The London School of Economics and Political Science

Essays in Political Economy

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Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

I declare that my thesis consists of 40,256 words.

Statement of conjoint work

I confirm that Chapter 3 was jointly co-authored with Alberto Parmigiani, a fellow PhD Candidate in the Department of Government at the London School of Economics whose main supervisors are Mathilde Emeriau and Valentino Larcinese, and I contributed with 50% of this work.

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Abstract

These essays are motivated by political economy problems in developing countries. The first chapter studies whether programmatic policies are irrelevant for politicians' electoral fortunes. I show that the answer is no with a political agency model where politicians' competence is uncertain to all. In my setup, an incumbent can allocate a budget to public goods and transfers, which differ in one key dimension: the former fluctuates more over time than the latter. When the incumbent increases the budget to public goods, two effects arise: his performance in office today reveals more information about his identity (an informativeness effect), and voters' anticipation of narrow transfers tomorrow increases the salience of political selection (a stakes effect). To the incumbent, these two effects move in opposing directions and, consequently, the strategic allocation of the budget helps him to advance his electoral fortunes. The second chapter studies a model where an economic elite wants to buy a public asset as cheaply as possible, whose ownership is decided by an incumbent politician. The elite can make a buying offer for the asset and manipulate the information that is available to voters about the incumbent's competence. By attacking the incumbent (trying to uncover bad news about his competence before making an offer) or threatening him (with uncovering bad), I show that the elite can reduce the prices that the incumbent would accept for selling the asset. I also show that the elite often uses threats against a leading incumbent and attacks against a trailing one. Finally, the third chapter (joint with Alberto Parmigiani) studies a model where an influential citizen can try to get away with tax evasion by investing in the complexity of his evasion scheme —which we call "brains", and by committing to delivering punishment against those that investigate him —which we call "muscles". By characterizing the citizen's optimal strategies, the model yields a testable prediction: estimates of international tax evasion display an inverted U-shape along the quality of institutions. We provide evidence of this finding by building a panel dataset of estimated offshore wealth by individuals for 37 countries between 2002 to 2016.

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Chapter 1

Merchants of Reputation:

Privatization under Elites' Manipulation of Information

Abstract

An economic elite wants to buy a public asset as cheaply as possible. Its ownership is decided by an incumbent politician who can be of high or low competence. The elite can make a buying offer for the asset and manipulate the information that is available to voters about the incumbent's competence. By attacking the incumbent (trying to uncover bad news about his competence before making him an offer) or threatening him (with uncovering bad news if he refuses to sell), I show that the elite can reduce the prices that the incumbent would accept for selling the asset. I also show that the elite often (but not always) uses threats against a leading incumbent (one who has better reputation than his challenger) and attacks against a trailing one. I further find that a better reputation can actually render an incumbent more susceptible to the elite's influence.

1.1 Introduction

Paraphrasing Mayhew's (1974) famous standpoint, reelection is any politician's north star. As such, politicians dread the revelation of electorally damaging information. This means that whoever can manipulate the information available to voters should yield great influence over representatives and, thereby, over the policies that they choose to take. And there are many reasons to believe that economic elites are at a decisive advantage in this domain. From the control of media outlets in developing and developed countries to the use of issue advocacy in the United States, elites everywhere have the ability to potentially hurt office-holders by trying to harm their reputation. But how much influence does this channel offer to elites? What type of strategy do they use?

To provide some answers to these important questions, I develop a model of the privatization of a public asset under the shadow of information manipulation by an economic elite.[1] My model has three key ingredients. First, an incumbent politician, who can be of high or low competence, can choose whether to sell a public asset and at what price to sell it. Second, voters can learn about the incumbent's competence by observing his performance in office. The amount of voter learning depends on the budget that he handles: the bigger the budget, the more can voters learn (see Ashworth, Bueno de Mesquita and Friedenberg, 2017). And, finally, there is an economic elite that wants to buy the public asset as cheaply as possible. To do so, the elite can commit to a strategy to manipulate voters' beliefs about the incumbent's competence: they can attack him (try to uncover bad news about his competence before making him a buying offer) or they can

[1] As I will argue later, the model is also applicable to other policy domains

threaten him (try to uncover bad news if he refuses to take their offer).

I show that, in order to achieve their goal of buying the asset cheaply, the elite often (but not always) uses threats against an electorally leading incumbent (one who, in the absence of additional information, has a better reputation than his challenger) and employs attacks against a trailing one. As I explain below, the elite's strategies emerge from the incumbent's electoral evaluation of the arrival of new information about his ability.

We can begin by considering first-order political distortions — an incumbent's incentives to sell the public asset in the absence of elites' capacity to manipulate information. Suppose that the elite is dealing with a trailing incumbent. If voters do not learn new information about his type, then by the time of the election he would remain as the worse candidate to appoint. To improve his chances of being reelected, he needs to prove himself to be better than this contender. In other words, he seeks the revelation of information about his true competence. Bad news about his type does not affect him much (he is already electorally behind), but good news could give him an edge to reduce his trail and perhaps even turn him into the leading candidate.

What would be the stance of this incumbent if presented with some offer to privatize the public asset? Precisely because of the informational consequences of privatization (an increase in the amount of voter learning as he would handle a bigger budget), he would be willing to sell as it would expand his possibilities of proving himself to be better than his contender. That is, a trailing incumbent's demand for information revelation creates incentives for him to over-sell the asset. The deeper his trail, the higher his incentives to over-sell it.

Suppose now that the elite faces a leading incumbent. Given that he is electorally ahead of his challenger, he has little to prove —voters believe that he is the best candidate in the electoral race. The arrival of good news could give him a further edge, but bad news could compromise his electoral chances. What would be his stance if a privatization offer was on the table? He may be unwilling to sell the asset, because it would increase the risk of losing his electoral status if he performs poorly despite having handled a bigger budget. That is, we can think that a leading incumbent is information-averse and, as a result, he has an incentive to under-sell the asset. The narrower his electoral lead, the higher his incentives to under-sell because the more damaging a potential arrival of bad news would be.

Let us now consider the second-order political distortions that emerge when we allow the elite to manipulate the information available to voters about the incumbent's competence. In my framework, the elite's commitment to an information manipulation strategy takes two forms. First, they can commit to a signal structure (which we can think of as an investigation) to persuade voters that the incumbent is incompetent; that is, the elite engages in Bayesian persuasion (Kamenica and Gentzkow, 2011). For example, they can devise a project of investigative journalism that would collect information about an office-holder's failures and achievements, which would suggest what type of politician the incumbent is more likely to be. Second, the elite can commit to a timing: use this investigation to attack the incumbent or to threaten him. An information manipulation strategy then consists of an investigation and how to make use of it.

With these preliminaries, suppose again that the elite faces a trailing incumbent. To them, this incumbent's need for information implies that there is always a price that he would accept for the asset. The elite's problem is not to compel him into selling, but to have him sell at cheap prices. How can the elite accomplish this goal?

On the one hand, the elite could use threats. Yet they anticipate that a trailing incumbent needs information and this renders him immune to this strategy. Even further, threats could be entirely counterproductive: the incumbent might have incentives to reject the offer, since by refusing it the incumbent would guarantee that voters would learn both from his performance in office *and* from the investigation —which would be triggered as a consequence.

On the other hand, the elite could attack him. They know that the higher the incumbent's electoral disadvantage, the higher his need for information. By attacking him, the elite can then gamble on the investigation yielding bad news and further tainting his reputation: this would reduce the prices that this incumbent would accept, as a consequence of his even greater need for information. In effect, the elite knows that attacks are risky: just like bad news could reduce the price that he would accept, good news may increase it. But since the incumbent is trailing (i.e. he has relatively low reputation), the likelihood of good news is low and, thus, there is little risk of an attack backfiring. Nevertheless, I show that as a safeguard for the backfiring risk, the elite's optimal investigation would keep this incumbent in his trailing status even if good news ensue —because they value his need for information revelation. Consequently, the elite attacks him in the hope of obtaining a lower price for the public asset.

Consider now a leading incumbent. To the elite, this incumbent's information aversion implies that he may refuse to take an offer for the asset. But then, it is precisely his aversion towards information revelation that makes him vulnerable to the elite's capacity to manipulate voters' beliefs about his type. I show that the elite's optimal investigation involves materializing a leading incumbent's worst fear after bad news: take away his electoral advantage and turn him into trailing. I also show that, in general, the elite prefers threats to attacks. This is because attacks can always backfire if the investigation produces good news, which would improve his reputation and, as a result, further reduce his unwillingness to sell.

The logic above indicates that an incumbent with a very small electoral advantage over his challenger is the most susceptible to this form of influence. The mere threat of the elite's optimal investigation induces such just-leading incumbent to sell the asset at the lowest possible price —and at a huge cost to the welfare of voters. On the other hand, as the incumbent's reputation for competence increases, the effectiveness of threats start to decrease because the less likely it is that the elite's investigation results in bad news about his type. I show that this effectiveness of threats can attenuate to the point where the elite would rather attack him instead. In so doing, the elite gambles on the investigation yielding in bad news: this would turn him into the trailing candidate, whose need for information revelation would make him willing to sell the asset for a relatively cheaper price.

Finally, the findings of this paper also have a key empirical implication for scholars concerned with measuring the influence that special interests exert on the policy-making process. While there is a vast theoretical literature that studies the effects of threats on political decisions (see Dal Bó and Di Tella, 2003; Wolton, 2020), this specific strategy imposes a hard bound on what empirical scholars can do: threats are never materialized in equilibrium. Although threats are also present in this paper, these are restricted for incumbents with a narrow electoral lead. For all other cases, the elite's form of influence involves attacks, which is potentially measurable as it can be observed —for instance, by examining a newspaper's scrutiny of an incumbent politician. That is, this paper's prediction of the effects that attacks may have on equilibrium privatization prices is something that calls to be brought to the data.

1.2 Related literature

This paper builds on the career-concerns and symmetric-uncertainty literature for studying political agency problems between an incumbent politician, who can be of varying ability, and a voter that is concerned with selecting competent office-holders. Among this literature, my model is closest to Ashworth, Bueno de Mesquita, and Friedenberg (2017), who investigate a model in which a politician's type and effort (in my case, a budget) interact in the production function of his performance in office, which triggers incentives to select an effort level so as to manipulate the probability distribution over observable statistics. I follow this insight but apply to a different setting, with the incumbent's problem being the price at which he would accept to sell an asset, taking into account the implications that an increase in the budget will have in his reelection chances due to an increase in the amount of voter learning about his competence.

It also builds on the literature that studies the distortions that lobbying can cause in the policy-making process. A vast amount of scholars have studied the influence of special interest groups through strategies such as campaign contributions or the transmission of policy-relevant information (see Austen-Smith 1996; Grossman and Helpman 2001; Lohmann 1995). This paper, in contrast, belongs to a part of the literature that focuses on outside lobbying, which some authors define as the "attempts by interest group leaders to mobilize citizens outside the policymaking community to contact or pressure public officials inside the policymaking community" (Kollman 1998, 3). Within this literature, outside lobbying has been modeled and understood in several ways, such as the provision of information in order to change the salience of issues (Kollman 1998; Yu 2005); trying to change voters' preferences over policies by affecting the information that media collects and provides to voters (Sobbrio 2011); or reduce the probability of bills being enacted by investing in political advertising (Wolton 2020). In contrast, this paper models and understands outside lobbying as a strategy to manipulate voters' beliefs about a politician's time-invariant characteristics (such as competence) in order to alter the political decisions that are taken.

My model is also close to Dal Bó and Di Tella (2003), and Dal Bó, Dal Bó and Di Tella (2006). In the former, the authors investigate a model where a reelection concerned and unbribable policy-maker has to choose between a good and a bad policy, and where a pressure group chooses a level of punishment if he chooses the good policy —which can, for instance, include legal harassment. They show both that threats can be a cause of distortions even when bribes are absent, and that threats can delay the adoption of good policies if the electoral rewards from holding office is not high enough. And in Dal Bó, Dal Bó and Di Tella (2006), the authors examine the interaction between bribery and threats, in a model where politicians could be bribable, the entry of policy-makers into the public sphere is endogenous but where office-holders do not have electoral motives. They show that threats can increase the effectiveness of bribes: when they are used, it reduces the size of bribes needed to push the public official into transferring to them the resources; hence, in a world with threats, pressure groups are more likely to become active.

There are three main differences with the before-mentioned models. First, a focus on threats may overlook a non-trivial amount of influence when special interests strategically prefer to engage in attacks. In my framework, I therefore allow attacks and threats as strategies to be endogenously chosen. Second, the threat of punishment is not explicitly modelled in the previous papers but parametrized (that is, it is left black-boxed). As such, the parameter can be given different interpretations, such as legal harassment or media attacks. I extend the literature by studying influence as a persuasion attempt, which can be used both as threats and attacks and where its success depends on the incumbent's underlying ability. Finally, in both papers the incentives for a special interest to engage in threats is to exert pressure over an office-holder's decision to take or not take an action —that is, an "extensive margin", such as a yes/no decision. In my model, it is rather the level of an action (the prices that an incumbent would accept for the sale of a public asset, i.e. an "intensive margin") which creates incentives for a special interest to exert influence.

Finally, I also build on the literature that employs Bayesian persuasion as a technology to manipulate voters' beliefs about the incumbent's ability (Kamenica and Gentzkow 2011; Alonso and Câmara 2016). The main technical innovation is that I allow a Bayesian persuasion strategy to be used by the elite as a threat in order to maximise their expected payoff. Additionally, this paper shows that the signal structure by the economic elite is different when the incumbent is trailing or leading, which highlights the importance to account for the ex-ante electoral fortunes of a player when designing a persuasion strategy.

1.3 The Model

I study a two-period ($t \in \{1, 2\}$) game between a representative voter (V); two politicians (J), an incumbent (I) and a challenger (C); and an economic elite (E).[2] The elite wants to buy a public asset, whose control is within the authority of the incumbent. In the first period, the elite can make a take-it-or-leave-it offer to the incumbent to purchase the asset. The incumbent's decision affects the budget available for the provision of public services in both periods.

Politicians can be of "high" or "low" ability (I use ability and competence interchangeably). The set of types is $\Theta = \{0, 1\}$, standing respectively for low and high types. A politician's type $\theta_J \in \Theta$ is fixed but known to all players (symmetric uncertainty), who commonly share a prior $\Pr(\theta_J = 1) = \pi_J \in (0, 1)$.

The provision of public services (g_t) depends on a production technology and a random shock. The production technology indicates how public goods are created from money: it maps the per-period budget available for public services ($b_t \in \mathbb{R}_+$) and the type of the office-holder into an outcome. In period $t \in \{1, 2\}$, the governance outcome is the given

[2] I reserve the pronouns "she" for the voter, "he" for politicians, and "they" for the elite.

by

$$g_t = b_t (1 + \theta_I) + \eta_t \tag{1}$$

where η_t is the random shock, which I assume to be independently drawn from a uniform distribution on $[-1, +1]$ —this is the minimum support to guarantee that resources are never enough to reveal with probability one the incumbent's type, which simplifies the exposition.

The budget for public goods provision depends on the revenues that the public asset generates. This asset is valuable because it produces a per-period unit of money —which implies that the total profitability of the asset across the two periods is equal to two units. The economic elite wants to buy the asset and can offer to the incumbent a price $\lambda \geq \underline{\lambda}$ for it, with $\underline{\lambda} > 1$ being an institutional reservation price.[3] The price that the elite offers is endogenous. If presented with an offer to buy, the incumbent determines whether to take it (and privatize it) or refuse it (and keep the asset under public ownership). As Table 1.1 shows, his decision has an impact on the budget for public goods provision both today and tomorrow.

