**, or **IV**) play what we call a social media game to pass on the signal to the audience of the other outlet. How likely the uninformed voters are to be convinced depends on both the ratio of IV who choose to share the information on social media, and how connected the society is. If both outlets accept the offer, or if both reject, the social media game becomes redundant and the game moves on to the final stage.

At the final stage of the game, voters vote either for the incumbent or a challenger of unknown type. Reelection yields a profit of $r > 0$ to both types of incumbents. Thus the payoff of the incumbent is $r - \sum_{i \in \mathcal{I}} t_i$ if the incumbent is reelected, and $-\sum_{i \in \mathcal{I}} t_i$ if he is not, where $\mathcal{I}$ is the set of media outlets who accept the incumbent's offer.

2.2 Social Media Game

The social media game is a global game played by the informed voters (IV) who have obtained the information that the incumbent is bad. Upon receiving this verifiable signal, IV can use the social media to propagate this information. If they succeed, the uninformed voters switch to the informative outlet and thus receive the verifiable signal about the incumbent's type. If they fail, the uninformed voters stay uninformed.

Whether uninformed voters receive the bad signal from the IV depends on two factors. First, the ratio of the IV who share the bad signal via social media, denoted by $\nu \in [0, 1]$ increases this likelihood. The second factor we call **connectedness**, and denote by $\theta \in \mathbb{R}$. We use the term to refer to both observable and unobservable measures of connectedness among members in a society. Observable measures include internet penetration and social media usage rates, as well as prevalence of mobile phones and other communication technologies. Unobservable measures refer to sociological concepts such as social capital or political trust, for example to what extent an individual is open to what others have to say, or how likely one's opinions, especially those with political content, are to reach others. A citizen in a society where there is strong trust among individuals may be easier to convince by other citizens relative to a similar individual in a society abundant in conspiracy theories or propaganda.

[5] The reason for this asymmetry is as follows: it is reasonable to assume that media outlets are aware of what each other publish. If an outlet chose to suppress the news, it has no incentives to point its audience towards an outlet that is more informative; it would lose face and potentially the transfers from the incumbent. In contrast, the informative outlet has strong incentives to let its audience know that it is more informative than its competitors, especially if that might lead them to broaden their audience and increase their commercial revenues, as is the case in this model.

The extent of social capital in a society may be roughly estimated by individuals in that society, but since each individual's interactions are limited to a subset of the society, and social capital is not precisely quantifiable, each individual has an imperfect information about it. To model this heterogeneity, we assume that the players' prior beliefs on θ are normally distributed with mean μ and precision α (variance $1/\alpha$). A voter i then receives a signal 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. An intuitive way to think about this is that the observable measures of connectedness such as internet penetration rate are common knowledge. These observables correspond to μ, the prior expectation of θ. Because of their interactions with others in their networks, individuals form their beliefs regarding connectedness in the overall society, which correspond to the actual value of θ plus an error term ϵ_i due to imperfect information accumulation. We assume that the incumbent and the media outlets receive no signal, and have to rely on the common priors when they make decisions.[6]

Given their belief about θ, the level of social connectedness; and the ratio of IV who share the news about the bad signal, $\nu \in [0, 1]$, the probability that the uninformed voters learn the incumbent's true type is given by the function $p(\theta, \nu)$. We assume that p is continuous and non-decreasing in both θ and ν. If the signal is shared by at least some informed voters, on the other hand, with probability $p(\theta, \nu)$ the uninformed voters learn the true type of the incumbent.

There is a cost associated with sharing the news of the bad signal about the incumbent, given by the expression $c(1 - \nu) + \delta$. The first part is in the form of punishment, such as fines or imprisonment.[7] It is decreasing in the ratio of IV who share the news, and is multiplied by a non-negative constant c which is a measure of the severity of the punishment depending on (legal or extralegal) threats related to social media use. The latter part is a strictly positive and arbitrarily small fixed cost associated with time and effort spent on sharing the news. For example, δ may be the opportunity cost of the time consumed composing a political blog, a Facebook post or a tweet.

There is also a benefit that informed voters derive from sharing information via social media, which we assume to be linear for purposes of expositional convenience: $b(\theta) = \theta$. This benefit may be in the form of material gain when the media in question is in the form of a political blog, where more clicks correspond to larger advertisement revenue for the owner. It may also be in the form of immaterial gain in the form of expressive utility or interactions for social media (e.g. "likes" and "comments" for Facebook or "likes" and

[6] This is to avoid the multiplicity of equilibria caused by the informational content of the incumbent and media outlets equilibrium strategies. See (Angeletos et al., 2006) for a discussion on signaling in global games.

[7] The extent to which such costs are relevant are discussed in Section 5.

"retweets" for Twitter). We assume that when connectedness increases, an informed voter is able to reach a greater audience, and therefore derives a larger utility.

3 Analysis

3.1 Equilibrium Voting Behavior

If a voter observes that the incumbent is bad, the expected utility of reelecting the incumbent is zero; whereas the expected utility of electing a challenger of unknown type is γ, the probability that the challenger is good. We assume that all voters use undominated pure strategies, so any voter who receives the signal that the incumbent is bad will vote against the incumbent.

If a voter observes no signal, they will believe that the incumbent is good with probability $\hat{\gamma} \geq \gamma$, since observing no signal is never *more* likely when the incumbent is bad. They will then vote for the incumbent. To see why, note that the case when $\hat{\gamma} > \gamma$ is obvious. When $\hat{\gamma} = \gamma$, suppose the voter votes for the challenger. Then the incumbent would have no incentive to make transfers to the media outlets, which would mean that $\hat{\gamma} > \gamma$, a contradiction.

Therefore it must be that 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. Recall that the only means by which the voters can observe the incumbent's type is through the media outlets, and that $\sigma_M > \sigma_A$. This means that the votes of $\mathbf{V_M}$ are decisive in an election (or conversely, the votes of $\mathbf{V_A}$ do not matter). Hence, the outcome of the elections ultimately boils down to whether $\mathbf{V_M}$ 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 elections with certainty. If neither the mainstream nor the alternative publishes, then the incumbent wins the elections. 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.

3.2 Equilibrium Information Sharing on Social Media

Consider a voter i who has learned via the outlet she follows that the incumbent is bad. Given the distribution of connectedness, the distribution of the signals and the signal individual i has received, the posterior expectation ρ_i of i who received signal x_i is given by (DeGroot, 2005)

$$\rho_i = \frac{\alpha\mu + \beta x_i}{\alpha + \beta}$$

The precision of the posterior expectation is equal to $\alpha + \beta$.

Using these posteriors, informed voters choose whether to share the news or not. Given the level of social connectedness, θ; and the ratio of IV who share the news about the bad signal, $\nu \in [0,1]$, with probability $p(\theta,\nu)$ the uninformed voters learn the true type of the incumbent, and all voters vote for the challenger.[8] Then, with probability γ, the type of the challenger who replaces the incumbent is good and voters receive a payoff of one. Therefore, if the informed voters are those who follow the alternative outlet, and $\mathbf{V_M}$ are uninformed, all informed voters have the expected utility $p(\theta,\nu)\gamma$, regardless of whether they choose to share or not. If the informed voters are those who follow the mainstream outlet, and $\mathbf{V_A}$ are uninformed, then whether news spread through social media does not affect the outcome of the elections, because the challenger wins the elections regardless of behavior on the internet.[9]

The informed voters' decision of whether to share the news or not depends on the relative payoffs of the two. Within the social media game, the payoff of an IV who shares the information, as a function of θ and ν is:

$$\theta + p(\theta,\nu)\gamma - c(1-\nu) - \delta$$

On the other hand, the expected payoff of an IV who refrains from sharing is:

$$p(\theta,\nu)\gamma$$

Then, the utility gain of sharing for an IV is:[10]

$$\theta - c(1-\nu) - \delta$$

There are three intervals in which we can examine the best responses of the informed voters:

- When $\rho \in (-\infty, \delta)$, refraining is a strictly dominant strategy for every informed voter, since the benefit of sharing is always lower than its cost, regardless of the actions of other IV.

