# Education and propaganda: Tradeoffs to public education provision in nondemocracies

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**Abstract**

Nondemocratic regimes face a tradeoff when investing in public education. Education promotes human capital acquisition, expanding the tax base. Yet it also enhances political sophistication and participation, at a cost to nondemocratic regimes. To relax this tradeoff, a regime can disseminate propaganda through its education system. I show that even Bayesian citizens can be influenced by propaganda. By deterring political opposition, propaganda can induce nondemocracies to invest in education when they otherwise would not, improving social welfare. When propaganda is too strong, however, it can generate a backlash. Using cross-country and survey data, I find evidence consistent with the predictions.

**JEL codes**: I25, H52, O43
**Key words**: Public education; propaganda; political participation; second-best; development; human capital; social capital; nondemocracy

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# 1 Introduction

Why do nondemocracies invest in public education? Doing so promotes human capital acquisition and social cohesion, favoring economic development and expanding the tax base.[1] Yet the same forces may also promote political development, enhancing political sophistication and participation.[2] Indeed, education has historically been restricted to certain groups in expectation of this. Many U.S. states banned the education of slaves prior to the Civil War, while Colonial powers in Africa and East Asia often adopted similar measures against indigenous peoples, even though the resulting productivity gains would have benefitted economic elites in both cases (Woodson, 1915; Bjork, 2005). Given this, the extent to which many modern nondemocracies invest in education is puzzling.[3]

Nevertheless, another view holds that nondemocratic regimes use public education to shape public opinion and control civil society. Early compulsory education systems in Europe and North America were designed principally to unify historically disparate groups around new national identities in the process of nation-building (Alesina and Reich, 2015; Bandiera et al, 2017). Likewise, 20th century authoritarian states often used public schools to promote compliance with autocratic power structures and state-sanctioned ideologies.[4]

This paper brings these two views together, treating them as separate dimensions of public education that interact in important ways. In doing so, it generates new insight into why many nondemocracies choose to invest in public education when doing so can promote political development. In particular, this paper explores how a ruler can alter the incentives underlying public education provision by manipulating

[1] See Gradstein and Justman (2000, 2002), Glaeser et al (2004), and Galor and Moav (2006).

[2] See Lipset (1959), Dee (2004), Milligan et al (2004), Yanagizawa-Drott (2014), Chong and Gradstein (2015), and Friedman et al (2016). Some argue that education leads to democracy. For this debate, see Acemoglu et al (2005) and Castelló-Climent (2008).

[3] Lott (1999) and Bursztyn (2016) note positive associations between nondemocracy and various measures of public education provision among lower income countries. Aghion et al (2014) find this trend more generally, although Acemoglu et al (2015) suggest a reversal at the secondary level. De la Croix and Doepke (2009) do not observe this trend, but find variance in education spending to be increasing in non-freedom, with non-free countries dominating the right tail.

[4] See Cantoni et al (2017), Alesina and Fuchs-Schundeln (2007) and Voigtlander and Voth (2015).

the content of education. To do this, I draw from a vast literature from across the social sciences, which conceives of political engagement as something learned and habituated early in life.[5] In this view, public education promotes political participation to the extent that it tends to facilitate involvement in political and other social activities. However, this effect varies with the style and content of education.

With that in mind, I develop a model examining a ruler's decision to invest in public education. With some probability the ruler has predatory objectives, seeking only to maximize his own rents. Indeed, providing education may increase his taxation revenues. Yet education also enables citizens to become active in political "clubs." In the model, this promotes acquisition of inputs needed for citizens to credibly oppose high taxes in the future (i.e. political participation).

A ruler is not naive to this: if he invests in education, then he decides whether to adopt a curriculum embedded with propaganda. In the model, the content of education provides a signal of the political environment,[6] influencing citizens' beliefs about the importance of developing inputs useful for political participation relative to labor. By distorting this signal, propaganda can decrease a citizen's expected payoffs from political uses of human capital relative to productive ones, making joining a political club seem more costly. As a result, it can induce suboptimal levels of political participation and higher taxes in an equilibrium with public education, making its provision more appealing to a predatory ruler.

However, citizens are also not naive to a ruler's incentives to disseminate propaganda. Although propaganda increases the likelihood that a citizen is exposed to a "ruler-favorable" curriculum, it also decreases the value of public schooling for learning about the political environment. Too much propaganda can generate excessive uncertainty, such that joining a political club becomes social insurance against future expropriation. In this case, propaganda *encourages* political participation and in turn lower taxes whenever a predatory ruler invests in public education.[7] Moreover,

[5]See Nie et al (1996), Nie and Hillygus (2001), Plutzer (2002), McFarland and Thomas (2006), Campbell (2008), Quintelier (2008), Gardner et al (2008), and Kahne et al (2013).

[6]Bowles and Gintis (1976) argue that public schooling is informative of political and economic institutions not only in terms of its content but also in its organizational structures.

[7]For discussions of "backlash" and other disutilities from the character of public schooling, see

as society becomes more productive, the potential costs of not becoming politically active increase, such that this outcome is more likely to occur.

Propaganda can therefore make investments in education more appealing to a predatory ruler when initial productivity growth from education is relatively modest, letting him promote economic development while extracting greater rents. Nevertheless, by making education provision desirable, propaganda can actually make citizens *better off*. Further development will then correspond to a shift away from propaganda to more neutral educational content, and in sufficiently high productivity settings, educational content will forgo propaganda entirely. In this latter scenario, a predatory ruler always benefits from investing in public education, inducing optimal political participation levels and low taxes. I provide evidence consistent with these predictions in section 3.

As previously noted, much of the existing literature treats public education provision as either a means for a ruler to increase his rents, often at the risk of uprising or democratization, or a means of indoctrinating citizens in order to *reduce* the risk of insurrection. This paper adds to this discussion by considering an interaction of these two views. On one hand, it follows Bourguignon and Verdier (2000), in which education promotes economic growth but is also politically costly, as in this paper. Both models generate equilibria in which sufficient income growth from education induces investment, even if political development cannot be constrained. In their setup, however, education serves as a *de facto* franchise extension, generating intermediate equilibria in which elites retain political power by providing education only to some. This paper considers an alternative mechanism by which political externalities of public education can be reduced without varying its provision. Namely, it considers how changes within the education system, particularly with regard to its content, can relax political barriers to public education provision. Also related is Glaeser et al (2007), who discuss a model of political transition in which human capital benefits more democratic regimes, and Campante and Chor (2012), who examine empirically the conditions under which education promotes political participation.

This article is also related to Alesina and Reich (2015). They model public

Fouka (2016), Carvalho and Koyama (2016), Gradstein and Justman (2005), and Swee (2015).

education as useful for its homogenizing effect, bringing citizens' preferences closer to elites'. In contrast, this paper considers the incentives to invest in public education when the homogenizing nature of education may actually be costly to a ruler, by facilitating political participation. This is consistent with empirical evidence that education favors political development. As in Alesina and Reich, however, public education may also serve as a political instrument. By using propaganda, a ruler can provide schooling while simultaneously minimizing the risk of uprising. A connected literature explores how the ideological content of education influences educational outcomes (Clots-Figueras and Masella, 2013; Meyersson, 2014; Carvalho et al, 2017). Also related is Fuchs-Schundeln and Masella (2016), who show that propaganda-based education in East Germany negatively impacted outcomes after reunification.

This paper relates in a more general way to the literature on nondemocratic institutions. Like many in that tradition, this paper concerns the expansion of public goods in settings with self-interested elites (Myerson, 2008; Gehlbach et al, 2016). Finally, the model itself is inspired by other models of strategic information transmission (Crawford and Sobel, 1982; Kamenica and Gentzkow, 2011, Edmond, 2013).

# 2 Model

The model has two players: a ruler and a citizen. The ruler's type is $\theta \in \{0, 1\}$, where $\theta = 1$ denotes a "benevolent" ruler who will choose policies that maximize social welfare, while $\theta = 0$ denotes a "predatory" ruler who will maximize his own rents. A ruler's type is private knowledge. The citizen's prior belief, $Pr(\theta = 1) = \pi \in (0, 1)$, indicates the extent to which she has been socialized prior to attending school to *trust* the ruler.

After learning his type, a ruler first decides whether to invest in public education, $g_\theta \in \{0, 1\}$. If he invests, the citizen then decides whether or not to enroll in a public school, $e \in \{0, 1\}$. Let $y(e)$ be her education-contingent labor income. If she enrolls, she acquires human capital and her labor income becomes $y(1) = w + \alpha h$, where

$h > 1$ is the *productivity effect* of education, and $\alpha > 0$.[8] Otherwise, she earns $y(0) = w \geq 0$. Human capital may also benefit the ruler down the line: once income is accrued, he imposes upon the citizen a lump sum tax, $\tau_\theta \geq 0$.

Public education provision also has political consequences. For instance, public schooling may expose the citizen to a larger peer network, enhancing her political efficacy via new social capital.[9] In the model, the citizen can become active in a *political club* while enrolled in school, a choice represented by $c \in \{0, 1\}$. If she does, then she acquires the capacity to challenge a predatory ruler's choice of $\tau_0$ after entering the labor force. However, joining a political club comes at the cost of time and effort that might otherwise have gone toward developing more productive inputs: if $c = 1$, then one unit of productivity is allocated toward *political participation* once she enters the labor force, inducing a proportionate decrease of $\alpha$ in labor income. Thus, the citizen's payoff function is

$$U = y(e) - \alpha c - \tau_\theta.$$

Here, political participation means having the capacity to challenge $\tau_0$. Let $r \in \{0, 1\}$ denote a politically active citizen's decision to mount a *political challenge* against a predatory ruler.[10] A challenge might arise nonviolently as a campaign or violently as a revolt. If the citizen mounts a challenge, with probability $q \in (0, 1)$ she succeeds in recovering $\tau_0$, but a fraction $1 - \sigma \in (0, 1)$ of income is destroyed.

Although nondemocracies often display kleptocratic qualities (i.e. $\theta = 0$), they vary with respect to the means and ease with which a citizen can participate in the political process and thus constrain those tendencies. $q$ and $\sigma$ characterize the institutional environment underlying political participation. I interpret $q$ as reflecting the citizen's *political power* relative to the ruler. For example, $q$ may reflect the prevalence of explicit repression (e.g. banning of parties and ideologies). $\sigma$ gives

[8] For algebraic simplicity, I treat $\alpha h$ as absorbing any direct private costs of attending school.

[9] See Gradstein and Justman (2000, 2002) and Helliwell and Putnam (2007). Also see the Online Appendix for a discussion of a two-citizen set up.

[10] Since a benevolent ruler only sets a tax to balance his budget constraint (i.e. pay off debts from education provision), I do not discuss the possibility that the citizen challenges a benevolent ruler.

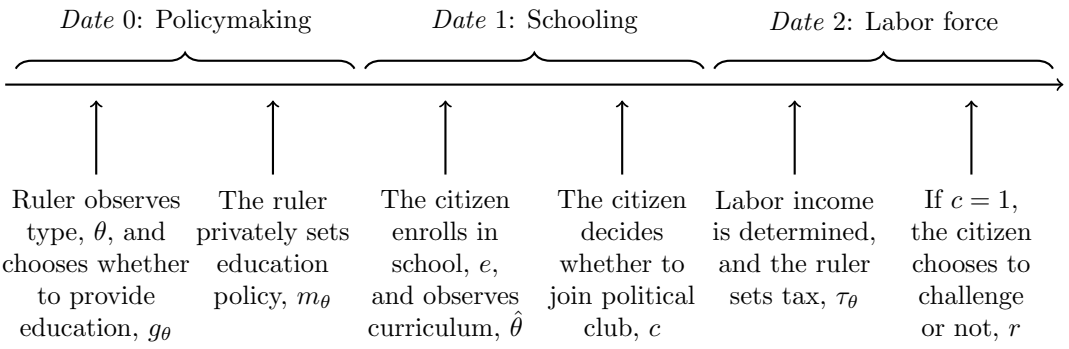


**Figure 1**: Timing of actions and events

the extent to which challenges are resolved nonviolently (e.g. via trials or elections), independent of who is favored to win a challenge. I interpret this as a measure of *rule of law*, or the availability of formal institutions for conflict resolution. Altogether, I take higher $q$ and $\sigma$ to imply the prevalence of more *inclusive* political institutions (i.e. greater initial political development).

Given these institutions and the possible outcomes following public education provision, a predatory ruler may or may not want to restrict public education. Depending on $\theta$, a ruler prefers to invest in public education if and only if his payoff,

$$V(\theta) = \theta U + (1 - \theta)R_\theta,$$

is greater with public education provision than in its absence. Here, $R_\theta \geq 0$ denotes the ruler's rents at the end of the game. Investment in public education also entails a cost, normalized to 1 if the citizen enrolls in public school, and is feasible only when the ruler's expected tax revenues are sufficiently large, i.e. satisfy the budget constraint

$$R_\theta + eg_\theta \leq R^I + \mathbb{E}(\tau_\theta|\theta), \tag{1}$$

where $R^I$ denotes his initial rents. For analytical simplicity, I restrict $R^I \geq \max\{1 - (1 - q)\sigma(w + \alpha h - \alpha), 0\}$ so that any equilibrium in which education provision is incentive-compatible satisfies (1). Finally, taxes are bounded by the feasibility constraint $\tau_\theta \leq y - \alpha c$, with no other limits on fiscal capacity.