Table 1.1: Budget for public goods provision

Ownership	$t = 1$	$t = 2$
Public	1	1
Private	λ	0

[3]We can think about the institutional reservation price as the price below which investigations are triggered, imposing the risk of an indictment to the incumbent and an annulment of the sale. The higher the institutional reservation price is, the stronger the institutions to protect the interests of the population (see Dal Bó, Dal Bó, and Di Tella 2003).

Naturally, the elite would like to the incumbent to sell them the asset at a cheap price. To distort the price that he would accept (which I call the "intensive margin"), they can commit to an information manipulation strategy aimed at using their media power to negatively affecting the voter's evaluation of his competence. This commitment takes two forms.

First, they can commit to a timing: before the incumbent makes his privatization decision —which I call an "attack", or conditional on his decision —which I call a "threat". Second, they can commit to a signal structure to manipulate the voter's beliefs about the incumbent's competence; that is, they engage in Bayesian persuasion (Kamenica and Gentzkow 2011).

This investigation can be be intuitively understood as the non-strategic disclosure of the results of an investigative journalism enterprise, such as "a survey [or] some regression analysis" (Austen-Smith 1998, 283), which is endogenously bounded by the fact that the higher the likelihood that the design of the investigation end up supporting the elite's interest (a signal that the incumbent is incompetent), the less informative it is about his true underlying incumbent's ability.

Formally, an investigation Ω consists of a finite realization space $s \in \mathcal{S} = \{0, 1\}$, and a family of likelihood functions over $\mathcal{S}$, $\{\Omega(\cdot|\theta_I)\}_{\theta_I \in \Theta}$, with $\Omega(.|\theta_I) \in \Delta(\mathcal{S})$. Given an investigation Ω and a prior π_I, each signal realization s leads to a posterior belief $\Pr(\theta_I = 1|s) = \mu_s \in \Delta(\Theta)$. Hence, given a prior π_I, an investigation Ω leads to a distribution of posteriors $\tau = \langle \Omega|\pi_I \rangle \in \Delta(\Delta(\Theta))$. The result of such investigation is a signal realization observed by all players.

An information manipulation strategy consists of an investigation and how to use it, which I define as a tuple (Ω, a), with $a \in \{0, 1\}$ stands for using the investigation to "attack" $(a = 1)$ or to "threaten" $(a = 0)$ the incumbent. I also allow the elite to do nothing, which for ease of exposition I leave without explicit notation.

Politicians are both office and legacy motivated. The utility function of politician $J \in \{I, C\}$ in period $t \in \{1, 2\}$ is

$$u_J = \begin{cases} w + (1 - w)\, g_t & \text{if in office} \\ 0 & \text{otherwise} \end{cases}$$

where $w \in (0, 1)$ measures the weights he attaches to office rents relative to his legacy.

By purchasing the asset, the economic elite expects to seize its total profitability. Their utility function is

$$u_G = \begin{cases} 2 - \lambda & \text{if the asset is bought} \\ 0 & \text{otherwise} \end{cases}$$

Finally, the voter only cares about the level of public services. Her utility function in period $t \in \{1, 2\}$ is simply equal to the level of services provided (that is, $u_V = g_t$).

The game proceeds as follows:

- **Period 1:**

  0. Nature draws the politicians' types and the random shocks;

  1. The elite designs an information manipulation strategy. If the strategy includes

an attack, then an investigation is conducted and players observe its signal realization;

2. The elite makes an offer to the incumbent to buy the public asset. If he refuses to sell and the information manipulation strategy included a threat, then an investigation is conducted and players observe its signal realization;
3. The incumbent uses the available budget to provide public services;
4. The voter decides whether to retain the incumbent.

- **Period 2:**

  1. The office-holder uses the available budget to provide public services;
  2. Payoffs are realized and the game ends.

The structure of the game is common knowledge. The per-period budget for public services is observed by all players. The solution concept employed is Perfect Bayesian Equilibrium. In a Perfect Bayesian Equilibrium, (i) the voter optimally decides whether to reelect the incumbent, given her beliefs about the politicians' types; (ii) players' beliefs are derived by Bayes' rule on the equilibrium path; and (iii) the incumbent and the pressure group act optimally given the voter's reelection strategy.

The use of a Bayesian persuasion technology requires to impose two conditions for an equilibrium: (i) when the incumbent is indifferent between privatizing and not privatizing, he chooses to privatize; and, (ii) when the expected competence of the candidates is the same, she votes for the challenger.[4] If any of these conditions does not hold, then it would

[4]This is adopted to simplify the analysis. The equilibrium condition only requires for the voter not to vote for the challenger with probability one.

not be possible to ensure the existence of an optimal signal structure (an investigation) that maximises the elite's expected utility.[5]

I also adopt two indifference-breaking rules. First, when the elite is indifferent between making an offer for the asset or not, they do not make an offer. Although this rule is without loss of generality, it allows more clarity of exposition on the possible distortions generated by the elite —as it is equivalent to saying that the elite would never buy the asset at its market price, that is, at the price at which it would be sold in a perfectly competitive market ($\lambda = 2$).

Second, notice that if the asset is privatized, then the candidates' competence no longer matters. Indeed, this is an artefact which allows me to focus entirely on the revenues that the public asset generates. Adopting this artefact implies that we then need to define an electoral rule if privatization occurs. I assume that the voter elects the challenger when she believes him to be of strictly higher competence than the incumbent; and she elects the incumbent otherwise. Notice further that this indifference-breaking rule would be optimal if I would incorporate an epsilon amount of budget tomorrow coming from any other source of revenues, such as from taxation.

Finally, the following definition will be useful for the analysis:

Definition: Leading and trailing incumbent. An incumbent is leading if the prior belief that he is competent is higher than the prior on the challenger ($\pi_I > \pi_C$); otherwise ($\pi_I \leq \pi_C$), he is trailing.

[5] Formally, these two conditions guarantee the upper semicontinuity of the elite's expected utility along the prior belief that the incumbent is competent, which in turn "ensures the existence of an optimal signal" (Kamenica and Gentzknow, 2011; p. 2596).

1.3.1 Comments on the model

There are five points worth stressing. The first point is the decision to lay out the model in a privatization setting. This particular approach comes with several advantages. One convenience is that privatization is an example of a political choice that can directly affect voters' welfare because of its impact on the public budgets for the provision of public goods and services. Precisely due to this effect, privatization has long been a concern of citizens not only in weak democracies (for Latin America, see Stahl 1994) but also in strong ones (for the United States, see Montagnes and Bektemirov 2018). That is, I focus on a relevant policy problem.

Additionally, this setting allows me to have precise benchmark: in my model, citizens suffer each time the asset is sold below its market price —as I abstract away from aspects such as the efficiency in its management. Put equivalently, by focusing on an office-holder's decision to privatize, I study the type of influence that the public is afraid of —one in which electoral incentives, instead of being a mechanism to discipline politicians, can be the very cause of policy distortions.

The second point concerns any evidence of the edge that economic elites may have on manipulating the information that is available to voters and, perhaps more importantly, any anecdotal evidence that an advantage in this domain would have possibly yielded them a benefit in a privatization process. Regarding the former, a proxy for the advantage that economic elites may have at manipulating information is the documented concentration in media ownership. Empirically, not only media concentration is a rather pervasive phenomenon across countries with different levels of development, but its owners often have financial stakes outside the media sector. In Peru, the Miró Quesada family (with financial stakes in the real estate and construction sectors) owns *El Comercio*, the newspaper with the most circulation of the country. In Mexico, Salinas Group (banking and insurance) owns *TV Azteca*, the second largest media conglomerate. In France, Dassault Group (real estate and aviation) owns *Le Figaro*, one of the newspapers with the largest readership. In the United States, the Murdoch family (with vast stakes in the entertainment industry) owns *The Wall Street Journal*, *The New York Post* and *Fox News*.

And with regards to the latter, the undue influence that the before-mentioned position of advantage could offer to economic elites has been pointed out in different privatization processes. For example, under the administration of president Carlos Menem in Argentina, the member of Congress Alberto Natale denounced irregularities in the privatization of public TV channels. Natale argued that "there was a strong suspicion that the terms of sale for channels 11 and 13 had been designed to favour the local groups Macri and Clarin respectively" (Natale 1993, 102; as cited by Manzetti 1999). This was also the editorial position of the media outlet *Ambito Financiero*, which considered the sale of channel 13 as "appalling" since, in their view, it was "a direct adjudication [that eliminated] three bidders to leave only Clarin" (*Ambito Financiero*, December 26, 1989; as cited by Sivak 2015, 143-144). At the time of this adjudication and until today, Clarin Group owns *Diario Clarin*, the most circulated newspaper of the country. Illicit monetary transactions (such as bribery) were never proven. It is in the view of this paper that, were these alleged irregularities true, the capacity of Clarin Group to manipulate the information available to voters through *Diario Clarin* may not have been an irrelevant factor in the decision to sell channel 13 to them. Specially if we consider, as some scholars suggest, that president Menem “was very sensitive to public opinion trends” given the “hyperinflation outbursts of 1989 and 1990” (Manzetti 1999, 87).

The third point regards the assumption that the elite can commit to triggering threats if the incumbent refuses to sell. This is a common assumption in the lobbying literature, such as with campaign contributions (Grossman and Helpman 2001) or with threats (Dal Bo and Di Tella 2003). Perhaps the most straightforward way to make justify it is to think of a richer model where there are repeated interactions between elite and office-holders. If this is the case, then the elite would not want to build a reputation of engaging on empty threats.

The fourth point is related to the way in which a threat would operate in real life. Although this could happen in explicit language (e.g. “If you do not sell me the public asset, then I will attempt to harm your reputation”), it can also be implicit: in equilibrium, the incumbent would infer the conditions in which the elite’s offer carries a threat if he refuses to sell —as well as the optimal investigation that the elite would use to try to affect his electoral fortunes.

Finally, the fifth point involves the suitability of the persuasion technology. In the general Sender-Receiver model, Bayesian persuasion gives a high commitment power to Sender. This can make it difficult to think about contexts where this assumption is likely to hold, because lying is often costless. In effect, Kamenica and Gentzkow (2011) motivate this technology in a court of law, where a prosecutor (Sender) would incur in the crime of perjury if he lies to the judge (Receiver). *Mutatis mutandis*, a similar rationale applies to this model: in the strongest case, the economic elite may order their team of journalists *how* to address an issue, but the deontological codes of the journalistic profession imposes some constraints in that the elite cannot coerce them into lying or manufacturing evidence.

1.4 Analysis

This section starts by laying out the equilibrium behaviour when the economic elite can only make take-it-or-leave-it offers to purchase the asset. This will be the baseline. Given the privatization prices at baseline, I then examine the elite's incentives to push these prices down down by engaging in information manipulation about the incumbent's competence.

1.4.1 First-order distortions: No information manipulation

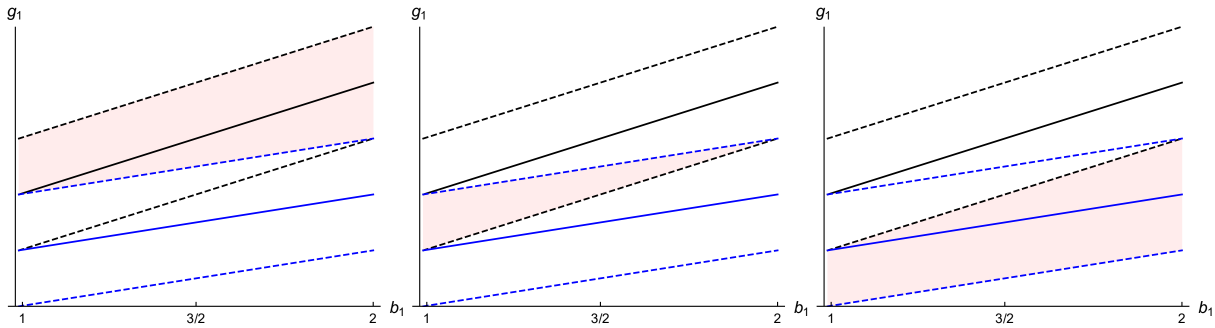
Working through backwards induction, in the second period the office-holder has no strategic options: he provides public services with whatever budget he has available. Thus, all the strategic tensions concentrate in the first period.

By the end of the first period and after observing the incumbent's performance in office, voters think about tomorrow with updated beliefs about his type —which I denote by $\Pr(\theta_I = 1 \,|\, g_1) = \mu_I \in [0,1]$. The voter prefers to vote for the incumbent if and only if

$$\begin{aligned} \mathbb{E}\big[g_2 \,|\, I\,\big] &> \mathbb{E}\big[g_2 \,|\, C\,\big] \\ \mathbb{E}_{\theta_I}\big[b_2\,(1+\theta_I)\big] &> \mathbb{E}_{\theta_C}\big[b_2\,(1+\theta_C)\big] \\ \Leftrightarrow \mu_I &> \pi_C \end{aligned} \tag{2}$$

Anticipating that the voter will only vote for him if she believes him to be more likely to be competent than his challenger, the incumbent internalises that his first-period performance will be crucial for his re-election chances. How much can the voter learn about the incumbent's competence upon observing the provision of public services?

Figure 1.1: Public services and posterior beliefs



Full learning: Competent $\big(g_1 > 1 + b_1\big)$ | No learning $\big(2\,b_1 - 1 \leq g_1 \leq 1 + b_1\big)$ | Full learning: Incompetent $\big(g_1 < 2\,b_1 - 1\big)$

Note. All points within the dashed black (blue) lines are outcomes that can be produced by a competent (incompetent) politician.

As in Izzo (2018), the learning process is stark: players learn everything or nothing about him. To understand how full learning is induced, notice that a low ability incumbent has an upper-bound on how well he can perform, which is given by any budget that he handles *and* the highest positive value that the random shock can take (that is, $1+b_1$). Any provision of public services above that level will reveal with certainty that the incumbent is competent. This is represented in the left panel of Figure 1.1.

Similarly, a high ability incumbent has a lower-bound on how badly he can perform, which is given by any budget that he handles *and* the lowest negative value that the random shock can take (that is, $2\,b_1 - 1$). As it is represented in the right panel of Figure 1.1, any provision of public services below that level will reveal with certainty that the incumbent is incompetent.

And, finally, there are performance levels that can be produced by either a competent and an incompetent incumbent. Upon observing such a performance, the voter will learn nothing about the incumbent's type. This is represented in the middle panel of Figure 1.1.

Lemma 1. *Each level of public services induces the following posterior beliefs about the incumbent's competence:*

(a) If the level of public services is high enough ($g_1 > 1 + b_1$), then the voter learns that the incumbent is of high ability with certainty ($\mu_I = 1$);

(b) If the level of public services is neither too high nor too low ($2\,b_1 - 1 \leq g_1 \leq 1 + b_1$), then the voter learns nothing about the incumbent ($\mu_I = \pi_I$);

(c) If the level of public services is low enough ($g_1 < 2\,b_1 - 1$), then the voter learns that the incumbent is of low ability with certainty ($\mu_I = 0$).