[8] The assumption that with probability $p(\theta,\nu)$ all uninformed voters learn the incumbent's type is a simplifying assumption. An alternative interpretation is that $p(\theta,\nu)$ is the probability with which more than half of all the voters learn the type of the incumbent, which complicates the analysis slightly but does not change the results qualitatively.

[9] This section focuses on the case where the $\mathbf{V_A}$ are informed and $\mathbf{V_M}$ are not, which is the case of interest for the purposes of this paper. It can be easily seen that the same analysis applies for the other case.

[10] Implicit in this setup is the assumption that the informed voters who share the signal on social media incur the costs of sharing regardless of the outcome of the elections. This is for purposes of simplicity and the model can easily be extended to accomodate costs that are dependent on the whether the bad incumbent stays in power or not.

- When $\rho \in [\delta, (\delta + c)]$, neither strategy is strictly dominant. Hence the equilibrium depends on players' beliefs about both the actual value of connectedness, and what the other players will do. The benefit of sharing is then characterized by $\delta \leq b(\theta) \leq c + \delta$ (strictly if $\theta \in (\delta, (\delta + c))$).[11]
- When $\rho \in ((\delta + c), \infty)$, sharing is a strictly dominant strategy for every informed voter, since the benefit of sharing is always greater than its cost, regardless of the actions of other IV.

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, $s_i(\rho_i) \in \{0, 1\}$ for all ρ_i. Note that, for any informed voter the expected utility gain of sharing increases as their posterior expectation of connectedness goes up, holding ν constant. If the optimal strategy of an IV is to share at some posterior expectation $\hat{\rho}$, it should be to share for any $\rho \geq \hat{\rho}$. Hence, it is natural to think of a strategy profile where each informed voter chooses to share when their posterior expectation of connectedness is higher than a cutoff ρ^*, and refrain when it is lower.

When every informed voter uses such a cutoff strategy, since their preferences are identical, their cutoff points must be equal as well. We will show below 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 cutoff point. For her to use ρ^* as the cutoff rule, she must be indifferent between sharing and refraining. This holds true only when the expected benefit of sharing equals the expected cost of sharing, that is $b(\rho_i) = c(1 - \nu) + \delta$. For a voter whose posterior on θ is ρ^*, the expected benefit of sharing is equal to $b(\rho^*) = \rho^*$. To see whether this equals to $c(1 - \nu) + \delta$, we must first calculate the expected value of ν, or the expected proportion of IV who share the information conditional on the posterior expectation ρ^*. Note that the proportion of IV who choose to share is equal to the probability that any single 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^*.

Given ρ_i, voter i believes that θ is distributed normally with mean ρ_i and precision $\alpha + \beta$. She also believes that 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 $\frac{1}{\alpha+\beta} + \frac{1}{\beta}$. Therefore, i's belief about j's posterior has precision:

$$\frac{1}{\frac{1}{\alpha+\beta} + \frac{1}{\beta}} = \frac{\beta(\alpha + \beta)}{\alpha + 2\beta}$$

[11] If there was perfect information on θ, there would be two self-fulfilling equilibria at $\nu = 0$ and at $\nu = 1$.

Hence we follow Morris and Shin (2001) and write:

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

Therefore, 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 cumulative distribution above as:

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

The equilibrium cutoff ρ^* must satisfy the equality:

$$b(\rho^*) = c\left(1 - \left(1 - \Phi\left(\sqrt{\eta}(\rho^* - \mu)\right)\right)\right) + \delta$$

Equivalently:

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

Note that both sides of the above equation are increasing in ρ^*. For there to be a unique cutoff point where the IV choose to share if and only if their posterior is greater than that cutoff point, the two sides of the above equation must cross exactly once. As standard in the literature, we assume the slope of the right hand side is less than 1, the slope of $b(\theta)$. The upper bound of the slope of the cumulative distribution function of the normal distibution is given by the probability function evaluated at the mean, that is $\sqrt{\eta/2\pi}$, hence we set the upper bound of the slope of the right hand side equal to $c\sqrt{\eta/2\pi}$.

Proposition 1. *When $\eta < \frac{2\pi}{c^2}$, there is a unique equilibrium. In this equilibrium, every IV shares the information if and only if their posterior $\rho > \rho^*$, where ρ^* is the unique solution to:*

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

Proof. All proofs are in Appendix B. □

Recall that an informed voter with signal x_i has the posterior:

$$\rho_i = \frac{\alpha\mu + \beta x_i}{\alpha + \beta}$$

Since she will share if and only if $\rho_i > \rho^*$, where ρ^* satisfies the equality in Proposition 1, this implies that an informed voter shares if and only if $x_i > \rho^* + \frac{\alpha}{\beta}(\rho^* - \mu)$. Since the incumbent and the media outlets believe that the x_i are distributed with mean μ and precision β, from the incumbent's perspective, the expected proportion of informed voters who share is given by:

$$\mathbb{E}[\nu|\rho^*] = 1 - \Phi\left(\sqrt{\eta}\left(\rho^* + \frac{\alpha}{\beta}(\rho^* - \mu) - \mu\right)\right)$$

The incumbent and the media outlets do not observe private signals, so for them the probability of overturn is only a function of the prior on the state, μ. Hence, we write $\mathbb{E}[p(\theta, \nu)|\mu] = p(\mu)$ and denote by it the probability of overturn when connectedness is distributed with mean μ and an expected fraction $\mathbb{E}[\nu|\rho^*]$ of informed voters share the signal.

3.3 Equilibrium Media Capture

The payoff of a media outlet depends not only on its own action, but also on whether the other outlet chooses to publish or not. When both publish, outlet *i* only reaches its own audience. When *-i* suppresses, however, with probability $p(\mu)$ the audience of *-i* is convinced by the informed voters via social media that *i* contains important news. In this case the audience of *-i* switch to *i* and therefore the expected payoff of the informative outlet increases:[12]

$$EU_i(\text{publish}) = \begin{cases} \sigma_i, & \text{if -}i\text{ publishes} \\ \sigma_i + p(\mu)\sigma_{-i}, & \text{if -}i\text{ suppresses} \end{cases}$$

When *i* suppresses, its payoff is the transfer proposed by the incumbent:

$$U_i(\text{suppress}) = t_i$$

In equilibrium, when a media outlet is indifferent between accepting or rejecting an offer, it will accept. Making any offer to an outlet that is strictly greater than its opportunity cost is a strictly dominated strategy for the incumbent. These are captured in the following lemma:

[12] We could introduce a punishment imposed by the audience of the uninformative outlet to the outlet itself, when the UV learn through social media that the incumbent is bad and the outlet chose to suppress this information in exchange of a transfer. Our results hold in that case as well.

Lemma 2. *Given the level of connectedness, the incumbent must adopt one of the following three strategies:*

$$\begin{array}{llll}
\text{1. Offer } t_M = \sigma_M + p(\mu)\sigma_A & \text{and} & t_A = \sigma_A + p(\mu)\sigma_M & \text{(capture both)} \\
\text{2. Offer } t_M = \sigma_M & \text{and} & t_A = 0 & \text{(capture M only)} \\
\text{3. Offer } t_M = 0 & \text{and} & t_A = 0 & \text{(no capture)}
\end{array}$$

In equilibrium, when both media outlets are captured the bad incumbent will be reelected for certain. When only M is captured, the incumbent will be reelected with probability $1 - p(\mu)$. And whenever M is not captured, the bad incumbent will certainly be overturned. Note that capturing A only is dominated by no capture, as in that case the incumbent will be overturned and still pay transfers.

