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# Digital Authoritarianism and the Future of Human Rights

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**Abstract** How will advances in digital technology affect the future of human rights and authoritarian rule? Media figures, public intellectuals, and scholars have debated this relationship for decades, with some arguing that new technologies facilitate mobilization against the state and others countering that the same technologies allow authoritarians to strengthen their grip on power. We address this issue by analyzing the first game-theoretic model that accounts for the dual effects of technology within the strategic context of preventive repression. Our game-theoretical analysis suggests that technological developments may not be detrimental to authoritarian control and may, in fact, strengthen authoritarian control by facilitating a wide range of human rights abuses. We show that technological innovation leads to greater levels of abuses to prevent opposition groups from mobilizing and increases the likelihood that authoritarians will succeed in preventing such mobilization. These results have broad implications for the human rights regime, democratization efforts, and the interpretation of recent declines in violent human rights abuses.

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Mass communication, in a word, is neither good nor bad; it is simply a force and, like any other force, it can be used either well or ill. Used in one way, the press, the radio and the cinema are indispensable to the survival of democracy. Used in another way, they are among the most powerful weapons in the dictator's army.

—Aldous Huxley, *Brave New World Revisited*<sup>1</sup>

As the development of digital technology continues to accelerate, what are the implications of these changes for the future of human rights? Will new technologies empower social movements, enabling them to demand human rights protections and even topple repressive regimes? Or will new technologies bring new-found power to the state, facilitating mass surveillance and control, driving resistance further and further into the shadows? Answers to these questions have important implications not only in terms of our ability to understand the future of human rights but also for the future of democracy promotion policies and the design of human rights institutions.

Just as many have argued that centuries ago the printing press weakened the Catholic Church and contributed to the downfall of absolute monarchism in Europe,<sup>2</sup> in recent decades prominent thinkers have contemplated how modern

1. Huxley 1958, 34

2. Habermas 1991.

digital technologies might change every aspect of human society,<sup>3</sup> and particularly the relationship between state and society. Some argue that advances in digital technology aid civil society groups and individuals in collectively mobilizing to bring down authoritarian rule.<sup>4</sup> From the fax machines of the Tiananmen Square protests in 1989 to the more recent use of social media platforms during the Arab Spring, antigovernment groups have famously used the latest technologies to mobilize their supporters. However, advances in digital technologies also allow governments to monitor and track regime opponents,<sup>5</sup> potentially giving authoritarian governments the power to prevent and crush organized opposition in its infancy. Activists have expressed growing concerns about the impact of these developments on human rights.<sup>6</sup> A recent Freedom House study indicates that digital authoritarianism is not only on the rise but is an international problem.<sup>7</sup> The latest technologies for authoritarian control diffuse across global networks, through both private and governmental channels.<sup>8</sup> As US Defense Secretary Mark Esper recently noted, for example, “The [Chinese Communist] party has constructed a twenty-first-century surveillance state with unprecedented abilities to censor speech and infringe upon basic human rights. Now, it is exporting its facial recognition software and systems abroad.”<sup>9</sup> Analyzing the mechanisms by which regimes can use these technologies to their advantage is a crucial step, therefore, to improving our understanding of what the international community can do to protect global human rights in the future.

Given the competing effects of technology in terms of facilitating both dissent and repression, what are the impacts of technological development on human rights and authoritarian rule? Using tools such as natural experiments and the analysis of large behavioral data sets, scholars have examined the effects of specific technologies, especially the Internet and social media.<sup>10</sup> Yet empirical work has not yielded conclusive answers to this question.<sup>11</sup>

We argue that, to answer this question, human rights scholars must first shift their attention in two important ways. First, we must shift our attention toward preventive repression. We define preventive repression as the set of activities governments use to reduce the risk that opposition groups threaten governments’ power, including

3. Diamond 2010; Gates et al. 1995; Gore 1991.

4. Diamond 2010. A broader literature analyzes the microfoundations of the relationship between communications technology and protest. Barbera and Jackson 2020; Christensen and Garfias 2018; Nikolopov, Makarin, and Petrova 2020; Manacorda and Tesei 2020; Pierskalla and Hollenbach 2013.

5. Dickson 2016; Gohdes 2020; Milner 2006; Morozov 2012; Qin, Strömberg, and Wu 2017.

6. Freedom House 2016; Human Rights Watch 2019; La Rue 2011.

7. Freedom House 2016.

8. Dobson 2012; McLaughlin 2016; Steve Stecklow, Paul Sonne, and Matt Bradley, “Mideast Uses Western Tools to Battle the Skype Rebellion,” *Wall Street Journal*, 1 June 2011. Retrieved from <<https://www.wsj.com/articles/SB10001424052702304520804576345970862420038>>.

9. David Vergun, “Addressing China Threats Requires Unity of US, World Effort, Esper Says,” *DoD News*, 24 January 2020. Retrieved from <<https://www.defense.gov/Explore/News/Article/Article/2065332/addressing-china-threats-requires-unity-of-us-world-effort-esper-says/>>.

10. Farrell 2012.

11. Reuter and Szakonyi 2015; Shapiro and Siegel 2015.

opposition efforts to mobilize and organize public dissent. Preventive repression can include a wide range of tactics aimed at identifying, monitoring, and tracking potential regime opponents so as to neutralize them before they pose any real threat to the government.<sup>12</sup> With some exceptions, human rights scholarship focuses more often on responsive or reactive repression, which occurs after dissent has mobilized to challenge the state.<sup>13</sup> Yet the theorized effects of the latest digital technologies affect dynamics in earlier stages of contentious politics, during which states attempt to prevent the opposition from mobilizing in the first place. This shift in focus is especially important because not only do preventive and reactive repression differ in terms of their strategic contexts—they also tend to differ in terms of their manifestations as human rights abuses. The most violent human rights abuses, such as mass atrocities, tend to occur as instances of reactive repression, whereas preventive repression, especially when successful, tends to involve less violent abuses such as mass surveillance and censorship. Understanding how new technology affects preventive repression, therefore, is crucial to our ability to interpret prominent claims that violent human rights abuses are on the decline.<sup>14</sup>

Second, we should consider the effects of technological innovation on human rights in the strategic context of dissent and preventive repression, rather than focusing on how technology affects governments or opposition groups separately.<sup>15</sup> The two competing effects of digital technology do not operate in isolation, but rather by affecting the complex strategic relationship between authoritarian governments and those who seek to topple them. Existing work has not scrutinized the effects of technology within the strategic context of preventive repression.<sup>16</sup> Addressing this theoretical gap can help inform future data collection, research design, and interpretation of results. While quasi-experiments and other empirical tools may be useful, they must be guided by theory to avoid overinterpreting what may be local effects. The effects of digital technology may be more complex and context dependent than analysts might initially conjecture (as we will demonstrate).

We provide a theory that analyzes the dual effects of technological development on human rights and authoritarian rule. We model the interaction between an authoritarian government and an opposition group. The model accounts for the dual effects of digital technology by assuming that innovation lowers both the cost of preventive repression and the cost of organizing dissent. Consistent with scholarly work, human rights reports, and journalistic accounts about how authoritarian governments

12. Dragu and Przeworski 2019.

13. Conrad and Moore 2010; Danneman and Ritter 2014; Davenport 2007; Dragu and Lupu 2018; Hibbs 1973; Hill and Jones 2014; Ritter and Conrad 2016; Siegel 2011a, b.