From the standpoint of the incumbent, the amount of voter learning is therefore a random variable. Further, the probability distribution over voter's posterior beliefs critically depends on the budget that he handles for the provision of public services: the larger the budget is, the more informative is his performance in office about his underlying competence —as illustrated in the middle panel of Figure 1.1, the set of outcomes that would lead to no learning shrinks as the budget increases. As a consequence, to the incumbent there is a mapping from the budget that he handles today to the probability that he is reelected at the end of the first period.

Lemma 2. *The probability that an incumbent is retained in office depends on his electoral status with respect to his challenger and on the first-period budget:*

(a) If the incumbent is trailing, then he is reelected with $\Pr(g_1 > 1 + b_1) = \pi_I\, b_1/2$*; and,*

(b) If the incumbent is leading, then he is reelected with $\Pr(g_1 > 2\,b_1 - 1) = 1 - (1 - \pi_I)\, b_1\,/2$*.*

This lemma gives us three main insights. The first is that the reelection probabilities are contingent on the ex-ante electoral status of the incumbent. The reason is that voter's electoral decision (specified in (2)), together with the stark nature of the learning process, results in different standards for reelection.

To see why, consider an incumbent's electoral fortunes if his performance in office results in no learning: while a leading one would be reelected with certainty (because $\pi_I > \pi_C$), a trailing one would be removed (because $\pi_I \leq \pi_C$). Put differently, the burden of proof is harsher on a trailing incumbent: while he needs to prove himself to be competent with certainty in order to be reelected, it is enough for a leading office-holder to prove that he is not incompetent with certainty.

The second insight regards the incumbent's electoral valuation of the marginal effect of increasing the budget he handles. From Lemma 2, it is easy to see that this marginal effect is positive for a trailing incumbent but negative for a leading one. Indeed, this is a result of the different standards for reelection. To the extent that a trailing incumbent needs to prove himself, he craves for information revelation. He thus positively values handling a larger budget because it would increase the informativeness of his performance in office. And because a leading incumbent would be reelected absent new information, he is information averse. To him, handling a larger budget would risk his relatively safe electoral fortunes.

In my setting, the budget that the incumbent handles is not fixed. It is a function of the first-period political decision of whether to privatize the public asset. If he chooses to take some buying offer, then he would handle a higher budget —because privatization would transfer to the present the future resources generated by the asset (see Montagnes and Bektemirov 2018).

With these preliminaries, we can now turn to the elite's problem of choosing how much to offer for the asset. It follows from the above discussion that an offer would be contingent on whether the incumbent is trailing or leading, given that an electoral status determines the direction of an office-holder's valuation of the marginal effect of increasing the first-period budget.

We can start by considering a trailing incumbent.[6] In general, he positively values an

[6]It is arguably of substantive interest to study the case of a trailing incumbent because, as some existing literature suggests, there are settings in which politicians in power can experience an electoral disadvantage by the very virtue of holding office (Klasnja and Titiunik 2017). Additionally, some literature also argues that reelection rates can be very low in developing countries (Golden, Nazrullaeva, and Wolton 2020).

offer to buy the asset: not only would it increase his chances of reelection, but it would also expand his opportunity to build a strong legacy today —as he may not be in office tomorrow. Faced with this incumbent, the elite will then have incentives to push down their offer for the asset as much as possible, precisely because they anticipate his general positive attitude towards privatization.

Proposition 1. *Suppose that the incumbent is trailing and that the elite cannot engage in information manipulation. Then, there exists a unique threshold $\hat{\pi}_I(w) \in (0, \pi_C]$, increasing in $w \in (0,1)$, such that*

(a) If $\pi_I \leq \hat{\pi}_I(w)$, then the elite offers $\lambda = \underline{\lambda}$ and the incumbent accepts; and,

(b) If $\pi_I > \hat{\pi}_I(w)$, then the elite offers $\lambda^{\dagger}(\pi_I, w) \in (\underline{\lambda}, 2)$, which is increasing in $\pi_I \in (0, \pi_C]$ and decreasing in $w \in (0,1)$, and the incumbent accepts.

The above proposition tells us that, in equilibrium, the asset is always privatized when the incumbent is electorally behind. This happens because, in general, this incumbent positively values an offer to buy the asset: not only would it increase his chances of reelection, but it would also expand his opportunity to build a strong legacy today —as he may not be in office tomorrow.

In addition, it tells us that the price at which the asset is sold will critically depend on the extent of his electoral disadvantage with respect to his challenger. When this incumbent's electoral outlooks are bad enough, then it is sufficient for the elite to offer him the institutional reservation price (the lowest possible price at which the asset can be sold). The key reason is that a pronounced electoral disadvantage implies a high chance that he performs poorly in the provision of public services, because the prior belief that he is competent would be low. And since it is likely that he may not be in office tomorrow, selling the asset cheaply would allow him both to build a legacy and boost his possibility of changing his electoral fortunes by proving to be competent.

But as his electoral disadvantage decreases, then the likelihood that he produces good outcomes increases —because the prior that he is competent would increase accordingly. Why would the incumbent sell the asset too cheap if it would shrink his possibilities of building a strong legacy tomorrow? After a threshold on the prior, the elite would need to up their offer.

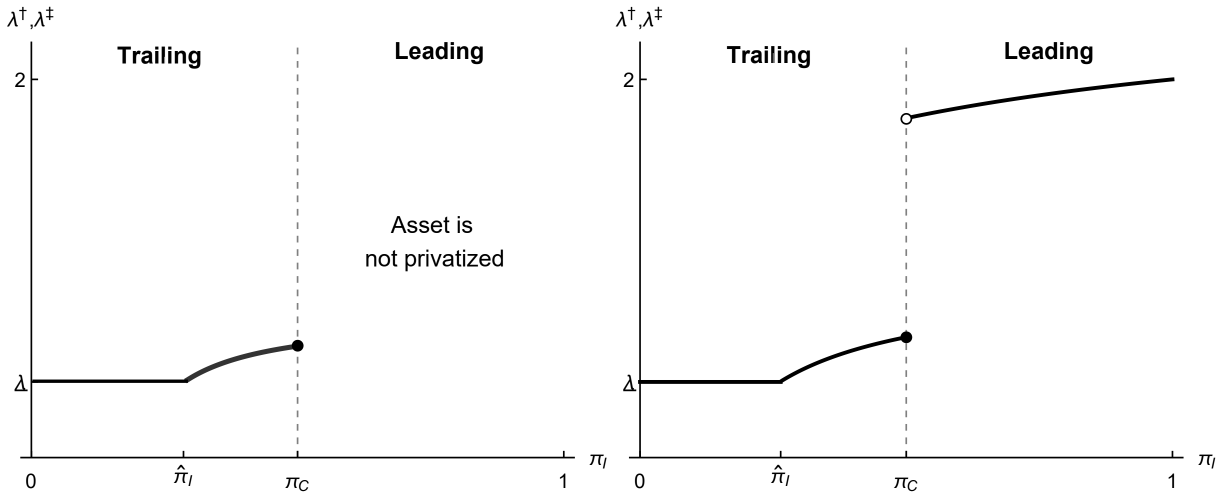
Proposition 2. *Suppose that the incumbent is leading and that the elite cannot engage in information manipulation. Then,*

(a) If $w < 1/2$, then the elite offers $\lambda^{\ddagger}(\pi_I, w) \in (\underline{\lambda}, 2)$, which is increasing in $\pi_I \in (\pi_C, 1)$ and in $w \in (0, 1/2)$, and the incumbent accepts; and,

(b) If $w \geq 1/2$, then the elite does not make an offer and the asset remains under public ownership.

Contrary to the case of a trailing incumbent, Proposition 2 tells us that an electorally advantaged office-holder may not be willing to privatize the asset. This is a consequence of his aversion to an increase in the amount of voter learning if he privatizes. The more he cares about office, the higher his incentives to reject an offer. For a leading incumbent to be willing to sell, it must be the case that the weight that he attaches to office is not too high —as he would rather not risk his chances of reelection otherwise.

Figure 1.2: Endogenous Privatization Prices:
First-order distortions



(a) High office motivation **(b)** High legacy motivation

Note. In the left panel, $w = 1/2$ which induces $\hat{\pi}_I = 2/7$; and in the right panel, $w = 1/10$ which induces $\hat{\pi}_I = 18/71$. In both panels, $\pi_C = 1/2$ and $\underline{\lambda} = 6/5$.

As illustrated in both panels of Figure 1.2, Proposition 2(a) highlights that even when a leading incumbent is open to privatization, he would never sell too cheaply: the prices at which the asset would be sold are strictly above the institutional reservation price. This happens precisely because the electoral fortunes of this incumbent are relatively safe. Albeit selling would allow him to expand the legacy that he builds today, he would never sell too low as it is likely that he also gets to provide public services tomorrow.

Remark 1. *The following inequality holds in equilibrium:* $\lim_{\pi_I \to \pi_C^-} \lambda^\dagger(\pi_I, w) < \lim_{\pi_I \to \pi_C^+} \lambda^\ddagger(\pi_I, w)$.

Finally, consider the standpoint of the voter. Because the elite only makes an buying offer only if the incumbent would accept anything below its market price (i.e. only if $\lambda < 2$), the voter is hurt every time the asset is sold. The lower the equilibrium selling price, the more the voter suffers. We can then think of the equilibrium privatization prices at baseline as first-order distortions when the elite can make take-it-or-leave-it offers for the asset —but not yet engage in manipulation of information. As stressed by Remark 1, and further illustrated in both panels of Figure 1.2, these first-order distortions are more pronounced when the incumbent is trailing (due to his need for information revelation), and are attenuated when he is leading (because of his aversion towards voter learning).

1.4.2 Second-order distortions: Allowing for information manipulation

From the analysis at baseline, we know that the privatization prices absent information manipulation critically depends on the office-holder's political motivations (the weights he attaches to office and legacy) and on his electoral status with respect to his challenger. Although the elite can obviously not affect the former, they could try to affect the latter in order to try to reduce the prices that the incumbent would accept.

Before turning to the analysis, it is useful to recall that an information manipulation strategy by the elite consists of an investigation and how to use it —which I denoted by (Ω, a), with Ω denoting the investigation and $a \in \{0, 1\}$ standing for using such investigation to threaten ($a = 0$) or attacking ($a = 1$) the office-holder. Recall also that an investigation would reveal information about the incumbent's competence: if conducted, it results in a public signal that he is incompetent ($s = 0$) or competent ($s = 1$), and each signal induces the posterior beliefs $\Pr(\theta_I = 1|s = 0) = \mu_0$ and $\Pr(\theta_I = 1|s = 1) = \mu_1$.

Given the analysis in the previous section, we can also examine the implications of the elite's use of some investigation to attack or to threaten the incumbent. If the elite attacks the incumbent before making their offer, then the investigation would result in a signal observed by all players, which would induce updated (posterior) beliefs about the office-holder's competence. Given this posterior, the elite may then present a buying offer. Using the notation at baseline, we can denote the resulting privatization prices by $\lambda(\mu_0, w)$ after a signal of incompetence, and $\lambda(\mu_1, w)$ after a signal of competence.

What is the likelihood that an investigation results in good or bad news about the incumbent's competence? In Bayesian persuasion, the larger the distance between a prior belief and some induced posterior after a signal realization, the lower the unconditional probability that such posterior is induced. For instance, if the posterior belief that would be induced after bad news is closer to the prior than that posterior after good news ($\pi_I - \mu_0 < \mu_1 - \pi_I$), then it is more likely that the investigation yields bad news —that is, $\Pr(s = 0) > \Pr(s = 1)$.[7] From the elite's standpoint, an attack is thus a lottery over optimal buying offers (i.e., $\lambda(\mu_0, w)$ or $\lambda(\mu_1, w)$), and where the lottery is defined by the unconditional probabilities of good or bad news about the incumbent.

If, instead, the elite employs threats, then the incumbent's refusal to take some offer would trigger an investigation. Similarly, we can use the notation at baseline to denote the privatization prices under threats by $\lambda(\pi_I, w \mid (\Omega, 0))$. This stresses that the privatization prices would be determined by the prior beliefs about the incumbent's competence (since no new information would arrive at this moment in time) and also by the investigation after a refusal.

With these preliminaries, we can start by investigating the case where the incumbent

[7]Formally, to push a posterior further down, the investigation would need to reduce the probability of bad news conditional on the incumbent being competent. But then the unconditional probability of bad news would shrink. And by the law of total probability, the unconditional probability of good news would need to increase accordingly.

is trailing. We know, by Proposition 1, that he sells relatively cheap because he needs to prove himself to be competent with certainty in order to be reelected. From his standpoint, privatizing is valuable as it would increase the informativeness of his performance in office —and it can be so valuable for him to accept selling the asset at the institutional reservation price.

Lemma 3. *If the incumbent is trailing, then* $\lambda(\pi_I, w \,|\, (\Omega, 0)) \geq \lambda(\pi_I, w)$ *for any* $\pi_I \in (0, \pi_C]$, $w \in (0,1)$ *and any* $\Omega = \{\Omega(\cdot|\theta_I)\}_{\theta_I \in \Theta}$.

The above lemma says that a trailing incumbent is immune to threats. To understand why, suppose that the elite makes a privatization offer that carries a threat and that it is rejected by the incumbent. From his viewpoint, his reelection chances may no longer lost if his performance in office fails to reveal that he is competent with certainty, because voters could still learn from the results of the investigation.[8] Put differently, it is this incumbent's need for information that renders him immune to this strategy.

To the elite, a threat may rather be counterproductive as it could generate incentives for the incumbent to reject their offer: by refusing to privatize and expecting the investigation to be triggered as a consequence, he would expand his reelection chances since voters would learn from two sources of information (his performance in office and the investigation). And with an (at least weakly) better outlook at building a legacy tomorrow if he refuses to sell, why would he sell the asset cheaper today?

With threats off the table, we can examine attacks. What posterior beliefs about the

[8] Notice that, even if good news cannot change his electoral fortunes ($\mu_1 < \pi_C$), the incumbent would still be strictly indifferent to such a threat.

incumbent's competence should bad or good news induce? From Proposition 1, we know that the incumbent would accept to sell at the institutional reservation price whenever the prior belief that he is competent is lower or equal than a critical threshold ($\pi_I \leq \hat{\pi}_I$). Should bad news induce a posterior belief below that threshold value (i.e. some $\mu_0 < \hat{\pi}_I$)? The answer is no.

As mentioned above, pushing such posterior belief further down the prior (and towards zero) would only reduce the likelihood that it is induced —without any further gains as the price cannot go any lower. To the elite, it is therefore more effective to have bad news making the incumbent just willing to sell the asset at the institutional reservation price (i.e. $\mu_0 = \hat{\pi}_I$). In addition, the elite does not want good news to turn the incumbent into the leading candidate (i.e. induce some $\mu_1 > \pi_C$). As emphasized by Remark 1 and further illustrated in Figure 1.2, this would be detrimental because it would lead to an upward discontinuity in the selling prices and, thereby, make the attack (which is a lottery over later buying offers) too risky.