Lemma 3. *The expected payoff of the incumbent is then:*

$$\begin{aligned}
EU_{Inc}(\textit{capture both}) &= r - \sigma_M - p(\mu)\sigma_A - (\sigma_A + p(\mu)\sigma_M) = r - 1 - p(\mu) \\
EU_{Inc}(\textit{capture M only}) &= r(1 - p(\mu)) - \sigma_M \\
EU_{Inc}(\textit{no capture}) &= 0
\end{aligned}$$

Before moving forward to the equilibria of this game let us denote by $r_1(\mu)$ the critical value of r at which the incumbent is indifferent between offering $t_M = \sigma_M$, $t_A = 0$ and offering $t_M = 0$, $t_A = 0$. In other words, $r_1(\mu)$ is the level of political rent that leaves the risk neutral incumbent indifferent between choosing to capture M alone, and capturing neither outlet, given the value θ. Formally:

$$r_1(\mu) = \frac{\sigma_M}{1 - p(\mu)}$$

It can easily be seen that $r_1(\mu)$ is increasing in μ.

Further, denote by $r_2(\mu)$ the critical value of r at which the incumbent is indifferent between offering $t_M = \sigma_M + p(\mu)\sigma_A$, $t_A = \sigma_A + p(\mu)\sigma_M$ and offering $t_M = \sigma_M$, $t_A = 0$, when $p(\mu) > 0$. That is to say when $r = r_2(\mu)$, the incumbent will be indifferent between capturing both outlets and capturing M alone. Formally:

$$r_2(\mu) = \frac{\sigma_A + p(\mu)}{p(\mu)} = 1 + \frac{\sigma_A}{p(\mu)}$$

Clearly, $r_2(\mu)$ is decreasing in μ. See Figure 4.1 for visuals of $r_1(\mu)$ and $r_2(\mu)$.

3.4 Equilibrium

The analysis in this section is summarized here. A formal proposition can be found in the Appendix.

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 believe that the incumbent is at least as likely to be good as a challenger, and votes for the incumbent.

If less than half of the voters observe the incumbent's type, those who do will choose to share the news on social media whenever their beliefs on connectedness is higher than the threshold characterized in Proposition 1. The level of connectedness therefore uniquely determines the probability of overturn when the incumbent chooses to capture the mainstream outlet only.

Given the probability of overturn, the incumbent chooses which outlets to capture, if at all. In particular, if $r_2(\mu) > r > r_1(\mu)$, then the incumbent captures M only. Otherwise he captures both if $r \geq \max\{r_1(\mu), r_2(\mu)\}$, and captures neither if $r < \max\{r_1(\mu), r_2(\mu)\}$.

Finally, the media outlets accept any offer from the incumbent in which transfers to them are at least as high as their expected commercial revenues of publishing information about the incumbent's type.

4 Results

4.1 Comparative Statics

First, taking σ_M and r as given, let us examine the effects of μ on capture. As μ goes up, we conjecture that media capture will move towards either extreme, but decrease in general.

To see why, note that as μ increases the payoff of the incumbent from capturing both outlets and capturing M only both decrease. The former happens because A's opportunity cost of suppressing increases. The latter happens because the probability of overturn increases when A publishes. Therefore, the set of political rent levels in which the incumbent finds it optimal to capture any outlet shrinks. However, since $r_2(\mu) = \frac{\sigma_A}{p(\mu)} + 1$ is decreasing in θ, the set of r in which capturing both outlets is preferred grows relative to capturing the mainstream outlet only. In other words, when $r_2(\mu) > r_1(\mu)$ for the marginal incumbent who is indifferent between capturing both and capturing M only, capturing both becomes strictly preferred as θ increases. This is because as $p(\mu)$ approaches one, the decrease in the probability of staying in power for the incumbent when he captures M only dominates the increase in the cost of capturing A when both outlets are captured.

Therefore we expect the press in highly connected countries to be generally either very independent or completely captured. In contrast, press in countries that are less connected should be on average less independent and have smaller cross-country variance. Naturally, greater press freedom leads to bad incumbents being identified and overturned more often. Therefore, voter welfare increases as press freedom goes up. All of this is summarized in the following proposition:

Proposition 4. *An increase in θ leads to an increase in $r_1(\mu)$ and a decrease in $r_2(\mu)$. Therefore, when $r_2(\mu) > r > r_1(\mu)$, and so only M is captured, the effect of an increase in θ can lead to complete capture or no capture depending on the exact values of parameters. Otherwise, an increase in θ has the unambiguous effect of increasing press freedom. Welfare is weakly increasing in press freedom.*

4.2 Empirical Analysis

To see how our findings fare against empirical data, we have examined various data sets such as the Database of Political Institutions by the World Bank (Beck et al., 2001) and the Freedom of the Press report by Freedom House (2013a). In the tables below "Penetration" is the 2012 worldwide internet penetration percentages data published by International Telecommunication Union. We divided our sample of 171 countries of which we had balanced data by the median level of internet penetration to examine how press freedom and voter welfare compare in more connected countries relative to less connected countries.

The index of press freedom we utilize for our analysis is the Freedom House's *Freedom of the Press 2013* Freedom House (2013a) report whose ratings cover events that took place between January 1, 2012, and December 31, 2012. This index was first conducted in 1980. Each year every country is given a score from 0 (best) to 100 (worst) according to 23 methodology questions and 109 indicators. Countries that have scores between 0 and 30 are regarded to have Free press; 31 to 60, Partly Free press; and 61 to 100, Not Free press.

Table 1: Internet Penetration and Press Freedom

	N	Mean press freedom score	Standard deviation of press freedom score
Below median internet penetration	86.00	60.14	17.88
Above median internet penetration	85.00	39.43	23.39