14. Fariss 2014.

15. We use the term *digital technology* to refer broadly to digital communication technologies, including methods, systems, and devices used for the storage, transmission, and retrieval of information.

16. While some have recently described the dual effects of technology (Dafoe and Lyall, 2015; Rød and Weidmann, 2015; Shapiro and Siegel, 2015) and others have theoretically analyzed them individually (Little, 2016), ours is the first strategic model of the dual effects of digital technology in the context of preventive repression.

have used digital technologies, our model is substantively motivated by the notion that the first line of defense of authoritarian governments is preventive, rather than reactive, repression. Our model is thus intended to capture the effects of digital technology not in the midst of mass protests or mass atrocities, but at *earlier stages* of contentious politics.<sup>17</sup> An essential feature of this setting is that once an opposition group can organize and mobilize large-scale protests against the government, the government has already failed in its preventive repression attempts. Modeling preventive repression leads to a novel strategic structure vis-à-vis existing formal studies of authoritarian politics and human rights: in our setting, the players' actions are strategic complements from the point of view of the government, but strategic substitutes from that of the opposition group.<sup>18</sup> This strategic complements/substitutes framework, as we shall show, is key to understanding the effects of changes in technology.

Using this theoretical framework, we derive several important implications for the public debate. First, our model indicates that technological innovation increases the equilibrium level of preventive repression. This is consistent with the recent empirical record. As a global average, individuals' Internet freedom is on the decline, for example. In recent years, limits on individuals' use of the Internet and violations of individuals' speech rights on the Internet have both increased.<sup>19</sup> Following successful mobilization in countries like Egypt and Turkey, governments have adopted new technologies and increased their preventive repressive capacity to avoid a repeat of earlier uprisings.<sup>20</sup>

Second, we show that technological innovation increases the equilibrium probability that the government stifles the opposition in its infancy (and does so despite lowering the cost of mobilizing dissent). This theoretical result has clear empirical implications: all else equal, our model suggests that, assuming technology continues to develop and decrease the cost of preventive repression, we should be less likely to observe the emergence of mobilized opposition groups that challenge authoritarian governments.

Third, we derive implications over the situations in which authoritarian governments prefer technological development. Technological innovation is often endogenous to an authoritarian government's ability to retain power; in many contexts, governments have the ability to promote or limit the adoption of new technologies in their societies.<sup>21</sup> Addressing this requires a theoretically grounded understanding of the conditions under which such governments do or do not prefer technological innovation. Our analysis suggests that authoritarian governments would (a) not allow technological developments that would only facilitate mobilizing dissent and

17. Others have analyzed the interaction between the opposition and the government in later stages of contentious politics in which an (already) organized opposition takes the first action while the government decides on a repression policy as a reaction to the opposition's protests. Pierskalla 2010.

18. Our model makes novel contributions to the broader theoretical literatures on repression and authoritarian politics. Dragu and Polborn 2013; Gehlbach, Sonin, and Svolik 2016; Moore 2000; Paine 2016; Rundlett and Svolik 2016; Siegel 2011a, b; Svolik 2008, 2012, 2013.

19. Freedom House 2016.

20. Tufekci 2017.

21. Deibert 2015; Rød and Weidmann 2015.

(b) would allow technological developments that reduce the extent to which opposition movements attempt to mobilize dissent. Furthermore, authoritarian governments do vary in their capabilities to prohibit some digital technologies while allowing others, and our analysis suggests that governments with such capabilities are more likely to entrench their stay in power in comparison with governments without such capabilities.

In this article we contribute to an international relations literature on the future of human rights. Although respect for human rights has improved in recent decades,<sup>22</sup> many question whether these positive developments are likely to continue.<sup>23</sup> Our article takes a step toward answering this question by showing that technological developments consistently increase preventive repression. This implies that, all else equal, we are likely to see more of these types of human rights abuses in authoritarian regimes in the future. One extended implication of this result is that international efforts to protect human rights—including through legal institutions, democracy assistance, conditional aid and economic ties, and normative pressure—may become especially important as the digital age progresses. Another implication is that we might observe fewer reactive human rights abuses, such as mass killings or arrests of protesters. While this would certainly be good news on one level, our theory suggests that such positive developments might not necessarily be caused by international efforts to protect human rights, but rather by governments' improved ability to prevent protests from occurring in the first place. If no protester is shot because there are no protests, as a society we would have to assess whether this implies success or failure for the human rights regime.

## The Effects of Digital Technology

Changes in digital technology have important effects on human rights. As technology has rapidly advanced in recent decades, scholars have increasingly analyzed issues such as its role in closely related phenomena including political competition,<sup>24</sup> authoritarian politics,<sup>25</sup> and both violent and nonviolent repression of human rights.<sup>26</sup> Many argue that digital technologies empower civil society by lowering mobilization costs, thus facilitating the organization of protest movements and other forms of mobilized dissent.<sup>27</sup> Mobilizing public dissent is costly, and the success of activist movements and opposition groups often depends in part on finding ways to reduce these costs.<sup>28</sup> Opposition groups in uprisings such as the

22. Fariss 2014.

23. Hopgood 2013; Moyn 2010.

24. Acemoglu and Robinson 2006.

25. Farrell 2012; Reuter and Szakonyi 2015.

26. Dafoe and Lyall 2015; King, Pan, and Roberts 2013; Roberts 2018; Rød and Weidmann 2015; Shapiro and Siegel 2015; Shapiro and Weidmann 2015.

27. Diamond 2010; Howard 2010; Shirky 2008.

28. Tilly 1978.

Arab Spring have famously used social media to coordinate their activities.<sup>29</sup> Empirical work has found that increases in Internet adoption rates are correlated with both transitions to democracy<sup>30</sup> and greater levels of democracy,<sup>31</sup> and thus improvements in respect for human rights. We refer to this as the *mobilization effect* of technology.

Technology can nonetheless also have a negative impact on human rights. Without denying the beneficial effects of digital technologies to opposition groups, many argue that technological advancements also empower authoritarian governments<sup>32</sup> by facilitating preventive repression. Preventive repression is often the first and most important line of defense for authoritarians, hence the Stroessner regime's famous practice of "nipping in the bud" the possibility of any antigovernment activist groups. Preventing potential opposition groups from organizing and being publicly heard has long been an essential feature of authoritarian governments, from the creation of Fouché's secret police to augment Napoleon's rule to Metternich's use of political police to buttress the Habsburgs' power. Preventive repression can have multiple effects on dissenting groups. It can raise the cost of mobilizing to challenge the state by disrupting the dissenting group, cutting off their communication, making gathering more difficult, and restricting access to resources.<sup>33</sup>

Technological innovation provides authoritarian governments a wider set of tools with which to conduct these activities, thus lowering the cost of preventive repression. Contemporary authoritarian governments have consistently and effectively used technological tools to abuse human rights and further their own antidemocratic ends.<sup>34</sup> Recently, for example, such governments have used voice recognition to scan mobile networks, tracked citizens' movement using GPS, read emails and text messages in order to monitor dissident groups and selectively censor information, and used malware and spyware to secretly turn on webcams built into personal laptops and microphones in cell phones. The Internet, in particular, facilitates the use of many tools that benefit such governments, including sophisticated digital monitoring. We refer to this effect of technology as the *preventive control effect*.

