Online Appendix A: Proofs.

Before proving Proposition 1, we look at the set of learning equilibria of the game in Table 1. A joint investment learning equilibrium exists if, when all dissidents in the population invest, the individual dissident is better off investing rather than not investing:

$$V - c \geq V/(2^R)$$

iff

$$[1 - 1/(2^R)]V \geq c \qquad (1)$$

Condition (1) becomes $V \geq 2c$ for $R = 1$, and $V \geq c$ for R approaching infinity, where by assumption the latter is always valid. The left-hand side of (1) increases in R, so that condition (1) is less stringent the larger R.

A joint non-investment learning equilibrium exists if, when no dissident in the population invests, the individual dissident is better off not investing rather than investing:

$$V/(2^R) \leq c \qquad (2)$$

Condition (2) becomes $V \leq 2c$ for $R = 1$, and $-c \leq 0$ for R approaching infinity, where the latter is always valid. The left-hand side of (2) decreases in R, so that condition (2) is less stringent the larger R. It follows from (1) and (2) that for $V > 2c$, only the joint investment equilibrium exists for a range of small R ($R \leq R^*$), and both the joint investment equilibrium and the joint non-investment equilibrium exist for the remaining range of large R; for $V < 2c$, only the joint non-investment equilibrium exists for a range of small R ($R \leq R^{**}$), and again both the joint investment equilibrium and the joint non-investment equilibrium exist for the remaining range of large R.

A mixed learning equilibrium exists if each dissident invests with probability p, in a manner that the other dissident is indifferent between investing and not investing. It is then a weak best response for the other dissident to invest with probability precisely p. Such an equilibrium exists if:

$$pV + (1 - p)[V/(2^R)] - c = pV/(2^R)$$

iff

$$p = \frac{c - [V/(2^R)]}{V[1 - 2/(2^R)]} = p^*(R) \qquad (3)$$

The mixed equilibrium exists if $0 < p^*(R) < 1$, which is valid if both $c > [V/(2^R)]$ and $c < [1 - 1/(2^R)]V$. Note that by (1) and (2), under these same conditions both the joint investment and the joint non-investment equilibrium exist, so that the mixed equilibrium only exists when the two other equilibria exist.

Proof of Proposition 1:

For R sufficiently low such that there is only a single equilibrium (which we have shown above is either the joint investment or joint non-investment equilibrium), it can easily be seen that each initial population state is in the basin of attraction of this equilibrium. For R high enough such that two equilibria exist, by (3) the individual

dissident is better off investing if $p > p^*(R)$, and is better off not investing if $p < p^*(R)$. Given our assumption that the initial population states are uniformly distributed over the range [0, 1], it follows that the size of the basin of attraction of the joint investment equilibrium (and the probability that this equilibrium is learned) equals $[1 - p^*(R)]$ and the size of the basin of attraction of the joint non-investment equilibrium (and the probability that this equilibrium is learned) equals $p^*(R)$. The probability that the initial population starts out precisely at $p = p^*(R)$ approaches zero, which is why the probability that the mixed equilibrium is learned is vanishingly small.
QED

Before showing Proposition 2, we first show a preparatory result in Lemma 1, which shows that the shape represented in Figure 2 of the paper for $p^*(R)$ is general.

Lemma 1: In the dissident game, consider the critical probability $p^*(R) = \frac{c-[V/(2^R)]}{V[1-2/(2^R)]}$ dividing the basin of attraction of the joint investment and joint non-investment equilibria, and consider a continuous approximation of $p^*(R)$. Then:

(a) for large benefits of protest ($V > 2c$), $p^*(R)$ is an increasing concave function of R which approaches $-\infty$ for R approaching one, and approaches $p^* = c/V < 1/2$ for R approaching $+\infty$*;*

(b) for small benefits of protest ($V < 2c$), $p^*(R)$ is a decreasing convex function of R which approaches $+\infty$ for R approaching one, and approaches $p^* = c/V > 1/2$ for R approaching $+\infty$.