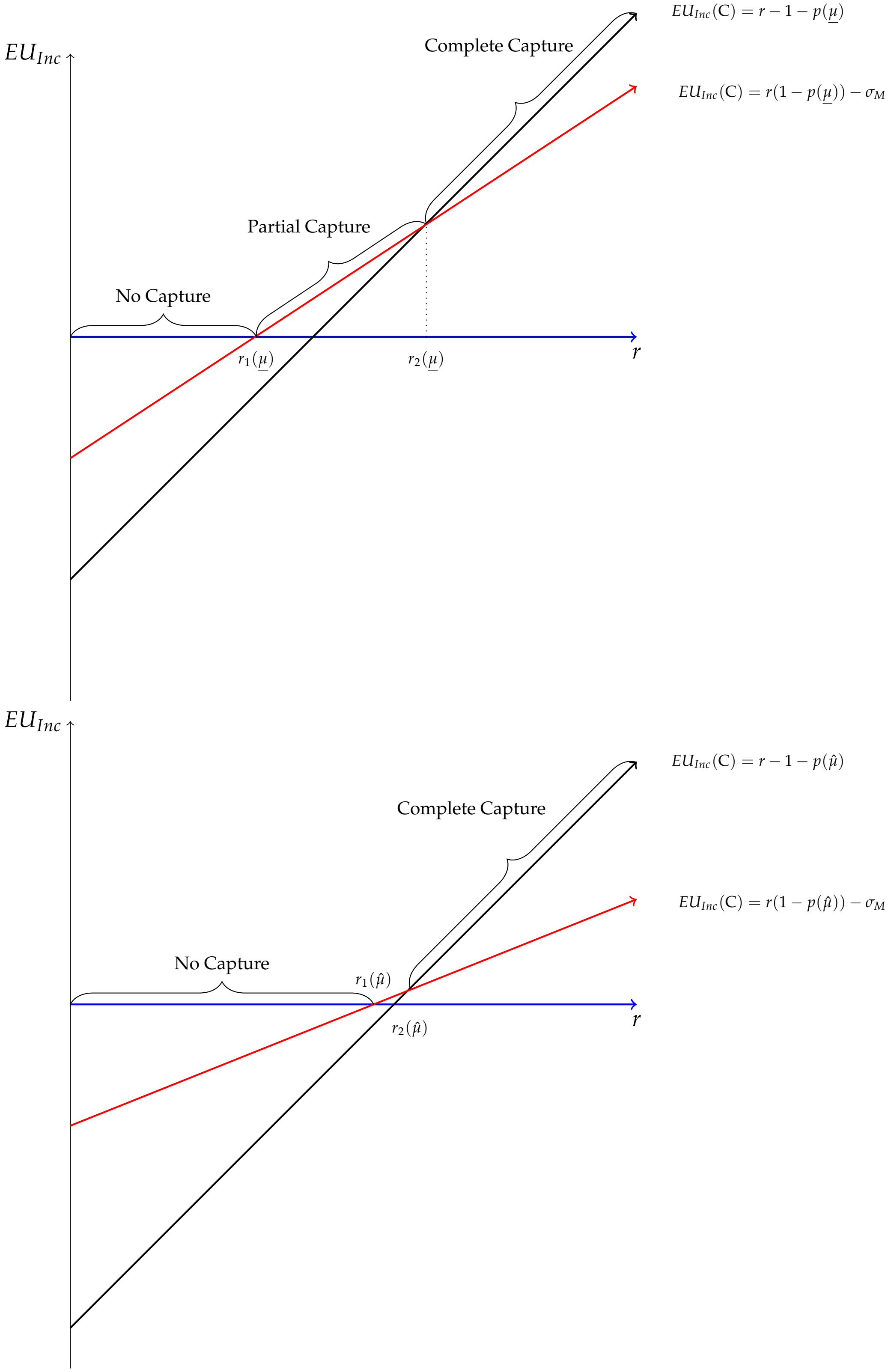
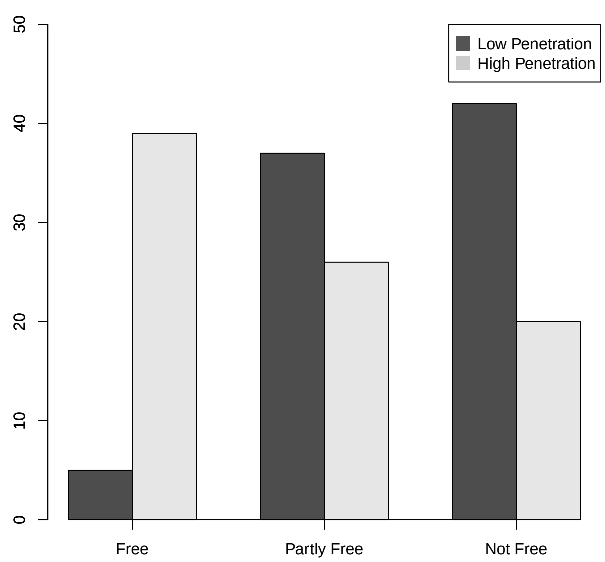


Figure 1: Best response correspondence of the incumbent for different levels of connectedness, with $\hat{\mu} > \underline{\mu}$, $r_1(\underline{\mu}) < r_1(\hat{\mu})$ and $r_2(\underline{\mu}) > r_2(\hat{\mu})$

Table 1 shows that if we divide the set of countries into two groups of equal size by the median level of internet penetration, the countries above this level have an average press freedom score of 39.4, a score significantly better than the countries with less than median penetration, which have an average of 60.1. This is in line with our hypothesis that higher connectedness is correlated with greater press freedom. Furthermore, highly connected countries also have a wider spread with a standard deviation of 23.4, compared with 17.9.[13] This corroborates our theoretical finding that as connectedness goes up press freedom is likely to go towards either extreme.

Figure 2 below is a histogram showing the frequency of countries in each category according to the ratings in the Freedom House (2013a) report, with high penetration countries shown in light grey against low penetration countries shown in dark grey. There are only five countries in our sample of 171 that have lower than median internet penetration rates and a Free press.[14] This contrasts with the press in high penetration countries, which are mostly Free. In line with our hypothesis, there are fewer countries with Partly Free press among high penetration countries relative to low penetration countries.

Figure 2: Internet Penetration and Press Freedom



Freedom House categorizes countries with press freedom scores between 0-30 as Free, 31-60 as Partly Free and 61-100 as Not Free.

The relationship between press freedom and corruption is well documented, (see for instance Brunetti

[13]Both the difference in means and the difference in standard deviations are significant at the 0.01 level.
[14]Those countries are Cape Verde, Ghana, Papua New Guinea, Sao Tome and Principe, and Suriname.

and Weder (2003)). As a proxy for voter welfare we use a corruption measure, namely the Corruption Perceptions Index 2012 Transparency International (2013), which aggregates data from a select number of different sources from credible institutions, including the World Bank, Global Insight and the World Economic Forum. In this index, 0 corresponds to highest possible level of perceived corruption, whereas 100 corresponds to least possible level of perceived corruption.

Table 2: Internet Penetration and Corruption

	N	Mean corruption score	Standard deviation of corruption score
Below median internet penetration	86.00	30.71	10.53
Above median internet penetration	85.00	55.37	18.76

Table 2 reveals that in line with our findings in Table 1 and Figure 2, countries with greater connectedness fare significantly better in terms of corruption compared to the countries with low connectedness. The former group has an average score of 55.4, almost twice as large as the average of the latter, 30.7. Even more striking is the difference in the standard deviation of the two groups. High penetration countries have a standard deviation of 18.8, much larger than the standard deviation of the low penetration countries, which is only 10.5.[15] This supports the hypothesis that connectedness can serve as a good deterrent against corruption, but in countries with high political rent, efforts to subvert connectedness despite high levels of internet penetration may be at least partially successful.

Table 3 presents our set of ordinary least squares and tobit regressions. The dependent variable is the press freedom index by Freedom House, where lower values refer to greater press freedom.[16] The main independent variable of interest is the internet penetration rate, whose sign is significant at the 0.001 level under all our specifications. We also use a range of controls. Number of checks on government is from the Database of Political Institutions, and refers to “the number of decision makers whose agreement is necessary before policies can be changed” (Beck et al., 2001). We include this variable to control for the potential for passing of laws that make it easier for governments to suppress press freedom. We take the log of the number of veto players with the intuition that their marginal effect on lawmaking diminishes as their numbers grow.[17] In every regression, this variable is highly significant with a coefficient of the expected sign. GDP per capita is relevant for a range of reasons, including infrastructure for press and

[15]Both the difference in means and the difference in standard deviations are significant at the 0.01 level.
[16]Our results are robust to the use of another press freedom index, available upon request.
[17]Our results are qualitatively the same if we use the number of checks and not their log.

audience related revenues for media outlets. It has a coefficient of the expected sign, but it is statistically non-significant in each of the regressions.

Our model essentially focuses on diffusion of information via social media, however data on Twitter usage and blog posts are not readily available. So we proxy for those using Facebook prevalence data, which is the ratio of Facebook users to all internet users. The coefficient on Facebook prevalence is significant at the 0.05 level, with higher Facebook usage associated with greater press freedom.[18] Another variable we control for is whether the chief executive has a finite term in office. This is to make sure that our results are also robust to the subset of countries where the constitution allows governments to be overturned by legal means. Finally, since the model suggests a non-monotonic relationship between internet penetration rate and press freedom, we control for the squared deviation of each observation from the mean level of internet penetration. The sign on the coefficient of this variables is the same as the sign on penetration, implying that the beneficial effect of an increase in internet penetration is greater for higher levels of penetration. This is in line with our finding that for sufficiently high values of connectedness, the set of political rents for which partial capture is optimal disappears, and thus any increase in connectedness from then on unambiguously improves press freedom.[19] Put differently, when penetration is sufficiently high, capturing any media becomes both prohibitively expensive and highly unlikely to keep information hidden from voters. Conversely, governments that have much at stake in holding on to power have high incentives to keep internet usage rates low.