New technology thus affects both (a) the government's ability to preventively stifle opposition groups' attempts to mobilize public protest and (b) opposition groups' ability to mobilize dissent. A given technology that has the potential to help dissenters organize may also have the effect of helping the authoritarian government stifle potential opponents before they can take actions that challenge the government. For example, while mobile phones can allow members of opposition groups to communicate, authoritarian governments can use this technology to monitor such communications and even locate these individuals before they can organize public

29. Tufekci 2017.

30. Norris 2001.

31. Milner 2006.

32. Kalathil and Boas 2003; Morozov 2012.

33. Tilly, 1978, 100.

34. Aday et al. 2010; Dickson 2016; Kalathil and Boas 2003; Lorentzen 2014; Rodan 1998.

actions. A United Nations report on the state of freedom of expression in the Internet age notes these dual effects of technological developments: “Innovations in technology have increased the possibilities for communication and protections of free expression and opinion, enabling anonymity, rapid information-sharing and cross-cultural dialogues. Technological changes have concurrently increased opportunities for State surveillance and interventions into individuals’ private communications.”<sup>35</sup> Thus, as Farrell cautions, “those who assume a simple relationship between new technologies and political outcomes may be making very serious mistakes.”<sup>36</sup>

The dual effects of technology are embedded in the strategic interaction between preventive repression and mobilization of dissent. “The same security features that appeal to users of the new platforms have brought them into conflict with governments,” resulting in blocks, shutdowns, and legal actions against Internet apps and platforms.<sup>37</sup> When considering whether to express disapproval of the regime, individuals fear retaliation from the government and find it difficult to exert effort to organize public dissent. In anticipation of such challenges, governments often choose to repress opposition groups before they have the capacity to organize large-scale protests to challenge the government’s grip on power. However, preventive repression is also costly to governments because it requires the expenditure of resources to collect information and act on it. In addition, leaders rely on agents to carry out their orders to repress, meaning that they must both compensate those agents and incur costs for possible agency loss.<sup>38</sup>

Given that technology affects both the cost of mobilizing dissent and the cost of preventive repression, what is the effect of technological advances on authoritarian control? In turn, how does technological innovation affect human rights conditions in authoritarian states? To answer these questions, we analyze these effects within the context of the strategic interaction between preventive repression and opposition effort to mobilize dissent.

## The Model

The players are an authoritarian government and an opposition group. The government chooses a level of preventive repressive effort  $r \in [0, \bar{r}]$  in order to stop the opposition group from organizing dissent against the government’s rule. The level of preventive repressive effort affects the probability that the government stops the opposition group from posing a challenge in the first place. The opposition group chooses a level of effort  $p \in [0, \bar{p}]$  to organize and mobilize dissent activities to try to bring down the government. The opposition group’s effort refers to a wide range of activities, including (but not limited to) effort to organize riots, strikes,

35. La Rue 2011.

36. Farrell 2012, 38.

37. Freedom House 2016: 6.

38. DeMerit 2015; Svobik 2013.

and protests. The level of opposition group effort affects the probability that the government will be able to remain in power.

Let  $S(r)$  be the probability that the government prevents the opposition group from organizing, where more preventive repressive effort is more effective at doing so. The probability  $S(r)$  is a twice continuously differentiable function that increases in  $r$  (i.e.,  $S' > 0$ ) and presents (weakly) marginal decreasing returns in  $r$  (i.e.,  $S'' \leq 0$ ). No government has unlimited resources, so preventive repression is costly. The government's cost of preventive repressive effort is given by a function  $C_g(r, t)$ . The government's cost is a twice continuously differentiable function that increases in  $r$  (i.e.,  $\frac{\delta C_g(r, t)}{\delta r} > 0$ ) and is convex in  $r$  (i.e.,  $\frac{\delta^2 C_g(r, t)}{\delta r^2} > 0$ ). Because of the preventive control effect of technology, the cost and the marginal cost of the government's preventive repressive effort decrease in the level of technology  $t$  (i.e.,  $\frac{\delta C_g(r, t)}{\delta t} < 0$  and  $\frac{\delta^2 C_g(r, t)}{\delta r \delta t} < 0$ ). That is, the government's (marginal) cost of preventive repressive effort is lower when  $t$  is larger (i.e., technology is more advanced).

Conditional on the government not being able to prevent the opposition group in its infancy from organizing (which occurs with probability  $1 - S(r)$ ), a larger level of opposition effort increases the probability that dissent is successfully mobilized and thus the likelihood that the government falls. Thus, let  $G(p)$  be the probability that the opposition group's effort to mobilize public dissent is successful in bringing down the government (conditional on the government not being able to stifle the opposition group in the first place). This probability  $G(p)$  is a twice continuously differentiable function that increases in the level of opposition effort (i.e.,  $G' > 0$ ) and presents (weakly) marginal decreasing returns in  $p$  (i.e.,  $G'' \leq 0$ ). The opposition group's cost of organizing is given by a function  $C_o(p, t)$ . The opposition group's cost is a twice continuously differentiable function that increases in  $p$  (i.e.,  $\frac{\delta C_o(p, t)}{\delta p} > 0$ ) and is convex in  $p$  (i.e.,  $\frac{\delta^2 C_o(p, t)}{\delta p^2} > 0$ ). Also, the cost and the marginal cost of opposition effort are decreasing in the level of technology  $t$  (i.e.,  $\frac{\delta C_o(p, t)}{\delta t} < 0$  and  $\frac{\delta^2 C_o(p, t)}{\delta p \delta t} < 0$ ).<sup>39</sup> That is, the opposition group's marginal cost of dissent effort is smaller when  $t$  is larger (i.e., technology is more advanced) because of technology's mobilization effect.

The outcome of the game is binary: the authoritarian government retains power or not. The government gets a payoff of 1 if it retains power and 0 if it is out of power. The opposition group has the opposite preference ranking over outcomes: it gets a payoff of 0 if the authoritarian government retains power and 1 if the government

39. Others directly model how technology facilitates coordination among opposition members. Little 2016. Building on this, we assume technology reduces the cost of such coordination and focus on other dynamics affected by this phenomenon.



falls. The outcome of the game is a probabilistic function of the players' actions, as follows: with probability  $[1 - S(r)]G(p)$ , the outcome of the game is that the authoritarian government falls, and with the remaining probability the government retains power.

Given these specifications, the authoritarian government's (expected) payoff is

$$U_g = S(r) \cdot 1 + [1 - S(r)][1 - G(p)] \cdot 1 + [1 - S(r)]G(p) \cdot 0 - C_g(r, t) \tag{1}$$

$$= 1 - G(p)[1 - S(r)] - C_g(r, t),$$

and the opposition group's (expected) payoff is

$$U_o = S(r) \cdot 0 + [1 - S(r)][1 - G(p)] \cdot 0 + [1 - S(r)]G(p) \cdot 1 - C_o(p, t) \tag{2}$$

$$= G(p)[1 - S(r)] - C_o(p, t).$$

The opposition group and the government choose their actions simultaneously.<sup>40</sup> Note that, as suggested in current public debates, advances in technology in our model have a dual effect: they decrease the opposition group's (marginal) cost of mobilizing dissent to bring down the government, but they also decrease the government's (marginal) cost of preventing the opposition from posing a threat in the first place.

