Online Appendix to A Model of Protests, Revolution, and Information; by Barbera and Jackson

Generalizations of the Model

We present a more general version of the model and an existence result.

Uncertainty

$\omega \in I\!R$ is the state of the world, which can encode information about the value of the revolt and what fraction of the population would gain from the revolt, and so forth.

There is a prior distribution over ω, denoted G - and agents do not directly observe ω.

$\theta_i \in I\!R$ is the type of agent i, which is the private information of that agent.[21]

The distribution over types depends on the state of the world and is denoted $F(\theta_i|\omega)$. We treat these as if they are independent across agents conditional upon the state, which is technically convenient but has some measurability issues that are easily handled as the limit of a finite model.[22]

We assume the standard ordering property on information:[23] conditional upon θ_i, the distribution on ω and others' types are both increasing in θ_i in the sense of strict first order stochastic dominance. Thus, higher types of an agent lead that agent to expect higher types of other agents.

Payoffs

An agent gets a value from the revolt as a function of whether it is successful or not and whether the agent participates or not. All of these payoffs can be type and state dependent,

[21]We could allow the states and types to be multidimensional and more complicated. The advantage of one dimension is that what we ultimately care about is whether an agent is sufficiently unhappy with the government would revolt. More dimensions would involve partial orders, but the story would basically be the same - some people are unhappy enough to revolt and others are not, and the agents are trying to learn about the relative fractions and potential for success.

[22]For a discussion of the issues of a continuum of agents having independent observations see Feldman and Gilles (1985) and Judd (1985). In our model, the independence is not really needed, and so a very easy way of formalizing the signals for our purposes is as follows. Uniformly at random, draw i_0 from $[0, 1]$ - this will be the agent who gets the lowest signal in society. Then let $\theta_i = F^{-1}(i - i_0|\omega)$, where $F^{-1}(\cdot|\omega)$ is the inverse of $F(\theta_i|\omega)$, and we take $i - i_0$ modulo 1, so that if $i < i_0$, then we set $i - i_0 \equiv i + 1 - i_0$. So, we randomly pick an agent to have the lowest signal, and then just distribute the signals then in a nondecreasing way for the rest of the agents with higher labels, and then wrap around beginning again at 0. This results in the right distribution of types without any measurability issues and the independence of types is not needed for our results, as agents only care about the population behavior rather than any particular agent's behavior.

[23]See Milgrom (1981).

and are given by the following table.

	$Success$	$Failure$
$Participate$	$a(\theta_i, \omega) + V_i(\theta_i, \omega)$	$b(\theta_i, \omega) - C_i(\theta_i, \omega)$
$NotParticipate$	$a(\theta_i, \omega)$	$b(\theta_i, \omega)$

Here, $a(\theta_i, \omega)$ is the value that an agent gets if the revolt is successful, regardless of whether the agent participates or not, and this can depend on the agent's type and the state. Similarly, $b(\theta_i, \omega)$ is the value that an agent gets if the revolt fails, regardless of whether the agent participates or not, and this can depend on the agent's type and the state. The values, $V_i(\theta_i, \omega)$ and $C_i(\theta_i, \omega)$ then are the additional value and cost that an agent gets from participating in the revolt as a function of whether it is successful or fails.

Generally, C_i will be positive ($-C_i$ is negative), which represents the personal cost to a person of being caught in an unsuccessful revolt - for instance, being jailed, fined, executed, etc. On the other side, V_i captures the personal pleasure or pain that a person would feel from participating in a successful revolt, as discussed in the paper. Again, as discussed above, the structure of this game is similar to that in the expressive voting literature (e.g., see Feddersen (2004) for a review).

Note that this is strategically equivalent to the following payoff matrix:

	$Success$	$Failure$
$Participate$	$V_i(\theta_i, \omega)$	$-C_i(\theta_i, \omega)$
$NotParticipate$	0	0

The strategic equivalence is due to the fact that the only thing that motivates an agent to participate is the difference that they experience from participating or not, as a function of whether the revolt is successful or not.