If a ruler does invest in public schooling, he can influence the content of education. In the model, the curriculum is informative of the political environment, i.e. provides a signal of the ruler's type, $\hat{\theta} \in \{0, 1\}$. If the citizen enrolls in public school, she observes $\hat{\theta}$ and updates her beliefs about the ruler's type, before deciding whether to join a political club. As such, a ruler may want to manipulate the curriculum to disseminate propaganda, a choice given by $m_\theta$. I refer to this as his *education policy*, where $m_\theta = 1$ indicates a *biased* education policy with propaganda, while $m_\theta = 0$ indicates a *neutral* education policy without. Critically, the citizen does not observe $m_\theta$; she can only infer it given her information about the ruler's type, which itself is endogenous to $m_\theta$. Without loss of generality, I limit $m_1 = 0$ to focus on the importance of propaganda for public education provision by a predatory ruler.[11]

By default, education policy is neutral. I assume that it remains neutral if a ruler is indifferent between policies. Under a neutral education policy, the curriculum provides a precise signal of the ruler's type (i.e. $Pr(\hat{\theta} = 0|\theta = 0, m_0 = 0) = 1$). If a predatory ruler sets a biased education policy, with probability $\gamma \in (0, 1]$ propaganda is successfully transmitted to the citizen, who then observes a *ruler-favorable* curriculum $\hat{\theta} = 1$.[12] Hence, $\hat{\theta} = 1$ may originate with a benevolent ruler, or a predatory ruler who has successfully shaped the education system through propaganda. In this scenario, the citizen's posterior belief is

$$\hat{\pi}(\theta = 1|\hat{\theta} = 1, m_0 = 1) = \frac{\pi}{\pi + \gamma(1 - \pi)} \in [\pi, 1).$$

In other words, since education policy is privately chosen, the citizen cannot tell apart a dishonest predatory ruler from a truly benevolent one whenever both would transmit $\hat{\theta} = 1$. In turn, her process of evaluating the ruler's preferences will be distorted, skewing her expectations about what $\tau_\theta$ will be once income is accrued.

Although propaganda often appeals outwardly to a ruler's benevolence, the actual channel through which it influences a citizen's behavior can vary. One potential channel is optimism, wherein propaganda convinces the citizen that a predatory ruler

[11] See the proof of Proposition 2 in the Appendix.

[12] I refer to all curricula $\hat{\theta} = 1$ as ruler-favorable, regardless of $\theta$, as it induces a higher payoff.

is truly benevolent and that she has less to lose in trusting him. Another is fear, wherein propaganda makes her believe that she has more to lose in *not* trusting him, i.e. by becoming politically active. The better interpretation will depend on the ruler. Some dictators, like Suharto or Muammar Gaddafi, have gained real popularity through development initiatives while simultaneously enriching themselves.[13] Others, like Ferdinand Marcos, have relied largely on intimidation. The interpretation adopted will not matter, however, so long as propaganda affect the citizen's belief about the opportunity cost of joining a political club.

Finally, there is one caveat to using propaganda. Though education policy is privately chosen, $\gamma$ gives the exogenous and commonly-known probability that the citizen will nonetheless correctly infer a predatory ruler's type when he sets a biased education policy. I conceive of $\gamma$ as the state of the ruler's *propaganda technology*. For example, a strong propaganda technology ($\gamma \to 1$) might reflect a highly centralized education system, while a weak technology ($\gamma \to 0$) might imply a greater prevalence of substitutes for information transmission among teachers and students.

## 2.1 Public education without propaganda

The purpose of this section is to establish the basic incentives that underlie public education provision, particularly by a predatory ruler. To begin, I define:

**Definition 2.1.** A *schooling equilibrium* [SE] consists of (i) public education provision by both types of ruler ($g_0^* = g_1^* = 1$); (ii) a predatory ruler's education policy choice $m_0^*$; (iii) enrollment in public schooling by the citizen ($e^* = 1$); (iv) the citizen's political club choice $c^*$; (v) a pair of tax choices $(\tau_0^*, \tau_1^*)$; and (vi) the citizen's political challenge choice $r^*$ whenever $c^* = 1$.

Since I am interested mainly in the strategic behavior of a predatory ruler, I will refer to all other equilibria, in which a predatory ruler refrains from providing schooling ($g_0^* = 0$), as *non-schooling equilibria* [NE]. In and of itself, a NE is rather uninteresting. In the absence of education, a predatory ruler just expropriates all income

[13] Winters (2011) notes how the perception of Suharto's Indonesia as a genuinely modernizing state, as opposed to an extractive oligarchy, was shared even by many prominent Western scholars.

$w$ from the citizen. If a benevolent ruler also refrains from providing schooling, he sets a social welfare maximizing tax of 0. If the citizen observes public education provision, however, there are three possible taxes $\tau_\theta^*$ that she may face, conditional upon the ruler's type $\theta$ and whether she joins a political club while in school:

1. *Benevolent taxation given education provision* (BE): any surplus rents $R_1$ would come at the expense of the citizen, such that $\tau_1^* = \max\{1 - R^I, 0\} \equiv \tau_1^{BE}$ and $R_1^* = R^I + \tau_1^{BE} - 1 \equiv R_1^{BE}$ under a benevolent ruler when $g_1 = 1$.

2. *Predatory taxation given education provision and a politically inactive citizen* (PI): a predatory ruler risks nothing by expropriating everything, such that $\tau_0^* = w + \alpha h \equiv \tau_0^{PI}$ and $R_0^* = R^I + \tau_0^{PI} - 1 \equiv R_0^{PI}$.

3. *Predatory taxation given education provision and a politically active citizen* (PA): a tax $\tau_0$ exists that is neither high enough to induce a political challenge, nor too low that he would rather risk a challenge than just commit to the tax, such that $\tau_0^* = (1 - q\sigma)(w + \alpha h - \alpha) \equiv \tau_0^{PA}$ and $R_0^* = R^I + \tau_0^{PA} - 1 \equiv R_0^{PA}$.[14]

Altogether, these imply:

**Lemma 1.** *$\tau_0^{PA} < \tau_0^{PI}$, where:*

*(i) For any pair of political power levels $(q, q')$ such that $q' > q$, $\tau_0^{PA}(q') < \tau_0^{PA}(q)$.*

*(ii) For any pair of rule of law levels $(\sigma, \sigma')$ such that $\sigma' > \sigma$, $\tau_0^{PA}(\sigma') < \tau_0^{PA}(\sigma)$.*

Thus, insofar as it socializes the citizen to be politically active, participation in a political club while in school induces greater accountability later on under a predatory ruler in the form of strictly lower taxes. Furthermore, the magnitude of this decrease in taxes is larger when initial political institutions are more inclusive.

Given these potential taxes, I start by solving a version of the model in which education policy is fixed at its default neutral state (i.e. is always $m_\theta = 0$). As such, the political knowledge generated by the curriculum will be accurate with regard to the ruler's type (i.e. $Pr(\hat{\theta} = 0|\theta = 0) = 1$). Consider the following equilibrium:

[14] See the proof of Lemma 1 in the Appendix. All proofs can be found in the Appendix.

**Definition 2.2.** A *developmental schooling equilibrium* [DSE] is a SE wherein (i) education policy remains neutral under a predatory ruler ($m_0^* = 0$), such that ruler types separate over $\hat{\theta}$; hence (ii) the citizen joins a political club ($c^* = 1$) if and only if the ruler is predatory ($\theta = 0$), and (iii) a predatory ruler always sets $\tau_0^* = \tau_0^{PA}$.

It is not difficult to imagine conditions under which a DSE arises. Whereas a benevolent ruler only invests in schooling if the citizen will benefit from it, subject to the budget constraint (1), a predatory ruler has other concerns – namely, whether promoting a more educated society will yield him sufficient rents. Moreover, when education policy is neutral, the citizen can perfectly infer the threat of future expropriation and hence always joins a political club when the ruler is predatory. Thus, stronger economic incentives (i.e. higher $h$) are needed to induce education provision by a predatory ruler relative to a benevolent one. Formally,

**Proposition 1.** *There exists a developmental schooling equilibrium [DSE] when* $m_0 = 0$. *In every DSE:*

*(i)* $\overline{h}$ *is the minimum* $h$ *such that a predatory ruler invests in public education, while* $\underline{h}$ *is the minimum* $h$ *such that a benevolent ruler would invest in public education. In a DSE,* $h \geq \overline{h} > \underline{h}$.

*(ii)* $\overline{h}$ *is increasing in* $q$, $\sigma$, *and* $w$ *and decreasing in* $\alpha$, *and* $\underline{h}$ *is weakly decreasing in* $\alpha$ *and* $R^I$.

By definition, this outcome always constitutes a socially efficient arrangement *ex post*. Thus, DSE are characterized by *optimal political participation*, where the citizen becomes politically active if and only if the threat of high taxes (i.e. $\tau_0 = \tau_0^{PI}$) is credible. Absent sufficient economic incentives for a predatory ruler, however:

**Definition 2.3.** A *repressive non-schooling equilibrium* [RNE] is a NE in which (i) a predatory ruler cannot suppress political club participation ($c^* = 1$), such that (ii) he does not invest in public education ($g_0^* = 0$) and (iii) expropriates $\tau_0^* = w$, even though (iv) the citizen prefers to enroll in public school ($e^* = 1$); meanwhile (v) a benevolent ruler invests in public education ($g_1^* = 1$) and (vi) sets $\tau_1^* = \tau_1^{BE}$.

From Proposition 1 can be inferred conditions under which a predatory ruler will not invest in schooling when $m_0 = 0$, whereas a benevolent ruler will (i.e. $h \in [\underline{h}, \overline{h})$), inducing a RNE in which education provision alone accurately signals ruler type.

Hence, the interval $[\underline{h}, \overline{h})$ characterizes the space in which a citizen can always expect to be made better off by education ($e^* = 1$) but a predatory ruler does not provide it ($g_0^* = 0$).[15] In turn, when a predatory ruler *does* in invest in education, the citizen will always enroll.[16] When this happens, however, the citizen will initially face uncertainty about the ruler's true objective in providing education. It is this initial uncertainty which a predatory ruler aims to exploit with propaganda. To see how this works, I will now solve the full model, in which setting a biased education policy is a feasible option for a predatory ruler.

## 2.2 Public education, propaganda, and productivity

In the baseline model just discussed, any uncertainty that arose when conditions for education provision by both types were satisfied disappeared as the citizen became educated, inducing optimal political participation. In this section, I explore how a predatory ruler can exploit this uncertainty via education policy (i.e. when $m_0 \in \{0, 1\}$) to influence the citizen's political socialization, in turn altering his incentives to invest in public education. I begin with the case in which the citizen sometimes does not join a political club when the ruler is a predatory type.

### 2.2.1 Suboptimal political participation

In the model, public education is necessary but not sufficient for the citizen to become politically active. Rather, it is the *content* of education that drives political socialization. Lemma 1 illustrates how a predatory ruler benefits from a less politically active citizenry. I now explore the conditions under which a predatory ruler will provide public education but embed the curriculum with propaganda.

[15] When $h < \underline{h}$, there arises a NE in which neither ruler type provides education. For the sake of space, I will henceforth discuss only equilibria in which at least one type invests.

[16] To see why this always holds, see the proofs of Propositions 1 and 2 in the Appendix.

Solving the model yields conditions under which a biased education policy ($m_0^* = 1$) generates a ruler-favorable curriculum ($\hat{\theta} = 1$) under a predatory ruler ($\theta = 0$), yet where the citizen nonetheless behaves as in a developmental schooling equilibrium [DSE] with optimal political participation (i.e. $c^* = 1$ only if $\hat{\theta} = 0$). As such, she sometimes does not join a political club when the ruler is predatory. In such cases, all human capital is allocated toward labor, rendering political challenges infeasible. In turn, political participation levels will be weakly *suboptimal* for her *ex post*, and a predatory ruler can expect his rents to be greater than in a DSE, *ceteris paribus*.

**Definition 2.4.** A *biased schooling equilibrium* [BSE] is a SE in which (i) a predatory ruler chooses a biased education policy ($m_0^* = 1$); (ii) the citizen joins a political club ($c^* = 1$) if and only if the curriculum is not ruler-favorable ($\hat{\theta} = 0$); and (iii) a predatory ruler chooses $\tau_0^* = \tau_0^{PA}$ if and only if $c^* = 1$.

**Proposition 2.** *There exists a biased schooling equilibrium [BSE]. In every BSE:*

*(i) There exists a threshold level of propaganda $\overline{\gamma} > 0$ below which the citizen joins a political club if and only if the curriculum is not ruler-favorable ($\hat{\theta} = 0$).*

*(ii) There exists a threshold $\underline{\gamma}$ above which a predatory ruler invests in public education and sets a biased education policy if $\gamma < \overline{\gamma}$, where $h \geq \underline{h}$ if $\gamma \geq \underline{\gamma}$.*

*(iii) When $\overline{\gamma} > \underline{\gamma}$ and $\gamma \in [\underline{\gamma}, \overline{\gamma})$,[17] with probability $(1-\pi)\gamma$ the citizen does not join a political club even though the ruler is predatory, inducing suboptimal political participation, and he sets the maximal tax $\tau_0^* = \tau_0^{PI}$.*

*(iv) $\overline{\gamma}$ is decreasing in $q$, $\sigma$, $h$, and $w$ and increasing in $\alpha$ and $\pi$, while $\underline{\gamma}$ is decreasing in $h$ and $\alpha$ and increasing in $q$, $\sigma$, and $w$ when $h > \alpha^{-1}$.*

The intuition behind this equilibrium is simple. A populace of politically engaged citizens is needed to prevent expropriation, and citizens that undergo less political socialization while in school make less politically sophisticated and engaged adults.

[17] Note that $h \geq \overline{h}$ is sufficient but not necessary for $\overline{\gamma} > \underline{\gamma}$.