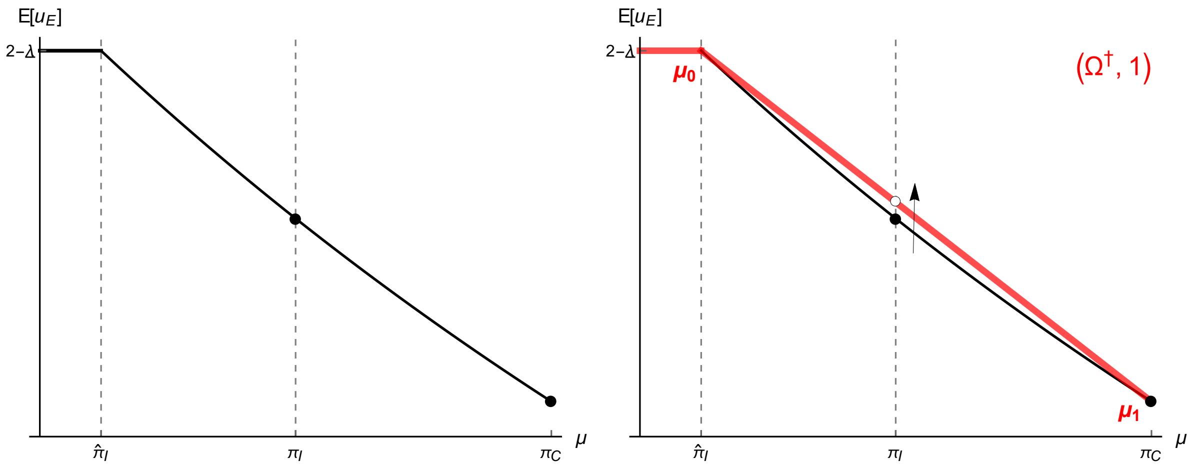
But what about good news inducing a posterior belief that keeps the incumbent with a worst reputation than his challenger (i.e. some $\mu_1 < \pi_C$)? By a similar reasoning, shortening the distance between a prior belief and an induced posterior after good news good would, in effect, increase the unconditional probability that such a posterior is induced. Given the objectives of the elite, this cannot be optimal. Put together, the elite wants good news to push this posterior up (to reduce the chances that it is induced) but not too high for the incumbent to turn into leading. Good news should therefore make the incumbent to be just trailing (i.e. $\mu_1 = \pi_C$).

Lemma 4. *If the incumbent is trailing, then the elite's optimal information manipulation strategy is* $(\Omega^{\dagger}, 1)$*, where* $\Omega^{\dagger}$ *induces either* $\mu_0 = \hat{\pi}_I$ *(the belief at which the incumbent would accept to sell at the institutional reservation price) or* $\mu_1 = \pi_C$*, with*

$$\Pr(s=0) = \frac{\pi_C - \pi_I}{\pi_C - \hat{\pi}_I} \quad \textit{and} \quad \Pr(s=1) = \frac{\pi_I - \hat{\pi}_I}{\pi_C - \hat{\pi}_I}$$

To illustrate the optimality of the information manipulation strategy in Lemma 4, consider the case presented in Figure 1.3. Absent information manipulation, the elite's expected utility is $2 - \lambda^{\dagger}(9/25, 1/10) \approx 0.74$, which is captured by the black dot along the smooth black line of both panels.

Figure 1.3: Elite's expected utility:
Attacking a trailing incumbent



(a) No information manipulation **(b)** Manipulating information

Note. Prior beliefs are $\pi_I = 9/25$ and $\pi_C = 1/2$; the institutional reservation price is $\underline{\lambda} = 6/5$; and the weight politicians attach to office rents is $w = 1/10$.

Lemma 4 tells us that the elite could do increase their expected utility by attacking the incumbent before making the offer. The attack should be done with an investigation that induces the posterior beliefs (i) $\mu_0 = 18/71$ after bad news about the incumbent, and (ii) $\mu_1 = 1/2$ after good news. In addition, it tells us that the unconditional distributions of inducing each of these posteriors are $\Pr(s = 0) \approx 57\%$ and $\Pr(s = 1) \approx 43\%$. If the investigation is launched before making the offer to the incumbent, then the elite's expected payoff would be equal to:

$$
\begin{aligned}
\mathbb{E}[u_E \mid (\Omega^\dagger, 1)] &= \underbrace{\Pr(s=0)\left(2 - \lambda^\dagger\left(\frac{18}{71}, \frac{1}{10}\right)\right)}_{\text{After a signal of incompetence}} + \underbrace{\Pr(s=1)\left(2 - \lambda^\dagger\left(\frac{1}{2}, \frac{1}{10}\right)\right)}_{\text{After a signal of competence}} \\
&\approx 0.75
\end{aligned}
$$

which is an increase in expected utility that is captured by the white dot along the smooth red line in Figure 1.3(b). It is important to notice that even though marginal gains may seem small in this case, these margins are crucial in privatization settings because public assets can be valued at hundreds of millions of U.S. dollars.[9]

Proposition 3. *Suppose that the incumbent is trailing. Then, the belief threshold at which the incumbent would accept to sell at the institutional reservation price, $\hat{\pi}_I(w) \in (0, \pi_C]$, is increasing in $w \in (0, 1)$ and it determines the elite's strategies as follows:*

(a) If $\pi_I \leq \hat{\pi}_I(w)$, then the elite does not engage in any information manipulation strategy, offers $\lambda = \underline{\lambda}$ for the asset, and the incumbent accepts.

(b) If $\pi_I > \hat{\pi}_I(w)$, then the elite attacks the incumbent before making their offer, $(\Omega^\dagger, 1)$,

[9]A similar point is made by Kang (2016) when studying the returns from lobbying in the energy sector. In particular, he argues that although"the effect of lobbying expenditures on a policy's equilibrium enactment probability is very small[,] the average returns from lobbying expenditures are estimated to be over 130%" (294)

which results in the following probability distribution:

(i) *With* $\Pr(s = 0)$, *they offer* $\lambda = \underline{\lambda}$ *for the asset and the incumbent accepts; and,*

(ii) *With* $\Pr(s = 1)$, *they offer* $\lambda = \lambda^{\dagger}(\pi_C, w) \in (\underline{\lambda}, 2)$ *for the asset and the incumbent accepts.*

This proposition stresses that when the incumbent would already accept to sell at the institutional reservation price, there is no incentive to engage in information manipulation since the price for the asset cannot go any lower. In addition, it highlights that attacking the incumbent before making an offer is a gamble: an attack always carries the risk of backfiring if the outcome of the investigation is good news about the incumbent's competence. In equilibrium, however, an attack is optimal because the possibility of the investigation backfiring is optimally minimized.

We can now turn to the case when the elite faces a leading incumbent. From Figure 1.2, we also know that for this incumbent to be willing to sell the asset, his office motivation should not be too high —as the prospects of building a better legacy today following the privatization would be of little value to him. In addition, by Proposition 2(a) we also know that even when this incumbent is willing to sell the asset, absent information manipulation by the elite he would never accept to sell at the institutional reservation price —which is graphically captured by the upward discontinuity in Figure 1.2(b). In both cases, this happens due to a leading incumbent's aversion towards information revelation —recall that, absent new information, this incumbent would be reelected with certainty. But then, it is precisely this incumbent's aversion to new information that can make him highly vulnerable to both threats (a strategy that was off the table for the case of a trailing incumbent) and attacks.

What would be the optimal investigation to be used as a threat? Would it be different than one used for attacks? It turns out that there exists a unique optimal investigation against a leading incumbent, independent of how it is used. The reason is rather simple: there exists a coincidence between (i) the elite's incentive to exploit in their benefit the price discontinuity that happens when the incumbent changes from leading to trailing, and (ii) a leading incumbent's least preferred investigation: one that, if conducted, would maximise the chances of turning him into the trailing candidate.

To understand the above claims, consider possible posterior beliefs after bad news. If a signal of incompetence pushes the beliefs down but not so much as for him to become trailing (some $\pi_C < \mu_0 < \pi_I$), then the elite fails to exploit the sharp discontinuity of prices. Thus, this cannot be optimal. If the elite pushes the posterior further down so as for the incumbent to have a worse reputation than his challenger (some $\mu_0 < \pi_C$), then elite exploits the price discontinuity but it shrinks the likelihood of bad news being the outcome of the investigation. To effectively achieve both objectives, bad news should turn the incumbent into a just trailing candidate (i.e. $\mu_0 = \pi_C$).

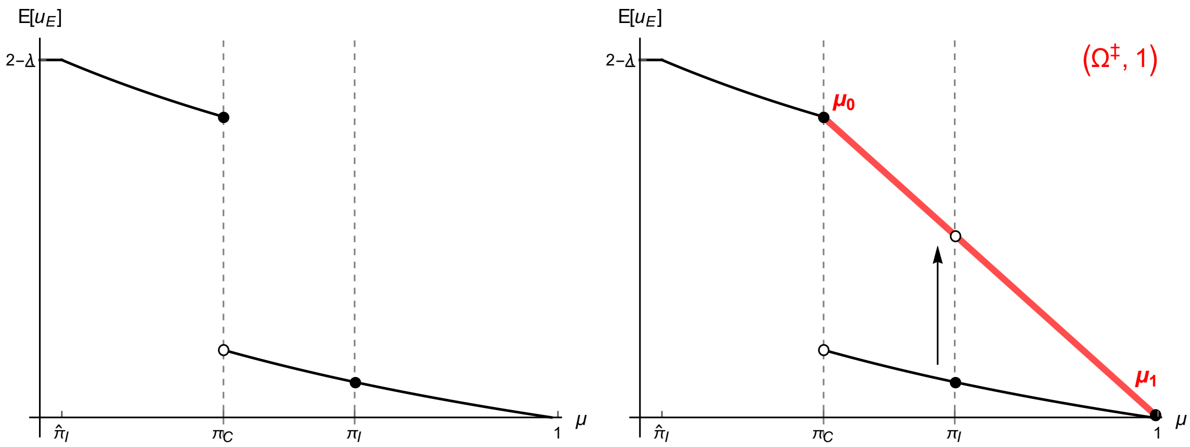
What posterior belief should good news induce? The elite could try to play it safe by having good news inducing a posterior that is bounded away from fully revealing that the incumbent is incompetent (i.e. $\pi_C < \mu_1 < 1$). However, this would also increase the probability that a such posterior is induced. It turns out that, in equilibrium, the elite finds it optimal to fully minimize the chances of good news by way of incompetent politicians never receiving them.

Lemma 5. *If the incumbent is leading, then for any $a \in \{0,1\}$ the elite's optimal investigation, denoted by $\Omega^{\ddagger}$, induces either $\mu_0 = \pi_C$ or $\mu_1 = 1$ with*

$$\Pr(s=0) = \frac{1-\pi_I}{1-\pi_C} \quad \textit{and} \quad \Pr(s=1) = \frac{\pi_I - \pi_C}{1-\pi_C}$$

If a leading incumbent already dreaded the arrival of new information about his ability, he dreads even more an investigation with the above features: good news occur if and only if he is competent, and bad news are the most likely event even if he is truly competent —which would flip his electoral fortunes for the worse.

Figure 1.4: Elite's expected utility:
Attacking a leading incumbent



(a) No information manipulation **(b)** Manipulating information

Note. Prior beliefs are $\pi_I = 7/10$ and $\pi_C = 1/2$; the institutional reservation price is $\underline{\lambda} = 6/5$; and the weight politicians attach to office rents is $w = 1/10$.

Given the optimal investigation against a leading incumbent, should the elite attack or threaten him? We can begin by exploring attacks and, as an illustration, we can consider the case presented in Figure 1.4. Absent information manipulation, the elite's expected utility would be equal to $2 - \lambda^{\ddagger}(7/10, 1/10) \approx 0.08$, which is captured by the black dot along the smooth black line of both panels. But if the elite conducts the investigation given by Lemma 5, which induces beliefs (i) $\mu_0 = 1/2$ after bad news and (ii) $\mu_1 = 1$ after good news, with unconditional probabilities equal to $\Pr(s = 0) = 60\%$ and $\Pr(s = 1) = 40\%$, their expected payoff would be

$$\begin{aligned}\mathbb{E}[u_E \mid (\Omega^{\ddagger}, 1)] &= \underbrace{\Pr(s = 0)\left(2 - \lambda^{\dagger}\left(\frac{1}{2}, \frac{1}{10}\right)\right)}_{\text{After a signal of incompetence}} + \underbrace{\Pr(s = 1)\left(2 - \lambda^{\ddagger}\left(1, \frac{1}{10}\right)\right)}_{\text{After a signal of competence}} \\ &\approx 0.57\end{aligned}$$

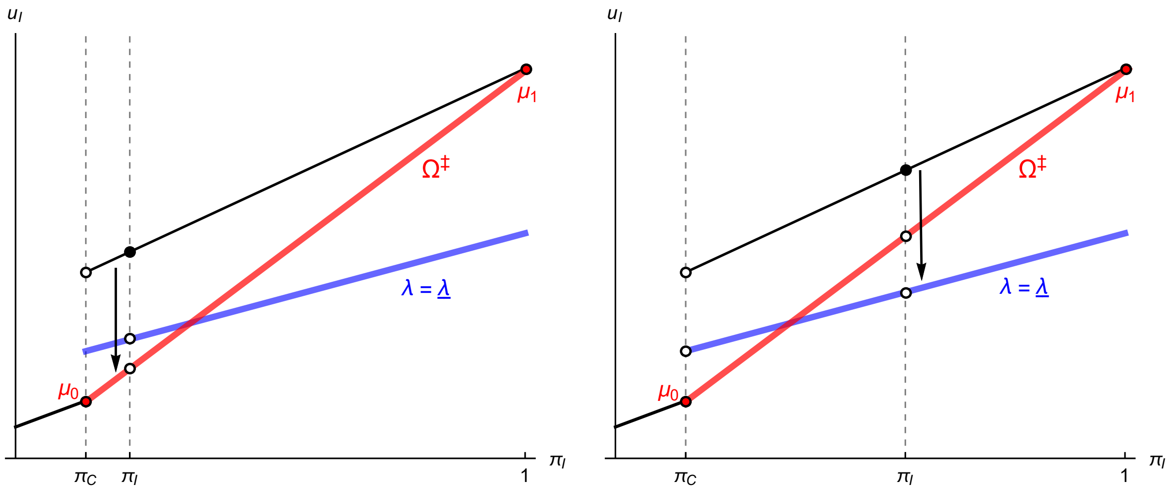
which is an increase in expected utility that is captured by the white dot along the smooth red line in Figure 1.4(b). It is straightforward to see that the significant increase in expected utility is due to the elite's possibility to exploit in their favour the discontinuity in the selling prices. Yet again, attacks make the elite better off but only in expectation because they carry a backfiring risk —which could be avoided by the use of threats.

Figure 1.5 illustrates that the extent to which threats can bring the prices down depends on the incumbent's electoral distance with respect to his challenger. To understand why, consider the case in Figure 1.5(a) where the incumbent's electoral advantage is very small (he is *barely* leading). Then, by Lemma 5, the likelihood that he becomes the trailing candidate if the investigation is conducted is very high.[10] This likelihood is indeed higher than if would choose to sell the asset for whatever price –recall that, by Lemma 1, the amount of voter learning from his performance in office is (i) independent of the electoral

[10]Notice that $\lim_{\pi_I \to \pi_C^+} \Pr(s = 0) = \lim_{\pi_I \to \pi_C^+} \frac{1 - \pi_I}{1 - \pi_C} = 1$.

distance with his challenger, and (ii) it is strictly lower than the investigation as the voter can learn nothing (which would guarantee his reelection).

Figure 1.5: Leading incumbent:
Elite's threat to manipulate information



(a) Low electoral advantage **(b)** High electoral advantage

Note. Prior beliefs are $\pi_C = 1/2$; the institutional reservation price is $\underline{\lambda} = 6/5$; and the weight politicians attach to office rents is $w = 1/10$.