### The Dual Effects Game

We solve for the Nash equilibrium of the game.<sup>41</sup> The government's optimal action is the solution to the following maximization problem:

$$\max_r \{ 1 - G(p)[1 - S(r)] - C_g(r, t) \},$$

which implies that the government's optimal action is the solution to the following first-order condition (FOC) equation:

$$S'(r)G(p) - \frac{\delta C_g(r, t)}{\delta r} = 0. \tag{3}$$

The government's optimal action  $r(p, t)$  increases in  $p$  because, by the implicit function theorem:

$$\frac{dr}{dp} = - \frac{S'(r)G'(p)}{S''(r)G(p) - \frac{\delta^2 C_g(r, t)}{\delta r^2}} > 0,$$

which implies that the government exerts more preventive repressive effort to subdue

40. This timing of the interaction is meant to capture the fact that the actors' actions are not observable (or are imperfectly observable) to each other. In the appendix, we show that all our results hold in a sequential game with imperfect observability of action: for example, the government chooses its level of preventive repressive activities  $r$ , and the opposition imperfectly observes the level of  $r$  before choosing its action.

41. The proofs for our propositions and formal results are in the appendix.

the opposition group in the first place if the opposition group can be expected to exert more effort to organize dissent activities.

The opposition group’s optimal action is the solution to the following maximization problem:

$$\max_p \{G(p)[1 - S(r)] - C_o(p, t)\},$$

which implies that the opposition’s optimal action is the solution to the following FOC equation:

$$G'(p)[1 - S(r)] - \frac{\delta C_o(p, t)}{\delta p} = 0. \tag{4}$$

The opposition group’s optimal action  $p(r)$  decreases in  $r$  because

$$\frac{dp}{dr} = - \frac{-S'(r)G'(p)}{G''(p)[1 - S(r)] - \frac{\delta^2 C_o(p, t)}{\delta p^2}} < 0,$$

which implies that the opposition group exerts less effort to organize dissent against the government if the government can be expected to exert more preventive repressive effort.

The equilibrium actions are found by solving the system of equations given by expressions (3) and (4).<sup>42</sup> Because the government’s optimal action increases in  $p$  and the opposition’s optimal action decreases in  $r$ , we have the following proposition:

*Proposition 1: The dual effects game has a unique pure strategy Nash Equilibrium.*

Given that the game has a unique pure strategy equilibrium, we can analyze comparative statics with respect to how technological developments (i.e., increases in  $t$ ) affect the players’ equilibrium actions.<sup>43</sup>

*Proposition 2: In the dual effects game, the equilibrium level of preventive repressive effort increases when the level of technology increases (i.e.,  $r^*(t)$  increases in  $t$ ). In the dual effects game, technological development leads to a decrease in the oppos-*

42. From a strategic perspective, the actions are strategic complements from the point of view of the government and strategic substitutes from that of the opposition group, which is similar to other asymmetric contest games such as terrorism prevention. Dragu 2011, 2017.

43. We focus our comparative statics exercise on (interior) equilibrium actions.

tion group's equilibrium level of effort to mobilize dissent if

$$-\frac{\delta^2 C_o(p, t)}{\delta p \delta t} < -\frac{\delta^2 C_g(r, t)}{\delta r \delta t} \cdot \frac{-S'(r)G'(p)}{S''(r)G(p) - \frac{\delta^2 C_g(r, t)}{\delta r^2}}, \tag{5}$$

and to an increase otherwise.

Proposition 2 indicates that a higher level of technological development leads unconditionally to an increase in the government's equilibrium level of preventive repressive effort. This has important implications for human rights conditions because it suggests equilibrium increases in the types of abuses most often associated with preventive repression, such as restrictions on freedom of speech, privacy rights, and freedom of movement. The intuition for this result is as follows. Because of the dual effects of technology, advances in technology work through two mechanisms—one direct and one strategic—on the government's equilibrium action. Directly, the decrease in the government's marginal cost of preventive repression (i.e., the preventive control effect) increases the government's ability to conduct more repressive effort. Strategically, while the mobilization effect of technology decreases the opposition group's marginal cost to organize dissent, the government anticipates this through its best response function (i.e.,  $r(p)$  increases in  $p$ ), and thus the government increases preventive repressive efforts in anticipation of the opposition group's changed incentives. Thus, both the direct and strategic mechanisms on the government work in the same direction to increase the equilibrium level of preventive repression when  $t$  increases.

Proposition 2 shows that technological development can either increase or decrease the opposition's equilibrium level of effort to mobilize dissent. Just as it does on the government, an increase in  $t$  works through direct and strategic mechanisms on the opposition's incentives to attempt to mobilize dissent, but these two mechanisms work in opposite directions. Directly, on one hand, technological innovation decreases the opposition's cost of organized dissent which, in turn, increases the opposition's equilibrium ability to organize dissent against the government. Strategically, on the other hand, technological innovation leads the opposition to expect an increase in preventive repression by the government because an increase in  $t$  decreases the government's cost of preventive repression. Because the optimal level of dissent effort decreases when the government's level of preventive repression increases, a larger  $t$  decreases the opposition group's equilibrium effort to mobilize dissent through this (strategic) chilling-effect mechanism.<sup>44</sup>

Recall that the probability that the government stops the opposition group in infancy increases in the level of preventive repression (i.e.,  $S(r)$  is increasing in  $r$ ).

44. Expression (5) precisely states the general conditions under which the strategic chilling effect outweighs the direct effect.

Because the equilibrium level of preventive repression always increases in  $t$ , we have the following result:

*Proposition 3: The equilibrium probability  $S(r^*)$  that the government stifles the opposition in its infancy increases in  $t$ .*

Proposition 3 has clear empirical implications: all else equal, our model suggests that we should be less likely to observe the emergence of opposition groups that organize mass dissent against authoritarian governments in the digital age compared to previous periods. In other words, our analysis suggests that it is less likely for opposition groups such as Solidarity (the prominent opposition group to the Polish Communist regime) and the April 6 Youth Movement (the activist group that planned the first mass protests leading to the end of the Mubarak regime in Egypt in 2011) to emerge at higher levels of technological development, all else equal. Note that this implication is limited to the probability of the *emergence* of such a group rather than to the probability of its success after having emerged. In turn, proposition 3 has an additional empirical implication in that it suggests that analyzing the impact of technological innovation on the success or failure of an *already organized* opposition is likely to underestimate the broader conditions (as a function of technological development) under which an authoritarian government can be successful at retaining its grip on power (a point we return to in more detail later).