In the model, the citizen's exposure to some propaganda prompts her to forgo political club participation. Hence, a moderately strong propaganda technology can induce a more apolitical citizenry. Since this helps to reinforce a balance of power otherwise reduced by schooling, public education provision becomes more desirable to a predatory ruler.

This outcome is more common ($\uparrow \overline{\gamma} - \underline{\gamma}$) when the citizen is more trusting in the ruler prior to schooling ($\uparrow \pi$), when political institutions are less inclusive ($\downarrow q, \sigma$), and when human capital is relatively more valuable ($\uparrow \alpha, \downarrow w$). Of these comparative statics, the first suggests a complementary role for other types of propaganda outside of the education system, while the other two complement the existing literature. For example, Campante and Chor (2012) provide evidence in support of a model in which the relationship between education and political participation is weaker when relative payoffs from productive activities are greater. In the present model, less inclusive institutions and relatively more productive human capital both increase the opportunity cost of engaging in political activities. Since propaganda works by increasing that perceived opportunity cost, weaker institutions and more productive human capital increase the marginal effectiveness of propaganda, making BSE more common.

Finally, the relationship between a BSE and productivity levels $h$ is more ambiguous, and I will revisit it shortly. First, however, consider the case in which a biased education policy induces suboptimal political participation, but insufficiently so. That is, the propaganda technology is too weak (i.e. when $\gamma \leq \underline{\gamma}$). Formally,

**Definition 2.5.** A *weak non-schooling equilibrium* [WNE] is a non-schooling equilibrium [NE] in which (i) a biased education policy ($m_0^* = 1$) induces political club participation ($c^* = 1$) if and only if the curriculum is not ruler-favorable ($\hat{\theta} = 0$), but (ii) a predatory ruler forgoes education provision ($g_0^* = 0$) and (iii) expropriates $\tau_0^* = w$; (iv) a benevolent ruler invests in schooling ($g_1^* = 1$) and (v) sets $\tau_1^* = \tau_1^{BE}$.

**Corollary 1.** *There exists a weak non-schooling equilibrium [WNE]. In every WNE, (i) $h \geq \underline{h}$ and $\gamma < \overline{\gamma}$ but $\gamma < \underline{\gamma}$, such that the propaganda technology is too weak to sufficiently suppress political participation, where (ii) $\gamma \not< \underline{\gamma}$ for all $h \geq \overline{h}$.*

Hence, a WNE arises when the propaganda technology cannot adequately suppress political development associated with schooling and the economic gains from education are insufficiently great to induce education provision under a predatory ruler without propaganda (i.e. $h \in [\underline{h}, \overline{h})$). This mirrors the last subsection, wherein a predatory ruler's education policy choice set was limited to $m_0 = 0$. However, now:

**Corollary 2.** *When $m_0 \in \{0, 1\}$ and $h \in [\underline{h}, \overline{h})$: if $\gamma < \underline{\gamma} < \overline{\gamma}$, then there exists a stronger propaganda technology $\hat{\gamma} \in [\underline{\gamma}, \overline{\gamma})$, which would strictly improve the citizen's expected payoffs by inducing public education provision under a predatory ruler.*

In other words, when setting a biased education policy is feasible and the propaganda technology is sufficiently strong, public education provision becomes attractive to predatory rulers in lower productivity settings (i.e. $h \in [\underline{h}, \overline{h})$). Since the citizen prefers to become educated ($e^* = 1$) when $h \geq \underline{h}$, propaganda can make her *better off* by making education provision possible. But can propaganda be too strong?

### 2.2.2 Overparticipation

The citizen knows $Pr(\hat{\theta} = 1 | \theta = 0, m_0 = 1) = \gamma$, such that her decision to join a political club after observing $\hat{\theta} = 1$ depends on the state of the propaganda technology. However, Proposition 2 alludes to an interesting caveat: the relationship between the level of propaganda and the incentive to become politically active is non-monotonic.

On one hand, if the citizen knows that a predatory ruler prefers a biased education policy ($m_0^* = 1$) but propaganda is sufficiently moderated, then apathy in the face of $\hat{\theta} = 1$ is rational. However, as the propaganda technology strengthens, the probability that she is wrongly exposed to a ruler-favorable curriculum ($\hat{\theta} = 1$) increases. By generating excessive uncertainty about the ruler's type, too much propaganda ($\gamma \geq \overline{\gamma}$) lowers the value of political knowledge generated by the curriculum. When this happens, propaganda actually *heightens* political engagement, inducing the citizen to join a political club under all curricula as social insurance against future expropriation, and producing an activistic citizenry that can always demand greater accountability over taxes. As before, this "overparticipation" outcome is suboptimal

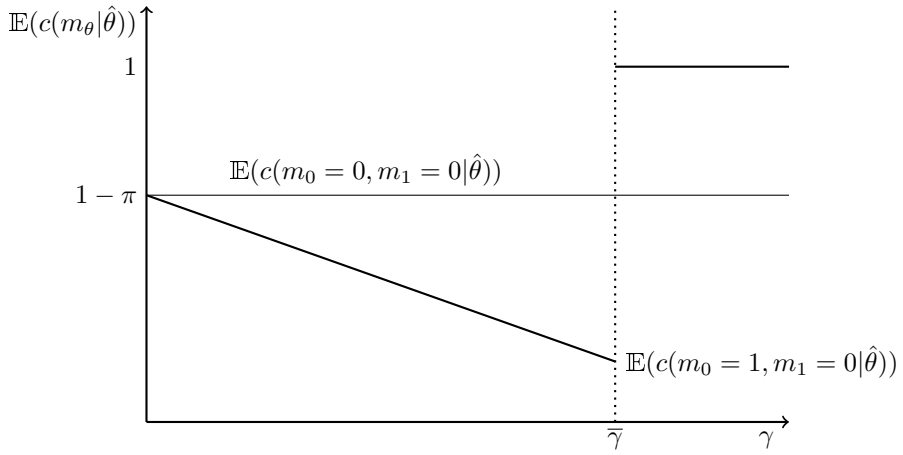


**Figure 2**: Average political participation of the educated, with and without propaganda

for the citizen, insofar as it involves her joining a political club even when it will induce an unnecessary loss (i.e. $c^* = 1$ when $\theta = 1$).

However, even more interesting are the welfare implications for a predatory ruler. In this event, he will either choose to invest in schooling but maintain a neutral education policy, inducing a developmental schooling equilibrium [DSE], or forgo education altogether, inducing a repressive schooling equilibrium [RNE]. Formally,

**Proposition 3.** *If setting a biased education policy is feasible for a predatory ruler,* $m_0 \in \{0, 1\}$*, but the propaganda technology is sufficiently strong,* $\gamma \geq \overline{\gamma}$*:*

*(i) There exists a developmental schooling equilibrium [DSE], with optimal political participation and less-than-feasible taxes, when* $h \geq \overline{h}$*.*

*(ii) There exists a repressive non-schooling equilibrium [RNE], with no public education and no political participation, when* $h \in [\underline{h}, \overline{h})$*.*

*(iii) Propaganda disappears with productivity growth:* $\overline{\gamma}|_{h=\overline{h}} > 0$*, but* $\lim_{h\to\infty} \overline{\gamma} = 0$*.*

As it turns out, a predatory ruler could have done better in both cases had he been able to set a *lower* value of $\gamma$ *ex ante*, inducing a biased schooling equilibrium [BSE]:

**Corollary 3.** *When* $m_0 \in \{0, 1\}$ *but* $\gamma \geq \overline{\gamma}$*: if* $\overline{\gamma} > \underline{\gamma}$*, there exists a weaker propaganda technology* $\tilde{\gamma} \in (\max\{\underline{\gamma}, 0\}, \overline{\gamma})$*, which would:*

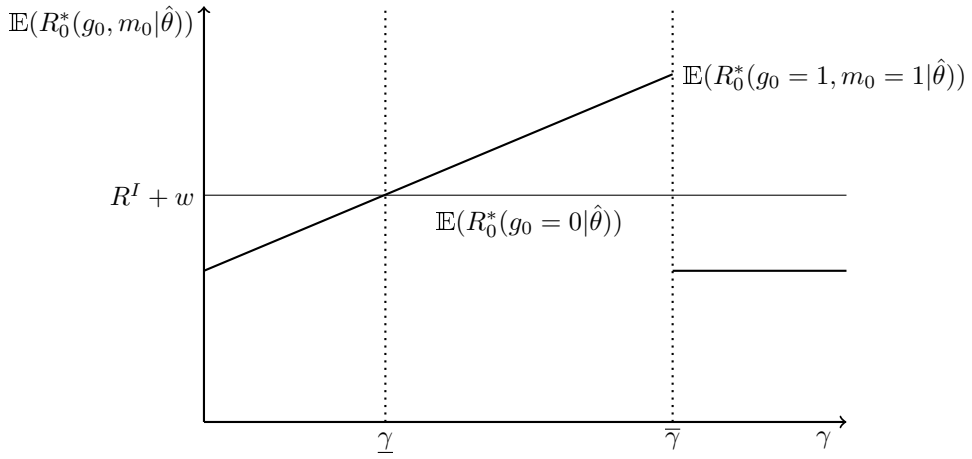


**Figure 3**: A predatory ruler's expected rents, with and without education provision, $h < \overline{h}$

*(i) Strictly improve a predatory ruler's expected payoffs, with a payoff-maximizing* $\tilde{\gamma} \equiv \tilde{\gamma}^* = \lim_{\overline{\varepsilon} \to 0} \overline{\gamma} - \overline{\varepsilon}$.

*(ii) Strictly improve the citizen's expected payoffs when* $h \in [\underline{h}, \overline{h})$*, by inducing public education provision by a predatory ruler.*

Hence, a predatory ruler can sometimes improve his payoffs by *weakening* propaganda. In lower productivity settings ($h \in [\underline{h}, \overline{h})$), for instance, a somewhat weak propaganda technology can help him avoid overparticipation and induce him to invest in public education.

This result also has dynamic implications. Any subsequent rise in productivity ($\uparrow h$) that might occur with development would lower the citizen's opportunity cost of becoming politically active. Insofar as this would make her more sensitive to propaganda ($\downarrow \overline{\gamma}$), rising productivity should further weaken a predatory ruler's incentives to use propaganda. Moreover, this effect would be amplified if political institutions were to also evolve to become more inclusive ($\uparrow q, \sigma$). Eventually, $\overline{\gamma} \to 0$ or $h \geq \overline{h}$, such that propaganda would cease to be useful, while productivity levels would be sufficiently high to sustain education provision without propaganda.

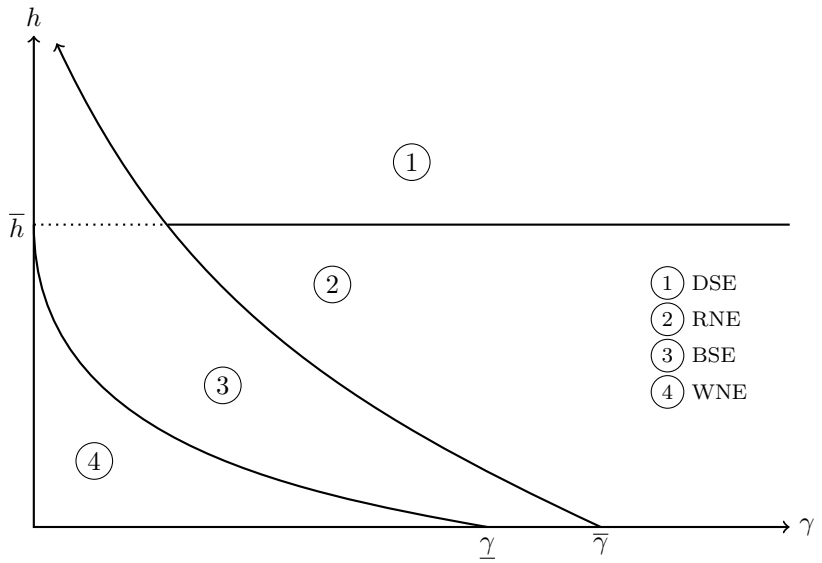


**Figure 4**: Equilibrium space over productivity ($h$) and propaganda technology ($\gamma$), $h > \underline{h}$

## 2.3 Overview of main findings

The model produces three main insights. First, an increase in the productivity effect of education from low to mid-$h$ may be sufficient to induce investments in public education by a predatory ruler. However, this is made possible only by the feasibility of biased education policies, by which public education provision occurs as part of a biased schooling equilibrium [BSE] with propaganda. Nevertheless, by making investments in education appealing to predatory rulers, propaganda can make citizens better off. This outcome is more likely when political institutions are initially less inclusive (i.e. low $q, \sigma$), the ruler maintains high levels of trust (i.e. high $\pi$), and human capital is relatively valuable (i.e. high $\alpha$, low $w$).

Then, as citizens become more productive ($\uparrow h$), an increasingly weaker propaganda technology is needed to sustain public education provision. In turn, one should see a shift away from biased to more neutral educational content among countries with public education. This effect is compounded as political institutions become more inclusive. However, investments in public education would nonetheless continue to improve a predatory ruler's expected payoffs, even as the frequency of political

development driven by education increases.

Finally, in sufficiently high productivity settings ($h \geq \overline{h}$), public education provision is *always* incentive-compatible, even as the optimal propaganda technology *ex ante* approaches a perfectly weak technology (i.e. $\overline{\gamma} \to 0$). In this developmental schooling equilibrium [DSE], education policy is always characterized by neutral educational content, regardless of initial political institutions. Moreover, in the absence of propaganda, education always favors political development, inducing optimal political participation and in turn lower taxes.