Against a barely leading incumbent, threats can hence be very effective: it would sufficient for the elite to offer him the institutional reservation price, because his expected utility from taking it (the white dot along the blue line) would be strictly higher than if he refuses it (the white dot along the red line). To the elite, using threats then dominate attacks. Not only would they avoid the backfiring risk of attacks, but they can bring the selling price down to its institutional floor level.

But as the incumbent's electoral lead increases, the chances that the investigation turns him into trailing decreases —equivalently, the chances of good news start to increase accordingly. As illustrated in Figure 1.5(b), the power of threats can be reduced to the point where the incumbent would not accept the institutional reservation price; he is better off rejecting it and try his luck with voters learning both from his performance in office *and* the elite's investigation.

Although selling the asset cheaply may keep his chances of reelection high (as the investigation would not be conducted), it would shrink the legacy that he is able to build as an office-holder. In order to buy the asset, the elite would therefore need to up their offer. Can this amount become large enough for the elite to change their strategy from threats to attacks (which can backfire)? The answer is yes.

Proposition 4. *Suppose that the incumbent is leading. Then, there exists a unique threshold* $\tilde{\pi}_I(w) \in (\pi_C, 1)$ *increasing in* $w \in (0, 1)$*, such that*

(a) If $\pi_I \leq \tilde{\pi}_I(w)$*, then the elite threatens the incumbent,* $(\Omega^\ddagger, 0)$*, offers* $\lambda \in \min\{\underline{\lambda}, \lambda^\ddagger\left(\pi_I, w \,|\, (\Omega^\ddagger, 0)\right)\}$ *for the asset, with* $\lambda^\ddagger\left(\pi_I, w \,|\, (\Omega^\ddagger, 0)\right)$ *increasing in* $\pi_I \in (\pi_C, 1)$ *and decreasing in* $w \in (0, 1)$*, and the incumbent accepts.*

(b) If $\pi_I > \tilde{\pi}_I(w)$*, then the elite attacks the incumbent before making their offer,* $(\Omega^\ddagger, 1)$*, which results in the following probability distribution:*

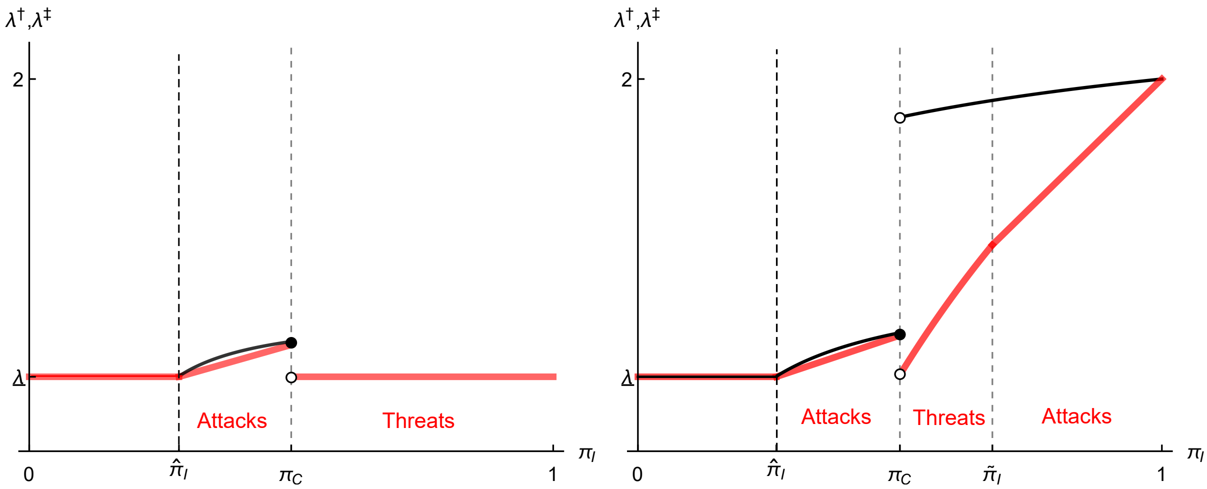
(i) With $\Pr(s = 0)$*, they offer* $\lambda = \lambda^\dagger(\pi_C, w)$ *and the incumbent accepts; and,*

(ii) With $\Pr(s = 1)$*, they offer nothing for the asset and it remains under public ownership.*

There are two key messages in the above proposition. The first is that the threshold that determines the elite's switch from using threats to attacks is increasing in the incumbent's office-motivation. Indeed, the more he cares about holding office, the higher his fear of this investigation being conducted after rejecting an offer.

As illustrated in Figure 1.6(a), a high enough office-motivation can make threats sufficient for the elite to buy the asset at the institutional reservation price —rendering attacks unnecessary altogether. Higher office-motivation implies a more frequent use of threats and, by Proposition 4(a), it also lowers the offer that the incumbent would accept for the asset.

Figure 1.6: Endogenous Privatization Prices:
Second-order distortions



(a) High office motivation **(b)** High legacy motivation

Note. In the left panel, $w = 7/10$, $\pi_C = 1/2$ and $\underline{\lambda} = 11/10$, which induces $\hat{\pi}_I \approx 0.128$. And, in the right panel, $w = 3/10$, $\pi_C = 1/2$ and $\underline{\lambda} = 11/10$, which induces $\hat{\pi}_I \approx 0.114$ and $\hat{\pi}_I \approx 0.676$.

The second message of Proposition 4, which is illustrated in Figure 1.6(b), is that attacks can emerge when the incumbent's electoral lead becomes high enough and when the weight that he attaches to office is low enough. Because this incumbent cares sufficiently about his legacy and because the likelihood of bad news decreases along with his electoral lead, the decreasing effectiveness of threats triggers incentives for the elite to gamble on attacking the incumbent before making an offer: if the attack is successful (the investigation results in bad news), then the incumbent's electoral fortunes would be turned upside down and he would become the trailing candidate —who would accept a strictly cheaper price for the asset given his demand for information revelation.

Finally, we consider again the standpoint of the voter whom, as emphasized in the previous section, is hurt whenever the asset is sold below its market price. As illustrated in Figure 6, the equilibrium privatization prices are significantly lower when the elite can complement their buying offer with an information manipulation strategy (the red lines in both panels) relative when they can only make offers (the black lines in both panels). We can think of this as second-order distortions, which can actually be at odds than the previously analysed first-order ones.

To understand the previous assertion, recall that in the absence of information manipulation, the voter suffered more when the incumbent was electorally trailing precisely because of his need for information revelation. But it is now a leading office-holder which can make the voter worse off, as he can even accept to privatize the asset at the lowest possible price precisely due to his aversion towards new information.

Put differently, the findings in this section highlight that we cannot understand the distortions that the elite can cause in the selling prices without considering their capacity to threaten (Dal Bo and Di Tella, 2003; Wolton, 2020) but *also* to attack an incumbent office-holder with manipulating the information that is available to voters about their time-invariant characteristics, such as their competence.

1.5 Allowing for savings

In this subsection, I allow for the incumbent to save the first-period revenues of the public asset. To do this, I introduce a small modification to the model by expanding the action space of the incumbent, who now also chooses an amount $\sigma \in \mathbb{R}_+$ of savings to be spent in the second period.

In light of the analysis in the previous sections, it is somewhat straightforward to see that, in equilibrium, an incumbent's decision to save is stark. Consider a trailing incumbent. If he craves for information revelation, why would he make his performance in office *less* informative about his competence by saving part of the budget for spending tomorrow? Indeed, a trailing incumbent saves nothing.

Table 1.2: Budget for public goods provision with savings

	$t = 1$	$t = 2$
Control	$1 - \sigma$	$1 + \sigma$
Privatize	$\lambda - \sigma$	σ

Consider now a leading incumbent. If he is averse to information, why would he not choose to save everything today? By saving everything, we know by Lemma 1(b) that his performance in office would be completely uninformative to the voter. As a consequence, he would guarantee to be reelected with certainty, grab office rents and build his legacy safely tomorrow.

Lemma 6. *If the incumbent is trailing, then he does not save the revenues of the asset* $(\sigma = 0)$*; and if he is leading, then he saves everything* $(\sigma = b_1)$*.*

Substantively, the key endeavor is to understand how can expanding the incumbent's action space affect both the strategies of the elite and the privatization prices. As I argue below, allowing the incumbent to save part of the budget can actually make the voter worse off.

From the elite's viewpoint, the possibility of savings does not affect the optimality of their behaviour against a trailing incumbent. Against this office-holder, nothing changes as he saves nothing; that is, he does not make use of his expanded action space. Thus, all results remain as given by the previous sections.

However, an electorally advantaged incumbent does make use of savings. Further, Lemma 6 tells us that this incumbent would save everything in order to shut down any the informativeness of his performance in office. But then, the voter may be able to extract information about this office-holder's competence from one (and only one) information source: the elite's investigation. Were the elite to conduct the investigation, then to the incumbent he would go from being a sure winner (since he would save all the budget for spending tomorrow) to a possibly sure loser unless he proves himself to be competent with certainty (since he may turn into the trailing candidate).

Proposition 5. *Suppose that the incumbent is leading and that savings are allowed. Then, the following inequalities hold in equilibrium:*

(a) The elite engages in threats more frequently: $\tilde{\pi}_I(w|\sigma^* = 1) > \tilde{\pi}_I(w|\sigma = 0)$*; and,*

(b) Privatization prices weakly decrease: $\lambda^\ddagger\left(\pi_I, w\,|\sigma^* = 1,\, (\Omega^\ddagger, 0)\right) \leq \lambda^\ddagger\left(\pi_I, w\,|\sigma = 0,\, (\Omega^\ddagger, 0)\right)$.

The above proposition tells us that, when savings are allowed, all the results from the previous section continue to hold but with some caveats. First, the elite engages in threats more frequently relative to the case when savings are not allowed. Intuitively, this is a consequence of the leading incumbent being able to save everything to guarantee his reelection: to the extent that the voter would only be able to learn from the elite's investigation, it puts them in a stronger position to exert influence. As a consequence, the very threat of conducting the investigation can be further effective for wider values on the prior beliefs about this incumbent's competence.information manipulation, the elite may be able to bring the privatization prices even further down.

1.6 Concluding remarks

This paper shows how an economic elite can complement their take-it-or-leave-it offers for a public asset by manipulating information about the incumbent's competence. By attacking an incumbent office-holder (trying to uncover bad news about his competence before his decision to sell) or threatening him (menacing to uncover bad news if he refuses to sell), the elite can further reduce the equilibrium privatization prices.

I have shown how, in the absence of information manipulation, a trailing incumbent's need for information revelation makes him accept lower offers for the public asset relative to a leading one —who is instead averse to the arrival of new information. But once we give an economic elite the capacity to manipulate information available to voters about politicians competence, the political incentives to privatize can reverse: a leading incumbent can sell at a lower price than a trailing one precisely because of his aversion of information. This reversal of incentives emphasize that we cannot understand the distortions in policy without taking into account elite's capacity to manipulate the information that is available to voters about office-holder's time-invariant characteristics, such as their competence.

In addition, I have shown that although in general elite's employ attacks against a trailing incumbent and threats against a leading one, there are non-obvious subtleties that emerge in equilibrium. In particular, optimal strategies can be non-monotonic along voter's prior beliefs about the incumbent's competence: elites can employ attacks, followed by threats, and back to attacks again. Understanding these non-monotonicity of strategies are of substantive importance because of its different effects on the equilibrium privatization prices, which can themselves become non-monotonic as a consequence.

Finally, it is important to note that the mechanism of influence that this paper studies can also be applied to other policy domains —precisely because, as argued in previous sections, it allows elites to harm any politician's north star: his chances of being reelected. Either if it is some policy with similar budgetary consequences as privatization —for example, if the elite wants the incumbent to engage in borrowing in order to benefit from the effects that public spending may have on fiscal multipliers; or if the political decision involves an incumbent's choice of a tax rate. An interesting area of future work is to apply this form of influence to other policy domains, in order to study both the elite's strategies and the magnitude of the distortions that it can generate in the policy-making process.

References

Alonso, Ricardo, and Odilon Câmara. 2016. "Persuading voters." *American Economic Review* 106(11): 3590-3605.

Ashworth, Scott, Ethan Bueno de Mesquita, and Amanda Friedenberg. 2017. "Accountability and information in elections." *American Economic Journal: Microeconomics* 9(2): 95-138.

Austen-Smith, David. 1996. "Interest groups: Money, information and influence." In *Perspectives on public choice: A Handbook*, ed. Dennis Mueller. Cambridge: Cambridge University Press, p. 296-321.

Austen-Smith, David. 1998. "Allocating access for information and contributions." *Journal of Law, Economics, & Organization* 14(2): 277-303.

Ernesto Dal Bó and Rafael Di Tella. 2003. "Capture by Threat." *The Journal of Political Economy* 111(5): 1123–1154.

Dal Bó, Ernesto, Dal Bó, Pedro, and Di Tella, Rafael. 2006. "Plata o Plomo?': Bribe and Punishment in a Theory of Political Influence." *The American Political Science Review* 100(1): 41–53.

Matthew Gentzkow, and Emir Kamenica. 2014. "Costly Persuasion." *The American Economic Review* 104(5): 457–462.

Gene M. Grossman, and Elhanan Helpman. 1994. "Protection for Sale." *The American Economic Review* 84(4): 833–850.

Golden, Miriam, Nazrullaeva, Eugenia, and Wolton, Stephane. 2020. "Politics in Poor Places? Clientelism and Elections in Democracies". http://dx.doi.org/10.2139/ssrn.3602680. (Accessed December 23, 2020).

Grossman, Gene M., and Helpman, Elhanan. 2001. *Special Interest Politics*. Cambridge, Mass.: MIT Press.

Izzo, Federica. 2018. "With friends like these, who needs enemies?." London School of Economics, working paper. shorturl.at/tSTZ4. (Accessed March 01, 2021).

Kollman, Ken. 1998. *Outside Lobbying: Public Opinion and Interest Group Strategies.* Princeton, N.J.: Princeton University Press.

Emir Kamenica, and Matthew Gentzkow. 2011. "Bayesian Persuasion." *The American Economic Review* 101(6): 2590-615.

Kang, Karam. 2016. "Policy influence and private returns from lobbying in the energy sector." *The Review of Economic Studies* 83(1): 269-305.

Klasnja, Marko, and Titiunik, Rocío. 2017. "The Incumbency Curse: Weak Parties, Term Limits, and Unfulfilled Accountability." *The American Political Science Review* 111(1): 129-148.

Lohmann, Susanne. 1995. "Information, access, and contributions: A signaling model of lobbying." *Public Choice* 85(3): 267-284.

Manzetti, Luigi. 1999. *Privatization South American style* (Oxford studies in democratization). Oxford: Oxford University Press.

Mayhew, David. 2004. *C*ongress: The electoral connection". New Haven; London: Yale University Press.

Montagnes, B. Pablo., & Bektemirov, Baur. 2018. "Political Incentives to Privatize." *The Journal of Politics* 80(4): 1254-1267.

Potters, Jan, and Van Winden, Frans. 1990. "Modelling political pressure as transmission of information." *European Journal of Political Economy* 6(1): 61-88.

Snyder, James, and Ting, Michael. 2008. "Interest groups and the electoral control of politicians." *Journal of Public Economics* 92(3): 482-500.

Sobbrio, Francesco. 2011. "Indirect lobbying and media bias." *Quarterly Journal of Political Science* 6(3-4): 235-274.

Stahl, Karin. 1994. "Política social en América Latina. La privatización de la crisis." *Nueva sociedad* 131: 48-71.