Next, we discuss how changes in the level of technology affect the equilibrium probability of government downfall. Recall that the probability of government downfall  $[1 - S(r)]G(p)$  is a composite of two factors: the probability that the government fails to prevent the opposition group in the first place ( $1 - S(r)$ ) multiplied by the probability that mobilization efforts against the government are successful ( $G(p)$ ). Proposition 3 indicates that the equilibrium probability that the government stifles the opposition increases in  $t$ , which implies that the equilibrium probability the government fails to stop the opposition in the first place  $1 - S(r^*(t))$  decreases in  $t$ . Because of this, the equilibrium probability of government downfall can, in fact, decrease at higher levels of  $t$  even if technological advancements decrease the cost of opposition's mobilization efforts, an effect that is missed by some who argue that technological advancements have benefits for opposition groups. In addition, because the opposition's equilibrium level of effort to mobilize dissent can decrease in  $t$  (as stated in proposition 2), then the equilibrium probability that the opposition group's effort to mobilize dissent is successful  $G(p^*(t))$  can either increase or decrease in  $t$  even if a higher  $t$  decreases the cost of the opposition's mobilization efforts. Changes in  $t$  are likely to have a non-monotonic effect on the likelihood of government downfall  $[1 - S(r^*(t))]G(p^*(t))$ . Therefore, our analysis indicates that the relationship between advances in technology and the probability of government downfall is not necessarily monotonic because it has often been assumed to be by both technology optimists and pessimists.

Finally, we illustrate how focusing on the success or failure of an already organized opposition is likely to underestimate the conditions (as a function of technological development) under which an authoritarian government can be successful at

maintaining its grip on power. If the government preventive efforts fail and therefore the opposition group is in a position to mobilize to challenge the government, the equilibrium probability that such an opposition group succeeds is  $G(p^*(t))$ . However, if we take into account that an opposition group might be stifled by the government before it poses any challenge, the total probability of the opposition group's success is  $[1 - S(r^*(t))]G(p^*(t))$ . Because  $S(r^*(t))$  is always increasing in  $t$ , we would underestimate the conditions (as a function of technology) under which an authoritarian government can be successful at maintaining its grip on power if we focus solely on the success or failure of an opposition group that has already mobilized dissent (i.e., by estimating the effect of  $t$  on  $G(p^*(t))$ ).

Our model also allows us to analyze the government's incentives for allowing or preventing certain technological developments. Technological innovation is likely to be endogenous to the government's preference for strengthening its grip on power. Therefore, investigating how changes in the level of technology would affect the government's equilibrium payoff is a necessary first step to understanding what kinds of technological developments authoritarian governments would allow or would block. The government's equilibrium payoff is

$$U_g^*(t) = 1 - G(p^*(t))[1 - S(r^*(t))] - C_g(r^*(t), t).$$

A change in  $t$  affects the government's equilibrium payoff through three mechanisms: it changes the opposition's equilibrium level of effort to organize dissent, it changes the equilibrium level of preventive repression, and it changes the government's cost of preventive repression. By the envelope theorem, the effect of a change in  $t$  that works through the government's equilibrium action has zero effect on the government's equilibrium payoff. As a result, the effect of a change in  $t$  on  $U_g^*(t)$  is given by how such a change in  $t$  affects the opposition group's equilibrium action and the government's cost for preventive repression. Because the government cost for preventive repression always decreases in  $t$  and because the opposition's equilibrium level of effort can increase or decrease in  $t$ , we need to consider two scenarios. First, if the opposition's equilibrium effort decreases in  $t$ , then the government's equilibrium payoff always increases at higher levels of technology. Second, if the opposition's equilibrium effort increases in  $t$ , the government's equilibrium payoff increases in  $t$  if the payoff gains from decreasing the cost of preventive repression outweigh the payoff losses due to increased opposition effort to topple the government.<sup>45</sup> We have the following result:

*Proposition 4:* In the dual effects game, (a) if  $p^*(t)$  decreases in  $t$ , the government's equilibrium payoff always increases in  $t$ , and (b) if  $p^*(t)$  increases in  $t$ , the

45. In the appendix, in the context of proving proposition 4, we provide a condition as a function of the primitives of the model for when the government's equilibrium payoff increases or decreases in  $t$  when  $p^*(t)$  increases in  $t$ .

*government's equilibrium payoff increases in  $t$  if the payoff gains from reducing the cost of preventive repression outweigh the payoff losses due to increased opposition effort.*

Proposition 4 helps us understand the technologies authoritarian governments would allow and the technologies they would attempt to block. For one, authoritarian governments would always prefer to allow technological developments that decrease the opposition's equilibrium effort to topple the government. On the other hand, if technological advances increase the opposition's equilibrium level of effort, the government would allow such technological developments only if the benefits due to decreases in the cost of preventive repression outweigh the potential losses due to stronger mobilization efforts by the opposition. To further illustrate the conditions under which the government would or would not allow certain technological developments, let us consider a scenario in which those technological advances have a negligible effect on the government cost of preventive repression. In this case, the government would always prefer to block technological advances that augment the opposition's equilibrium effort to topple the government. Our analysis of the one-sided effect of technological developments will show precisely this result.

### **One-Sided Effects of Technological Development**

Our previous analysis pertains to a situation in which a change in  $t$  affects both the government's cost of preventive repression and the opposition group's cost of mobilizing dissent. In some scenarios, authoritarian governments cannot choose whether to allow specific technologies while banning others. Authoritarian governments vary in their capabilities to do so. To further investigate the governments' preferences to promote or limit the adoption of new technologies in their societies, we need to also analyze scenarios in which a change in  $t$  affects only one player's cost—that is, technology has a mobilization effect only or a preventive control effect only—and then derive the governments' preferences over such technological developments.

These analyses are also of substantive relevance because such scenarios are realistically possible, especially when there is a temporal lag between the mobilization effect of a technology and its preventive control effect, or vice versa. Activists often comprehend and act upon the potential benefits of a new technology before government bureaucracies realize its potential. The emergence of a new technology might quickly reduce the cost of organizing dissent before a government has the opportunity to invest the resources needed to take advantage of its preventive control effects. In theory, individual technologies might have strictly mobilization effects or strictly preventive control effects. A new application, such as "Whatsapp," may reduce the cost of organizing dissent, but may not provide additional benefits to the government beyond the benefits of pre-existing Internet and telecommunications platforms on which this application runs (e.g., the ability to shut down or monitor traffic on any app). Likewise, governments can use automated

facial recognition tools to monitor opposition groups, whereas such tools may not provide significant utility to opposition groups.

We provide a theoretical analysis of the scenarios in which (1) an increase in  $t$  decreases only the opposition group's marginal cost of organizing dissent (i.e., it has no preventive control effect); and (2) an increase in  $t$  decreases only the government's cost and marginal cost of preventive repression (i.e., it has no mobilization effect).<sup>46</sup> This provides a comprehensive analysis of the ways in which changes in technological development affect the players' equilibrium incentives and the equilibrium outcome. This will also allow us to investigate the government's equilibrium preferences for such technological developments.

### *The Mobilization Effect Game*

First, let us analyze the case in which a change in  $t$  decreases only the opposition's marginal cost of organizing dissent. We label this model the "mobilization effect game." Similar to the previous analysis, the game has a unique pure strategy Nash equilibrium, and we can analyze comparative statics on the effects of changes in  $t$ . In this situation, an increase in  $t$  always increases the opposition's equilibrium level of effort because the marginal costs of such effort to mobilize dissent decrease. At the same time, an increase in  $t$  also always increases the government's equilibrium level of preventive repression because the government's optimal level of repression increases in the level of opposition effort. This leads to the following proposition:

*Proposition 5: In the mobilization effect game, both the equilibrium level of preventive repression and the opposition group's equilibrium level of effort to organize dissent increase with an increase in  $t$ . The equilibrium probability  $S(r^*)$  that the government stifles the opposition in its infancy increases in  $t$ .*

Because an increase in  $t$  increases the equilibrium level of preventive repression, this implies that the equilibrium probability that the government prevents the opposition from being in a position to mobilize a large-scale dissent increases in  $t$  even if changes in the levels of technology decrease the cost of opposition only. In other words, proposition 2 is robust to a scenario in which only the opposition benefits from a higher level of technological development. The implications of this proposition for the future of human rights are important: even if technological innovation benefits only opposition movements, the effect of such innovation would be an increase in human rights abuses associated with preventive repression.