Since V_i can already encode relevant heterogeneity in the population via θ_i, from a strategic perspective only V_i/C_i matters and so it is without loss of generality for the strategic analysis to normalize the model so that $C_i = C > 0$ for all i. We still keep C as a variable, as we wish to consider cases in which a government adjusts the penalties for participating in a failed revolt.

We presume that V_i is symmetric across agents - depending on their identity only via their type and thus drop the subscript i. We take V be nondecreasing in θ_i, ω, and increasing in at least one of the two arguments.

Thus, we consider games of the form:

	$Success$	$Failure$
$Participate$	$V(\theta_i, \omega)$	$-C$
$NotParticipate$	0	0

Let us mention two canonical cases:

(Correlated) Private Values

One case of interest is that of "private-values" so that $V(\theta_i, \omega)$ depends only on θ_i. In this case it is without loss of generality (adjusting distributions) to set $V(\theta_i, \omega) = \theta_i$, and so payoffs are

	Success	*Failure*
Participate	θ_i	$-C$
NotParticipate	0	0

An interpretation of this case is that each citizen knows how unhappy he or she is with the government - which is the θ_i. Here, the state of the world ω captures how unhappy the overall population is via the distribution of θ_i's. Agents, via Bayes' rule, can infer how unhappy the rest of the world is by inference given that higher states, ω's, lead to a higher distribution over θ_i's. So, if an agent is very unhappy, then she infers that it is likely that ω is high and so it is then likely that other agents are unhappy too.

Common Values Another case of interest is where $V(\theta_i, \omega)$ depends only on ω. In this case, if preferences are symmetric, then it is without loss of generality (adjusting distributions) to set $V(\theta_i, \omega) = \omega$, and so payoffs are

	Success	*Failure*
Participate	ω	$-C$
NotParticipate	0	0

This case is one in which agents do not really know whether they would like to have a successful revolt – that is governed by a state ω. For instance, agents might not know how competent or corrupt the government really is, or what might replace it. Each agent has a signal θ_i which is some noisy information about the state, and so they must infer ω via Bayes' rule from their own types.

For our purposes, it is not really important which formulation we use as they all have similar effects: agents with higher θ_i's are more optimistic that there is a high payoff from participation and that other agents feel the same. So, they all have the same basic structure of equilibria: agents with types or signals (θ_is) above some threshold participate, and others do not. Thus, we first state that general result, and then we specialize to the model with private values, for a clean and intuitive analysis.

Strategies and Best Responses

A strategy for player i is a function $\sigma_i : I\!R \to \Delta(\{0, 1\})$, which specifies a probability of participating, $\sigma_i(\theta_i) \in [0, 1]$, as a (Lebesgue measurable) function of an agent's type. Let σ denote the profile of strategies.[24]

[24] We work with strategies that are also Lebesgue measurable as a function of the agents' labels. Generally, the equilibria will naturally depend only on agents' types and not their labels, and so this is not really a restriction.

Let $p_\sigma(\theta_i)$ denote i's beliefs that at least a fraction q of the other agents will participate, conditional on other players playing according to σ and the agent seeing θ_i.

Given the continuum, an agent is never pivotal in determining whether there is a fraction of at least q of the population who participate, and so this is a straightforward calculation.

The expected payoff to participation is then

$$p_\sigma(\theta_i)E[V(\theta_i,\omega)|\theta_i] - (1-p_\sigma(\theta_i))C,$$

and the payoff from non-participation is 0, and so it is a best response to participate if and only if

$$\frac{E[V(\theta_i,\omega)|\theta_i]}{C} \geq \frac{1-p_\sigma(\theta_i)}{p_\sigma(\theta_i)} \quad \text{or, equivalently} \quad p_\sigma(\theta_i) \geq \frac{C}{E[V(\theta_i,\omega)|\theta_i]+C}. \tag{6}$$

Note that, given the ordering of types and preferences, $\frac{E[V(\theta_i,\omega)|\theta_i]}{C}$ is strictly increasing in θ_i.