Wolton, Stephane. 2020. "Lobbying, inside and out: how special interest groups influence policy choices." http://dx.doi.org/10.2139/ssrn.2190685. (Accessed December 27, 2020).

Yu, Zhihao. 2005. "Environmental protection: A theory of direct and indirect competition for political influence." *The Review of Economic Studies* 72(1): 269-286.

1.8 Appendix

1.8.1 Proof of Lemma 1.

Proof. Let $g_1^+ = \{g_1 : g_1 > 1 + b_1\}$, $g_1^- = \{g_1 : g_1 < 2\,b_1 - 1\}$ and $g_1^\varnothing = \{g_1 : 2\,b_1 - 1 \leq g_1 \leq 1 + b_1\}$. Upon observing a performance level in $g_1 \in g_1^+$, Bayesian updating yields

$$\begin{aligned}\Pr\left(\theta_I = 1 | g_1 \in g_1^+\right) &= \frac{\Pr\left(g_1 \in g_1^+ | \theta_I = 1\right)\,\Pr(\theta_I = 1)}{\Pr\left(g_1 \in g_1^+ | \theta_I = 1\right)\,\Pr(\theta_I = 1) + \Pr\left(g_1 \in g_1^+ | \theta_I = 0\right)\,\Pr(\theta_I = 0)}\\ &= \frac{\Pr\left(g_1 \in g_1^+ | \theta_I = 1\right)\,\Pr(\theta_I = 1)}{\Pr\left(g_1 \in g_1^+ | \theta_I = 1\right)\,\Pr(\theta_I = 1) + 0\,\Pr(\theta_I = 0)} = 1\end{aligned}$$

The procedure is similar for the posterior induced by an outcome in $g_1 \in g_1^-$. Upon observing an outcome in $g_1 \in g_1^\varnothing$, Bayesian updating yields

$$\begin{aligned}\Pr\left(\theta_I = 1 | g_1 \in g_1^\varnothing\right) &= \frac{\Pr\left(g_1 \in g_1^\varnothing | \theta_I = 1\right)\,\Pr(\theta_I = 1)}{\Pr\left(g_1 \in g_1^\varnothing | \theta_I = 1\right)\,\Pr(\theta_I = 1) + \Pr\left(g_1 \in g_1^\varnothing | \theta_I = 0\right)\,\Pr(\theta_I = 0)}\\ &= \frac{\Pr\left(2\,b_1 + \eta \leq 1 + b_1\right)\,\pi_I}{\Pr\left(2\,b_1 + \eta < 1 + b_1\right)\,\pi_I + \Pr\left(b_1 + \eta \geq 2\,b_1 - 1\right)\,(1 - \pi_I)}\\ &= \frac{\Pr\left(\eta \leq 1 - b_1\right)\,\pi_I}{\Pr\left(\eta < 1 - b_1\right)\,\pi_I + \left(1 - \Pr\left(\eta \leq b_1 - 1\right)\right)(1 - \pi_I)}\\ &= \frac{\left(\frac{2 - b_1}{2}\right)\,\pi_I}{\left(\frac{2 - b_1}{2}\right)\,\pi_I + \left(1 - \frac{b_1}{2}\right)\,(1 - \pi_I)} = \pi_I\end{aligned}$$

which completes the proof. ■

1.8.2 Proof of Lemma 2.

Proof. Given the voter's retention rule given by (2), an incumbent computes his re-election chances. For a leading incumbent, his probability of reelection is

$$\begin{aligned}
\Pr\left(g_1 \notin g_1^-\right) &= \Pr\left(b_1\left(1+\theta_I\right)+\eta_1 \geq 2\,b_1-1\right) \\
&= \pi_I\ \Pr\left(2\,b_1+\eta_1 \geq 2\,b_1-1\right)+\left(1-\pi_I\right)\Pr\left(b_1+\eta_1 \geq 2\,b_1-1\right) \\
&= \pi_I+\left(1-\pi_I\right)\left(1-\Pr(\eta_1 \leq b_1-1)\right) \\
&= 1-\frac{\left(1-\pi_I\right)b_1}{2}
\end{aligned}$$

Whereas for a trailing incumbent, his chances of retention are

$$\begin{aligned}
\Pr\left(g_1 \in g_1^+\right) &= \Pr\left(b_1\left(1+\theta_I\right)+\eta_1 \geq 1+b_1\right) \\
&= \pi_I\ \Pr\left(2\,b_1+\eta_1 \geq 1+b_1\right)+\left(1-\pi_I\right)\Pr\left(b_1+\eta_1 \geq 1+b_1\right) \\
&= \pi_I\Big(1-\Pr(\eta_1 \leq 1-b_1)\Big) \\
&= \frac{\pi_I\,b_1}{2}
\end{aligned}$$

which completes the proof. ■

For the proofs to follow below, I introduce the following notation: denote by $e \in \{0,1\}$ the voter's decision to oust or retain the incumbent, respectively; and denote by $d \in \{0,1\}$ the incumbent's decision to not privatize and privatize the asset upon presented some offer $\lambda \in (\underline{\lambda}, 2)$ by the elite, respectively.

1.8.3 Proof of Proposition 1.

Proof. We find the price that leaves a trailing incumbent indifferent between selling and not selling the asset. His expected utility from not taking the offer is

$$
\begin{aligned}
\mathbb{E}\left[u_I \,|\, d=0\right] &= \mathbb{E}\left[(1-w)\, g_1 + \mathbb{1}_{\{\mathrm{e}=1\}}\ \left(w + (1-w)\ g_2\right) |d=0\right] \\
&= (1-w)\left(2\,\pi_I + (1-\pi_I)\right) + \frac{\pi_I}{2}\Big(w + 2(1-w)\Big) \\
&= (1-w) + \frac{(4-3\,w)\,\pi_I}{2} \qquad (3)
\end{aligned}
$$

Notice that $\mathbb{E}[g_1|d=0] < \mathbb{E}[g_2|d=0, e=1]$ because the second period legacy building accounts for a selection effect: if a trailing incumbent gets reelected, it must be that he is a high type with certainty. If he takes the privatization offer, his expected utility is

$$
\begin{aligned}
\mathbb{E}\left[u_I \,|\, d=1\right] &= \mathbb{E}\left[(1-w)\, g_1 + \mathbb{1}_{\{\mathrm{e}=1\}}\ \left(w + (1-w)\ g_2\right) |d=1\right] \\
&= (1-w)\left(2\,\pi_I\lambda + \lambda(1-\pi_I)\right) + \frac{\lambda\,\pi_I}{2}\big(w\big) \\
&= \lambda\Big((1-w) + \frac{(2-w)\,\pi_I}{2}\Big) \qquad (4)
\end{aligned}
$$

The incumbent is indifferent between selling and not selling the asset if and only if

$$
\begin{aligned}
\mathbb{E}\left[u_I \,|\, d=0\right] &= \mathbb{E}\left[u_I \,|\, d=1\right] \\
(1-w) + \frac{(4-3\,w)\,\pi_I}{2} &= \lambda\Big((1-w) + \frac{(2-w)\,\pi_I}{2}\Big) \\
\Leftrightarrow \lambda &= \frac{2\,(1-w) + \ \pi_I(4-3\,w)}{\pi_I(2-w) + 2(1-w)} := \lambda^{\dagger}(\pi_I, w)
\end{aligned}
$$

Recall that $\underline{\lambda} > 1$. It is easy to check, by inspection, that that $\lim_{\pi_I \to 0} \lambda^{\dagger}(\pi_I, w) = 1$ for any $w \in (0,1)$, so he would always accept $\lambda = \underline{\lambda}$. Suppose now that there exists some $w \in (0,1)$ such that

$$\begin{aligned} \lim_{\pi_I \to 1} \lambda^{\dagger}(\pi_I, w) &= 1 \\ \frac{6 - 5\,w}{4 - 3\,w} &= 1 \\ \Leftrightarrow w &= 1 \end{aligned}$$

which is a contradiction, so it must be that $\lim_{\pi_I \to 1} \lambda^{\dagger}(\pi_I, w) > 1$. Consequently, there must exist a value $\hat{\pi}_I(w) \in (0, \pi_C]$ such that $\lambda^{\dagger}(\hat{\pi}_I, w) = \underline{\lambda} > 1$. Algebraically (and this will be useful for later in the analysis), we can recover this by solving

$$\begin{aligned} \frac{2\,(1-w) + \pi_I(4 - 3\,w)}{\pi_I(2-w) + 2(1-w)} &= \underline{\lambda} \\ \Leftrightarrow \pi_I &= \frac{2((1-w)(\underline{\lambda} - 1))}{4 - 3\,w - \underline{\lambda}(2-w)} \end{aligned} \tag{5}$$

Finally, it is easy to verify that

$$\begin{aligned} \frac{\partial \lambda^{\dagger}(\pi_I, w)}{\partial w} &= -\frac{2\,(\pi_I)^2}{((2+\pi_I)\,w - 2(1+\pi_I))^2} \; < 0 \\ \frac{\partial \lambda^{\dagger}(\pi_I, w)}{\partial \pi_I} &= \frac{4\,(1-w)^2}{((2+\pi_I)\,w - 2(1+\pi_I))^2} \; > 0 \end{aligned}$$

which completes the proof. ■

1.8.4 Proof of Proposition 2.

Proof. As before, we find the price that leaves a leading incumbent indifferent between selling and not selling the asset. To emphasize that his legacy-building prospects in the second period has a richer selection effect, I write his expected utility from not privatizing as

$$\begin{aligned}
\mathbb{E}\left[u_I|d=0\right] &= \mathbb{E}\left[(1-w)g_1 + \mathbb{1}_{\{\mathrm{e}=1\}}\ (w+(1-w)\ g_2)\,|d=0\right] \\
&= (1-w)(1+\pi_I) + \Pr\left(g_1 \in g_1^{+}\right)\ \Big(w+2\,(1-w)\Big) + \Pr\left(g_1 \in g_1^{\varnothing}\right)\ \Big(w+(1-w)(1+\pi_I)\Big) \\
&= (1-w)(1+\pi_I) + \frac{\pi_I}{2}\Big(w+2\,(1-w)\Big) + \frac{1}{2}\Big(w+(1-w)(1+\pi_I)\Big) \\
&= \frac{3-2\,w+(5-4\,w)\,\pi_I}{2} \qquad (6)
\end{aligned}$$

And if he takes the privatization offer, his expected utility is

$$\begin{aligned}
\mathbb{E}\left[u_I\,|\,d=1\right] &= \mathbb{E}\left[(1-w)\,g_1 + \mathbb{1}_{\{\mathrm{e}=1\}}\ (w+(1-w)\ g_2)\,|d=1\right] \\
&= (1-w)(1+\pi_I) + \Pr\left(g_1 \in g_1^{+}\right)\ \big(w\big) + \Pr\left(g_1 \in g_1^{\varnothing}\right)\ \big(w\big) \\
&= w + \lambda\Big(1+\pi_I - \frac{(3+\pi_I)\,w}{2}\Big) \qquad (7)
\end{aligned}$$

The incumbent is indifferent between selling and not selling the asset if and only if

$$\begin{aligned}
\mathbb{E}\left[u_I\,|\,d=0\right] &= \mathbb{E}\left[u_I\,|\,d=1\right] \\
\frac{3-2\,w+(5-4\,w)\,\pi_I}{2} &= w + \lambda\Big(1+\pi_I - \frac{(3+\pi_I)\,w}{2}\Big) \\
\Leftrightarrow \lambda &= \frac{(4\,w-3)+(4\,w-5)\pi_I}{(3\,w-2)-(2-w)\pi_I} := \lambda^{\ddagger}(\pi_I, w)
\end{aligned}$$

An incumbent is unwilling to sell if he would sell at a value higher than the asset's market price. That is, if

$$\lambda^{\ddagger}(\pi_I, w) > 2$$

$$(4\,w-3)+(4\,w-5)\pi_I > 2((3\,w-2)-(2-w)\pi_I)$$

$$(1-\pi_I)(2\,w-1) > 0$$

$$\Leftrightarrow w > 1/2$$

from where it follows that if $w \leq 1/2$, then $\lambda^{\ddagger}(\pi_I, w) \leq 2$. Assume henceforth that $w \leq 1/2$. It is easy to verify that $\lim_{\pi_I \to 1} \lambda^{\ddagger}(\pi_I, w) = 2$. Notice now that

$$\frac{\partial \lambda^{\ddagger}(\pi_I, w)}{\partial w} < 0$$

$$\frac{1+\pi_I(2-3\,\pi_I))}{(3\,w-2-(2-w)\pi_I)^2} < 0$$

$$\Leftrightarrow 1+\pi_I(2-3\,\pi_I)) < 0 \Leftrightarrow \pi_I < 0 \text{ or } \pi_I > 1$$

which is a contradiction. Therefore, it must be that $\partial \lambda^{\ddagger}(\pi_I, w)/\partial w > 0$. Additionally, notice that

$$\frac{\partial \lambda^{\ddagger}(\pi_I, w)}{\partial \pi_I} = \frac{4(1-w)(2\,w-1)}{(3\,w-2-(2-w)\pi_I)^2} < 0$$

$$\Leftrightarrow w > 1/2$$

which is a contradiction. Therefore, it must be that $\partial \lambda^{\ddagger}(\pi_I, w)/\partial \pi_I > 0$. With these two insights, it is easy to verify that

$$\overbrace{\lim_{\substack{w\to 0\\ \pi_I\to 0}} \lambda^{\ddagger}(\pi_I, w)}^{\text{Lowest selling price}} = \frac{3}{2}$$

which implies that the incumbent never sells at the institutional reservation price unless $\underline{\lambda} > 3/2$ —that is, unless it is exogenously required to obtain at least 75% of the asset's market price. ■

1.8.5 Proof of Remark 1.

Proof. We know from Propositions 1 and 2 we know that (i) $\lambda^{\dagger}(\pi_I, w)$ is increasing in $\pi_I \in (0, \pi_C]$ and decreasing in $w \in (0, 1)$; and (ii) $\lambda^{\dagger}(\pi_I, w)$ is increasing both in $\pi_I \in (\pi_C, 1)$ and $w \in (0, 1/2]$. If there exists parameter values such that Remark 1 would not to hold, then it would be under the following conjecture:

$$\overbrace{\lim_{w\to 0}\left(\lim_{\pi_I\to 1} \lambda^{\dagger}(\pi_I, w)\right)}^{\text{Highest price if trailing}} > \overbrace{\lim_{w\to 0}\left(\lim_{\pi_I\to 0} \lambda^{\ddagger}(\pi_I, w)\right)}^{\text{Lowest price if leading}}$$
$$\frac{3}{2} > \frac{3}{2}$$

which is a contradiction, thus proving that $\lambda^{\dagger}(\pi_I, w) < \lambda^{\ddagger}(\pi_I, w)$. ■

1.8.6 Proof of Lemma 3.

Proof. Suppose that the elite makes some privatization offer λ that carries the threat of conducting Ω if the incumbent rejects. By accepting, his expected utility is as defined in (4). But by rejecting it, his expected utility includes the results of the investigation.