Proof:
Considering (3), and taking the limit to $R = 1$ and $R = +\infty$, the results follow. Taking the derivate of p^* with respect to R:

$$\frac{\partial p^*}{\partial R} = \frac{-\ln(1/2)[V/(2^R)]\{V[1-2/(2^R)]\} - V[-2/(2^R)]\ln(1/2)\{c - [V/(2^R)]\}}{\{V[1-2/(2^R)]\}^2}$$
$$= V\ln(2)[1/(2^R)]\frac{V-2c}{\{V[1-2/(2^R)]\}^2}$$

It follows that $\frac{\partial p^*}{\partial R} \gtreqless 0$ iff $2c \lesseqgtr V$.

The second derivative equals:

$$\frac{\partial^2 p^*}{\partial R^2} = -V(V-2c)\ln(2)$$
$$\frac{\ln(2)[1/(2^R)]\{V[1-2/(2^R)]\}^2 + \ln(2)2[2V/(2^R)]\{V[1-2/(2^R)]\}}{\{V[1-2/(2^R)]\}^4}$$

It follows that $\frac{\partial^2 p^*}{\partial R^2} \gtreqless 0$ iff $V \lesseqgtr 2c$.
QED

Proof of Proposition 2:
The effect on the probability that the joint investment equilibrium is learned, follows directly from Proposition 1, considering that $(1 - p^*(R))$ is the size of the basin of attraction of the joint investment equilibrium, and from Lemma 1.

Proof of Proposition 3:

In an approximation where R is considered a real number with $R \geq 0$ rather than an integer, the optimal R is found by solving the maximization problem:

$$\max_R[-p^2V - 2p(1-p)V/(2^R) - kR]$$

The first-order condition yields:

$$2p(1-p)V(ln2)(1/2)^R - k = 0$$

It can be checked that the second-order condition is valid. Considering R as a real number, the first-order condition solves to:

$$R^*(p) = \frac{ln[2p(1-p)(V/k)(\ln(2))]}{\ln(2)} \tag{4}$$

Taking the first and second derivative of the right-hand side of (4), we obtain that:

$$\frac{\partial R^*(p)}{\partial p} = \frac{[2p(1-p)(V/k)(ln2)]^{-1}(1-2p)}{ln(2)} \tag{5}$$

$$\frac{\partial^2 R^*(p)}{\partial p^2} = \frac{-[2p(1-p)(V/k)(ln2)]^{-2}(1-2p)^2 - 2[2p(1-p)(V/k)(ln2)]^{-1}}{ln(2)} < 0 \tag{6}$$

By (5) and (6), it follows that $R^*(p)$ is a concave function that reaches a maximum at $p = 1/2$. $R^*(p)$ in (4) is negative both for $p = 0$ and $p = 1$. Given that a maximum is reached when $p = ½$, it follows that as long as $k < 0.5V\ln(2)$, $R^*(½) > 0$, and $R^*(p)$ has two points where $R^*(p) = 0$, positioned between zero and one. $R^*(½)$ is decreasing in k, where for k approaching zero, $R^*(½)$ approaches infinity, and the two points where $R^*(p) = 0$ approach 0 and 1.

We next look at the non-approximated $R^*(p)$, where R only takes on integer values. For $p = 0$, the government never sets R higher than one, as one check suffices to generate a zero value. As $V > k$, the government sets $R = 1$ in this case. For $p = 1$, the government sets R as small as possible, as R does not have any effect; given our assumption that $R \geq 1$, it follows that in this case $R = 1$ as well. Furthermore, as $R^*(p)$ in (4) is a continuous function, levels of p exist such that $R^*(p)$ happens to be an integer. In the neighborhood of such values, the non-approximated $R^*(p)$ is flat. It follows that the non-approximated $R^*(p)$ takes the form of a hill-shaped step function.

QED

Before showing Proposition 4, we first provide a preparatory result in the form of Lemma 2, where we derive the equilibria of the government-dissident game with a myopic government (where an equilibrium is a learning equilibrium of the dissident game with an R that is the government best response to the fraction of investing dissidents in the learning equilibrium).