As a robustness check, we also pre-processed the data using matching analysis, where treated observations are matched with untreated observations and weighed accordingly.[20] The internet penetration rate was used as the treatment variable. The most natural cutoff suggested by the theory is 50, because regardless of the size of the audience share of the alternative media, when at least half of the population is online that should be sufficient for a majority of the people to learn the incumbent's type. One potential pitfall is that the mean internet user age is lower than the mean age in most countries, and therefore the fact that at least half of the population is online might not necessarily imply more than half of the *voters* are online. As such, it is possible that a more precise cutoff could be slightly above 50.

For this reason, we tried a range of cutoffs as well as a variety of matching methods to test our hypotheses. The reader can see in Table 4 that although coefficients somewhat vary between different matching

[18] This result is robust to omission of countries where access to Facebook is blocked.

[19] Among the countries whose internet usage rate is greater than 80%, 17 are Free, 3 are Not Free (Bahrain, Qatar, UAE), and the only country (South Korea) that is Partly Free has a score of 31, where the threshold to be considered Free is 30.

[20] Matching safeguards against the possibility of results being driven by a small number of extreme observations by under-weighing such observations, and reduces bias due to confounding.

Table 3: Press Freedom (Freedom House)

	OLS	OLS	OLS	OLS	OLS	Tobit
(Intercept)	82.09***	92.46***	90.41***	93.92***	94.81***	94.81***
	(2.58)	(8.16)	(8.21)	(9.18)	(9.06)	(8.85)
Penetration	−0.34***	−0.28***	−0.32***	−0.32***	−0.29***	−0.29***
	(0.04)	(0.06)	(0.07)	(0.07)	(0.07)	(0.06)
Checks (log)	−20.32***	−20.29***	−18.95***	−18.31***	−17.60***	−17.60***
	(2.19)	(2.21)	(2.33)	(2.69)	(2.67)	(2.61)
GDP per capita (log)		−1.56	−0.63	−0.77	−0.57	−0.57
		(1.15)	(1.19)	(1.20)	(1.18)	(1.16)
Facebook prevalence			−10.19*	−9.95*	−10.94*	−10.94*
			(4.86)	(4.89)	(4.84)	(4.72)
Finite term in office				−3.31	−3.76	−3.76
				(4.80)	(4.74)	(4.62)
Squared deviation of					−0.40*	−0.40*
internet penetration					(0.18)	(0.17)
Log(scale)						2.69***
						(0.06)
N	160	159	149	148	148	148
R^2	0.56	0.56	0.57	0.57	0.59	
adj. R^2	0.56	0.56	0.56	0.56	0.57	
Resid. sd	15.55	15.56	15.27	15.31	15.10	
log L						−608.15
p(Wald)						0.00

Standard errors in parentheses

† significant at $p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

methods, the results are qualitatively and quantitatively similar.[21]

Then, we ran propensity score matching with the full range of cutoffs on internet penetration rate. The coefficient on the treatment variable is significant at the 0.01 level for any cutoff between 37 and 78, both inclusive. Furthermore, any cutoff between 50 and 71 is significant at the 0.001 level, and the lowest p-value is a attained when the cutoff is set to 55%.[22]

[21] Afghanistan, Bosnia-Herzegovina, Belarus, Bolivia, Brazil, Central African Republic did not have entries for the number of checks on government for the year 2012, so they have been approximated by the value of checks for the closest year available, 2010. The omission of these observations do not change the results qualitatively, but make some coefficients slightly less significant (but still highly significant) due to smaller sample size.

[22] The countries with rates of penetration between 50 and 55 are Albania, Azerbaijan, Kazakhstan, Russia, Saudi Arabia. All of them

Table 4: Press Freedom (Freedom House)

	CBPS	Full	Genetic	Optimal	Prop. score
(Intercept)	99.32***	95.12***	108.50***	100.72***	103.21***
	(10.19)	(8.57)	(11.91)	(10.98)	(11.00)
Penetration above 50%	−13.15***	−8.22**	−19.96***	−11.91***	−12.13***
	(2.89)	(2.76)	(4.23)	(3.48)	(3.53)
Finite term in office	−2.23	8.54*	1.62	−2.96	−3.48
	(5.22)	(4.00)	(6.20)	(5.77)	(5.93)
Checks (log)	−22.14***	−23.17***	−28.66***	−22.31***	−21.49***
	(2.91)	(2.84)	(3.28)	(3.43)	(3.53)
GDP per capita (log)	−2.62*	−3.58***	−2.50*	−2.81*	−3.09*
	(1.09)	(0.90)	(1.16)	(1.24)	(1.24)
N	164	164	81	122	122
R^2	0.49	0.60	0.73	0.52	0.50
adj. R^2	0.48	0.59	0.71	0.50	0.48
Resid. sd	1.87	12.74	14.76	16.55	16.76

Higher scores of the dependent variable refer to lower press freedom
Standard errors in parentheses
† significant at $p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

As a final robustness check, we examined the subset of countries with penetration rates close to the threshold to be better able to discern the effect of being just above it versus just below it. When we restrict attention to the subset of countries with penetration rates between 45 and 65, and use 55 as the cutoff, the sample size goes down to 28. This makes the coefficient of the treatment statistically significant only at the 0.1 level, but it is qualitatively the same, as can be seen in Table 5.

Overall, the empirical analyses present strong and robust evidence in favor of our theoretical findings. Greater internet use generally corresponds to improvements in press freedom; however especially for intermediate values of internet penetration there is clearly some deterioration in press freedom as internet use becomes more widespread.

except for the first have press freedom scores above 80.

Table 5: Press Freedom (Freedom House)

	Propensity score
(Intercept)	91.85^{**}
	(30.43)
Penetration above 55%	$-11.84^{\dagger}$
	(6.60)
Finite term in office	-14.46
	(13.10)
Checks (log)	-20.56^{*}
	(7.53)
GDP per capita (log)	-0.82
	(3.19)
N	28
R^2	0.49
adj. R^2	0.40
Resid. sd	17.26

Standard errors in parentheses

† significant at $p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

5 The Case of Turkey

In this section we relate the assumptions and findings of our model to what happened in Turkey in the summer of 2013. We assume in the model that media can be divided into two subgroups, mainstream media and alternative media. The incumbent can target these differently, and may capture one while largely ignoring the other, which appeared to be the case in Turkey.

A brief exploration of Turkish media yields the answer to why some outlets appeared to be free to produce whatever news they wish, whereas most others chose to ignore what seem to be very significant historical events. Like Halk TV, the newspaper Sözcü is universally acknowledged to be extremely anti-government. Many of its editors moved to Sözcü after they were fired from their previous outlets, allegedly due to government pressure. Similarly, a huge portion of Sözcü's audience switched to the anti-government daily after their previous newspapers changed their stances to accommodate the then incumbent prime minister Erdoğan's Islamist government. Eventually Sözcü became a haven for the disillusioned secularists in an increasingly polarized society. It should be no surprise that Sözcü sold an average of 363,057 copies in the last week of June 2013, soon after the protests erupted, a sixfold increase after its initial debut in

June 2007 when it only sold an average of 61,183 copies on its first week, and three times as much as what it sold in late 2008. Not only is the audience of Sözcü utterly opposed to Erdoğan and his Justice and Development Party (AKP), its staunch adherence to old Kemalist principles makes it unlikely to ever appeal to the Islamists and the liberals of the country:

> [D]espite being among the country's highest-circulating dailies, Sözcü only reaches the substantial minority already predisposed to its secularist Kemalist views, which would never vote for the AK Party. It is not a government target. (Freedom House, 2014)

This is in contrast to the more mainstream media outlets in Turkey, who have a relatively milder tone, and are much less extreme, regardless of whether they are pro- or anti-government. Among them are the TV channels NTV, Kanal D, ATV, Haber Türk, Show TV and CNN Türk, as well as a number of very popular newspapers:

> There is also a group of newspapers considered "mainstream", meaning that despite their political legacies they can reach an audience beyond the true believers of one ideological group. These papers include Hürriyet (409,000), Milliyet (168,000), Sabah (319,000), and Akşam (103,000). A key aspect of the government's efforts to control the media has been to focus most of its attention and pressure on these "mainstream" outlets. (Freedom House, 2014)

Erdogan's AKP government chose to accommodate both extreme pro-government and extreme anti-government media outlets, and focused its efforts almost exclusively on the mainstream outlets that reached a much broader audience. How they managed to do that, of course, is another very important question.