## 2.4 Extension: A dynamic model of unproductive education

The findings of the previous section imply that a rise in the human capital from public education can decrease a predatory ruler's payoffs from providing it, by promoting transition from a biased schooling equilibrium [BSE] with propaganda to a developmental schooling equilibrium [DSE] with optimal political participation. Indeed, a predatory ruler may wish to prevent this. A temporary solution, of course, would be for him to simply use less propaganda for each subsequent cohort of citizens, as implied by Corollary 3. However, a second approach would be for him to actually impede productivity growth. Take the following example:

**Example 1.** *Fix the ruler's propaganda technology at $\gamma = \overline{\gamma}_{h=\overline{h}}$. By Proposition 3, when $h = \overline{h}$, there is a DSE, while a lower $h \in [\underline{h}, \overline{h})$, conditional upon $\gamma \geq \underline{\gamma}$, induces a BSE. Then there exists some $\eta = \hat{\eta} > 0$, such that a predatory ruler's payoffs from a BSE with a productivity effect of education, $h = \overline{h} - \eta$, exceed his payoffs from a DSE with a greater productivity effect, $h = \overline{h}$, for any value of $\eta \in (0, \hat{\eta})$.*

Hence, under certain conditions, a predatory ruler will prefer propaganda over productivity. This points to an interesting dynamic problem, in which a predatory ruler has an incentive to sabotage increases in human capital. That is, he may want to choose an education policy that not only manipulates citizens' beliefs about the political environment, but also negatively impacts the productivity of education, so to sustain a BSE in the long-term. As counterintuitive as that may seem, the notion that propaganda-based education may also lower the return on education has

received empirical support (Fuchs-Schundeln and Masella, 2016). In this section, I explore a dynamic extension of the model in which this arrangement is sometimes preferable from the standpoint of a predatory ruler. Furthermore, I will show that this enriches the equilibrium structure described in the proceeding sections.

There are now two time periods $t \in \{1, 2\}$, and human capital acquired in the first period increases the productivity of education in the second. A ruler with type $\theta \in \{0, 1\}$ rules over both periods. At the end of the first period, a citizen with a prior belief, $\pi_1 \in (0, 1)$, reproduces. Before dying, she transmits some information about the political environment to her offspring. To reflect this, if the ruler is a predatory type, then the second period citizen inherits a more informative prior, $\pi_2 < \pi_1$. Otherwise, $\pi_2 > \pi_1$. However, each citizen is myopic and makes decisions only with regard for her own payoffs.

If the ruler invests in education, $g_{\theta t} \in \{0, 1\}$, in any period, then an education system always exists thereafter, and he incurs a cost of 1 each remaining period. At the end of each period, he must balance the budget constraint, $R_{\theta t} + e_t g_{\theta t} \leq R^I_{\theta t} + \mathbb{E}(\tau_{\theta t}|\theta)$. He is endowed with new rents $R^I$ at the beginning of each period, such that $R^I_{\theta 1} = R^I$ and $R^I_{\theta 2} = R_{\theta 1} + R^I$, with $R^I_{\theta t}$ restricted as before.

If he invests in education in the first period, then human capital acquisition promotes increased productivity in the second:

$$h_2 = h + (1 - \delta)h_1 > h_1,$$

where $\delta \in (0, 1)$. The ruler decides whether to invest in education in the first period given a lifetime payoff function,

$$V(\theta) = \theta U_1 + (1 - \theta)R_{\theta 1} + \beta[\theta(t - 1)U_2 + (1 - \theta)(R_{\theta 2} - R_{\theta 1})],$$

where $\beta \in (0, 1]$ is the time discount factor. This functional form assumes that a benevolent ruler internalizes citizens' myopia, while a predatory ruler does not double count the rents he acquired in the first period.

As before, if a citizen enrolls in a public school, $e_t \in \{0, 1\}$, then she has the

choice to join a political club, $c_t \in \{0,1\}$, and dedicate some of her time to developing politics-specific human capital. If $c_t = 1$, then she can later mount a political challenge against a predatory ruler, $r_t \in \{0,1\}$. If the citizen challenges a predatory ruler in period 1 and wins, then the ruler is replaced in period 2 by a new ruler who, with probability $1 - \pi_1$, is also predatory. However, a predatory ruler can try to influence this political club decision via education policy.

With the addition of dynamic human capital accumulation, I now allow education policy to vary over two dimensions. The curriculum continues to provide a signal of the ruler's type, $\hat{\theta}_t \in \{0,1\}$, so a predatory ruler may want to manipulate the curriculum to disseminate propaganda that targets the citizen's *beliefs* in period $t$, a choice given by $m^A_{\theta t} \in \{0,1\}$. However, if he opts to use propaganda, he may want to structure education such that propaganda also affects the *return* on education, suppressing human capital accumulation from period 1 to 2. I model this as a one-time choice, $m^B_\theta \in \{0,1\}$. This effect might be direct if the content of propaganda entails transmission of less productive values, or it might work through complementary teaching styles and reward structures that inhibit critical thinking or promote rent-seeking (Algan et al, 2013; Fuchs-Schundeln and Masella, 2016).

With probability $\gamma = Pr(\hat{\theta} = 1 | \theta = 0, m^A_{0t} = 1) \in (0,1]$, propaganda affects the citizen's beliefs about a predatory ruler in period $t$. If in addition $m^B_0 = 1$, then a portion $\rho \in (0,1)$ of education in period 1 is unproductive (i.e. $h_1 = (1-\rho)h$). Less human capital being acquired in period 1 results in a decreased productivity effect of education in period 2, relative to if $m^B_0 = 0$. I assume these two effects of propaganda to be orthogonal *ex ante*. However, they will nonetheless be highly interdependent in equilibria with propaganda, as will soon become clear.

The general structure of the game within each period remains unchanged. In turn, the results from the basic model regarding optimal taxes and rents for any schooling equilibrium [SE] will continue to hold for all $t$. I can now define the following:

**Definition 2.6.** An *unproductive biased schooling equilibrium* [UBSE] is a two period BSE in which (i) a predatory ruler chooses a biased education policy in both periods ($m^{A*}_{0t} = 1$ for all $t$); (ii) propaganda suppresses human capital accumulation from period 1 to 2, decreasing the return on education ($m^{B*}_0 = 1$); (iii) a citizen joins a

political club ($c_t^* = 1$) if and only if the curriculum is not ruler-favorable ($\hat{\theta}_t = 0$) for all $t$; and (iii) a predatory ruler chooses $\tau_{0t}^* = \tau_{0t}^{PA}$ if and only if $c_t^* = 1$ for all $t$.

**Proposition 4.** *When the propaganda technology is sufficiently strong such that* $\gamma < \overline{\gamma}(h_1|m_0^B = 0)$ *in period 1 but* $\gamma \geq \overline{\gamma}(h_2|m_0^B = 0)$ *in period 2, there exists an unproductive biased schooling equilibrium [UBSE]. In every UBSE:*

*(i) There exists a positive level of unproductive education* $\rho > \underline{\rho} \geq 0$ *for which neither generation of citizen becomes politically active if exposed to a ruler-favorable curriculum* ($\hat{\theta}_t = 0$).

*(ii) If* $\rho > \underline{\rho}$, *then there exists an upper level of unproductive education* $\rho = \overline{\rho} > 0$ *below which a predatory ruler sets a biased education policy with unproductive education if he invests in education in period 1.*

*(iii)* $\underline{\rho}$ *is increasing in* $\gamma$ *and* $h$, *while* $\overline{\rho}$ *is increasing in* $\gamma$ *and decreasing in* $h$.

The intuition behind this equilibrium is simple. Human capital accumulation (i.e. $h_2 > h_1$) decreases the effectiveness of propaganda in period 2 (i.e. $\overline{\gamma}(h_2) < \overline{\gamma}(h_1)$), making it more likely that education induces a DSE with optimal political participation and lower taxes. By letting propaganda not only impact beliefs but also lower the productivity of education in a small but non-zero way, this can be avoided. Although human capital still feeds into the productivity of education over time, it does not induce a transition from a BSE in period 1 to a DSE in period 2.

Nevertheless, the comparative statics generated by this exercise suggest that use of strategy will be short-lived. First, note that the two effects of propaganda – on beliefs and on the productivity of education – are complementary. A strong effect of propaganda on beliefs ($\uparrow \gamma$) enhances both the importance of and the incentives to use unproductive education ($\uparrow \underline{\rho}, \overline{\rho}$) for preventing transition to a DSE in period 2. Likewise, if propaganda cannot sufficiently lower the productivity of education (i.e. if $\rho \not\geq \underline{\rho}$), then a predatory ruler will prefer a weaker beliefs effect ($\downarrow \gamma$) in order to retain a BSE. Since this is more likely to occur if human capital continues to accumulate even a little (i.e. $\uparrow \underline{\rho}$ and $\downarrow \overline{\rho}$ if $\uparrow h$), a predatory ruler will eventually prefer little or no propaganda, as in the basic model.

Despite the simple environment assumed in this extension, it yields several interesting results that strengthen and expand the implications of the basic model. Moreover, it points to avenues for future theoretical work in which these assumptions are relaxed. For instance, it would be interesting to explore how propaganda's ability to impact citizens' beliefs may change over time, as well as how a predatory ruler might alter the propaganda technology to promote persistence in beliefs. I leave these as possibilities for future research.

# 3 Empirical evidence

Numerous studies have documented a robust relationship between education and democracy (Barro, 1999; Bobba and Coviello, 2007). Many others have helped illustrate, at least in part, a complex interplay between human or social capital and political development.[18] This section highlights some additional evidence relevant to this discussion, by testing two of the model's main relationships. One is a predatory ruler's incentives to use propaganda following investments in public education. Another is a citizen's tendency to be politically active after receiving an education, given her exposure to propaganda. Modeling each empirically, I establish strong and robust correlations that support the model's main predictions.

## 3.1 Education provision and propaganda

To study the connection between public education and propaganda, I use data from the World Bank's (WB) World Development Indicators (WDI) index, spanning across 136 countries from 1997 to 2014. Since countries that use less propaganda exhibit political development in the model, I do not limit the sample to nondemocracies. In order to gauge a government's relative demand for public education, I use education expenditures as a percentage of total government expenditures as the explanatory variable. The response variable should thus indicate its investment in propaganda.

[18] See Gradstein and Justman (2000), Tabellini (2010), Algan et al (2013), Nannicini et al (2013).

Unfortunately, there is no measure of propaganda within education systems across countries or over time. I therefore adopt a more general measure of propaganda – Freedom House's (FH) Freedom of the Press index, rescaled to be out of 10, with a larger value indicating more constraints on the press – as a proxy, implicitly assuming that press independence is perfectly correlated with academic independence. Nevertheless, to address concerns that this variable is too removed from the use of propaganda in schools, or similar only insofar as both are likely to be correlated with certain institutional qualities, I construct a cross-country "academic constraints" variable. This indicator takes a value of 1 only if a country appears in the Scholars at Risk (SAR) Incident Index as having punished scholars with imprisonment, prosecution, or travel restrictions.[19] In a cross section of countries, a 10% increase in a country's FH score corresponds to around a 7.5% increase in the probability that a country is assigned a 1 for academic constraints, even after controlling for general institutional qualities. Those estimates are available in the Online Appendix.

Additional cross-country variables are also derived from the WDI. To proxy for a country's productivity, I use GDP per capita (in USD 2010). To control for other potential sources of variation driving choices of press constraints, I include as covariates military expenditures as a percentage of GDP and government expenditures as a percentage of GDP.[20] To gauge a country's political institutions, I include Polity IV's POLITY2 index, which ranges from $-10$ to 10 with 10 being most democratic. I also use POLITY2 to derive a "crisis" dummy, since propaganda may be more prevalent in more volatile times. This variable takes a value of one for any year Polity IV denotes a country as being in interregnum or transition – plus the years before and after an interregnum, transition, or foreign interruption – as well as a value of one for any year immediately preceding or following a change in POLITY2 score larger than 5.[21] Finally, I include country and year fixed effects and cluster

[19] I exclude incidents involving violence or loss of position, since the former usually follow general protests unrelated to academic content, while the latter typically reflect non-state retaliation.

[20] Cross-country observations are transformed logarithmically for greater normality. As a result, zero or near-zero military expenditure values become outliers. In Table A.3 in the Online Appendix, I repeat the main regressions with an alternative military expenditures variable correcting for this.

[21] Summary statistics can be found in Tables A.1.1-3 in the Online Appendix.