Lemma 2: Equilibria of the dissident game-government with a myopic government are:

(a) for large benefits of protest ($V > 2c$):

(i) the joint investment equilibrium with minimal repression ($R = 1, p = 1$);

(ii) in a continuous approximation where $R^*(p)$ can take on non-integer values, for sufficiently small k and for sufficiently small benefits of protest within the range of large benefits of protest, additionally two mixed equilibria (p_i^L, R_i^L) (with $i = 1,2$), where $p^*(R_i^L) = p_i^L < 1/2$. It is the case that $p_2^L > p_1^L$, $R_2^L > R_1^L$.

(b) for small benefits of protest ($V < 2c$):

(i) the joint investment equilibrium with minimal repression ($R = 1, p = 0$).

(ii) in a continuous approximation where $R^*(p)$ can take on non-integer values, for sufficiently small k and for sufficiently large benefits of protest within the range of small benefits of protest, additionally two mixed equilibria (p_i^S, R_i^S) (with $i = 1,2$), where $p^*\left(R_i^S\right) = p_i^S > 1/2$. It is the case that $p_1^S > p_2^S$, $R_1^S < R_2^S$.

Proof:

Any pure-strategy equilibrium must either have $p = 0$ or $p = 1$. For each of these values of p, as shown in Proposition 3, the government's best response is $R = 1$. Given Proposition 1, for $R = 1$ a single learning equilibrium exists for the dissident game with $p = 0$ when $V < 2c$, and with $p = 1$ when $V > 2c$.

In the continuous approximation of the government-dissident game, a mixed equilibrium is given by a pair (p^E, R^E) such that $R^*(p^E) = R^E$ and $p^*(R^E) = p^E$, where the functions $R^*(.)$ and $p^*(.)$ were derived in Proposition 3 and Lemma 1. Given that $R^*(.)$ is a hill-shaped function that reaches a maximum for $p = 1/2$ (Proposition 3), and given that $p^*(.)$ is either a concave increasing function that lies everywhere below $p = 1/2$ ($V > 2c$), or a convex decreasing function that lies everywhere above $p = 1/2$ ($V < 2c$) (Lemma 1), and given how changes in k and c shift these functions, the result follows.[1]

QED

Proof of Proposition 4:

We show that of the equilibria described in Lemma 2, only the pure-strategy equilibria will be played. We do this by showing that these equilibria are learned starting from any possible initial p and R.

When $R^*(.)$ (derived Proposition 3) and $p^*(.)$ (derived in Lemma 1) do not intersect, with $V > 2c$, every best-response repression level that the government can adapt, puts the dissidents in the basin of attraction of the joint investment equilibrium, so that only this equilibrium can be learned; with $V < 2c$, every best-response repression level that the government can adapt, puts the dissidents in the basin of attraction of the joint non-investment equilibrium, so that only this equilibrium can be learned.

We next consider the cases where $R^*(.)$ and $p^*(.)$ intersect. Denote by ${p_1}^L$ the level of p corresponding to point 1 in Figure 4(a) in the paper, and by ${p_2}^L$ the level of p corresponding to point 2 in Figure 4(a). For large benefits of protest, consider any state in Figure 4(a) where it is both the case that $p > {p_2}^L$ and $p > p^*(R)$. Then, as p is situated in the basin of attraction of the joint investment equilibrium, p will increase; also, R will move along the hill-shaped best response curve, to the right. It follows that for any such initial state, the pure-strategy equilibrium with $p = 1$, $R = 1$

[1] Note that for precise values of c and k, a limit case also exists where $R^*(.)$ and $p^*(.)$ are tangent, so that a single mixed equilibrium exists.

is learned. Yet, this is also true for states outside of this area. Consider any state in Figure 4(a) both to the left of $p^*(R)$, and such that $p > p_1{}^L$; then p decreases. Yet, because of the delay with which the government sets its best response, p will typically continue to decrease until $p < p_1{}^L$, as indicated by the arrow pointing to the left. Once the government is able to set its best response to the lower p, as indicated by the downward pointing arrow, the government sets a low repression level. As we are now to the right of $p^*(R)$, p increases again, as indicated by the arrow pointing to the right. As long at the delay with which the government can set its best response is sufficiently large, we inevitably move into the area $p > p_2{}^L$ and $p > p^*(R)$, in which case the pure-strategy equilibrium with $p = 1$, $R = 1$ is inevitably learned. Finally, we again point out that the probability of having either of the two mixed equilibria Lemma 2(a)(ii) as a starting point is vanishingly small.