Commercial revenues for media outlets are limited in Turkey, and it is understood that often the owners of media outlets are in this business so that they have a means to show their loyalty to the government in charge, in the hopes that the favor will be returned. 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, are run by the prime minister's office. Given that the prime minister has the final say on many lucrative business contracts, it is hardly surprising that media in Turkey seems to be under the government's influence, and they suppress some information they would otherwise publish.[23]

[23] "A remark heard frequently during Freedom House's investigations is that many owners of powerful holding companies regard media properties as a burden rather than a privilege—a levy that must be paid to ensure continued access to government contracts. An increasingly common phenomenon is a game of 'pass the can,' where holding companies bear the cost of running a pro-government media group for a time and then try to transfer ownership to another beneficiary of government favor as quickly as circumstances allow." (Freedom House, 2014)

It is only reasonable that the citizens of Turkey started depending on the internet, in particular the social media, to receive news about their country. This is indeed what happened increasingly, as one report shows that average daily time spent on the internet increased by 50 percent between 2011 and 2013. Meanwhile the time spent on TV and newspaper decreased by 11 percent. Furthermore, Turkey is a close contender to the top spot in rankings of countries with the highest penetration rate of popular social media websites, most notably Facebook and Twitter.

In our model, this means that the prior expectation of connectedness in Turkey was relatively high, but perhaps not high enough so that the incumbent would capture all media. Thus, people who consumed the alternative outlets had a chance to take the news to social media, and try to convince those who followed other outlets to switch.

While Turkey is an interesting case, it is by no means an exception. The recent proliferation of social media slowly but surely alters the way people across the world receive and share news across the globe. A Eurovision study published in February 2013 claims that 43% of young people surveyed find their news via social media instead of search engines (Hahn, 2013). Another report by the Pew Internet Center published in November 2012 found that 30% of the registered voters in the USA had been encouraged to vote for either the Democrat or the Republican candidate in the 2012 presidential elections by family and friends via posts on social media (Rainie, 2012). Moreover, social media has been central throughout the Arab Spring. As Farrell (2012) argues: "Facebook and other organizing tools played a significant roleâĂŤbut only together with more traditional means of organizing, and more traditional media such as al-Jazeera." Evidence shows that protesters across Middle East and North Africa utilized social media to disseminate information regarding the incumbent as well as organizing rallies and demonstrations (Howard et al., 2011).[24]

It appears that politicians have caught up with this trend, and they are trying to find ways of discouraging the public from sharing news on the social media. In many countries, including Iran, Bahrain, Oman and Belarus social media users have been jailed or arrested for posts critical of the government. Turkey's then prime minister, as a response to the wide-spread use of Twitter during the June 2013 protests, called it a "menace to society" (Freedom House, 2013b). Soon after, public figures were personally targeted by pro-government media outlets for tweets in support of the protests. In Vietnam, a law came into effect in September 2013 that makes it illegal to post and share information gathered from press organizations on social media (Greenhouse, 2013). Furthermore, according to the Freedom on the Net report published by

[24] One example is a video showing Tunis' ex president Zine El Abidine Ben Ali's wife using a government jet to make expensive shopping trips to Europe.

the Freedom House in October 2013, 22 of the 60 governments examined in the study found evidence of hired pro-government commentators to manipulate online discussions.

6 Conclusion

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, due to its independent nature, may serve as an invaluable complement to traditional media in this sense.

Information technologies keep on spreading across the globe. However, this does not necessarily mean that press freedom and political accountability should improve universally. Governments whose survival depend on the control of information to further their interests find means to counteract the spread of information, and can sometimes even reverse this trend. In other words, while internet penetration rate increases in most countries with a problematic press, connectedness may not show an equivalent rise. This is sometimes done by direct censor of social media, which is the case in China, Iran, Syria and Pakistan among others. A more common practice is enacting laws that introduce fines or prison sentences to citizens who share information on politicians online. A relatively new method that is spreading quickly is to hire pro-government commentators to manipulate online discussions in an effort to counterbalance the increasing time spent online by citizens. All of these serve to decrease connectedness among voters despite the overall trend of increasing penetration.

Our results indicate that connectedness is a useful predictor of both press freedom and corruption. Our empirical research supports this hypothesis. It is not very surprising to see that the introduction of new information technologies hurts those who rely on lack of information. What is surprising, however, is our novel finding that in high political rent countries where there is only partial capture in the absence of social media, proliferation of information technologies may lead to increased suppression of press. That is because alternative media, complemented by social media, may offer substantial opposition to the incumbent. Again, empirical evidence does not reject this hypothesis, and in fact seems to corroborate it.

Our findings highlight the importance of social media and internet freedom as a means to overcome suppression of information, especially of political nature. To this end, it is crucial to promote freedom of speech online. Also important is information about internet freedom across countries. While Freedom

House's *Freedom on the Net* report is commendable, it includes only 65 countries, a number which fades in comparison to the number of countries in Freedom House's *Freedom of the Press* report, 197.

Further research may focus on endogenizing media capture, in the sense that instead of assuming that mass media is made up of two distinct groups, the incumbent may choose what fraction of the market share to capture. Also interesting would be a study of extensions where the incumbent can take a costly action to interfere with connectedness by hiring pro-government commentators that spread misinformation online, or by introducing new laws and regulations that effectively increase the cost of sharing, c. As for the empirical part, an important research question is how social capital fares with respect to the other critical variables, particularly press freedom, corruption, and penetration.

Appendix A: Equilibrium

The analysis in section 3.4 is formalized in the following proposition:

Proposition 5. *The following constitutes an equilibrium:*

Beliefs of Voters:

$$\textit{the audience of M believe } P(\theta = g) = \begin{cases} 0 & if \quad s_M = b \\ \hat{\gamma}_M & if \quad s_M = \varnothing \end{cases}$$

$$\textit{the audience of A believe } P(\theta = g) = \begin{cases} 0 & if \quad s_A = b \\ \hat{\gamma}_A & if \quad s_A = \varnothing \end{cases}$$

where

$$\hat{\gamma}_M = \begin{cases} 1 & \text{if } r < r_1(\mu) \\ \gamma + p(\mu) - p(\mu)\gamma & \text{if } r_1(\mu) \leq r < r_2(\mu) \\ \gamma & \text{if } r \geq \max\{r_1(\mu), r_2(\mu)\} \end{cases}$$

and

$$\hat{\gamma}_A = \begin{cases} 1 & \text{if } r < \max\{r_1(\mu), r_2(\mu)\} \\ \gamma & \text{otherwise} \end{cases}$$

Strategies of Informed Voters:

Informed voters share if $\rho > \rho^*$, and refrain otherwise, where ρ^* is the unique solution to:

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

Strategies of Voters:

Audience of i vote for incumbent if $s_i = \varnothing$ and $s_{-i} = \varnothing$. If $s_i = b$ they vote for the challenger. If $s_i = \varnothing$ and $s_{-i} = b$, and if they switch to outlet -i as a result of the social media game, they observe $s_{-i} = b$ and therefore vote for the challenger. Otherwise they vote for the incumbent.