Existence

As this is a coordination game, equilibria exist and in fact there are generally multiple equilibria. For instance, nobody participating is always a strict equilibrium: if none of the other agents participate then the revolt will surely fail and so it is a best response not to participate. However, in many cases there also exist participatory equilibria.

These games have equilibria in which agents play monotone strategies: their probability of participating is non-decreasing in θ_i, and for the cases that we examine those will be the only equilibria. Generally, given the increasing preferences and ordering on information, such equilibria always exist. Nonetheless, for some special cases there do exist other equilibria, although for generic distributions these will be the only equilibria.[25]

Proposition 4 *Equilibria exist, and in fact, symmetric and monotone equilibria exist. Each monotone equilibrium can be described by a single threshold t (the same for all agents), such that an agent participates if $\theta_i > t$ and not if $\theta_i < t$. Monotone equilibria are all symmetric up to the possible mixing that occurs at t. Monotone equilibria can be ordered by their thresholds, with ∞ always being an equilibrium threshold.*

This follows from an application of Tarski's fixed point theorem, which establishes that equilibria form a complete lattice, which here is just ordered in terms of the thresholds. Given that the proof is standard, we omit it. The symmetry is implied by the continuum of agents who have the same priors, and the fact that payoffs are monotone in types and

[25]For an example of a non-monotone equilibrium consider a common values setting with $\omega = 2,3$ with equal probability and $C = 1$; and such that $\theta_i = \omega$ so that all agents know the state. In this case, regardless of q, there is always a 'best' equilibrium in which all agents participate, and there is a worst equilibrium in which no agents participate, in either state. However, there is also a non-monotone equilibrium in which all agents participate if $\theta_i = \omega = 2$ and none participate if $\theta_i = \omega = 3$.

states, so that higher types lead have higher expected payoffs from participation conditional on success.

So, we can represent monotone equilibria by thresholds t, such that an agent participates if $\theta_i > t$ and not if $\theta_i < t$. In cases with atoms in the distribution it is possible to have mixing at t.

Equilibria for Continuous Distributions Consider a canonical case in which θ_i distributed with mean ω plus some noise ε_i, where ε_i is distributed according to H (so, $F_\omega(\theta) = H(\theta - \omega)$).

$$\theta_i = \omega + \varepsilon_i.$$

In this case, the probability of success is $1 - G(t - H^{-1}(1-q))$. This follows since it must be that the fraction of people with $\omega + \varepsilon_i$ below t less than $1-q$. So, $H(t-\omega)$ must be at most $1-q$, and so ω must at least $t - H^{-1}(1-q)$. The probability of that is $1 - G(t - H^{-1}(1-q))$.

Thus, in the case of private values an equilibrium t satisfies (assuming no atoms in the distributions and an interior t):

$$t = \frac{G(t - H^{-1}(1-q)|\theta_i = t)}{1 - G(t - H^{-1}(1-q)|\theta_i = t)}.$$

Note that by Bayes' rule, if H and G have densities, h and g, then

$$G(\omega'|\theta) = \frac{\int_{-\infty}^{\omega'} h(\theta - \omega) g(\omega) d\omega}{\int_{-\infty}^{\infty} h(\theta - \omega) g(\omega) d\omega}.$$

Then a common values equilibrium is characterized by

$$\int \omega' dG(\omega'|t) = \frac{G(t - H^{-1}(1-q)|\theta_i = t)}{1 - G(t - H^{-1}(1-q)|\theta_i = t)}.$$

Some Further Thoughts and Comments

We close with a few additional thoughts on the implications of the model for how a government might act, as well as other topics that can be studied in further detail in future research.

Other Actions by Governments A government can change the world from being one in which there is an equilibrium with a revolt to one in which there is not, by affecting the various parameters.[26,27] This presumes that the government would like to avoid a revolution

[26] For important analyses of governments and propaganda as well as censoring and other informational distortions in models that are very different from ours, see Edmond (2013) as well as Egorov, Guriev, and Sonin (2009), Little (2012), and King, Pan and Roberts (2013).