The proof for small benefits of protest, based on Figure 4(b), is fully analogous, and is omitted.

Proof of Proposition 5:

For $V > 2c$, the government sets R to solve:

$$\max_R\{-[1 - p^*(R)]V - kR\} \tag{7}$$

where by Proposition 1, $p^*(R) = \frac{c-[V/(2^R)]}{V[1-2/(2^R)]}$, and by Lemma 1(a), $p^*(R)$ is an increasing concave function of R. Taking a continuous approximation of $p^*(R)$, where R is considered also taking on non-integer values, the first-order condition of (7) becomes:

$$\frac{\partial p^*(R)}{\partial R}V - k = 0 \tag{8}$$

Given Lemma 1(a), the second-order condition is valid, so that (8) determines an optimal R for sufficiently small k.

For $V < 2c$, by Proposition 1, the government can achieve that no dissident invests by setting $R = 1$. Given that each dissident's participation in the protest is pivotal, this undoes all the benefits from the protest.

QED

Online Appendix B. Extensions.

In the model in the body of the paper, we take several simplifying assumptions. We here show that when relaxing these assumptions to obtain a more general, but also more complex model, our results are maintained. We do this by means of ten extensions, numbered (i) to (x), which are shortly referred to in the paper in the subsection Extensions of the section Dissident Game with Exogenous Preemptive Repression. Each time, we first state the simplifying assumption that our model takes, and then elaborate on how the results are affected when this simplifying assumption is relaxed.

(i) We assumed that in any pair of dissidents, each dissident is targeted with equal probability. Table B1 considers a variant of the dissident game in Table 1 where the

Row dissident is checked with probability q (with $0.5 < q < 1$), and the Column dissident is checked with probability $(1-q)$. Define now $\Delta_1^R = V[1-(1-q^R)]$ as the added benefit of investing jointly to the Row player, $\Delta_1^C = V[1-q^R]$ as the added benefit of investing jointly to the Column player, $\Delta_0^R = Vq^R$ as the added benefit of investing alone to the Row player, and $\Delta_0^C = V(1-q)^R$ as the added benefit of investing alone to the Column player. Then it can easily be seen that Δ_1^i increases in R for $i = R, C$, and that Δ_0^i decreases in R for $i = R, C$. Also, it is easily checked now that $\Delta_1^R \geq \Delta_1^C \geq \Delta_0^C$ (where $\Delta_1^R = \Delta_1^C = V$ for $R \to \infty$, and $\Delta_1^C = \Delta_0^C = V(1-q)$ for $R = 1$), and $\Delta_1^R \geq \Delta_0^R \geq \Delta_0^C$ (where $\Delta_0^R = \Delta_0^C = 0$ for $R \to \infty$, and $\Delta_1^R = \Delta_0^R = qV$ for $R = 1$). Finally, $\Delta_1^C = \Delta_0^R = 0.5V$ for $q^R \approx 0.5$, meaning that $R \approx \ln(2)/[-\ln(q)]$.