Table 1: Public education provision and constraints on the press and media

| Dependent variable: | Proxy for propaganda: press constraints and media censorship | | | | | |
|---|---|---|---|---|---|---|
| | (1a) | (1b) | (1c) | (1d) | (2) | (3) |
| *lnEducation* | 1.850** | 1.850** | 1.958** | 1.822** | 2.011** | 2.517*** |
| | (0.731) | (0.717) | (0.762) | (0.782) | (0.817) | (0.921) |
| *lnEdu* × *lnGDPpc* | −0.241*** | −0.243*** | −0.259*** | −0.240** | −0.262** | −0.309*** |
| | (0.092) | (0.091) | (0.096) | (0.098) | (0.102) | (0.116) |
| *lnGDPpc* | 0.272 | 0.253 | 0.289 | 0.243 | 0.359 | 0.408 |
| | (0.333) | (0.332) | (0.333) | (0.339) | (0.299) | (0.397) |
| *Polity* | −0.108*** | −0.105*** | −0.107*** | −0.104*** | −0.125*** | −0.098*** |
| | (0.020) | (0.020) | (0.022) | (0.023) | (0.024) | (0.026) |
| *Crisis* | – | 0.176* | 0.189* | 0.194* | 0.140 | 0.169 |
| | | (0.100) | (0.106) | (0.108) | (0.150) | (0.122) |
| *lnMilitary* | – | – | −0.025 | 0.008 | 0.029 | 0.040 |
| | | | (0.102) | (0.118) | (0.096) | (0.134) |
| *lnGovExpend* | – | – | – | −0.045 | −0.196 | −0.183 |
| | | | | (0.215) | (0.175) | (0.237) |
| *lnEdu*+*lnEdu*×*lnGDP*$_{min}$ | 0.588** | 0.578** | 0.605** | 0.565* | 0.641** | 0.872*** |
| | (0.271) | (0.264) | (0.280) | (0.292) | (0.305) | (0.330) |
| *lnEdu*+*lnEdu*×*lnGDP*$_{10\%}$ | 0.363* | 0.352* | 0.365* | 0.341 | 0.397* | 0.586** |
| | (0.199) | (0.194) | (0.206) | (0.215) | (0.225) | (0.243) |
| *lnEdu*+*lnEdu*×*lnGDP*$_{90\%}$ | −0.714** | −0.734** | −0.790** | −0.732** | −0.773** | −0.790* |
| | (0.285) | (0.287) | (0.303) | (0.304) | (0.308) | (0.374) |
| Country fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Balanced panel? | No | No | No | No | No | Yes |
| Mean imputation? | No | No | No | No | Yes | No |
| Observations | 1452 | 1452 | 1366 | 1343 | 2134 | 1092 |
| Countries | 136 | 136 | 132 | 131 | 132 | 85 |
| Adj. $R^2$ | 0.22 | 0.23 | 0.23 | 0.22 | 0.25 | 0.21 |

Standard errors are clustered by country, with ***, **, and * denoting significance at the 1%, 5%, and 10% levels, respectively. Column 2 applies a country mean imputation procedure to the education expenditure data and controls for a dummy, which takes a value of 1 when a value is missing. Rows labeled $lnEdu + lnEdu \times lnGDP$ report the combined effect (and standard errors) of *lnEducation* and $lnEdu \times lnGDPpc$ at different levels (sample minimum, 10% and 90%) within the sample distribution of *lnGDPpc*.

standard errors by country.

With these data, I analyze two predictions regarding investment in propaganda: that 1) public education spending should be positively correlated with propaganda in less productive settings, and that 2) this positive correlation should disappear with rises in productivity. Given these predictions, I include in each regression a term interacting education expenditures with real GDP per capita.

The estimates, as shown in Table 1, match these predictions. There is a positive and significant relationship between a government's education expenditures and its press constraints among observations in the bottom third of the distribution of real GDP per capita. This positive correlation disappears with productivity: the coefficient on the term interacting education expenditures and GDP per capita is negative and significant. This can also be seen by looking at the combined effect of education expenditures and its interaction with real GDP per capita. This is reported in Table 1 at different levels (sample minimum, 10%, and 90%) within the sample distribution of logged real GDP per capita. Finally, these results are also presented using standardized beta coefficients in Table A.6 in the Online Appendix.

Since collecting and reporting on macroeconomic data is likely to be correlated with a country's institutions, I deal with concerns regarding missing education expenditures observations in columns (2) and (3). First, following Glaeser et al (2007), I impute missing education expenditure values using country means, controlling for a dummy indicating when a value is missing. The estimates change little.[22] A second approach simply drops underreporting countries from the sample. These estimates in (3) remain substantively similar as well. Altogether, this exercise provides strong evidence in support of the model.

## 3.2 Education, propaganda, and political participation

To study how political participation levels following education vary with exposure to propaganda, I use individual-level data from the World Values Survey (WVS), spanning across 70 countries from 1994 to 2014, in addition to FH's press freedom

[22]See Table A.4 in the Online Appendix for more on these relationships.

and Polity IV's POLITY2 indexes. As before, I do not limit the sample based on polity.[23] Because the theory concerns the effects of propaganda observed while in school on political engagement thereafter, I match survey respondents with a FH score corresponding to the year of some *base age* (e.g. 18 years old), to proxy for exposure to propaganda during later adolescence. Since FH began publishing numeric scores in 1993, individuals in the sample range from 18 to 43 years of age.

To gauge adult political engagement, I use four WVS variables to create two composite response variables.[24] The first measures *passive* political participation and takes into account survey respondents' 1) interest in politics and 2) beliefs about its importance. The most passively engaged respondents received a score of 6; the least, a score of 0. The second measures *active* participation and considers survey respondents' participation in 1) lawful demonstrations and 2) petition signings. The most actively engaged respondents received a score of 4; the least, a score of 0.

Besides press constraints, the main explanatory variable is educational attainment, with responses ranging from 0 (incomplete primary) to 7 (university). In each specification with press constraints, I include a term interacting an individual's educational attainment with press constraints at her base age. Then, prompted by the model's prediction that the effects of propaganda will be non-monotonic, I allow press constraints to affect the correlation between education and political participation quadratically in columns (3a-3c). Finally, I include as controls a host of individual characteristics, as well as country and year fixed effects, and cluster standard errors by country.

Given this, I want to test three of the model's claims regarding the effects of propaganda: 1) the effect of educational attainment on political participation will be positive; 2) exposure to more propaganda will decrease the effects of education on political participation; and 3) the effect of propaganda on the relationship between education and political participation will decrease with the level of propaganda.

[23] I do however follow Glaeser et al (2007) in excluding countries with Polity IV autocracy scores that average $> 4$ over the period, since those may be more likely to mandate political participation.

[24] See the Online Appendix for explicit details about how variables were derived from WVS variables. See Table A.7 for some specifications run using each of the four original variables.

Table 2: Press constraints at age 18, education, and political participation, passive

| Dependent variable: | Measure of passive political participation | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2a) | (2b) | (3a) | (3b) | (3c) |
| $EducationAttainment$ | 0.088*** | 0.141*** | 0.097** | 0.183*** | 0.172*** | 0.167*** |
| | (0.010) | (0.029) | (0.044) | (0.045) | (0.040) | (0.040) |
| $EA \times PressConstraints_b$ | – | −0.012** | −0.008 | −0.057*** | −0.053*** | −0.052*** |
| | | (0.005) | (0.006) | (0.017) | (0.013) | (0.012) |
| $EA \times PressConstraints_b^2$ | – | – | – | 0.005*** | 0.005*** | 0.005*** |
| | | | | (0.002) | (0.001) | (0.001) |
| $EA \times Polity_t$ | – | – | 0.004 | 0.004 | 0.004** | 0.005** |
| | | | (0.003) | (0.003) | (0.002) | (0.002) |
| $PressConstraints_b$ | – | 0.022 | 0.007 | 0.255*** | 0.251*** | 0.258*** |
| | | (0.025) | (0.028) | (0.097) | (0.071) | (0.064) |
| $PressConstraints_b^2$ | – | – | – | −0.027** | −0.023*** | −0.024*** |
| | | | | (0.011) | (0.007) | (0.006) |
| $Polity_t$ | −0.003 | 0.011 | −0.004 | −0.003 | 0.025 | 0.019 |
| | (0.018) | (0.028) | (0.033) | (0.034) | (0.024) | (0.023) |
| $Age_t$ | 0.054*** | 0.056*** | 0.057*** | 0.055*** | 0.053*** | 0.055*** |
| | (0.018) | (0.021) | (0.021) | (0.021) | (0.018) | (0.018) |
| $Age_t^2$ | −0.001** | −0.001* | −0.001** | −0.001* | −0.001* | −0.001** |
| | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) |
| $IncomeLevel_t$ | 0.033*** | 0.031*** | 0.031*** | 0.032*** | 0.025*** | 0.025*** |
| | (0.007) | (0.007) | (0.007) | (0.007) | (0.005) | (0.006) |
| $Student_t$ | – | – | – | – | 0.158*** | 0.156*** |
| | | | | | (0.030) | (0.033) |
| Country fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Non-students only? | Yes | Yes | Yes | Yes | No | No |
| Mean imputation? | No | No | No | No | No | Yes |
| Observations | 43714 | 32432 | 32432 | 32432 | 49552 | 56129 |
| Countries | 65 | 65 | 65 | 65 | 70 | 70 |
| Adj. $R^2$ | 0.13 | 0.13 | 0.13 | 0.13 | 0.11 | 0.11 |

Standard errors are clustered by country, with ***, **, and * denoting significance at the 1%, 5%, and 10% levels, respectively. Base year ($b$) is derived from the survey year ($t$), minus the respondent's age ($Age_t$), plus 18. All regressions control for sex, relationship status, number of children, and employment status. Columns (2c) and (2d) also apply a mean imputation procedure to educational attainment, income level, sex, relationship status, number of children, employment, and student status and control for dummies, which equal 1 when an observation is missing.

Using age 18 as the base age,[25] the estimates in specifications with passive political participation are consistent with those predictions. Although the overall effect of having press constraints on the correlation between education and political participation is at most slightly negative, quadratic specifications indicate a strong and significant effect when press constraints are relatively weak. As a level of constraints rises, this effect diminishes. If press constraints is a good proxy for propaganda, then this is reassuring evidence in favor of the model's predictions. When the response variable instead describes active participation as in Table 3, the results are similar, albeit at slightly lower levels of statistical significance. Results using standardized beta coefficients are presented in Table A.10 in the Online Appendix.

Though the main specifications limit to sample to those who have completed schooling, the results should also hold for those still in school, for whom propaganda induces a greater allocation of time toward substitute activities. These estimates can be found in columns (3b) of Tables 2 and 3. They remain generally the same, with the correlation between being a student and being politically active being strong.

As before, many respondents correspond to missing observations. Luckily, there is more flexibility in this setting, as countries have multiple observations per year. In turn, I am able to perform a country-year mean imputation procedure, generating greater variation among imputed values. There are no major differences between models with or without imputation. Columns (3c) summarize these results.

Another issue is that it is impossible to know whether a respondent was educated (and thus exposed to propaganda) in her country of current residence. Fortunately, WVS does ask some respondents about their immigration and citizenship statuses. I exclude from the analysis respondents identifying as immigrants or non-citizens, since those individuals are more likely to have characteristics that would bias the estimates, distracting from the mechanism of interest. This exclusion produces only trivial changes to the estimates. However, this is possibly due to the fact that the number of reported immigrants and non-citizens in the sample is relatively small.

Indeed, it is likely that other respondents are also immigrants. Moreover, it is

[25] Is 18 the best base age if political socialization is still ongoing during college years? See Table A.8 for a version with 22 as the base age. The estimates are similar.

Table 3: Press constraints at age 18, education, and political participation, active

| Dependent variable: | Measure of active political participation | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2a) | (2b) | (3a) | (3b) | (3c) |
| $EducationAttainment$ | 0.111*** | 0.147*** | 0.115*** | 0.138*** | 0.129*** | 0.136*** |
| | (0.006) | (0.016) | (0.039) | (0.043) | (0.037) | (0.033) |
| $EA \times PressConstraints_b$ | – | −0.008*** | −0.006 | −0.019* | −0.019* | −0.022** |
| | | (0.003) | (0.004) | (0.011) | (0.010) | (0.009) |
| $EA \times PressConstraints_b^2$ | – | – | – | 0.001 | 0.002* | 0.002** |
| | | | | (0.001) | (0.001) | (0.001) |
| $EA \times Polity_t$ | – | – | 0.003 | 0.003 | 0.003 | 0.002 |
| | | | (0.003) | (0.003) | (0.002) | (0.002) |
| $PressConstraints_b$ | – | 0.033** | 0.023 | 0.058 | 0.070 | 0.076 |
| | | (0.015) | (0.019) | (0.052) | (0.048) | (0.046) |
| $PressConstraints_b^2$ | – | – | – | −0.004 | −0.005 | −0.005 |
| | | | | (0.005) | (0.005) | (0.004) |
| $Polity_t$ | 0.026 | 0.036 | 0.025 | 0.026 | 0.040** | 0.043** |
| | (0.020) | (0.027) | (0.027) | (0.027) | (0.020) | (0.018) |
| $Age_t$ | 0.018 | 0.008 | 0.009 | 0.008 | 0.006 | 0.014 |
| | (0.012) | (0.016) | (0.016) | (0.016) | (0.015) | (0.014) |
| $Age_t^2$ | −0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | −0.00004 |
| | (0.0002) | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) |
| $IncomeLevel_t$ | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.004 |
| | (0.006) | (0.007) | (0.007) | (0.007) | (0.005) | (0.005) |
| $Student_t$ | – | – | – | – | 0.193*** | 0.208*** |
| | | | | | (0.034) | (0.040) |
| Country fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Non-students only? | Yes | Yes | Yes | Yes | No | No |
| Mean imputation? | No | No | No | No | No | Yes |
| Observations | 41221 | 30546 | 30546 | 30546 | 46492 | 52399 |
| Countries | 65 | 65 | 65 | 65 | 70 | 70 |
| Adj. $R^2$ | 0.23 | 0.23 | 0.23 | 0.23 | 0.22 | 0.22 |

Standard errors are clustered by country, with ***, **, and * denoting significance at the 1%, 5%, and 10% levels, respectively. Base year ($b$) is derived from the survey year ($t$), minus the respondent's age ($Age_t$), plus 18. All regressions control for sex, relationship status, number of children, and employment status. Columns (2c) and (2d) also apply a mean imputation procedure to educational attainment, income level, sex, relationship status, number of children, employment, and student status and control for dummies, which equal 1 when an observation is missing.

also possible that some individuals might have been in the sample had they not migrated prior to the survey. Could the decision to migrate be correlated with education or press constraints? Fortunately, the existence of some respondents who were asked about immigration and citizenship allows me to make some rough inferences about the *types* of individuals who might have migrated. Being an immigrant or non-citizen, or both (i.e. "international"),[26] seems to be somewhat negatively correlated with educational attainment. However, each is similarly negatively correlated with political participation and does not appear to alter the relationship between education and political participation. As such, there is probably little reason for concern over unobservable inclusion or exclusion of migrants in the sample.