[27] Events beyond a government's control that uncover its weaknesses can also change conditions, enhancing the possibility of a revolution - for instance, see González-Torres, Ada and Elena Espisito's (2017) discussion of Ebola and social unrest.

and keep the status quo.

Let us examine some of those behaviors.

Costs Most directly, by increasing the cost to failed revolutionaries (increasing C), the government can make the conditions for a revolt harder to satisfy. For instance, in the base model, it is sufficient to raise C to a point at which

$$\theta_H/C < \frac{(1-\pi)(1-z)}{\pi z}$$

to avoid the revolution. Correspondingly, there are values of C that prevent revolution for different levels of information.[28]

Information Control, Seclusion, and Homophily The government can also suppress and censor information. As we saw, having only a few meetings with others, or if those meetings are mostly with own type then this can lessen the chance that people have to learn about the number of others who support change. By limiting information flows, especially across groups or geography, so that most interactions are limited and local, one could shift an equilibrium to preclude a revolt. As we have seen however, it could also work the other way in cases in which the prior beliefs are strong enough – by encouraging information exchange one could end up undercutting the support for a revolt and preclude it. Which policy a government would want to undertake would depend on the information structure.[29]

Our results on homophily also suggests that a revolutionary group might want to seclude its members. By allowing its members to possibly meet others who do not support the revolt, the group risks having its members doubt the possibility of success which could disrupt the revolt.[30]

Propaganda and Fake News The government could also bias information via propaganda.[31] Propaganda is interesting in that it does not have to convince all of the potential revolutionaries that revolt is a bad idea or that the state is Low, but instead it just needs to convince enough of them so that the remaining types know that they will no longer have sufficient numbers to be successful. For instance, if more than $z-q$ of the potential revolutionaries are convinced by the propaganda, then the revolt cannot succeed, regardless of whether the remaining H types are convinced or not.

Thus, propaganda can be disruptive even if it only convinces a small subset of the population that they should not take part in a revolt. This could happen by convincing people

[28] For a model of repression, see Shadmehr and Boleslavsky (2016).

[29] See Luo and Rozenas (2016) for more discussion of informational control by a government.

[30] This applies quite generally, and military forces and paramilitary groups are at times discouraged from interacting with populations that might raise doubts about their mission or the support for it.

[31] For different views of information manipulation in the face of social coordination, see Edmond (2016), Little (2016b), and Song and Zhao (2018).

that they stand no chance of success, for instance, by inflating the estimates of how many θ_L types there are in the population; or by convincing people that they are better off than they are, or better off than what would happen after a revolution, etc.

Noisy news sources can have the same effect as propaganda, effectively lowering the confidence that individuals have in the information that they receive as well as increasing the chance that some others may be discouraged. It can work in the same way as overt propaganda in that if people are concerned that a small subset of supporters of change may be discouraged, then that can unravel the revolt. Of course, it could work in reverse, convincing a small group that might not otherwise participate which then enables a revolt.

Redistribution Finally, the government could also redistribute resources. Again, the government does not have to redistribute resources to all of the potential revolutionaries, they simply need to buy enough of them off to discourage the rest - so they just need to please $z - q$ of the H types. They can produce some very unhappy parts of the population, provided that they make the middle range sufficiently happy that they will no longer revolt.

Specifically, suppose that redistribution by the government is observable and that the government knows the state (so it knows the condition of the whole population). Thus, whenever the government does redistribute income, then the population knows it is the High state. So, it is clear that in that case they must pay at least θ_H to a fraction $z - q$ to avoid the revolt. The equilibrium must be one in mixed strategies. To see this note that if it were a pure strategy equilibrium, then it would be one in which the government only redistributed in the High state. But then when seeing no redistribution, agents would infer it is the Low state and not revolt. In that case, the government would not need to redistribute in order to avoid the revolt. Thus, the redistribution must be in mixed strategies. In order for this to make sense with a continuum of agents, we then allow agents to correlate their strategies, so that H types revolt with some probability p when not seeing redistribution. The probability of redistribution is then just enough to make agents indifferent conditional on seeing no redistribution, and the probability of revolt is just enough to keep the government indifferent between being overthrown and paying the redistribution.