It follows that, just as in the game in Table 1 in the paper, there continues to be a case $V > c/(1-q)$ with large benefits of protest, in which an increase in R makes the game change from one with a unique joint investment equilibrium, to one with both a joint investment equilibrium and a joint non-investment equilibrium, and where a deterrence effect is obtained. Also, there continues to be a case $V < c/q$ with small benefits of protest, in which an increase in R makes the game change from one with a unique joint non-investment equilibrium, to one with both a joint investment equilibrium and a joint non-investment equilibrium, and where a backfiring effect is obtained. Two additional cases are obtained for the game in Table B1. When $2c < V < c/(1-q)$, as R is increased, the game switches from having a single equilibrium where only the Row player invests, to having a unique joint investment equilibrium, to finally having both a joint investment equilibrium and a joint non-investment equilibrium. Thus, while for larger R we obtain a deterrence effect as in Proposition 2(a), for smaller R, the effect goes in the opposite direction. When $c/q < V < 2c$, as R is increased, the game switches from having a single equilibrium where only the Row player invests, to having a unique joint non-investment equilibrium, to finally having both a joint investment equilibrium and a joint non-investment equilibrium. It follows that, while for larger R we obtain a backfiring effect as in Proposition 2(b), for smaller R the effect again goes in the opposite direction. These additional cases obtained do not fundamentally affect our results as long as the asymmetry in the probability of being targeted is small. The range of benefits of protest where $c/q < V < c/(1-q)$ is then small, and moreover within this range, the range of small R for which the effects run in the opposite direction is small (as can be seen from the fact that for q just above 1, $R \approx \ln(2)/[-\ln(q)]$ is close to 1).

	Invest	*Don't invest*
Invest	$V-c, V-c$	$Vq^R - c, Vq^R$
Don't invest	$V(1-q)^R, V(1-q)^R - c$	0, 0

Table B1. Dissident game with asymmetric probability of being checked.

(ii) Our security forces only perform random checks. What if security forces can invest in performing targeted checks, aimed specifically at dissidents who do not invest in countermeasures? In this case, one can see higher investments in repression not as leading to a higher number of random checks, but as leading to more targeted checks (De Jaegher and Hoyer 2016b). Consider in particular a government that performs a single check, and can either at small costs make this check random (such that it hits each dissident with equal probability), or at large costs make the check targeted (such that it hits a non-investing dissident with certainty). The comparison of these two situations is the same as the comparison in our analysis with random checks of the case $R = 1$, and the case R approaching infinity (as a government that performs a very large number of random checks finds a dissident who did not invest in countermeasures with probability approaching one). This shows that our results are maintained if larger investments in repression are re-interpreted as a higher fraction of targeted checks for a given number of checks, rather than as a larger number of random checks.

(iii) We have limited ourselves to a two-player dissident game. Consider a variant of the game where players are matched into groups of n players. Benefits from protest are obtained only if all n dissidents participate in the protest. When $R = 1$, the added benefit of investing jointly equals V/n, as does the added benefit of investing alone. It follows that for $R = 1$, only a joint-investment equilibrium exists when $V > nc$, and only a joint non-investment equilibrium exists when $V < nc$. For R approaching infinity, again starting from a situation of joint investment, the expected payoff obtained by a deviating dissident who does not invest equals zero; starting from joint non-investment, the expected payoff obtained by a deviating dissident who invest equals $-c$; it continues to be true that the dissident game in this case has two pure-strategy equilibria. This shows that the dichotomy between large and small benefits of protest is maintained. Yet, the range of benefits that is considered large becomes more limited as n is increased. Moreover, as shown in De Jaegher (2017), for $V < nc$, while a switch from $R = 1$ to large R always has a deterrence effect, the effect of a small increase in R on the probability of protest around $R = 1$ is still positive, so that R in this case has a non-monotonous effect of the probability of protest.

(iv) In the model in Table 1 in the paper, countermeasures are always successful in making checks ineffective. We here consider an extension where the individual dissident who invests in countermeasures and is checked, is only able to participate in the protest with probability $s > 0.5$. This yields the payoff matrix in Table B2. The added benefit of investing jointly now equals $s^2V - s(2s-1)V/(2^R)$; this increases in R, equaling $(sV)/2$ for $R = 1$ and s^2V for R approaching infinity. The added benefit of investing alone equals $sV/(2^R)$; this decreases in R, equaling $(sV)/2$ for $R = 1$ and 0 for R approaching infinity. It follows that the backfiring effect operates for $V < (2c)/s$, and the deterrence effect for $V > (2c)/s$, meaning that the deterrence effect applies for a smaller range of benefits. The extension is important, because it justifies assuming $R \geq 1$ for $p = 1$. In the dissident-government game with a myopic government, for $p = 1$ the government solves $\max_R[-[s^2V + 2s(1-s)V/(2^R)] - kR]$, leading to the solution $R = [\ln\{[2s(1-s)V]\ln(2)/k\}]/[\ln(2)]$. For k sufficiently small, the government indeed puts $R \geq 1$.