Lastly, it is worth noting that having greater press constraints at age 18 is positively correlated with passive (but not active) participation among individuals with less education (i.e. less then secondary). Whether this speaks to press censorship having a lesser effect on the uneducated or more government-favorable forms of political engagement among the uneducated deserves further study. A first step for future research into the connections between propaganda, education, and political participation would be the creation of a cross-country index of educational content. The current article cites a cross-sectional index of academic constraints as support for its use of press and media constraints to proxy for propaganda in educational settings. However, to my knowledge no systematic effort has been made to date to measure the relative prevalence of political propaganda or censorship in public schools across countries. Detailed analysis of state-sponsored curricula and teaching practices, including textual analysis of textbooks and education laws, is needed to better understand the importance of educational content for economic and political development. Finally, future research should also exploit educational reforms and regional variation in education policy in order to document causal effects of educational content on economic and political outcomes in specific settings.

[26]See Tables A.9.1-3 in the Online Appendix.

# 4 Concluding remarks

Nondemocratic regimes face a tradeoff when investing in public education. On one hand, education promotes economic development. On the other hand, it may also facilitate political engagement and new social ties among citizens, elevating future political opposition movements. As a result, the economic incentives underlying public education provision may be insufficient to induce investment therein.

I present a model in which a ruler can relax this tradeoff by disseminating propaganda through the education system. I show that educational content will tend to be embedded with propaganda in less developed countries with public education. By making investments in education more appealing to a nondemocratic regime, however, propaganda can also make citizens better off. Further development should then coincide with decreases in propaganda. Perhaps the most important takeaway from this is that it may ultimately be a bad idea to promote "Western" (e.g. secular) education standards in illiberal countries. If successful, those efforts could drive down levels of investment in education, slowing development. Rather, if education does promote development, this transformation should eventually happen on its own.

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# Appendix

## Proofs

### Parameter key

| Summary of variables and parameters | | |
|---|---|---|
| Parameter | Interpretation | Description |
| $\theta \in \{0,1\}$ | The ruler's type | The ruler's preference for policies that maximize social welfare versus his own rents. |
| $\pi \in (0,1)$ | The citizen's trust level | The citizen's prior belief that the ruler will maximize social welfare (i.e. $Pr(\theta = 1)$). |
| $g_\theta \in \{0,1\}$ | Public education provision | The ruler's choice of whether to invest in public education. |
| $e \in \{0,1\}$ | Enrollment in school | The citizen's choice of whether to attend public school. |
| $w > 0$ | Non-productive income | – |
| $h > 1$ | Productivity effect of education | A measure of productivity growth under education. |
| $\alpha > 0$ | Income effect of human capital | – |
| $\tau_\theta \geq 0$ | Ruler's choice of tax | – |
| $R^I \geq 0$ | Initial rents* | The ruler's rents at the start of the game. |
| $R_\theta \geq 0$ | Final rents | The ruler's rents at the end of the game. |
| $c \in \{0,1\}$ | Political club participation | The citizen's choice of whether to join a political club while enrolled in school. |
| $r \in \{0,1\}$ | Mounting of a political challenge | The citizen's choice to contest a ruler's choices of $\tau_\theta$, conditional upon $c = 1$. |
| $q \in (0,1)$ | Political power | The probability that the citizen wins a political challenge. |
| $\sigma \in (0,1)$ | Rule of law | The extent to which political challenges are resolved nonviolently (i.e. are non-destructive). |
| $\hat{\theta} \in \{0,1\}$ | Curriculum | Informs upon and mirrors the state and structure of the political environment, as defined by the ruler's type. A *ruler-favorable* curriculum is $\hat{\theta} = 1$, regardless of $\theta$. |
| $m_\theta \in \{0,1\}$ | Ruler's education policy | The ruler's choice of whether to embed propaganda within (i.e. bias) the education system. *Neutral* policy is $m_\theta = 0$. *Biased* policy is $m_\theta = 1$. |
| $\gamma \in (0,1]$ | State of the propaganda technology | The extent to which propaganda is successfully transmitted under a biased education policy. Higher $\gamma$ implies stronger technology. |
| $\rho \in (0,1)$ | Unproductive education | The extent to which propaganda decreases the productivity of education in the extension model's first period. |

*Model later assumes $R^I \geq \max\{1 - (1-q)\sigma(w + \alpha h - \alpha), 0\}$.

## Proof of Lemma 1

*Proof.* Suppose an educated ($e = 1$), politically active ($c = 1$) citizen observes $\tau_\theta = \tau_0$, revealing $\theta = 0$. Her expected payoff from challenging the ruler ($r = 1$) is $q\sigma(w + \alpha h - \alpha)$. Otherwise, it is $w + \alpha h - \alpha - \tau_0$. The latter exceeds the former if and only if $\tau_0 \leq (1 - q\sigma)(w + \alpha h - \alpha)$.

A predatory ruler's expected payoff when $e = 1$, $c = 1$, and $r = 1$ is $R^I + (1 - q)\sigma(w + \alpha h - \alpha) - 1$. A predatory ruler's expected payoff when $e = 1$ and $c = 1$ if he sets the highest possible $\tau_0$ at which $r^* = 0$ is $R^I + (1 - q\sigma)(w + \alpha h - \alpha) - 1$. The latter exceeds the former for all $\sigma < 1$. Hence, a predatory ruler always prefers $\tau_0^* = (1 - q\sigma)(w + \alpha h - \alpha) \equiv \tau_0^{PA}$ when the citizen is educated ($e = 1$) and politically active ($c = 1$), where $\tau_0^{PA} < w + \alpha h \equiv \tau_0^{PI}$, such that the citizen never mounts a political challenge ($r^* = 0$) thereafter. □

## Proof of Proposition 1

*Proof.* (i) *Political club participation ($c^* = 1$)*: Fix education policy at neutral ($m_0 = m_1 = 0$). Suppose the citizen observes public education provision ($g_\theta = 1$) and enrolls ($e = 1$). Then $\hat{\pi}(\theta|\hat{\theta}) = 1$. Suppose $\theta = 1$. Her payoff from $c = 1$ is $w + \alpha h - \alpha - \tau_1^{BE}$. Her payoff from $c = 0$ is $w + \alpha h - \tau_1^{BE}$. Hence, $c^* = 0$ whenever $\theta = 1$. Now suppose $\theta = 0$. Her payoff from $c = 1$ is $q\sigma(w + \alpha h - \alpha)$. Her payoff from $c = 0$ is 0. Hence, $c^* = 1$ whenever $\theta = 0$. Hence, when $g_0 = g_1 = e = 1$ and $m_0 = m_1 = 0$, $c^* = 1$ if and only if $\theta = 0$.

*Enrollment ($e^* = 1$)*, Case 1: suppose the citizen knows that $g_0 = 0$ and $g_1 = 1$, such that $g_\theta = 1$ implies ruler type. Then $c^* = 0$ whenever $e = 1$, such that her payoff from $e = 1$ after observing $g_\theta = 1$ is $w + \alpha h - \max\{1 - R^I, 0\}$. Her reservation payoff is $w$, where $e^* = 1$ if and only if the former exceeds the latter.

Case 2: suppose that the citizen knows that $g_0 = g_1 = 1$. Then $c^* = 1$ if and only if $\theta = 0$, such that her expected payoff from $e = 1$ is

$$Pr(\hat{\theta} = 0)\hat{\pi}(0|0)q\sigma(w + \alpha h - \alpha) + Pr(\hat{\theta} = 1)\hat{\pi}(1|1)(w + \alpha h - \max\{1 - R^I, 0\}),$$

where $e^* = 1$ if and only if this is greater than $\pi w$.

*Public education provision ($g_0^* = 1$)*: By Lemma 1, a predatory ruler's expected payoff from $g_0 = 1$ when $e^* = 1$ and $c^* = 1$ if and only if $\theta = 0$ is $R^I + (1 - q\sigma)(w + \alpha h - \alpha) - 1$. His reservation payoff is $R^I + w$. Suppose $g_0 = 1$.

$$R^I + (1 - q\sigma)(w + \alpha h - \alpha) - 1 \geq R^I + w \Leftrightarrow h \geq \frac{1 + \alpha(1 - q\sigma) + q\sigma w}{\alpha(1 - q\sigma)} \equiv \overline{h}.$$

Hence, there exists a value of $h \equiv \overline{h}$ above which $g_0^* = 1$ under these conditions.

A benevolent ruler's expected payoff from $g_1 = 1$ when $e^* = 1$ and $c^* = 1$ if and only

if $\theta = 0$ is $w + \alpha h - \alpha \mathbb{E}(c(m_\theta|\hat{\theta})|\theta = 1) - \max\{1 - R^I, 0\}$. His reservation payoff is $w$. Suppose $g_1 = 1$. Then

$$w + \alpha h - \alpha \mathbb{E}(c(m_\theta|\hat{\theta})|\theta = 1) - \max\{1 - R^I, 0\} \geq w$$
$$\Leftrightarrow h \geq \frac{\max\{1 - R^I, 0\} + \alpha \mathbb{E}(c(m_\theta|\hat{\theta})|\theta = 1)}{\alpha} \equiv \underline{h}.$$

Hence, there exists a value of $h \equiv \underline{h}$ above which $g_1^* = 1$ under these conditions.

By inspection, $\overline{h} > \frac{1+\alpha}{\alpha} \geq \underline{h}$ for all $R^I \geq 0$. Hence, when $m_0 = m_1 = 0$, $g_1^* = 1$ is necessary for $g_0^* = 1$ when $e^* = 1$ and $c^* = 1$ if and only if $\theta = 0$.

*Confirming enrollment ($e^* = 1$)*: By inspection, $e^* = 1$ if $h \geq \underline{h}$. Hence, $h \geq \overline{h} > \underline{h}$ is necessary and sufficient for a developmental schooling equilibrium [DSE] when $m_0 = m_1 = 0$.

(ii) $\frac{\partial \overline{h}}{\partial q} = \frac{\sigma(1+w)}{\alpha(1-q\sigma)^2} > 0$, $\frac{\partial \overline{h}}{\partial \sigma} = \frac{q(1+w)}{\alpha(1-q\sigma)^2} > 0$, $\frac{\partial \overline{h}}{\partial w} = \frac{q\sigma}{\alpha(1-q\sigma)} > 0$, and $\frac{\partial \overline{h}}{\partial \alpha} = -\frac{1+q\sigma w}{\alpha^2(1-q\sigma)} < 0$. The derivative of $\underline{h}$ with respect to $\alpha$ is $-(1-R^I)\alpha^{-2} < 0$ if $1 > R^I$ and 0 otherwise, while the derivative of $\underline{h}$ with respect to $R^I$ is $-\alpha^{-1} < 0$ if $1 > R^I$ and 0 otherwise. □

## Proof of Proposition 2

*Proof.* (i) *Political club participation ($c^* = 1$)*: Now let education policy $m_\theta$ be anything. Suppose the citizen observes $g_\theta = 1$ and chooses $e = 1$.

Suppose the citizen then observes $\hat{\theta} = 0$, such that her expected payoff from $c = 1$ is

$$\hat{\pi}(0|0)q\sigma(w + \alpha h - \alpha) + \hat{\pi}(1|0)(w + \alpha h - \alpha - \max\{1 - R^I, 0\}).$$

Her payoff from $c = 0$ is $\hat{\pi}(1|0)(w+\alpha h-\max\{1-R^I, 0\})$. Fix $m_1 = 0$, such that $\hat{\pi}(1|0) = 0$. Hence, $c^* = 1$ for all $m_0$ when $\hat{\theta} = 0$ and $m_1 = 0$.

Now suppose the citizen observes $\hat{\theta} = 1$. A citizen's payoff from $c = 1$ is

$$\hat{\pi}(0|1)q\sigma(w + \alpha h - \alpha) + \hat{\pi}(1|1)(w + \alpha h - \alpha - \max\{1 - R^I, 0\}).$$

Her payoff from $c = 0$ is $\hat{\pi}(1|1)(w + \alpha h - \max\{1 - R^I, 0\})$. Again fix $m_1 = 0$, but now suppose $m_0 = 1$. There exists a threshold of $Pr(\hat{\theta} = 1|\theta = 0, m_0 = 1) = \gamma \equiv \overline{\gamma}$, where $c^* = 0$ when both $\hat{\theta} = 1$ and $m_1 = 0$ if and only if

$$\gamma < \frac{\pi\alpha}{(1-\pi)q\sigma(w + \alpha h - \alpha)} \equiv \overline{\gamma}.$$

Hence, $c^* = 1$ if and only if $\hat{\theta} = 0$ when $g_0 = g_1 = 1$, $m_1 = 0$ and $m_0 = 1$, and $e = 1$, conditional upon $\gamma < \overline{\gamma}$.