Other topics We have focused on the coordination issues and the role of information. There can also be public-good aspects and free-riding behavior in protests and revolutions that we have not modeled here and could be interesting to combine with the coordination issue.[32]

We have provided our analysis in the context of correlated private values, but a similar analysis applies to more general affiliated and common value settings. The analog of homophily is still that people with similar types are likely to meet each other – so that people who are in close contact are likely to be getting similar information, and thus do not learn as much from meeting each other as meeting a uniformly random draw from the population.

[32] For an interesting paper on free-riding in protests, see Cantoni, Yang, Yuchtman, and Zhang (2017).

Our focus in terms of learning has been on the population learning how many others are willing to support a revolt. In some instances, it might be that the key learning that goes on is whether sufficient numbers of the military and/or police would also support a revolt, and whether they would fire upon the population. This could easily be added to the model by having different roles in the population, and could explain why some governments try to isolate some of their key military from the general population.

In our analysis we have taken the meeting and homophily structures as exogenous. Control of social media by a government, as well as rules that limit internal movement, could be used to control the interaction structure within a society, and could be interesting to explore as another extension of the model.

In our model agents have been Bayesians who understand the full model. One could also suppose that people fail to realize that their sample is biased. For instance, if they neglect homophily, then this could increase support for a revolt since people fail to realize that the population is more heterogeneous then the people that they meet. For a more on various sorts of correlation neglect see Frick, Iijima, and Ishii (2018) and Jackson (2019a,2019b).

Finally, the feedback between politics and protests is something that is deserving of much more study. This can fit into a more general study of the endogeneity of governments.[33]

References

Acemoglu, Daron; Georgy Egorov, and Konstantin Sonin. (2012). "Dynamics and Stability of Constitutions, Coalitions, and Clubs," *The American Economic Review*, 102(4), 1446-1476.

Acemoglu, Daron; Tarek A. Hassan and Ahmed Tahoun (2014). "The Power of the Street: Evidence from Egypt's Arab Spring". Mimeo.

Aghion, Philippe; Alberto Alesina and Francesco Trebbi (2004). "Endogenous Political Institutions," *The Quarterly Journal of Economics*, 119(2), 565-611.

Aidt, Toke, Gabriel Leon, and Max Satchell (2017) "The social dynamics of riots: Evidence from the Captain Swing Riots, 1830–31," mimeo: University of Cambridge.

Angeletos, George-Marios; Christian Hellwig and Alessandro Pavan (2007). "Dynamic Global Games of Regime Change: Learning, Multiplicity, and the Timing of Attacks". *Econometrica*, 75(3), 711-756.

Banerjee, Abhijit V. (1992). "A Simple Model of Herd Behavior". *The Quarterly Journal of Economics*, 107(3), 797-817.

Barbera, Salvador, and Matthew O. Jackson. (2004). "Choosing How to Choose: Self-Stable Majority Rules," *The Quarterly Journal of Economics*, 119(3), 1011-1048.

[33]E.g., see Aghion, Alesina, Trebbi (2004), Barbera and Jackson (2004), Acemoglu, Egorov, Sonin (2012), and Egorov and Sonin (2017).

Battaglini, Marco (2016). "Public Protests and Policy Making". forthcoming in the *Quarterly Journal of Economics*.

Bikhchandani, Sushil; David Hirshleifer and Ivo Welch (1992). "A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades". *The Journal of Political Economy*, 100(5), 992-1026.

Bikhchandani, Sushil; David Hirshleifer and Ivo Welch (1998). "Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades". *The Journal of Economic Perspectives*, 12(3), 151-170.

Breuer, Anita; Todd Landman and Dorothea Farquhar (2015). "Social Media and protest Mobilization: Evidence from the Tunisian Revolution". *Democratization*, 22(4), 764-792.