	Invest	*Don't invest*
Invest	$s^2V + 2s(1-s)V/(2^R) - c$, $s^2V + 2s(1-s)V/(2^R) - c$	$sV/(2^R) - c, sV/(2^R)$
Don't invest	$sV/(2^R), sV/(2^R) - c$	0, 0

Table B2. Dissident game where countermeasures fail with probability s.

(v) We assumed that each dissident's participation in the protest is pivotal in producing any benefit from the protest. Put otherwise, considering participation as an input, each dissident's participation is a perfect complement to the other dissident's participation (for a taxonomy of technologies for public-good production, see Hirshleifer 1983). Based on De Jaegher and Hoyer (2016a), Table B3 represents an extension of the game in Table 1 where, if a single dissident does not participate (because she did not invest in countermeasures, and was checked), benefit $V(1-k)$ is still obtained. Here k denotes the degree of complementarity between the dissidents' inputs. For $k = ½$, a first participating dissident adds as much to the common benefit as the second participating dissident; for $k = 1$, no common benefit is produced without a second participating dissident. It can be calculated that the dichotomy of a backfiring effect for small benefits of protest and a deterrence effect for large benefits of protest is maintained as long as $k > ⅔$, i.e. as long as the degree of complementarity is sufficiently large. However, the range of benefits of protest for which the deterrence effect applies is reduced the smaller the degree of complementarity.

	Invest	*Don't invest*
Invest	$V - c$, $V - c$	$V\{1/(2^R) + (1 - 1/(2^R)(1 - k))\} - c$, $V\{1/(2^R) + (1 - 1/(2^R)(1 - k))\}$
Don't invest	$V\{1/(2^R) + (1 - 1/(2^R)(1 - k))\}$, $V\{1/(2^R) + (1 - 1/(2^R)(1 - k))\} - c$	$V(1 - k)/(2^{R-1})$, $V(1 - k)/(2^{R-1})$

Table B3. Dissident game with degree of complementarity k, for given repression level R, with $R \geq 1$.

(vi) In the game in Table 1 in the paper, a dissident who does not invest in countermeasures and is checked, does not incur any other cost than foregoing the benefits of protest. Yet, more realistically, such a dissident may incur a cost, e.g. the cost from being arrested. Such a cost α is added in Table B4. The added benefit of investing jointly now becomes $[1-1/(2^R)](V+\alpha)$; the added benefit of investing alone becomes $(V-\alpha)/(2^R)+\alpha$. Both of the added benefits equal $(V+\alpha)/2$ for $R=1$. The former added benefit equals $(V+\alpha)$, and the latter α for R approaching infinity. The former added benefit therefore always increases in R, while the latter decreases in R as long as $\alpha < V$. For $\alpha < V$, it can be calculated that $p^* = \frac{c-[V/(2^R)]-[1-1/(2^R)]\alpha}{V[1-2/(2^R)]}$, which increases in R (meaning that the basin of attraction of the joint investment equilibrium decreases, deterrence effect) when $\alpha < c < (V+\alpha)/2$, and which decreases in R (meaning that the basin of attraction of the joint investment equilibrium increases, backfiring effect) when $(V+\alpha)/2 < c < (V+\alpha)$. For $\alpha > V$, the basin of attraction of the joint investment equilibrium always increases in R. Thus, as we increase α, the deterrence effect occurs for a smaller range of benefits of protest, and ultimately vanishes. This extension also makes it clear that our result that higher R may increase the expected payoff of the dissident is driven by the public-good aspect of the model. If in Table B4, $V=0$, then the dissident's payoff when not investing equals $-[1-1/(2^R)]\alpha$, and when investing equals $-c$; it follows that in this case, the expected payoff always weakly decreases in R.