Strategies of the Incumbent:

Incumbent offers:

If $r < \sigma_M$, then $t_M = 0$ and $t_A = 0$.

If $r_2(\mu) \geq r_1(\mu)$ and

if $r \geq r_2(\mu)$, then $t_M = \sigma_M + p(\mu)\sigma_A$ and $t_A = \sigma_A + p(\mu)\sigma_M$,

if $r_2(\mu) > r \geq r_1(\mu)$, then $t_M = \sigma_M$ and $t_A = 0$,

if $r_1(\mu) > r$, then $t_M = 0$ and $t_A = 0$.

If $r_1(\mu) > r_2(\mu)$ and

if $r \geq r_1(\mu)$, then $t_M = \sigma_M + p(\mu)\sigma_A$ and $t_A = \sigma_A + p(\mu)\sigma_M$,

if $r_1(\mu) > r$, then $t_M = 0$ and $t_A = 0$.

Strategies of the media outlet *i*:

For outlet M:

Accept if $t_M \geq \sigma_M + p(\mu)\sigma_A$,

Reject otherwise.

For outlet A:

Accept if $t_A \geq \sigma_A + p(\mu)\sigma_M$, or if $t_A \geq \sigma_A$ and $t_M < \sigma_M + p(\mu)\sigma_A$,

Reject otherwise.

Appendix B: Proofs

Proof of Proposition 1 Denote by $u(\rho, \hat{\rho})$ the expected utility of an informed voter with the posterior expectation ρ who shares, when all other informed voters use the cutoff $\hat{\rho}$. Conditional on ρ 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:

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

If $\theta\leq\delta$, sharing is weakly dominated, regardless of the actions of the other IV. Let $\rho_1=\delta$. Then, any IV with $\rho\leq\rho_1$ will refrain[25]. This gives us the first round of elimination of dominated strategies for low values of ρ. Since all informed voters know this, they realize that when others have posteriors lower than ρ_1 they will never share. 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 also the best response threshold strategy to ρ_1. Furthermore, since $u(.,.)$ is increasing in the first argument and decreasing in the second, we know that $\rho_2\geq\rho_1$. Due to $\rho_2\geq\rho_1$ and the fact that payoffs are symmetric, 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:

$\rho_1\leq\rho_2\leq...\leq\rho_k\leq...$

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

A symmetric argument from the other side, that is to say, for high values of ρ, establishes a similar sequence:

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

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 premise $\eta\leq\frac{2\pi}{c^2}$ ensures that there is a unique value of ρ such that $u(\rho,\rho)=0$, and therefore $\rho_m=\rho^m$, which concludes our proof. ■

Proof of Lemma 2 The first strategy leads to the capture of all media outlets where transfers equal to the expected profits of publishing are made to both M and A. In other words, if M deviates its product will be consumed by its audience with size σ_M and also by the audience of A with probability $p(\theta)$, and it will receive a payoff of $\sigma_M+p(\mu)\sigma_A$ as a result. The incumbent must transfer the equal amount in equilibrium in order to capture M. If A deviates, its product will be consumed by its audience with size σ_A,

[25]The equality part follows from our assumption that voters use undominated strategies.

and furthermore with the probability of $p(\mu)$ it will also be consumed by the audience of M with size σ_M. A's expected payoff from publishing is therefore $\sigma_A + p(\mu)\sigma_M$, and the incumbent must transfer an equal amount to A to capture it as well.

The second strategy leads to M's capture, but since $t_A = 0$, A will reject the offer and publish the bad signal. In fact the incumbent could offer any amount strictly lower than $\sigma_A + p(\mu)\sigma_M$, and the outcome would be the same. But for simplicity of notation we assume that they offer zero whenever they wish not to capture an outlet.

In the third strategy M rejects the offer because it is strictly below the expected payoff of publishing. Since M publishes the signal, the V_M will not switch to A, thus making the expected payoff of publishing σ_A for the alternative outlet. Hence the incumbent has no incentive to transfer any amount greater than σ_A.

Note that the strategy $t_M = 0$, $t_A = \sigma_A$ 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 alone are enough to overturn the incumbent.

Finally, the incumbent has no incentive to offer an amount greater than σ_M to M and greater than $\sigma_A + p(\mu)\sigma_M$ to A in any case. ■

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 will be 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 will be overturned with certainty. If the incumbent decides to offer a positive transfer to the alternative outlet nevertheless, and the alternative outlet accepts the transfer, the incumbent will lose the transfer and receive nothing in return.

If the incumbent chooses to capture both outlets by offering $t_M = \sigma_M + p(\mu)\sigma_A$ and $t_A = \sigma_A + p(\mu)\sigma_M$, then the media will be captured completely, and the incumbent will be reelected for sure and receive $r - \sigma_M - p(\mu)\sigma_A - (\sigma_A + p(\mu)\sigma_M)$. Finally, if only the mainstream outlet is captured, the incumbent will be reelected with probability $(1 - p(\mu))$, and therefore their expected utility is equal to $r(1 - p(\mu)) - \sigma_M$. ■

Proof of Proposition 5

a) The proof that a voter will believe that the incumbent is good with probability zero upon receiving the bad signal is trivial, since bad signals are verifiable.

To prove the latter, note that upon receiving no bad signal, every voter will deduce that incumbent is good with a probability at least as high as γ. As likelihood of capture decreases or the probability of information about the incumbent spreading via social media increases, the expectations regarding the incumbent's type improve when the signal is empty.

b) This part follows from Proposition 1.

c) We assume that all types of 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 fixed at γ. Therefore a voter who observes $s = b$ strictly prefers the challenger, and votes against the incumbent.

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

We need to show that the voter who observes $s_i = \varnothing$ will vote for the incumbent when $\hat{\gamma}_i = \gamma$. Assume for a contradiction that she votes against the incumbent. Then the bad incumbent has no incentive to pay a transfer to media outlet i, since the readers of i vote against the incumbent even when the signal $s_i = \varnothing$. Therefore the incumbent offers $t_i = 0$ and the outlet i rejects and publishes the bad signal. If bad incumbent never captures outlet i, then $\hat{\gamma}_i = 1$. $\Rightarrow\Leftarrow$

Therefore when $\hat{\gamma}_i = \gamma$ it must be that the audience of outlet i vote for the incumbent.

d) Recall as in proposition 2 the incumbent must choose from one of the three strategies described.

The incumbent will find it optimal not to capture either outlet when $r < \sigma_M$, since in any capture equilibrium it must capture M, and if M is too expensive to capture then the incumbent is better off not capturing any outlet. Let us now examine the case when $r_2(\mu) \geq r_1(\mu)$.