To start, suppose that Ω induces a posterior $\mu_0 < \pi_I$ after $s = 0$, and some posterior $\pi_C > \mu_1 > \pi_I$ after $s = 1$. If so, then

$$\begin{aligned}
\mathbb{E}\left[u_I \,|\, d = 0, (\Omega, 0)\right] &= \mathbb{E}\left[(1-w)\, g_1 + \mathbb{1}_{\{\mathrm{e}=1\}}\ (w + (1-w)\ g_2)\,|d = 0, (\Omega, 0)\right] \\
&= \Pr(s=0)\Big((1-w)\,(1+\mu_0) + \frac{\mu_0}{2}\Big(w + 2(1-w)\Big)\Big) \\
&\quad + \Pr(s=1)\Big((1-w)\,(1+\mu_1) + \frac{\mu_1}{2}\Big(w + 2(1-w)\Big)\Big) \\
&= (1-w)\Big((\Pr(s=0) + \Pr(s=1)) + (\Pr(s=0)\mu_0 + \Pr(s=1\mu_1))\Big) \\
&\quad + \frac{\Pr(s=0)\mu_0 + \Pr(s=1)\mu_1}{2}\Big(w + 2(1-w)\Big)
\end{aligned}$$

and since $\Pr(s=0) + \Pr(s=1) = 1$ (by the law of total probability) and $\Pr(s = 0)\mu_0 + \Pr(s = 1\mu_1) = \pi_I$ (by the martingale property of Bayesian learning); then this expected utility must be equal to that defined in (3). That is, we show that under this conjecture then $\lambda^\dagger(\pi_I, w) = \lambda^\dagger(\pi_I, w \,|\, (\Omega, 0))$.

Suppose now that Ω induces a posterior $\mu_0 < \pi_I$ after $s = 0$, and some posterior

$\mu_1 > \pi_C > \pi_I$ after $s = 1$. If so, then

$$\begin{aligned}
\mathbb{E}\left[u_I \,|\, d = 0, (\Omega, 0)\right] &= \mathbb{E}\left[(1-w)\, g_1 + \mathbb{1}_{\{\mathrm{e}=1\}}\ \ (w + (1-w)\ g_2)\,|d = 0, (\Omega, 0)\right] \\
&= \Pr(s=0)\Big((1-w)\,(1+\mu_0) + \frac{\mu_0}{2}\Big(w + 2(1-w)\Big)\Big) \\
&\quad + \Pr(s=1)\Big[(1-w)\,(1+\mu_1) + \frac{\mu_1}{2}\Big(w + 2(1-w)\Big) \\
&\qquad + \Pr(g_1 \in g_1^{\varnothing})\Big(w + (1-w)(1+\mu_1)\Big)\Big] \\
&= (1-w)\Big((\Pr(s=0) + \Pr(s=1)) + (\Pr(s=0)\mu_0 + \Pr(s=1\mu_1))\Big) \\
&\qquad + \frac{\Pr(s=0)\mu_0 + \Pr(s=1)\mu_1}{2}\Big(w + 2(1-w)\Big) \\
&\qquad + \Pr(g_1 \in g_1^{\varnothing})\Big(w + (1-w)(1+\mu_1)\Big) \\
&= \mathbb{E}\left[u_I \,|\, d = 0\right] + \Pr(g_1 \in g_1^{\varnothing})\Big(w + (1-w)(1+\mu_1)\Big)
\end{aligned}$$

and since $\mathbb{E}\left[u_I \,|\, d = 0, (\Omega, 0)\right] > \mathbb{E}\left[u_I \,|\, d = 0\right]$, then it must be that $\lambda^{\dagger}(\pi_I, w) < \lambda^{\dagger}(\pi_I, w \,|\, (\Omega, 0))$. This completes the proof. ■

1.8.7 Proof of Lemma 4.

Proof. First, if $\lambda^{\dagger}(\pi_I, w)$ is concave along π_I, then the elite's expected utility as a function of μ will be convex. Second, the voter's retention rules causes the incumbent's expected utility along π_I to be lower-semicontinuous which, in turn, implies the upper-semicontinuity of the elite's expected utility. As shown by Kamenica and Gentzkow (2011), these two criteria would guarantee the existence of an optimal signal.

For the first part, notice that

$$\begin{aligned}\frac{\partial^2 \lambda^{\dagger}(\pi_I, w)}{\partial \pi_I^2} &= \frac{\partial^2}{\partial \pi_I^2}\left(\frac{2\,(1-w)+\ \pi_I(4-3\,w)}{\pi_I(2-w)+2(1-w)}\right) \\ &= \frac{8\,(2-w)(1-w)^2}{(-2(1+\pi_I)+w(2+\pi_I))^3}\end{aligned}$$

By inspection, it is easy to see that the numerator is positive. Suppose that the denominator is positive as well. If so, then it must be that

$$\begin{aligned}(-2(1+\pi_I)+w(2+\pi_I))^3 > 0 \\ -(2-w)\pi_I > 2(1-w) \\ \pi_I < -\frac{2(1-w)}{(2-w)}\end{aligned}$$

which is a contradiction since $\pi_I > 0$. Therefore, it must be that $\partial^2 \lambda^{\dagger}(\pi_I, w)/\partial \pi_I^2 < 0$ and, hence, it is concave along π_I. Because the elite's expected utility is equal to $2 - \lambda^{\dagger}(\pi_I, w)$, then it is convex along π_I.

Given that now we know that an optimal signal exists, we need to derive it. As shown by Kamenica and Gentzkow (2011), this solution is the concave closure of the elite's expected utility which, as illustrated in Figure 3, must induce beliefs $\mu_0 = \hat{\pi}_I$ and $\mu_1 = \pi_C$. The optimal investigation structure is then a solution to the following system of equations:

$$\Omega^\dagger : \begin{cases} \pi_I = \Pr(s=1)\,\pi_C + \Pr(s=0)\,\hat{\pi}_I & \text{Bayes-plausibility} \\ 1 = \Omega(s=0|\theta_I=0) + \Omega(s=1|\theta_I=0) & \text{Law of total probability} \\ 1 = \Omega(s=0|\theta_I=1) + \Omega(s=1|\theta_I=1) & \text{Law of total probability} \\ \pi_C = \dfrac{\Omega(s=1|\theta_I=1)\,\pi_I}{\Omega(s=1|\theta_I=1)\,\pi_I + \Omega(s=1|\theta_I=0)\,(1-\pi_I)} & := \mu_1 \\ \hat{\pi}_I = \dfrac{\Omega(s=0|\theta_I=1)\,\pi_I}{\Omega(s=0|\theta_I=1)\,\pi_I + \Omega(s=0|\theta_I=0)\,(1-\pi_I)} & := \mu_0 \end{cases}$$

Solving these system of equations yields the following signal structure:

$$\Omega(s=0|\theta_I=0) = \frac{(1-\hat{\pi}_I)(\pi_C-\pi_I)}{(\pi_C-\hat{\pi}_I)(1-\pi_I)} \qquad \Omega(s=0|\theta_I=1) = \frac{\hat{\pi}_I(\pi_C-\pi_I)}{\pi_I(\pi_C-\hat{\pi}_I)}$$

$$\Omega(s=1|\theta_I=0) = \frac{(\pi_I-\hat{\pi}_I)(1-\pi_C)}{(\pi_C-\hat{\pi}_I)(1-\pi_I)} \qquad \Omega(s=1|\theta_I=1) = \frac{\pi_C(\pi_I-\hat{\pi}_I)}{\pi_I(\pi_C-\hat{\pi}_I)}$$

To verify that the above family of likelihood functions is a solution to the before-mentioned system of equations, consider first the posterior beliefs induced following a signal $s=0$. We then have,

$$\begin{aligned} \frac{\Omega(s=0|\theta_I=1)\,\pi_I}{\Omega(s=0|\theta_I=1)\,\pi_I + \Omega(s=0|\theta_I=0)\,(1-\pi_I)} &= \frac{\left(\dfrac{\hat{\pi}_I(\pi_C-\pi_I)}{\pi_I(\pi_C-\hat{\pi}_I)}\right)\pi_I}{\left(\dfrac{\hat{\pi}_I(\pi_C-\pi_I)}{\pi_I(\pi_C-\hat{\pi}_I)}\right)\pi_I + \left(\dfrac{(1-\hat{\pi}_I)(\pi_C-\pi_I)}{(\pi_C-\hat{\pi}_I)(1-\pi_I)}\right)(1-\pi_I)} \\ &= \frac{\dfrac{\hat{\pi}_I(\pi_C-\pi_I)}{(\pi_C-\hat{\pi}_I)}}{\dfrac{\hat{\pi}_I(\pi_C-\pi_I)}{(\pi_C-\hat{\pi}_I)} + \dfrac{(1-\hat{\pi}_I)(\pi_C-\pi_I)}{(\pi_C-\hat{\pi}_I)}} \\ &= \frac{\hat{\pi}_I(\pi_C-\pi_I)}{\hat{\pi}_I(\pi_C-\pi_I) + (1-\hat{\pi}_I)(\pi_C-\pi_I)} \\ &= \hat{\pi}_I \end{aligned}$$

A similar procedure corroborates that a signal realization $s = 1$ induces $\mu_1 = \pi_C$. To check the Bayes-plausibility, we look at

$$
\begin{aligned}
\Pr(s=1)\,\pi_C + \Pr(s=0)\,\hat{\pi}_I &= \Big(\Pr(\theta_I=0)\,\Omega(s=1|\theta_I=0) + \Pr(\theta_I=1)\,\Omega(s=1|\theta_I=1)\Big)\,\pi_C \\
&\quad + \Big(\Pr(\theta_I=0)\,\Omega(s=0|\theta_I=0) + \Pr(\theta_I=1)\,\Omega(s=0|\theta_I=1)\Big)\,\hat{\pi}_I \\
&= \left((1-\pi_I)\,\frac{(\pi_I-\hat{\pi}_I)(1-\pi_C)}{(\pi_C-\hat{\pi}_I)(1-\pi_I)} + \pi_I\,\frac{\pi_C(\pi_I-\hat{\pi}_I)}{\pi_I(\pi_C-\hat{\pi}_I)}\right)\,\pi_C \\
&\quad + \left((1-\pi_I)\,\frac{(1-\hat{\pi}_I)(\pi_C-\pi_I)}{(\pi_C-\hat{\pi}_I)(1-\pi_I)} + \pi_I\,\frac{\hat{\pi}_I(\pi_C-\pi_I)}{\pi_I(\pi_C-\hat{\pi}_I)}\right)\,\hat{\pi}_I \\
&= \left(\frac{(\pi_I-\hat{\pi}_I)(1-\pi_C)}{(\pi_C-\hat{\pi}_I)} + \frac{\pi_C(\pi_I-\hat{\pi}_I)}{(\pi_C-\hat{\pi}_I)}\right)\,\pi_C \\
&\quad + \left(\frac{(1-\hat{\pi}_I)(\pi_C-\pi_I)}{(\pi_C-\hat{\pi}_I)} + \frac{\hat{\pi}_I(\pi_C-\pi_I)}{(\pi_C-\hat{\pi}_I)}\right)\,\hat{\pi}_I \\
&= \frac{\pi_I\,\pi_C - \hat{\pi}_I\,\pi_C + \hat{\pi}_I\,\pi_C - \pi_I\,\hat{\pi}_I}{(\pi_C-\hat{\pi}_I)} \\
&= \frac{\pi_I\,(\pi_C-\hat{\pi}_I)}{(\pi_C-\hat{\pi}_I)} \\
&= \pi_I
\end{aligned}
$$

and we prove that the expected posterior is equal to the prior, so this investigation is Bayes-plausible. Finally, the law of total probability for each pair of conditional distributions (for $s = 0$ and $s = 1$) can be verified by inspection. ■

1.8.8 Proof of Proposition 3.

Proof. All the equilibrium selling prices follow exactly from Proposition 1 and from Lemma 4. The only additional step left to show is that the incumbent's expected utility is indeed higher by using this investigation before making the offer. By using it, the elite's expected utility is

$$\begin{aligned}
\mathbb{E}[u_E \,|\, (\Omega^\dagger, 1)] &= \Pr(s=0)\left(2-\lambda(\mu_0 w)\right) + \Pr(s=1)\left(2-\lambda(\mu_1, w)\right) \\
&= \left(\frac{\pi_C - \pi_I}{\pi_C - \hat{\pi}_I}\right)\left(2-\lambda^\dagger(\hat{\pi}_I, w)\right) + \left(1-\frac{\pi_C - \pi_I}{\pi_C - \hat{\pi}_I}\right)\left(2-\lambda^\dagger(\pi_C, w)\right) \\
&= 2-\lambda^\dagger(\hat{\pi}_I, w)\left(\frac{\pi_C - \pi_I}{\pi_C - \hat{\pi}_I}\right) - \lambda^\dagger(\pi_C, w)\left(1-\frac{\pi_C - \pi_I}{\pi_C - \hat{\pi}_I}\right) \\
&= 2-\underline{\lambda}\left(\frac{\pi_C - \pi_I}{\pi_C - \hat{\pi}_I}\right) - \lambda^\dagger(\pi_C, w)\left(1-\frac{\pi_C - \pi_I}{\pi_C - \hat{\pi}_I}\right)
\end{aligned}$$

Suppose now that

$$\begin{aligned}
&\mathbb{E}[u_E \,|\, \text{No attacks}] > \mathbb{E}[u_E \,|\, (\Omega^\dagger, 1)] \\
&\quad 2-\lambda^\dagger(\pi_I, w) > 2-\underline{\lambda}\left(\frac{\pi_C - \pi_I}{\pi_C - \hat{\pi}_I}\right) - \lambda^\dagger(\pi_C, w)\left(1-\frac{\pi_C - \pi_I}{\pi_C - \hat{\pi}_I}\right) \\
&\qquad\qquad 0 > \lambda^\dagger(\pi_I, w) - \lambda^\dagger(\pi_C, w) + \left(\frac{\pi_C - \pi_I}{\pi_C - \hat{\pi}_I}\right)\left(\lambda^\dagger(\pi_C, w) - \underline{\lambda}\right) := \Delta(\pi_I, w)
\end{aligned}$$

Recall the selling price is strictly increasing in the incumbent's legacy motivation. Notice that using the definition of $\hat{\pi}_I$ as given by (5), we have that $\lim\limits_{w\to 0} \hat{\pi}_I(w) = \frac{\underline{\lambda}-1}{2-\underline{\lambda}}$. We can then examine

$$\begin{aligned}
\lim_{w\to 0} \Delta(\pi_I, w) &= \left(2-\frac{1}{1+\pi_I}\right) - \left(2-\frac{1}{1+\pi_C}\right) + \left(\frac{\pi_C - \pi_I}{\pi_C - \left(\frac{\underline{\lambda}-1}{2-\underline{\lambda}}\right)}\right)\left(\left(2-\frac{1}{1+\pi_C}\right) - \underline{\lambda}\right) \\
&= \left(\frac{1}{1+\pi_C} - \frac{1}{1+\pi_I}\right) + \left(\frac{(2-\underline{\lambda})(\pi_C - \pi_I)}{(1+2\pi_C) - \underline{\lambda}(1+\pi_C)}\right)\left(2-\left(\frac{1}{1+\pi_C} + \underline{\lambda}\right)\right) \\
&= \frac{(\pi_C - \pi_I)(1-\underline{\lambda} + \pi_I(2-\underline{\lambda}))}{(1+\pi_C)(1+\pi_C)}
\end{aligned}$$

it is easy to see that the numerator is negative if and only if

$$\pi_I(2-\lambda) < (\underline{\lambda}-1)$$
$$\Leftrightarrow \pi_I < \frac{\underline{\lambda}-1}{2-\underline{\lambda}}$$
$$\Leftrightarrow \pi_I < \lim_{w\to 0} \hat{\pi}_I(w)$$

which is a contradiction, since we are studying conditions in the domain $\pi_I \in [\hat{\pi}_I, \pi_C]$. Therefore, it must be that $\lim_{w\to 0} \Delta(\pi_I, w) > 0$ and, as a result, it must be that $\mathbb{E}[u_E \,|\, \text{No attacks}] < \mathbb{E}[u_E \,|\, (\Omega^{\dagger}, 1)]$. This completes the proof. ■