	Invest	*Don't invest*
Invest	$V-c, V-c$	$V/(2^R)-c$, $V/(2^R)-[1-1/(2^R)]\alpha$
Don't invest	$V/(2^R)-[1-1/(2^R)]\alpha$, $V/(2^R)-c$	$-[1-1/(2^R)]\alpha, -[1-1/(2^R)]\alpha$

Table B4. Dissident game with private costs of being checked without countermeasures.

(vii) Our security forces affect only how often dissidents are checked, but do not affect the intensity i with which each check is performed. It makes sense that if the government increases this intensity, the cost c to a dissident of eluding checks, is increased. Let $c(i)$ therefore denote the cost of countermeasures c as an increasing function of the intensity of repression i. Moreover, as is clear from equation (3) in Online Appendix A, an increase in the cost of countermeasures reduces the basin of attraction of the joint investment equilibrium. All else equal, by increasing intensity i, the government can thus make it less attractive for the dissidents to invest. In the government costs kR of investing in repression, we may now simply put $k=i$, so that government costs become iR. The government simply spends resources i on each check, which are multiplied by the number of checks R. This modification of the model is particularly relevant for the dissident-government game with a farsighted government. When from the perspective of the repression level, an iron-first strategy is optimal, the government needs to take into account that setting a high repression level R makes it more costly to maintain the same intensity of repression i, whereas maintaining a high intensity also reduces the basin of attraction of the joint-investment equilibrium. For this reason, the government should limit the repression level; while this does not undo the iron-fist strategy, the number of checks set by the government will still be lower. When from the perspective of the repression level a velvet-glove strategy is instead optimal, a by-product is that repression intensity becomes cheaper, and the government should set a higher intensity. Apart from this extension, higher R may also increase c and reduce the basin of attraction of the joint investment equilibrium, because an individual dissident who happens to face several checks should find it more costly to elude such checks, the higher their number. With large benefits of information, the farsighted government now has even more reason to set an iron-fist strategy. With small benefits of information, the backfiring effect says that the government should reduce R, whereas the positive effect of R on c says that the government should increase R. This makes the velvet-glove strategy less pronounced, but does not exclude it.

(viii) We have assumed that the government only uses individualized preemptive repression, but not collective preemptive repression. Consider a government that not only sets individualized preemptive repression in the form of R, but also collective preemptive repression, where at costs lt^2, the government can reduce the benefits of protest by t (where the cost function is chosen such that the second-order condition of the maximization problem is valid). This means that the range of protest benefits that falls under the case of small benefits of protest is increased ($V<2c+t$). A myopic government now solves $\max_{R,t}[-p^2(V-t)-2p(1-p)(V-t)/(2^R)-kR-lt^2]$. Following (4), this means that $R^*(p)=\frac{ln[2p(1-p)[(V-t)/k](\ln(2))]}{\ln(2)}$. Additionally, it can be checked that $t^*(p)=\frac{p^2+0.5^{R-1}p(1-p)}{2l}$. It follows that $R^*(p)$ does not change in shape, and that as long as l is not too small, the same cases continue to apply. A farsighted government does not only consider the direct effect of preemptive repression in reducing V, but also the indirect effect in reducing the basin of attraction of the joint investment equilibrium. For $V > 2c + t$, the farsighted government solves $\max_{R,t}\{-[1 - p^*(R)](V - t) - kR - lt^2\}$, where $p^*(R) = \frac{c-[(V-t)/(2^R)]}{(V-t)[1-2/(2^R)]}$. Following (8), this yields the first-order condition $\frac{\partial p^*(R)}{\partial R}(V - t) - k = 0$, and additionally the first-order condition $[1 - p^*(R)] - 2lt = 0$. It follows that as long as l is not too small, the results are again not qualitatively changed. For $V < 2c + t$, the farsighted government continues to set minimal R.