Also, because an increase in  $t$  increases both the equilibrium level of effort to organize dissent and the equilibrium level of preventive repression, the equilibrium

46. All other assumptions from the initial set-up apply in these extensions.

probability of government downfall is likely nonmonotonic in  $t$  even if the applicable technology has only a mobilization effect.

Next, let us analyze how an increase in  $t$  affects the government's equilibrium payoff. The government's equilibrium payoff is

$$U_g^*(t) = 1 - G(p^*(t))[1 - S(r^*(t))] - C_g(r^*(t)).$$

A change in  $t$  affects the government's equilibrium payoff through two mechanisms: it changes the opposition's equilibrium level of effort to organize dissent and changes the equilibrium level of preventive repression. By the envelope theorem, the effect of a change in  $t$  that works through the government's equilibrium action has zero effect on the government's equilibrium payoff. As a result, the effect of a change in  $t$  on  $U_g^*(t)$  is given by how such a change in  $t$  affects the opposition group's equilibrium action. Because the opposition's equilibrium level of effort increases in  $t$  and because the government's payoff decreases in  $p$ , an increase in  $t$  decreases the government's equilibrium payoff.

Putting together these results, we have the following proposition:

*Proposition 6: In the mobilization effect game, the government's equilibrium payoff always decreases in the level of technology.*

A simple implication of proposition 6 is that an authoritarian government has a preference for preventing the development or introduction of any technology that has the effect of decreasing only the cost of mobilizing dissent.

### *The Preventive Control Effect Game*

Second, let us analyze the game in which a change in  $t$  affects only the government's marginal cost of preventive repression, which we label the "preventive control effect game." Similar to the dual effects game, the government's optimal effort increases in the level of opposition's effort to mobilize dissent, and the opposition's optimal effort decreases in the level of preventive repression. Therefore, the game has a unique pure strategy Nash equilibrium. An increase in  $t$  increases the equilibrium level of preventive repression because the government's marginal cost decreases. An increase in  $t$  decreases the opposition's equilibrium level of effort because of the increase in the level of preventive repression. Thus, we have the following:

*Proposition 7: In the preventive control effect game, an increase in  $t$  increases the equilibrium level of preventive repression and decreases the opposition group's equilibrium level of effort to mobilize dissent. The equilibrium probability  $S(r^*)$  that the government stifles the opposition in its infamy increases in  $t$ .*

This result shows that the effect of changes in  $t$  on the equilibrium level of preventive repression is in the same direction in all three versions of our model. Regardless of



whether technological innovation reduces the cost of preventive repression, the cost of mobilization, or both, in equilibrium it can be expected to increase the types of human rights abuses associated with preventive repression. We will return to this point in more detail in the conclusions. Moreover, the proposition indicates that the equilibrium probability  $S(r^*)$  that the government stifles the opposition in its infancy increases in  $t$  in the preventive control game, a result that is in the same direction in all three versions of our model.

Because the equilibrium level of preventive repression increases in  $t$  while the equilibrium level of effort to mobilize dissent decreases in  $t$ , the equilibrium probability of government downfall decreases when the level of technology increases. Similar to the mobilization effect game, the effect of a change in  $t$  on  $U_g^*(t)$  is given by how a change in  $t$  affects the government's equilibrium payoff through changes in the opposition's equilibrium action and through changes to the government's cost of preventive repression. Because the opposition group's equilibrium effort decreases in  $t$ , and the government's cost of preventive repression decreases in  $t$ , an increase in  $t$  increases the government's equilibrium payoff.

Putting together these results, we have the following proposition:

*Proposition 8: In the preventive control effect game, the equilibrium probability of government downfall decreases when  $t$  is higher. In the preventive control effect game, the government's equilibrium payoff increases when the level of technological development is higher.*

A simple implication of proposition 8 is that the authoritarian government has a preference for allowing technological developments that decrease the cost of preventive control. Taken together, propositions 6 and 8 intuitively suggest that authoritarian governments prefer to allow technological developments that decrease the cost of preventive control while they prefer to block technological advances that augment the opposition's equilibrium effort to topple the government. This implies that authoritarian governments that have the capabilities to allow (or not) specific technological developments are more likely to enhance their stay in power compared to those governments without the same capabilities.<sup>47</sup>

## **Technology, Authoritarian Control, and Human Rights: A Parametric Analysis**

We analyze a parametric version of our model to illustrate the results. To this end, let the probability of subduing the opposition group in the first place be given by  $S(r) = r$

47. This implication follows from the fact that in the preventive control effect game, the equilibrium probability of government downfall always decreases in  $t$  and thus government that can target which technological developments to allow or not are less likely to lose control in comparison to those that cannot.

and the probability of successful effort to organize dissent activities be given by  $G(p) = p$ . Also, let the cost of preventive repression and the cost of effort to mobilize dissent be given by  $C_g(r, t) = \frac{1}{2} \frac{1}{t} r^2$  and  $C_o(p, t) = \frac{1}{2} \frac{1}{t} p^2$ , respectively.<sup>48</sup>

**The dual effects game.** Given these parametric specifications, in the dual effects game the equilibrium actions are  $p^*(t) = \frac{t}{1+t^2}$  and  $r^*(t) = \frac{t^2}{1+t^2}$ .<sup>49</sup> As such, the equilibrium probability that the government stops the opposition in the first place is  $S(r^*) = \frac{t^2}{1+t^2}$ , which is increasing in  $t$  as claimed.

The equilibrium probability of government downfall is  $[1 - S(r^*(t))]G(p^*(t)) = \frac{t}{(1+t^2)^2}$ . A simple calculation of how changes in  $t$  affect this equilibrium probability shows that, in the dual effects game, the equilibrium probability of government downfall increases in  $t$  for  $t \leq \bar{t}$  and decreases in  $t$  for  $t > \bar{t}$ .<sup>50</sup> Therefore the relationship between  $t$  and the equilibrium probability of government downfall is nonmonotonic. This result further suggests that, at relatively low levels of technology,  $t \leq \bar{t}$ , advances in technology increase the equilibrium probability of authoritarian government downfall whereas when  $t \geq \bar{t}$ , further advances in technology decrease the equilibrium probability of government downfall. We can think of  $\bar{t}$  as a *technological turning point*, beyond which the strategic chilling effect of increased preventive repression induces the opposition group to lower its equilibrium level of effort to mobilize dissent. As such, advances in technology at such higher levels of  $t$  increase the equilibrium level of preventive repression effort and decrease the equilibrium level of opposition groups' effort to mobilize dissent, both of which decrease the equilibrium probability of government downfall.<sup>51</sup>

**The mobilization effect game.** In the mobilization effect game, all functional forms are as described before except that  $C_g(r) = \frac{1}{2} r^2$  (i.e., changes in  $t$  do not affect the government's cost of preventive repression). Given these parametric specifications, in the mobilization effect game, the equilibrium actions are

48. In this context,  $t > 0$  because otherwise the cost functions would be negative.

49. Notice that for any  $t > 0$ , the equilibrium actions are always interior, that is,  $0 < r^* < 1$  and  $0 < p^* < 1$ .