(ii) *Education policy ($m_0^* = 1$)*: Suppose $g_0 = 1$, $e^* = 1$, and $c^* = 1$ if and only if $\hat{\theta} = 0$. Again fix $m_1 = 0$. Suppose $m_0 = 1$. A predatory ruler's expected payoff from $g_0 = 1$ when $m_0 = 1$, conditional upon $\gamma < \overline{\gamma}$, is

$$R^I + \gamma(w + \alpha h) + (1 - \gamma)(1 - q\sigma)(w + \alpha h - \alpha) - 1,$$

which is increasing in $\gamma$. Hence, $m_0^* = 1$ if $m_1 = 0$, $g_0 = 1$, $e^* = 1$, and $c^* = 1$ if and only if $\hat{\theta} = 0$.

*Benevolent rulers never propagandize ($m_1^* = 0$)*: Suppose $g_0 = g_1 = 1$. Suppose $m_1 = 0$. The citizen's expected payoff from $e = 1$ when $m_0 = 0$, or when $m_0 = 1$ but $\gamma < \overline{\gamma}$, such that $c^* = 1$ if and only if $\hat{\theta} = 0$, is

$$\begin{aligned} Pr(\hat{\theta} = 0)[\hat{\pi}(0|0)q\sigma(w + \alpha h - \alpha) + \hat{\pi}(1|0)(w + \alpha h - \alpha - \max\{1 - R^I, 0\})] \\ + Pr(\hat{\theta} = 1)\hat{\pi}(1|1)(w + \alpha h - \max\{1 - R^I, 0\}) \end{aligned}$$

$Pr(\hat{\theta} = 0|\theta = 1) = 0$ if and only if $m_1 = 0$. Deviating to $m_1 = 1$, such that $Pr(\hat{\theta} = 0|\theta = 1) > 0$, would increase the probability that the citizen chooses $c^* = 1$ and bears the cost $\alpha$ when $\theta = 1$, decreasing her expected payoffs. Hence, $m_1^* = 0$ when $g_0 = g_1 = 1$ and either $m_0 = 0$ or $m_0 = 1$ but $\gamma < \overline{\gamma}$, such that $c^* = 1$ if and only if $\hat{\theta} = 0$.

Now suppose $\gamma \geq \overline{\gamma}$. Recall that $m_\theta = 0$ is set by default, where $m_\theta = 1$ only if it is strictly improving. If a benevolent ruler decides to stay at $m_1 = 0$, then he knows that $c^* = 1$ for all $\hat{\theta}$ if $m_0 = 1$, or $c^* = 1$ if and only if $\theta = 0$ if $m_0 = 0$. But conditional upon $m_1 = 0$, a citizen will always condition her choice of $c$ on $m_0 = 0$ as well, since she knows a predatory ruler cannot improve his payoffs by setting $m_0 = 1$ when $m_1 = 0$. Thus $m_1 = 0$ always yields a benevolent ruler's best possible payoff, in which $c^* \neq 1$ when $\theta = 1$.

Hence, $m_1^* = 0$ in all schooling equilibrium [SE].

*Public education provision ($g_0^* = 1$)*: Suppose $g_0 = 1$. Recall that $m_0^* = 1$ if $g_0 = 1$ when $\gamma < \overline{\gamma}$. A predatory ruler's payoffs from $g_0 = 0$ are $R^I + w$. Hence, he prefers to invest in public education ($g_0^* = 1$) when $\gamma < \overline{\gamma}$ if and only if

$$\begin{aligned} R^I + \gamma(w + \alpha h) + (1 - \gamma)(1 - q\sigma)(w + \alpha h - \alpha) - 1 \geq R^I + w \\ \Leftrightarrow \gamma \geq 1 - \frac{\alpha h - 1}{q\sigma(w + \alpha h) + (1 - q\sigma)\alpha} \equiv \underline{\gamma}. \end{aligned}$$

Suppose $g_1 = 1$. Recall that $\gamma \leq 1$. If $\gamma \geq \underline{\gamma}$, then $\underline{\gamma} \leq 1$. $\underline{\gamma} \leq 1$ if and only if $h \geq \alpha^{-1}$. $m_1^* = 0$, so $\mathbb{E}(c(m_\theta|\hat{\theta})|\theta = 1) = 0$, such that $\alpha^{-1} \geq \underline{h}$, by Proposition 1.1. Thus, if $h \geq \alpha^{-1}$, then $h \geq \underline{h}$. Hence, $\gamma \geq \underline{\gamma}$ is sufficient for $h \geq \underline{h}$. By Proposition 1.1, $g_1^* = 1$ if and only if $h \geq \underline{h}$. Hence, $g_1^* = 1$ is necessary for $g_0^* = 1$ when $m_1^* = 0$, $m_0^* = 1$, $e^* = 1$, and $c^* = 1$ if

and only if $\hat{\theta} = 0$. Hence, $\gamma \in [\underline{\gamma}, \overline{\gamma})$ must hold in a biased schooling equilibrium [BSE].

*Confirming enrollment ($e^* = 1$)*: Suppose $e = 1$. Following Proposition 1.1, suppose $c^* = 1$ if and only if $\hat{\theta} = 0$ and that $g_0 = g_1 = 1$, $m_0 = 1$, and $m_1 = 0$. Then the citizen's expected payoff from $e = 1$ is

$$Pr(\hat{\theta} = 0)\hat{\pi}(0|0)q\sigma(w + \alpha h - \alpha) + Pr(\hat{\theta} = 1)\hat{\pi}(1|1)(w + \alpha h - \max\{1 - R^I, 0\})$$

if and only if $g_0 = g_1 = 1$, for which $h \geq \underline{h}$ is a necessary condition. Furthermore, by inspection, $h \geq \underline{h}$ implies that

$$Pr(\hat{\theta} = 0)\hat{\pi}(0|0)q\sigma(w + \alpha h - \alpha) + Pr(\hat{\theta} = 1)\hat{\pi}(1|1)(w + \alpha h - \max\{1 - R^I, 0\}) \geq \pi w.$$

Hence, $e^* = 1$ if and only if $g_1 = 1$ when $g_0 = 1$, $m_0 = 1$, $m_1 = 0$, and $c^* = 1$ if and only if $\hat{\theta} = 0$. Hence, $\gamma \in [\underline{\gamma}, \overline{\gamma})$ is necessary and sufficient for a BSE.

(iii) Hence, when $\gamma \in [\underline{\gamma}, \overline{\gamma})$, with probability $(1 - \pi)\gamma$, $c^* = 0$ when $\theta = 0$. To choose $c^* = 0$ when $\theta = 0$ is suboptimal *ex post*: if $c^* = 0$ when $\theta = 0$, $\tau_0^* = \tau_0^{PI}$.

(iv) $\frac{\partial \overline{\gamma}}{\partial q} = -\frac{\pi\alpha}{(1-\pi)q^2\sigma(w+\alpha h-\alpha)} < 0$, $\frac{\partial \overline{\gamma}}{\partial \sigma} = -\frac{\pi\alpha}{(1-\pi)q\sigma^2(w+\alpha h-\alpha)} < 0$, $\frac{\partial \overline{\gamma}}{\partial h} = -\frac{\pi\alpha^2}{(1-\pi)q\sigma(w+\alpha h-\alpha)^2} < 0$, $\frac{\partial \overline{\gamma}}{\partial w} = -\frac{\pi\alpha}{(1-\pi)q\sigma(w+\alpha h-\alpha)^2} < 0$, $\frac{\partial \overline{\gamma}}{\partial \alpha} = \frac{\pi w}{(1-\pi)q\sigma(w+\alpha h-\alpha)^2} > 0$, $\frac{\partial \overline{\gamma}}{\partial \pi} = \frac{\alpha}{(1-\pi)^2 q\sigma(w+\alpha h-\alpha)} > 0$, $\frac{\partial \gamma}{\partial h} = -\frac{\alpha(q\sigma(w+1)+(1-q\sigma)\alpha)}{(q\sigma(w+\alpha h)+(1-q\sigma)\alpha)^2} < 0$, $\frac{\partial \gamma}{\partial \alpha} = -\frac{1+q\sigma(wh+h-1)}{(q\sigma(w+\alpha h)+(1-q\sigma)\alpha)^2} < 0$, $\frac{\partial \gamma}{\partial q} = \frac{\sigma(\alpha h-1)(w+\alpha h-\alpha)}{(q\sigma(w+\alpha h)+(1-q\sigma)\alpha)^2} > 0$, $\frac{\partial \gamma}{\partial \sigma} = \frac{q(\alpha h-1)(w+\alpha h-\alpha)}{(q\sigma(w+\alpha h)+(1-q\sigma)\alpha)^2} > 0$, and $\frac{\partial \gamma}{\partial w} = \frac{q\sigma(\alpha h-1)}{(q\sigma(w+\alpha h)+(1-q\sigma)\alpha)^2} > 0$, the last three of which hold only when $h > \alpha^{-1}$. □

## Proof of Corollary 1

*Proof.* (i) By Propositions 1.1 and 2.1-2, $h \geq \underline{h}$ is necessary and sufficient for $g_1^* = 1$ and therefore $e^* = 1$, and $\gamma < \overline{\gamma}$ is necessary and sufficient for $c^* = 1$ if and only if $\hat{\theta} = 0$ when $m_0 = 1$ and $m_1 = 0$, such that $m_0^* = 1$ when $g_0 = 1$. However, by Proposition 2.2, $\gamma < \underline{\gamma}$ implies $g_0^* = 0$, inducing a weak non-schooling equilibrium [WNE].

(ii) By Proposition 2.4, $\underline{\gamma}$ is strictly decreasing in $h$. $\underline{\gamma}|_{h=\overline{h}} = 0$. Hence, $\max\{\underline{\gamma}, 0\} = 0$ when $h \geq \overline{h}$. $\gamma > 0$. Hence, $\gamma \not< \underline{\gamma}$ for all $h \geq \overline{h}$. □

## Proof of Corollary 2

*Proof.* By Corollary 1, $\gamma < \underline{\gamma}$ is sufficient for $h < \overline{h}$, and $\gamma < \underline{\gamma}$ and $\gamma < \overline{\gamma}$ are necessary and sufficient for a WNE. Hence, $h \in [\underline{h}, \overline{h})$ and $\gamma < \underline{\gamma} < \overline{\gamma}$ are sufficient for a WNE. However, if $\gamma = \hat{\gamma} \in [\underline{\gamma}, \overline{\gamma})$, then a predatory ruler would prefer $g_0^* = 1$ and set $m_0^* = 1$, inducing a

BSE. Moreover, because $\gamma > 0$, $\underline{\gamma} > 0$ if $\gamma < \underline{\gamma}$. Thus when $\gamma < \overline{\gamma}$, a citizen's expected payoffs from $e = 1$ are *strictly* greater in a BSE than a WNE. Hence, when $h \in [\underline{h}, \overline{h})$ and $\gamma < \underline{\gamma} < \overline{\gamma}$, $\gamma = \hat{\gamma}$ would strictly improve the citizen's expected payoffs. □

## Proof of Proposition 3

*Proof.* (i) Suppose $g_0 = g_1 = 1$, $m_0 = 1$, $m_1 = 0$, $e = 1$, and $c = 1$ for all $\hat{\theta}$. Then by Proposition 2, $c^* = 1$ for all $\hat{\theta}$ if and only if $\gamma \geq \overline{\gamma}$. When $\gamma \geq \overline{\gamma}$, a predatory ruler's payoff when $g_0 = 1$, $m_0 = 1$, $e^* = 1$, and $c^* = 1$ is $R^I + (1 - q\sigma)(w + \alpha h - \alpha) - 1$. His reservation payoff is $R^I + w$. By Proposition 1, it must be the case that $h \geq \overline{h}$ if $g_0^* = 1$. By Proposition 1, $\overline{h} > \underline{h}$, such that if $g_0^* = 1$, then $g_1^* = 1$, and if $g_1^* = 1$, then $e^* = 1$.

However, recall that a ruler never deviates from $m_\theta = 0$ if he is indifferent. Suppose $m_0 = 0$. By Proposition 1.1, the citizen chooses $c^* = 1$ only if $\theta = 0$. Then a predatory ruler's payoff when $g_0 = 1$ but $m_0 = 0$ is still $R^I + (1 - q\sigma)(w + \alpha h - \alpha) - 1$. Hence, when $\gamma \geq \overline{\gamma}$ and $h > \underline{h}$, $m_0^* = 0$, where $g_0^* = g_1^* = 1$, $m_1^* = 0$, $e^* = 1$, and $c^* = 1$ if and only if $\hat{\theta} = 0$. Hence, $h \geq \overline{h}$ and $\gamma \geq \overline{\gamma}$ are necessary and sufficient for a DSE when $m_0 \in \{0, 1\}$.

(ii) Now let $h \in [\underline{h}, \overline{h})$, but suppose a predatory ruler chooses $g_0 = 1$ and $m_0 = 1$. Then $c^* = 1$ for all $\hat{\theta}$. However, since his payoff from $m_0 = 1$ is the same as his payoff from $m_0 = 0$ when $\gamma \geq \overline{\gamma}$, $m_0^* \neq 1$. Suppose he instead sets $m_0 = 0$. Then $c^* = 1$ if and only if $\hat{\theta} = 0$. But by Proposition 1.1, $g_0^* \neq 1$ when $m_0 = 0$ and $h < \overline{h}$. Hence, when $\gamma \geq \overline{\gamma}$ but $h \in [\underline{h}, \overline{h})$, $g_1^* = 1$ but $g_0^* = 0$ and $m_0^* = 0$, where $m_1^* = 0$, $e^* = 1$ if and only if $g_\theta = 1$ is observed, and $c^* = 1$ whenever $e^* = 1$. Hence, $h \in [\underline{h}, \overline{h})$ and $\gamma \geq \overline{\gamma}$ are necessary and sufficient for a repressive non-schooling equilibrium [RNE] whenever $m_0 \in \{0, 1\}$.