(ix) We have assumed that all dissidents in a group are active dissidents preparing for a protest. Consider a variant of the game where players are matched into groups of n players (with $n > 2$), x of which are active dissidents preparing for a protest (with $2 \leq x < n$). Each of the x dissidents decides whether or not to invest in countermeasures (where investing comes at cost c); the remaining $(n - x)$ players play an entirely passive role in the game. When the government cannot distinguish ex ante between active and inactive dissidents, all dissidents in a group (whether active or not) are sampled R times without replacement. Each dissident obtains zero benefit from the protest when an active dissident who does not take countermeasures is sampled at least one time; otherwise, each dissident obtains payoff V from the protest. This reflects the idea that one active dissident who is caught in the act of preparing, may betray who the other active dissidents are. When $R = 1$, the added benefit of investing jointly equals V/n, as does the added benefit of investing alone. It follows that for $R = 1$, only a joint-investment equilibrium exists when $V > nc$, and only a joint non-investment equilibrium exists when $V < nc$. For R approaching infinity, starting from a situation of joint investment, the expected payoff obtained by an active dissident who does not invest equals zero; starting from joint non-investment, the expected payoff obtained by an active dissident who invests equals $-c$; it continues to be true that the dissident game in this case has two pure-strategy equilibria. This shows that the analysis is analogous to the analysis when $x = n$.

(x) Our model is fully focused on the defense by the individual dissident of her ability to protest, and on the government's pre-emption of the protest by incapacitating dissidents, rather than on dissidents' decision on whether or not to participate in the protest itself, and on the government's reactive repression given the protest. A more general model can be constructed where dissidents decide not only whether or not to invest in countermeasures, but also whether or not to participate in the protest in the first place. The dissident game in this case is represented in Table B5, where participating in the protest comes at a cost d, and where we assume that $V > c + d$. Each dissident can either invest in countermeasures or not, and can participate in the protest ("act") or not, leading to four possible strategies. The strategy of investing in countermeasures and at the same time not participating in the protest can be ignored, as it is dominated; if one does not plan to participate in the protest, there are no benefits to defend. To show that such a more general model leads to identical results, we compare the case where $R = 1$ to the case where R approaches infinity. When $V < 2c$, for $R = 1$ the dissident game in Table B5 has a unique pure-strategy equilibrium where neither dissident participates or invests in countermeasures; for R approaching infinity, the game continues to have this equilibrium, and additionally has an equilibrium where both dissidents participate and invest in countermeasures. Thus, for a sufficiently large increase in R, there continues to be a backfiring effect for small benefits of protest. When $V > 2c$, for $R = 1$ the dissident game in Table B5 has both a pure-strategy equilibrium where neither dissident participates or invests in countermeasures, and an equilibrium where both dissidents participate and invest in countermeasures. The former equilibrium does not have a basin of attraction if “Don’t Act, Don’t Invest” is not played by any dissident in the dissident population. If “Act, Don’t Invest” is not played by any dissident, the basin of attraction of the equilibrium where all dissidents act and invest equals $[V - (c + d)]/V$. For R approaching infinity, if “Don’t Act, Don’t Invest” is not played by any dissident in the dissident population, the case where all dissidents act but do not invest gets a positive basin of attraction, as does the equilibrium where all act and all invest; if “Act, Don’t Invest” is not played by any dissident, the basin of attraction of the equilibrium where all act and all invest continues to be equal to $[V - (c + d)]/V$. This shows that it continues to be the case that the basin of attraction of the equilibrium where all act and all invest decreases as R is increased, in line with the deterrence effect. In the dissident-government game based on Table B5, the only change is that in the case of large benefits of protest and a myopic government, with the minimal repression set by the government, an equilibrium where dissidents do not act and do not invest is also possible; however, such an equilibrium is less likely to be learned than with a farsighted government.

	Act, Invest	*Act, Don’t invest*	*Don’t act, Don’t invest*
Act, Invest	$V - c - d$, $V - c - d$	$V/2^R - c - d$, $V/2^R - d$	$-c - d$, 0
Act, Don’t invest	$V/2^R - d$, $V/2^R - c - d$	$-d$, $-d$	$-d$, 0
Don’t act, Don’t invest	0, $-c - d$	0, $-d$	0, 0

Table B5. Dissident game with both participation in protest and investing in countermeasures for given repression level R, with $R \geq 1$.

References for Online Appendix B:

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