Brummitt, Charles D.; George Barnett and Raissa M. D'Souza (2015). "Coupled Catastrophes: Sudden Shifts Cascade and Hop among Interdependent Systems". *Journal of the Royal Society Interface*, 12(112), 1-12.

Bueno de Mesquita, Ethan (2010). "Regime Change and Revolutionary Entrepreneurs". *American Political Science Review*, 104(3), 446-466.

Cantoni, Davide; David Y. Yang, Noam Yuchtman, Y. Jane Zhang, (2017). "Are Protests Games of Strategic Complements or Substitutes? Experimental Evidence from Hong Kong's Democracy Movement" mimeo.

Chen, Ying and Hulya Eraslan (2014). "Rhetoric in legislative bargaining with asymmetric information". *Theoretical Economics*, 9, 483-513.

Chwe, Michael Suk-Young (2000). "Communication and Coordination in Social Networks". *Review of Economic Studies*, 67, 1-16.

Christensen, Darin, and Francisco Garfias (2018) "Can You Hear Me Now? How Communication Technology Affects Protest and Repression," *Quarterly Journal of Political Science* 13.1, 89-117.

Duffie, Darrell, Gaston Giroux, and Gustavo Manso (2010) "Information percolation." American Economic Journal: Microeconomics 2.1: 100-111.

Edmond, Chris (2013). "Information Manipulation, Coordination, and Regime Change". *Review of Economic Studies*, 80 (4): 1422-1458

Edmond, Chris (2016). "Information Manipulation and Social Coordination", mimeo.

Egorov, Georgy and Konstantin Sonin (2017). "Elections in Non-Democracies". mimeo Northwestern University and University of Chicago.

Egorov, Georgy; Sergei Guriev and Konstantin Sonin (2009). "Why Resource-poor Dictators Allow Freer Media: A Theory and Evidence from Panel Data". *American Political Science Review*, 103(4), 645-668.

Farrell, Henry (2012). "The Consequences of the Internet for Politics". *Annual Review of Political Science*, 15, 35-52.

Feddersen, Timothy J. (2004) "Rational choice theory and the paradox of not voting." The Journal of Economic Perspectives 18.1, 99-112.

Feldman, Mark and Christian Gilles (1985). "An Expository Note on Individual Risk without Aggregate Uncertainty". *Journal of Economic Theory*, 35, 26-32.

Frick, Mira, Ryota Iijima, and Yuhta Ishii. (2018) "Dispersed Behavior and Perceptions in Assortative Societies." working paper. Yale University.

González-Torres, Ada and Elena Espisito (2017) "Epidemics and Conflict: Evidence from the Ebola outbreak in Western Africa," mimeo: U.C. Berkeley.

Granovetter, Mark (1978). "Threshold Models of Collective Behavior". *The American Journal of Sociology*, 83(6), 1420-1443.

Hassanpour, Navid (2017)*Leading from the periphery and network collective action*, Cambridge University Press.

Jackson, Matthew O. (2008). *Social and Economic Networks*, Princeton, NJ: Princeton University Press.

Jackson, Matthew O. (2014) "Networks in the Understanding of Economic Behaviors," *Journal of Economic Perspectives*, 28(4), 3–22.

Jackson, Matthew O. (2019a) *The Human Network*, Pantheon Books, New York.

Jackson, Matthew O. (2019b) "The friendship paradox and systematic biases in perceptions and social norms," *Journal of Political Economy*, 127(2), 777-818.

Jackson, Matthew O., Leo K. Simon, Jeroen M. Swinkels, and William R. Zame. (2002). "Communication and equilibrium in discontinuous games of incomplete information." *Econometrica*, 70(5): 1711-1740.

Judd, Kenneth L. (1985). "The Law of Large Numbers with a Continuum of IID Random Variables". *Journal of Economic Theory*, 35, 19-25.

King, Gary; Jennifer Pan and Margaret E. Roberts (2013). "How Censorship in China Allows Government Criticism but Silences Collective Expression". *American Political Science Review*, 107(2), 326-343.