50. In this context,  $\bar{t} = \sqrt{\frac{1}{3}}$ .

51. In this parametric model, the government's equilibrium payoff is also decreasing in  $t$  at lower levels of technology and increases in  $t$  at higher levels. Given that  $r^*(t)$  increases in  $t$ , this suggests that a higher equilibrium level of preventive repression (as a result of an increase in  $t$  when  $t$  is at low levels) is not always beneficial for the government because it also increases in the equilibrium level of opposition dissent, and this latter effect dominates the beneficial effect due to an increased  $r^*(t)$ . This result that a higher equilibrium level of preventive repression could be detrimental for the government is in a similar vein as the repression backlash effect documented in the existing literature.

$p^*(t) = \frac{t}{1+t}$  and  $r^*(t) = \frac{t}{1+t}$ . As such, the equilibrium probability that the government stops the opposition in the first place is  $S(r^*) = \frac{t}{1+t}$ , which is increasing in  $t$  as claimed.

The equilibrium probability of government downfall is  $[1 - S(r^*(t))]G(p^*(t)) = \frac{t}{(1+t)^2}$ , which is increasing in  $t$  if  $t < \bar{t}$  and decreases in  $t$  if  $t \geq \bar{t}$ .<sup>52</sup> Therefore the relationship between  $t$  and the equilibrium probability of government downfall is nonmonotonic in the mobilization effect game as well.

**The preventive control effect game.** In the preventive effect game, all functional forms are as described initially except that  $C_o(p) = \frac{1}{2}p^2$  (i.e., changes in  $t$  do not affect the opposition's cost of organizing dissent). Given these parametric specifications, the equilibrium actions are  $p^*(t) = \frac{1}{1+t}$  and  $r^*(t) = \frac{t}{1+t}$ . As such, the equilibrium probability that the government stops the opposition in the first place is  $S(r^*) = \frac{t}{1+t}$ , which is increasing in  $t$  as claimed.

Moreover, the equilibrium probability of government downfall is  $[1 - S(r^*(t))]G(p^*(t)) = \frac{1}{(1+t)^2}$ , which is always decreasing in  $t$  as stated in proposition 8.

## Implications and Conclusion

The future of human rights, and perhaps the future of democracy, depends in large part on the ways in which new technologies are changing the relationship between state and society. Many agree that digital technology can have competing effects: it can allow information to be more easily shared, but also more easily monitored. Thus, digital technology can both reduce the cost of organizing dissent and facilitate the surveillance, tracking, and subjugation of opposition groups and activist movements. We construct a model that accounts for the dual effects of digital technology, allowing us to generate predictions regarding the net effect of technological change on human rights and authoritarian rule. To do this requires us to consider the relationship between technology, human rights, and authoritarian control in the context of the strategic interaction between preventive repression and the opposition's effort to organize dissent. Here, we discuss the broader implications of our model for human rights, technology, and authoritarian rule.

52. In this context,  $\bar{t} = 1$ .

First, our model has important implications for human rights. One of the most important developments in recent human rights scholarship is the finding that respect for physical integrity rights has improved in recent years.<sup>53</sup> Yet our models consistently suggest that preventive repression should increase as technology continues to develop in the future.<sup>54</sup> How should we interpret this theoretical prediction in conjunction with the empirical evidence? Physical integrity rights violations are violent. The worst such abuses, such as mass atrocities, tend to occur after dissent has mobilized rather than as efforts to prevent such mobilization. Preventive repression, on the other hand, tends to be less violent, often involving human rights abuses that are not physical integrity abuses. It is therefore possible for physical integrity abuses to decrease while preventive repression increases. In fact, if technology has already improved governments' capacity to engage in nonviolent forms of repression that prevent organized dissent in the first place, this could in part explain why physical integrity abuses have decreased. If so, the recent positive news about physical integrity rights may also portend negative implications for other forms of human rights abuse and for efforts to democratize authoritarian regimes. Future decreases in violent human rights abuses, while a welcome and positive development, may in part be a result of the increased strength of preventive repression, and not only caused by growing concerns for human rights or strengthened human rights norms. We therefore encourage human rights scholars to shift their attention toward preventive repression to better understand the future of human rights.

Our model also has implications for the effects of human rights institutions.<sup>55</sup> Although we conceptualize  $t$  as the level of digital technology, viewing it as an alternative concept can yield potentially useful insights.<sup>56</sup> Legal constraints and punishments, including constitutional and international law, are often argued to *increase* the cost of repression, including preventive repression,<sup>57</sup> whereas our model assumes technology *decreases* this cost. By reconceiving of  $t$  as the level (and effectiveness) of legal constraints and accordingly reversing the direction of the predictions generated by the preventive control effect game, we can further extrapolate from our results. Doing so suggests that, if and to the extent legal constraints make preventive repression more costly, they would decrease preventive repression but increase mobilized dissent, which, interestingly, accords with theoretical expectations and empirical tests about the effects of international human rights law.<sup>58</sup>

53. Fariss 2014, 2019.

54. Recall that this is a consistent result of all three models.

55. Conrad and Ritter 2013; Hafner-Burton and Tsutsui 2005; Hill 2010; Lupu 2013a, b.

56. As Bueno de Mesquita and Downs 2005 note, economic development can reduce the cost of organizing dissent activities. Yet, as our model suggests, this does not necessarily lead to an increase in the probability of authoritarian government downfall. Their informal argument is in some ways similar to the mobilization effect game, except that the factor reducing the cost of dissent in their argument is development. Our model's conclusions are similar to theirs in the sense that we show that when only the cost of organizing dissent is decreased, the effect on the probability of government downfall is ambiguous.

57. Lupu 2015; Nalepa 2008; Simmons 2009.

58. Conrad and Ritter 2019.

The relationship between dissent and repression is one of the most important topics in the human rights literature. Our analysis suggests that this strategic relationship is conditioned by digital technology. For example, when technology lowers only the costs of mobilizing dissent, the mobilization effect game predicts advances in technology lead to increases in both dissent and preventive repression. However, when technology lowers only the costs of preventive repression, the preventive control effect game predicts advances in technology to lead to increases in preventive repression accompanied by decreases in efforts to mobilize dissent. Finally, the dual effects game suggests a nonmonotonic relationship between technological advances and dissent, accompanied by increases in preventive repression. This set of theoretical results is interesting in part because it mirrors the diversity of findings in empirical studies of the relationship between dissent and repression, with existing results ranging from a direct, inverse, convex, and concave relationship between these phenomena.<sup>59</sup> Our theory therefore suggests that technology may be a missing factor in some existing analyses that potentially explains some of these divergent findings. Including measures of technology in such analyses may improve future empirical studies of the dissent–repression relationship and potentially facilitate progress in this debate.