(iii) By Proposition 2.4, $\overline{\gamma}$ is strictly decreasing in $h$. Finally, $\overline{\gamma}|_{h=\overline{h}} = \frac{\alpha\pi(1-q\sigma)}{(1-\pi)q\sigma(1+w)} > 0$. □

## Proof of Corollary 3

*Proof.* By Proposition 3.1, if $\gamma \geq \overline{\gamma} > \underline{\gamma}$, $m_0^* = 0$, such that a predatory ruler's payoff from $g_0 = 1$ is $R^I + (1 - q\sigma)(w + \alpha h - \alpha) - 1$. His payoff from $g_0 = 0$ is $R^I + w$. By Proposition 2, $\gamma \in [\underline{\gamma}, \overline{\gamma})$ is necessary and sufficient for a BSE, where his payoff is $R^I + \gamma(w + \alpha h) + (1 - \gamma)(1 - q\sigma)(w + \alpha h - \alpha) - 1$. The latter payoff is always strictly greater than either of the first two when $\gamma > \max\{\underline{\gamma}, 0\}$, conditional upon $\gamma < \overline{\gamma}$.

A ruler's payoff in a BSE is strictly increasing in $\gamma$ for all $\gamma < \overline{\gamma}$. $\gamma \leq 1$. If $\gamma \geq \overline{\gamma}$, then it must be the case that $\overline{\gamma} \leq 1$. Hence, the payoff-maximizing $\gamma \equiv \tilde{\gamma}^* = \lim_{\overline{\varepsilon} \to 0} \overline{\gamma} - \overline{\varepsilon} < 1$.

It follows from this and Corollary 2 that this is also weakly payoff-improving for the citizen when $h \in [\underline{h}, \overline{h})$. □

## Proof of Example 1

*Proof.* Let $h \geq \underline{h}$. By Propositions 1.1 and 2.2, $e^* = 1$, $m_1^* = 0$, and $g_1^* = 1$. Fix $\gamma = \overline{\gamma}|_{h=\overline{h}}$.

Suppose $h = \overline{h}$, such that $\gamma = \overline{\gamma}$. By Proposition 2.1, $c^* = 1$ for all $\hat{\theta}$ if $m_0^* = 1$. Otherwise $c^* = 1$ if and only if $\hat{\theta} = 0$. Then by Proposition 3.1, $m_0^* = 0$, such that a predatory ruler's payoff from $g_0 = 1$ is $R^I + (1 - q\sigma)(w + \alpha\overline{h} - \alpha) - 1$.

Now suppose $h = \overline{h} - \eta < \overline{h}$. By Proposition 2.4, $\gamma < \overline{\gamma}|_{h=\overline{h}-\eta}$. Now $m_0^* = 1$ whenever $g_0 = 1$, such that a predatory ruler's payoff from $g_0 = 1$ is

$$\begin{aligned} R^I + \overline{\gamma}|_{h=\overline{h}}(w + \alpha(\overline{h} - \eta)) + (1 - \overline{\gamma}|_{h=\overline{h}})(1 - q\sigma)(w + \alpha(\overline{h} - \eta) - \alpha) - 1 \\ = R^I + \frac{\alpha\pi(1 - q\sigma)(w + \alpha\overline{h} - \alpha\eta)}{(1 - \pi)q\sigma(1 + w)} + (1 - q\sigma)(w + \alpha\overline{h} - \alpha\eta - \alpha) \\ - \frac{\alpha\pi(1 - q\sigma)^2(w + \alpha\overline{h} - \alpha\eta - \alpha)}{(1 - \pi)q\sigma(1 + w)} - 1. \end{aligned}$$

Plugging in $\overline{h}$, the latter is greater if and only if $\eta < \frac{\pi(q\sigma(1+w)+(1-q\sigma)\alpha)}{(1-q\sigma)q\sigma(\pi\alpha+(1-\pi)(1+w))} \equiv \hat{\eta} > 0$. □

## Proof of Proposition 4

*Proof. Preliminary information*: Optimal taxes and rents $(\tau_{0t}^*, \tau_{1t}^*, R_{0t}^*, R_{1t}^*)$, and in turn $r_t^*$, are the same as in the basic model for all $t$. When $\theta = 1$, this follows from the citizen's myopia and the fact that if $h \geq \underline{h}$ in period 1, then $h_2 > \underline{h}$. When $\theta = 0$ and $t = 2$, this follows from Lemma 1. When $\theta = 0$ and $t = 1$, a predatory ruler's tax choice $\tau_{01}$ must account for the possibility that if $r_1 = 1$, then he survives into period 2 with probability $q$. However, if he survives, his $t = 2$ payoffs are the same as if $r_1 = 0$. Let his second period payoffs be $V_2$. A predatory ruler's expected payoff when $e_1 = 1$ and $c_1 = 1$ if he sets the highest possible $\tau_{01}$ at which $r_1^* = 0$ is $R^I + (1 - q\sigma)(w + \alpha h - \alpha) - 1 + \beta V_2$.

$$\begin{aligned} (1 - q\sigma)(w + \alpha h - \alpha) + \beta V_2 > (1 - q)[\sigma(w + \alpha h - \alpha) + \beta V_2] \\ \Leftrightarrow (1 - \sigma)(w + \alpha h - \alpha) + q\beta V_2 > 0. \end{aligned}$$

*Sustaining a BSE into period 2 ($c_2^* = 1$ if and only if $\hat{\theta}_2 = 0$)*: Let $h \geq \underline{h}$. By Propositions 1.1 and 2.2, $e_t^* = 1$, $m_{1t}^{A*} = 0$, and $g_{1t}^* = 1$ for $t = 1$ and therefore all $t$. A benevolent ruler cannot benefit from weakening the productivity of education, such that $m_1^{B*} = 0$.

Suppose period 1 is a BSE: Let $\gamma < \overline{\gamma}(h_1|m_0^B = 0)$. $h_1 = h$ if $m_0^B = 0$, such that, by Propositions 2.1 and 2.4, $c_1^* = 1$ if and only if $\hat{\theta}_1 = 0$ for all $m_{01}^A$ and $m_0^B$.

Suppose $m_{01}^A = 1$ and $m_0^B = 0$. Without unproductive education, period 2 is a DSE: Let $\gamma \geq \overline{\gamma}(h_2|m_0^B = 0)$, where by Proposition 2.1,

$$\overline{\gamma}(h_2|m_0^B = 0) \equiv \frac{\pi_2\alpha}{(1 - \pi_2)q\sigma(w + \alpha h + \alpha(1 - \delta)h - \alpha)},$$

such that $c_2^* = 1$ for all $\hat{\theta}_2$ and thus $m_{02}^{A*} = 0$ if there is no unproductive education ($m_0^B = 0$).

Now instead suppose that $m_0^B = 1$, such that $h_1 = (1-\rho)h$ and $h_2 = h+(1-\delta)(1-\rho)h$. Suppose that $m_{02}^A = 1$ but $c_2 = 0$ when $\hat{\theta}_2 = 1$. By Proposition 2.1, this is true if and only if

$$\gamma < \frac{\pi_2\alpha}{(1-\pi_2)q\sigma(w+\alpha h+\alpha(1-\delta)(1-\rho)h-\alpha)} \equiv \overline{\gamma}(h_2|m_0^B=1).$$

Rearranging, $c_2^* = 1$ if and only if $\hat{\theta}_2 = 0$ when $m_{02}^A = 1$ and $m_0^B = 1$ if and only if

$$\rho > 1 - \frac{\pi_2\alpha - \gamma(1-\pi_2)q\sigma(w+\alpha h-\alpha)}{\gamma(1-\pi_2)q\sigma\alpha(1-\delta)h} \equiv \underline{\rho}.$$

$\rho > \underline{\rho}$ implies $\gamma < \overline{\gamma}(h_1|m_0^B = 1)$, since $\rho > \underline{\rho}$ implies $\gamma < \overline{\gamma}(h_2|m_0^B = 1)$, and $h_2 > h_1$ implies $\overline{\gamma}(h_2|m_0^B = 1) < \overline{\gamma}(h_1|m_0^B = 1)$ for all $\pi_2 < \pi_1$ by Proposition 2.4.

$\rho > \underline{\rho}$ also implies $\gamma < \overline{\gamma}(h_1|m_0^B = 0)$, since $\rho > \underline{\rho}$ implies $\underline{\rho} < 1$ for all $\rho < 1$, and $\underline{\rho} < 1$ implies $\gamma < \overline{\gamma}(h_1|m_0^B = 0)$. Finally, $\gamma \geq \overline{\gamma}(h_2|m_0^B = 0)$ implies $\underline{\rho} \geq 0$.

*Unproductive propaganda ($m_{01}^{A*} = m_{02}^{A*} = m_0^{B*} = 1$)?* Suppose $m_{01}^A = m_{02}^A = m_0^B = 1$. By Propositions 2.1 and 3.1, a predatory ruler's expected payoff in period 1 from $m_0^B = 1$, conditional upon $\gamma < \overline{\gamma}(h_1|m_0^B = 0)$, $\gamma \geq \overline{\gamma}(h_2|m_0^B = 0)$, and $\rho > \underline{\rho}$, is

$$R^I + \gamma(w+\alpha(1-\rho)h) + (1-\gamma)(1-q\sigma)(w+\alpha(1-\rho)h-\alpha) - 1 + \beta[R^I + \gamma(w+\alpha h + \alpha(1-\delta)(1-\rho)h) + (1-\gamma)(1-q\sigma)(w+\alpha h+\alpha(1-\delta)(1-\rho)h-\alpha) - 1]. \quad (2)$$

His expected payoff from $m_0^B = 0$ in period 1 is

$$R^I+\gamma(w+\alpha h)+(1-\gamma)(1-q\sigma)(w+\alpha h-\alpha)-1+\beta(R^I+(1-q\sigma)(w+\alpha h+\alpha(1-\delta)h-\alpha)-1). \quad (3)$$

The former is greater than the latter if and only if

$$\rho < \frac{\beta\gamma(q\sigma(w+\alpha(2-\delta)h)+(1-q\sigma)\alpha)}{\alpha h(1+(1-\delta)\beta)(1-(1-\gamma)q\sigma)} \equiv \overline{\rho} > 0.$$

Hence, when $\gamma < \overline{\gamma}(h_1|m_0^B = 0)$ but $\gamma \geq \overline{\gamma}(h_2|m_0^B = 0)$, $\rho \in (\underline{\rho}, \overline{\rho})$ is a necessary and sufficient condition for $c_t^* = 1$ if and only if $\hat{\theta}_t = 0$ and $m_{0t}^{A*} = m_0^{B*} = 1$ for all $t$, when $g_{0t} = g_{1t}^* = e_t^* = 1$ for all $t$, and $m_{1t}^{\gamma^*} = m_1^{B*} = 0$ for all $t$.

Finally, a predatory ruler's expected payoff from $g_{01} = g_{02} = 0$ is

$$(1+\beta)(R^I + w). \quad (4)$$

His expected payoff from $g_{01} = 0$ and $g_{02} = 1$, conditional upon $\gamma < \overline{\gamma}(h_2 = h)$, is

$$R^I + w + \beta(R^I + \gamma(w+\alpha h) + (1-\gamma)(1-q\sigma)(w+\alpha h-\alpha) - 1). \quad (5)$$

When $\gamma < \overline{\gamma}(h_2|m_0^B = 0)$, then unproductive education is unneeded. Finally, recall that if $\gamma \not< \overline{\gamma}(h_1|m_0^B = 0)$, then $\underline{\rho} \geq 1$, such that $\rho \not> \underline{\rho}$. Hence, when $\gamma < \overline{\gamma}(h_1|m_0^B = 0)$, $\gamma \geq \overline{\gamma}(h_2|m_0^B = 0)$, $h \geq \underline{h}$, and (2) exceeds the greater of (4) and (5), $\rho \in (\underline{\rho}, \overline{\rho})$ is necessary and sufficient for an unproductive biased schooling equilibrium [UBSE] in which human capital accumulates, yet $m_{0t}^{A*} = 1$ and $c_t^* = 1$ if and only if $\hat{\theta}_t = 0$ for all $t$.

Finally, to confirm that this equilibrium space is nontrivial, set $w = 0$, $\beta = 1$, $h = \overline{h}$, and $\gamma = \overline{\gamma}(h_2|m_0^B = 0)$. Then $\underline{\rho} = 0$. Then since $\overline{\rho} > 0$, $\overline{\rho} > \underline{\rho}$. Moreover, (3) exceeds (5) and (5) exceeds (4), such that (2) exceeds (3), (4), and (5) whenever $\rho < \overline{\rho}$.

(ii) $\frac{\partial \underline{\rho}}{\partial \gamma} = \frac{\pi_2}{\gamma^2(1-\pi_2)q\sigma(1-\delta)h} > 0$, $\frac{\partial \underline{\rho}}{\partial h} = \frac{\pi_2\alpha - \gamma(1-\pi_2)q\sigma(w-\alpha)}{\gamma(1-\pi_2)q\sigma\alpha(1-\delta)h^2} > 0$,
$\frac{\partial \overline{\rho}}{\partial \gamma} = \frac{\beta(1-q\sigma)(q\sigma(w+\alpha(2-\delta)h)+(1-q\sigma)\alpha)}{\alpha h(1+(1-\delta)\beta)(1-(1-\gamma)q\sigma)^2} > 0$, and $\frac{\partial \overline{\rho}}{\partial h} = -\frac{\beta\gamma(q\sigma w+(1-q\sigma)\alpha)}{\alpha h^2(1+(1-\delta)\beta)(1-(1-\gamma)q\sigma)} < 0$. □