If $r \geq r_2(\mu)$, then the incumbent will want to capture both outlets since:

$EU_{Inc}(\sigma_M + p(\mu)\sigma_A, \sigma_A + p(\theta)\sigma_M) = r - 1 - p(\mu) \geq r(1 - p(\mu)) - \sigma_M = EU_{Inc}(\sigma_M, 0)$

If $r_2(\mu) > r \geq r_1(\mu)$, then the incumbent will choose to capture M only, and take the risk that it will be overturned if the informed voters successfully convince the others about the type of the incumbent, because:

$EU_{Inc}(\sigma_M, 0) = r(1 - p(\mu)) - \sigma_M > r - 1 - p(\mu) = EU_{Inc}(\sigma_M + p(\theta)\sigma_A, \sigma_A + p(\theta)\sigma_M)$

If $r_1(\mu) > r$, then the incumbent will choose not to capture either outlet because he must pay σ_M to capture, but with the probability $p(\mu)$ he will still lose his seat. Therefore his expected utility from capturing M is:

$r(1 - p(\mu)) - \sigma_M < 0.$

In the case when $r_1(\mu) > r_2(\mu)$:

If $r \geq r_1(\mu)$, then the incumbent will want to capture both outlets since:

$EU_{Inc}(\sigma_M + p(\theta)\sigma_A, \sigma_A + p(\theta)\sigma_M) = r - 1 - p(\mu) \geq 0 = EU_{Inc}(0, 0)$

And finally, if $r_1(\mu) > r$, the incumbent will offer zero to both outlets for the same reasons as above.

e) The expected payoff of outlet i when it publishes but it is not the only one to do so is σ_i, so it will accept any offer equal to or greater than that. When i is the only outlet to publish the bad signal, on the other hand, its expected payoff is $(\sigma_i + p(\mu)\sigma_{-i})$, since with probability $p(\mu)$ the informed voters will convince others to switch to i. Therefore, i will accept a transfer if and only if it is greater than or equal to $(\sigma_i + p(\mu)\sigma_{-i})$ when $-i$ is captured. Lower offers will be rejected. ■

Appendix C: An extension

One potential critique towards the baseline model is our assumption that informed voters may derive positive benefits from sharing news on social media. In this appendix, we remove this assumption, and examine a situation where informed voters receive higher utility from the successful overturn of a bad incumbent, relative to those who refrained from sharing. This may be the case when citizens who spread the bad signal about the incumbent are thought to be the proponents of the overturn, and treated as such by a grateful challenger. We show that with a few technical assumptions, our results hold in this case as well.

As before, the probability that the uninformed voters learn the incumbent's true type is given by the function $p(\theta, \nu)$, which is differentiable and non-decreasing in both θ and ν. In this extension, we assume that social media acts merely as a catalyst for social interaction, and it is redundant in a perfectly connected society. In other words, for sufficiently high values of θ we have that $p(\theta, 0) = 1$. Conversely, in a society where people are extremely disconnected due to lack of information technologies and want of social capital, we assume that any attempt to spread information via social media will be in vain. Hence, for sufficiently low values of θ we have that $p(\theta, 1) = 0$.[26]

When a portion of the voters is informed that the incumbent is bad, their expected payoff when the incumbent retains power is zero, whereas overturning the incumbent and electing a challenger of unknown type has an expected payoff of γ. Moreover, informed voters receive higher utility from overturning the incumbent when they actively participated in spreading information about them. That is to say, in the case that the bad incumbent is overturned and succeeded by a challenger of unknown type, a voter who shared the news receives the expected payoff $\gamma + \kappa$ (where $\kappa > 0$ is the political advantage obtained by voters who were active in social media), whereas a voter who refrained receives the expected payoff γ. Therefore, if an informed voter believes that the incumbent will be overturned with probability $p(\theta, \nu)$, his expected payoff from sharing as a function of θ and ν is:

[26] The former scenario of a perfectly connected society is only plausible in real life when the society in question is sufficiently small so that news can spread without any effort on the part of the informed voters. The other extreme is somewhat more realistic, as according to 2012 statistics many countries in Sub-Saharan Africa and Southeast Asia have internet penetrations lower than 5%.

$$p(\theta, \nu)(\gamma + \kappa) - c(1 - \nu) - \delta$$

On the other hand, the expected payoff of an IV who refrains from sharing is:

$$p(\theta, \nu)\gamma$$

Then, the utility of sharing minus the utility of refraining for given values of θ and ν:

$$p(\theta, \nu)\kappa - c(1 - \nu) - \delta$$

Note that if $\kappa < \delta$, then for any value of θ sharing is strictly dominated by refraining. When this is the case the presence of social media becomes irrelevant and the model is reduced to a setting very similar to that of (Besley and Prat, 2006). Therefore we only examine the case where $\kappa > \delta$. In fact to ensure the two-sided limit dominance property standard in the global game literature, we further restrict our attention to the case when $\kappa > c + \delta$. That is to say, we focus on the setting that when the incumbent is overturned for sure, the utility of sharing is strictly greater than its cost, even when none of the other informed voters share the signal. [27]

By the assumptions above and by the continuity of $p(\theta, \nu)$ in θ, there exists a critical level of connectedness $\bar{\theta}$, such that the following equality holds:

$$p(\bar{\theta}, 0)\kappa = c + \delta$$

Similarly, denote by $\underline{\theta}$ the critical level of connectedness that satisfies the following:

$$p(\underline{\theta}, 1)\kappa = \delta$$

Since $p(\theta, \nu)$ is non-decreasing in both arguments, it must be that $\underline{\theta} \leq \bar{\theta}$, strictly when $c > 0$. Hence, there are three intervals in which we can examine the best responses of the informed voters:

- When $\theta < \underline{\theta}$, refraining is a strictly dominant strategy for every informed voter, since the benefit of sharing is always lower than its cost, regardless of the actions of other IV.

[27] $\delta < \gamma\kappa < c + \delta$ leads to one-sided limit dominance, which is outside the scope of this paper. For an application of one-sided limit dominance, see (Bueno De Mesquita, 2010).

- When $\underline{\theta} \leq \theta \leq \bar{\theta}$, neither strategy is strictly dominant. Hence the equilibrium depends on players' beliefs about both the actual value of connectedness, and what the other players will do.
- When $\bar{\theta} < \theta$, sharing is a strictly dominant strategy for every informed voter, since the benefit of sharing is always greater than its cost, regardless of the actions of other IV.

By iterating the arguments in the baseline model, we get that the equilibrium cutoff ρ^* must satisfy the equality:

$$p\left(\rho^*, \left(1 - \Phi\left(\sqrt{\eta}(\rho^* - \mu)\right)\right)\right)\kappa = c\left(1 - \left(1 - \Phi\left(\sqrt{\eta}(\rho^* - \mu)\right)\right)\right) + \delta$$

Therefore we have:

$$p\left(\rho^*, \left(1 - \Phi\left(\sqrt{\eta}(\rho^* - \mu)\right)\right)\right)\kappa = c\Phi\left(\sqrt{\eta}(\rho^* - \mu)\right) + \delta$$

This equation means that an increase in the cutoff rule has three effects on the marginal informed voter whose posterior expectation is exactly equal to the cutoff point. On the right hand side we see that as the threshold increases, the ratio of informed voters who share the bad news about the incumbent goes down, which means that the cost of sharing increases. The other two effects can be seen on the left hand side. First of these is the direct effect which states that as connectedness goes up, the uninformed voters will have a greater probability of switching to the informative outlet and receiving the signal that the incumbent is bad. The second effect on the left hand side is the indirect effect, which says that as the threshold the informed voters use to decide increases, a lower ratio of informed voters choose to share, and the probability of the uninformed voters switching goes down. In other words, an increase in ρ^* in the above equation leads to an increase in the right hand side, but the effect on the left hand side is ambiguous.

To make sure that the benefits of sharing is equal to the costs of sharing for exactly one value of θ, which is a technical assumption standard in the global games literature, we assume $p_1 - p_2\sqrt{\eta}\phi(\rho^*) > \frac{c\sqrt{\eta}}{\kappa}\phi(\rho^*)$ for all $\rho^* \in$, where p_1 refers to the derivative of $p(\theta, \nu)$ with respect to the first argument, and p_2 refers to the derivative of $p(\theta, \nu)$ with respect to the second argument, and ϕ is the probability mass function of the standard normal distribution. We can rewrite the above inequality as follows:

$$p_1 > \phi(\rho^*)\sqrt{\eta}\left[p_2 + \frac{c}{\kappa}\right]$$

Propositions 1 and 4 can easily be replicated in this setting

It should be clear that our results in the baseline model do not depend on the particular payoff structure, and can be accomodated in a wide range of specifications, so long as the two-sided limit dominance property standard in the global game literature is satisfied.

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