With respect to authoritarian control, our analysis suggests that the relationship between technology and the probability of authoritarian downfall is not always monotonic. While existing analyses argue for a monotonic relationship between technological developments and the probability of authoritarian government downfall (although they disagree on its direction), we show that this relationship is likely more complex. This suggests that both technology optimists and pessimists are correct, but only up to a point. Our results also demonstrate how game-theoretic analysis can contribute to answering questions of this type. Determining the net effect of technology cannot be achieved by simply discussing the two competing effects in isolation, but rather by understanding these competing effects within a strategic context. Our results indicate that, as technology continues to evolve and improve, both governments and private actors will need to more carefully analyze whether such advances serve their interests.

The relationship between technology and authoritarian downfall is likely to be difficult to observe directly, but government efforts to promote or prevent the adoption of digital technologies are often more observable. This suggests two important questions for future work. First, building on work such as Kalathil and Boas, when have authoritarian regimes attempted to block new technologies and when have they promoted them?<sup>60</sup> We provide theoretical predictions for the conditions under which governments are more or less likely to favor technological advances. By offering predictions about the relationship between these efforts and the underlying effects of technology, our model can allow researchers to understand the expected effects of some technologies based on whether or not governments promoted or attempted to

59. Moore 1998; Ritter 2014.

60. Kalathil and Boas 2001.

block them. For example, when an authoritarian government with capabilities to allow (or not) specific technologies does in fact allow (or even promote) a new digital technology, our analysis suggests that technology is likely to reduce the probability of government downfall.

A second question for future research concerns the conditions under which authoritarian governments are more or less capable of blocking new technologies. Propositions 6 and 8 imply that these capabilities, which are outside our model, may have important effects on authoritarian governments' ability to stay in power. Future theoretical work may build on ours by directly modeling the government's ability to allow or block a technology. We also encourage future empirical work on the conditions under which authoritarian states have the capabilities to block new technologies. Our model suggests that, if and to the extent the government has such capabilities, it would allow only new technologies that lower the cost of preventive repression, rather than those that also or instead lower the cost of mobilization. In such instances, the preventive control game may better approximate the real dynamics in such a society, suggesting that the probability of authoritarian downfall would consistently decrease as technology develops. Existing work on digital authoritarianism already suggests that China and Russia have well-developed capabilities both to control technological development at home<sup>61</sup> and to export it to other authoritarian regimes.<sup>62</sup> Especially given the pessimistic predictions of the preventive control game, it is therefore important for political scientists to continue to examine these issues directly and systematically.

Finally, our results also have implications for two dictator's dilemmas commonly discussed by scholars of authoritarian politics. The first version of the dictator's dilemma refers to the fact that authoritarian governments may be able to foster popular support, and thus ensure their grip on power, by promoting economic development. On the other hand, promoting development also requires adopting new technologies that could empower opposition groups.<sup>63</sup> Implicit in this dilemma is the notion that technology can facilitate opposition. A key assumption is that new technologies associated with economic development have greater potential to hurt an authoritarian's grip on power than further it.

The second dictator's dilemma, identified by Wintrobe, is that "dictators cannot—either by using force or the threat of force, or by promises, even of vast sums of money or chunks of their empires—know whether the population genuinely worships them or worships them because they command such worship."<sup>64</sup> Such regimes repress dissent to remain in power, but overly repressing dissent may prevent them from being able to accurately gauge their strength. If an authoritarian government underestimates the extent of latent opposition to its rule, it may suddenly find itself

61. Gunitsky 2015.

62. Deibert 2015; Polyakova and Meserole 2019.

63. Kalathil and Boas 2003; Shultz 1984.

64. Wintrobe 1998, 20.

deposed.<sup>65</sup> Technology plays a key role in this problem. The second dictator's dilemma is in part an information problem; the government ideally would allow just enough expression of dissent to gauge its strength, but not enough to allow dissent to mobilize. Different levels of technological development allow for different means of expressing dissent and collecting information about such dissent.

To overcome both dilemmas, an authoritarian government requires a technology that meets two criteria: (1) generating economic development; and (2) allowing the government to gauge support while preventing opposition groups from becoming too strong to mobilize large-scale dissent and challenge the government. Meeting both criteria may be the key because many technologies do meet the first. The key to meeting these criteria may derive from the preventive control effect. As technology develops, its preventive control effect qualitatively changes; at lower levels, the preventive control effect can facilitate government information gathering, but doing so is relatively costly when information is not in digital form, contained in a centralized system, or easily searchable. It would be costly, for example, for the government to tap and listen to all of the population's land-line phone conversations. Yet at higher levels of technology, the preventive control effect begins to facilitate relatively less costly search, filtering, and censorship functions that allow governments to gather massive amounts of information while controlling the diffusion of information. Improvements in technology when the preventive control effect is large can drastically reduce the cost of preventive repression. When that is the case, opposition groups can anticipate concomitant increases in preventive repression and will be more likely to lay low. More importantly, the equilibrium probability that the government stops an opposition group in its infancy increases with such improvements in technology, stifling opposition groups in their infancy.

Technologies with large preventive control effects may be those that are sufficiently centralized and searchable that the government can control and analyze the flow of information without shutting it off. Land-line telephone technology is unlikely to meet these criteria because it would be prohibitively costly for the government to both allow individuals to use telephones and monitor their conversations to the extent necessary to censor and control them. Broadcast technology like radio and television can be more easily controlled by the government, but tightly censored or government-run stations may not allow for sufficient expression of dissent to meet criterion (2). Recent analyses suggest that allowing the expression of dissent while preventing organized dissent is precisely how the Chinese Communist Party uses the Internet to maintain power. The government has promoted a hugely successful economic development program by, among many other policies, allowing

65. This dilemma can be illustrated by the Augusto Pinochet regime's referendum in 1988 on whether its rule over Chile should be extended. Pinochet miscalculated: he was confident he would win the referendum and thus strengthen his rule (Butler and Ranney 1994, 7; Muñoz 2008, 199) but ended up losing because he underestimated Chileans' disapproval of his regime and the opposition's ability to coordinate a campaign against him. After fifteen years of repressive rule, he had few means of determining the extent to which Chileans truly supported him or had simply been expressing such support out of fear.

organizations and individuals to adopt Internet technologies. The government also allows individuals to express disapproval of at least some of its policies, which allows it to gauge levels of public support. Yet the government uses its central control of the Internet to selectively censor content that might facilitate collective action.<sup>66</sup> It may be the case, therefore, that the preventive control effects of these technologies are sufficiently large that they have allowed governments like China's to overcome these dilemmas, at least for a time. We hope our models lead to future work analyzing the relationship between technology and the dictator's dilemmas.<sup>67</sup>

## Supplementary Material

Supplementary material for this article is available at <<https://doi.org/10.1017/S0020818320000624>>.

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66. Dobson 2012.

67. Another interesting extension of our analysis would be to incorporate preventive repression in a broader framework to investigate how it interacts with other strategies of authoritarian control. For example, authoritarian governments often take great efforts to conceal some repressive tactics, such as digital surveillance of opposition groups, while in other instances they engage in “open deterrence,” such as posting large numbers of soldiers in focal public places during symbolic events (such as the anniversary of Tiananmen Square) to leave no doubt about the kind of response that would follow an organized protest. It would be fruitful to build on our framework to investigate why authoritarian governments conceal some repressive choices while publicizing others.



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