Kiss, Hubert Janos, Ismael Rodriguez-Lara, and Alfonso Rosa-Garcia (2017) “Overthrowing the dictator: a game-theoretic approach to revolutions and media,” *Social Choice and Welfare*, 49: 329, 329-355.

Kricheli, Ruth; Yair Livne and Beatriz Magaloni (2011). ”Taking to the Streets. Theory and Evidence on Protests under Authoritarianism”. Mimeo, Stanford University.

Little, Andrew T. (2012). ”Elections, Fraud, and Election Monitoring in the Shadow of Revolution”. *Quarterly Journal of Political Science* 7, 249-283.

Little, Andrew T. (2016). ”Communication Technology and Protest,” *Journal of Politics*, 78(1), 152-166.

Little, Andrew T. (2016b). ”Propaganda and Credulity,” mimeo.

Loeper, Antoine; Jakub Steiner, Colin Stewart (2014) ”Influential Opinion Leaders,” *The Economic Journal*, 124, (581), 1147-1167.

Lohmann, Susanne (1993). ”A Signaling Model of Informative and Manipulative Political Action”. *The American Political Science Review* 87(2), 319-333.

Lohmann, Susanne (1994a). ”Information Aggregation Through Costly Political Action”. *The American Economic Review*, 84(3), 518-530.

Lohmann, Susanne (1994b). ”The Dynamics of Informational Cascades: The Monday Demonstrations in Leipzig, East Germany, 1989-91”. *World Politics*, 47(1), 42-101.

Lohmann, Susanne (2000). ”Collective Action Cascades: An Informational Rationale for the Power in Numbers”. *Journal of Economic Surveys*, 14(5), 655-684 .

Luo, Zhaotian and Arturas Rozenas (2016). ”Ruling the Ruling Coalition: Information Control and Autocratic Governance,” mimeo, NYU.

Manacorda, Marco and Andrea Tesei (2016). ”Liberation Technology: Mobile Phones and Political Mobilization in Africa”. Mimeo.

McPherson, Miller; Smith-Lovin, Lynn and James M. Cook (2001). ”Birds of a feather: Homophily in social networks,” *Annual Review of Sociology*, 27, 415-444.

Milgrom, Paul (1981). “Good News and Bad News: Representation Theorems and Applications,” *Bell Journal of Economics*, 12, 380 - 391.

Myatt, David P. (2016). ”A theory of protest voting.” *The Economic Journal*, 1-41.

Pierskalla, Jan H. and Florian M. Hollenbach (2013). ”Technology and Collective Action: The Effect of Cell Phone Coverage on Political Violence in Africa”. *American Political Science Review*, 107(2), 207-224.

Shadmehr, Mehdi (2015). "Extremism in Revolutionary Movements". *Games and Economic Behavior*, 94, 97-121.

Shadmehr, Mehdi and Bernhardt, Dan (2016a). "Information Aggregation and Coordination". mimeo.

Shadmehr, Mehdi and Bernhardt, Dan (2016b). "Vanguards and Revolution". mimeo.

Shadmehr, Mehdi and Bernhardt, Dan (2017). "When Can Citizen Communication Hinder Successful Revolution?" *Quarterly Journal of Political Science* 12: 301-23.

Shadmehr, Mehdi and Boleslavsky, Raphael (2016). "Institutions, Repression and the Spread of Protest". mimeo.

Song, Yangbo and Mofei Zhao "Fickle for Survival: Bayesian Persuasion by a Strategic Regime," mimeo Chinese University of Hong Kong.

Steinert-Threlkeld, Zachary C.; Delia Mocanu; Alessandro Vespignani and James Fowler (2015). "Online Social Networks and Offline Protest". *EPJ Data Science*, 4(1), 1-9.

Weinstein, Jonathan, and Muhamet Yildiz (2007). "A structure theorem for rationalizability with application to robust predictions of refinements." *Econometrica* 75(2): 365-400.