1.8.9 Proof of Lemma 5.

Proof. The elite's optimal signal structure results from the investigation that minimizes the incumbent's expected utility. Given that the incumbent's expected utility is lower semi-continuous at the belief $\mu = \pi_C$, from an equivalent reasoning as in Lemma 4 it follows that the optimal posteriors to induce are $\mu_0 = \pi_C$ after a signal that the incumbent is of low ability, and a posterior $\mu_1 = 1$ after a signal that the incumbent is of high ability. The signal structure is a solution to the following system of equations:

$$
\begin{cases}
\pi_I = \Pr(s=1) + \Pr(s=0)\,\pi_C & \text{Bayes-plausibility} \\[2ex]
1 = \Omega(s=0|\theta_I=0) + \Omega(s=1|\theta_I=0) & \text{Law of total probability} \\[1ex]
1 = \Omega(s=0|\theta_I=1) + \Omega(s=1|\theta_I=1) & \text{Law of total probability} \\[1ex]
1 = \dfrac{\Omega(s=1|\theta_I=1)\,\pi_I}{\Omega(s=1|\theta_I=1)\,\pi_I + \Omega(s=1|\theta_I=0)\,(1-\pi_I)} & \\[2ex]
\pi_C = \dfrac{\Omega(s=0|\theta_I=1)\,\pi_I}{\Omega(s=0|\theta_I=1)\,\pi_I + \Omega(s=0|\theta_I=0)\,(1-\pi_I)} &
\end{cases}
$$

Solving these system of equations yields the following signal structure:

$$
\Omega(s=0|\theta_I=0) = 1 \qquad \Omega(s=0|\theta_I=1) = \frac{\pi_C\,(1-\pi_I)}{\pi_I\,(1-\pi_C)}
$$

$$
\Omega(s=1|\theta_I=0) = 0 \qquad \Omega(s=1|\theta_I=1) = \frac{\pi_I - \pi_C}{\pi_I\,(1-\pi_C)}
$$

To verify that the above family of likelihood functions is a solution to the before-mentioned system of equations, consider first the posterior beliefs induced following a signal $s=0$. We would have that,

$$
\begin{aligned}
\frac{\Omega(s=0|\theta_I=1)\,\pi_I}{\Omega(s=0|\theta_I=1)\,\pi_I + \Omega(s=0|\theta_I=0)\,(1-\pi_I)} &= \frac{\frac{\pi_C\,(1-\pi_I)}{\pi_I\,(1-\pi_C)}\,\pi_I}{\frac{\pi_C\,(1-\pi_I)}{\pi_I\,(1-\pi_C)}\,\pi_I + (1-\pi_I)} \\
&= \frac{\frac{\pi_C(1-\pi_I)}{(1-\pi_C)}}{(1-\pi_I)\left(1+\frac{\pi_C}{1-\pi_C}\right)} \\
&= \frac{\frac{\pi_C(1-\pi_I)}{(1-\pi_C)}}{(1-\pi_I)\left(\frac{1}{1-\pi_C}\right)} \\
&= \pi_C
\end{aligned}
$$

A similar procedure corroborates that a signal realization $s=1$ induces $\mu_1 = 1$. To check the Bayes-plausibility, we look at

$$
\begin{aligned}
\Pr(s=1)+\Pr(s=0)\,\pi_C &= \Big(\Pr(\theta_I=0)\,\Omega(s=1|\theta_I=0)+\Pr(\theta_I=1)\,\Omega(s=1|\theta_I=1)\Big) \\
&\quad + \Big(\Pr(\theta_I=0)\,\Omega(s=0|\theta_I=0)+\Pr(\theta_I=1)\,\Omega(s=0|\theta_I=1)\Big)\,\pi_C \\
&= \left((1-\pi_I)\,0+\pi_I\,\frac{\pi_I-\pi_C}{\pi_I\,(1-\pi_C)}\right)+\left((1-\pi_I)\,1+\pi_I\,\frac{\pi_C\,(1-\pi_I)}{\pi_I\,(1-\pi_C)}\right)\pi_C \\
&= \left(\frac{\pi_I-\pi_C}{1-\pi_C}\right)+\pi_C\left((1-\pi_I)+\frac{\pi_C(1-\pi_I)}{1-\pi_C}\right) \\
&= \frac{1}{1-\pi_C}\Big((\pi_I-\pi_C)+\pi_C\big((1-\pi_I)(1-\pi_C)+\pi_C(1-\pi_I)\big)\Big) \\
&= \frac{1}{1-\pi_C}\Big(\pi_I-\pi_C+\pi_C(1-\pi_I)\Big) \\
&= \pi_I
\end{aligned}
$$

which means that the expected posterior is equal to the prior. Finally, the law of total probability for each pair of conditional distributions can be verified by inspection. ■

1.8.10 Proof of Proposition 4.

Proof. Suppose that the elite makes some privatization offer λ that carries the threat of conducting $\Omega^{\ddagger}$ if the incumbent rejects. By accepting, his expected utility is as defined in

(7). But by rejecting it, his expected utility would be

$$
\begin{aligned}
\mathbb{E}\left[u_I \,|\, d=0,(\Omega^{\ddagger},0)\right] &= \mathbb{E}\left[(1-w)\,g_1 + \mathbb{1}_{\{\mathrm{e}=1\}}\;(w+(1-w)\;g_2)\,|d=0,(\Omega,0)\right] \\
&= \Pr(s=0)\Big((1-w)\,(1+\mu_0)+\frac{\mu_0}{2}\Big(w+2(1-w)\Big)\Big) \\
&\quad + \Pr(s=1)\Big((1-w)\,(1+\mu_1)+\left(1-\frac{(1-\mu_1)}{2}\right)\Big(w+2(1-w)\Big)\Big) \\
&= (1-w)\Big(1+\pi_I\Big)+\big(2-w\big)\Big(\Pr(s=0)\frac{\mu_0}{2}+\Pr(s=1)\Big) \\
&= (1-w)\Big(1+\pi_I\Big)+\big(2-w\big)\left(\frac{4+\pi_I(3\pi_C-2)-5\pi_C}{2(1-\pi_C)}\right)
\end{aligned}
$$

Define the difference between privatizing and not, by $\Delta(\pi_I,\pi_C,w) := \mathbb{E}[u_I|d=0] - \mathbb{E}\left[u_I \,|\, d=0,(\Omega^{\ddagger},0)\right]$. And notice that

$$
\lim_{\substack{w\to 1\\ \lambda\to 1}} \Delta(\pi_I,\pi_C,w) = \frac{1-\pi_I}{2(1-\pi_C)} > 0
$$

and that

$$
\begin{aligned}
\lim_{\substack{w\to 0\\ \lambda\to 1}} \Delta(\pi_I,\pi_C,w) = \frac{\pi_C-\pi_I(2-\pi_C)}{1-\pi_C} &> 0 \\
\Leftrightarrow \pi_I &< \frac{\pi_C}{2-\pi_C} \\
\pi_I &> \pi_C \qquad \text{(Condition for being leading)} \\
\Leftrightarrow -\pi_C(1-\pi_C) &> 0
\end{aligned}
$$

which is a contradiction. Therefore, it must be that $\lim_{\substack{w\to 0\\ \lambda\to 1}} \Delta(\pi_I,\pi_C,w) < 0$. By the Intermediate Value Theorem, there must exist some $\hat{w} \in (0,1)$ such that $\Delta(\pi_I,\pi_C,\hat{w}) = 0$.

When $w \geq \hat{w}$, then the incumbent would privatize the asset even at whatever institutional reservation price —because $\underline{\lambda} > 1$. We can recover a closed-form solution by examining

$$\begin{aligned}
\lim_{\lambda \to 1} \Delta(\pi_I, \pi_C, w) &= 0 \\
\frac{w + 2\pi_C(1-w) + \pi_I(3w + 2\pi_C(1-w) - 4)}{2(1-\pi_C)} &= 0 \\
&\Leftrightarrow w = \frac{2(\pi_C - \pi_I(2-\pi_C))}{2\pi_C + \pi_I(2\pi_C - 3) - 1} := \hat{w}(\pi_I)
\end{aligned}$$

and notice that

$$\frac{\partial \hat{w}(\pi_I)}{\partial \pi_I} = \frac{4(1-\pi_C)}{(1 + 3\pi_I - 2\pi_C(1+\pi_I))^2} > 0$$

which implies that $\hat{w}(\pi_I)$ is increasing in $\pi_I \in (\pi_C, 1)$. In addition, for the degenerate case when the incumbent's lead is very narrow, we have

$$\lim_{\pi_C \to \pi_I} \hat{w}(\pi_I) = \frac{2\,\pi_I}{1 + 2\,\pi_I}$$

and this can be interpreted as an upper bound condition on how high his office motivation must be for him to accept any reservation price —that is, $\hat{w}(\pi_I) \in \left(\frac{2\,\pi_I}{1+2\,\pi_I}, 1\right)$

Suppose henceforth that $w < \hat{w}$ so that he would not necessarily accept just any offer of the exogenous reservation price. We can then recover the selling price by

$$\begin{aligned}
&\Delta(\pi_I, \pi_C, w) = 0 \\
&\qquad \Leftrightarrow \lambda = \frac{2 + \pi_I(6-4w) - 4w + \pi_C(5w - 4 + \pi_I(3w-4))}{(1-\pi_C)(2 + \pi_I(2-w) + 3w)} := \lambda^{\ddagger}\left(\pi_I, w \,|\, (\Omega^{\ddagger}, 0)\right)
\end{aligned}$$

To examine its properties, we look at

$$\frac{\partial \lambda^{\ddagger}\left(\pi_I, w \,|\, (\Omega^{\ddagger}, 0)\right)}{\partial \pi_I} = \frac{4(1-w)(2-w(2-\pi_C))}{(1-\pi_C)(3w-2-\pi_I(2-w))^2} > 0$$

$$\Leftrightarrow w < \frac{2}{2-\pi_C}$$

which holds true for any $\pi_C \in (0,1)$ since (i) when $\pi_C \to 0$, then $w < 1$, and (ii) when $\pi_C \to 1$, then $w < 2$. Thus, $\lambda^{\ddagger}\left(\pi_I, w \,|\, (\Omega^{\ddagger}, 0)\right)$ must be increasing in $\pi_I \in (\pi_C, 1)$. Additionally,

$$\frac{\partial \lambda^{\ddagger}\left(\pi_I, w \,|\, (\Omega^{\ddagger}, 0)\right)}{\partial w} = -\frac{2(1-\pi_I)(1+\pi_C-\pi_I(1-\pi_C))}{(1-\pi_C)(3w-2-\pi_I(2-w))^2} > 0$$

$$\Leftrightarrow \pi_I > \frac{1+\pi_C}{1-\pi_C}$$

$$\pi_I < 1 \qquad \text{(By assumption)}$$

$$\Leftrightarrow \pi_C < 0$$

which is a contradiction. Thus, $\lambda^{\ddagger}\left(\pi_I, w \,|\, (\Omega^{\ddagger}, 0)\right)$ must be decreasing in $w \in (0, \hat{w})$.

This value of $\lambda^{\ddagger}\left(\pi_I, w \,|\, (\Omega^{\ddagger}, 0)\right)$ may be above or below $\underline{\lambda} \in (1,2)$. Suppose that it is above. The elite's problem is to choose whether to engage in threats and buy the asset at the before-mentioned price, or to attack the incumbent before making the offer. With the aid of Proposition 1 and 2, we can compute their expected utility if they engage in attacks,

$$\begin{aligned}\mathbb{E}[u_E|s,(\Omega^\ddagger,1)] &= \Pr(s=0)\Big(2-\lambda^\dagger(\pi_C,w)\Big)+\Pr(s=1)\Big(2-\lambda^\dagger(1,w)\Big)\\ &= \left(\frac{1-\pi_I}{1-\pi_C}\right)(2-\lambda^\dagger(\pi_C,w))+\left(\frac{\pi_I-\pi_C}{1-\pi_C}\right)(2-\lambda^\ddagger(1,w))\\ &= \left(\frac{1-\pi_I}{1-\pi_C}\right)(2-\lambda^\dagger(\pi_C,w))\end{aligned}$$

which incorporates the fact that $\lambda^\ddagger(1,w)=2$. The elite is indifferent between threats and attacks if and only if

$$\begin{aligned}\mathbb{E}[u_E|(\Omega^\ddagger,0)] &= \mathbb{E}[u_E|(\Omega^\ddagger,1)]\\ 2-\lambda^\ddagger(\pi_I,w|(\Omega^\ddagger,0)) &= \left(\frac{1-\pi_I}{1-\pi_C}\right)(2-\lambda^\dagger(\pi_C,w))\\ \Leftrightarrow \pi_I &= \frac{5w-4+\sqrt{32+16\pi_C(w-2)(w-1)+w(33w-64)}}{2(2-w)} := \tilde{\pi}_I(w)\end{aligned}$$

where it is easy to verify that it is strictly increasing in $w\in(0,1)$ since

$$\begin{aligned}\lim_{w\to 0}\frac{\partial\tilde{\pi}_I(w)}{\partial w} &= \frac{-2\sqrt{2}(1+\pi_C)+3\sqrt{1+\pi_C}}{4\sqrt{1+\pi_C}} > 0 \Leftrightarrow \pi_C < 1\\ \lim_{w\to 1}\frac{\partial\tilde{\pi}_I(w)}{\partial w} &= 4(1-\pi_C) > 0 \Leftrightarrow \pi_C < 1\end{aligned}$$

which completes the proof. ■

1.8.11 Proof of Lemma 6.

Proof. It is sufficient to show that a trailing incumbent's expected utility is strictly decreasing in savings. Recall that by Lemma 2(a), his chances of reelection are strictly increasing in the first period budget. If he would be purely office motivated and given a choice to save, he would then save nothing. On the other hand, if he were purely legacy motivated and given a choice to save, then his expected utility when he saves some amount $s \in \mathbb{R}_+$ and keeps the control of the asset would be:

$$\begin{aligned}
\lim_{w \to 0} \left(\mathbb{E} \left[u_I \mid s, d = 0 \right] \right) &= \lim_{w \to 0} \left(\mathbb{E} \left[(1-w)\, g_1 + \mathbb{1}_{\{\mathrm{e}=1\}} \;\; (w + (1-w)\;\, g_2) \mid s, d = 0 \right] \right) \\
&= (1-0)\,(2(1-s)\,\pi_I + (1-s)(1-\pi_I)) + \frac{\pi_I(1-s)}{2} \Big(0 + 2(1+s)(1-0) \Big) \\
&= -s^2\,\pi_I - s(1+\pi_I) + 2\,\pi_I + 1 \qquad (8)
\end{aligned}$$

which is easy to see by inspection that it is strictly decreasing in $s \in \mathbb{R}_+$. Similarly, if he privatizes at some price λ, then his expected utility would be

$$\begin{aligned}
\lim_{w \to 0} \left(\mathbb{E} \left[u_I \mid s, d = 1 \right] \right) &= \lim_{w \to 0} \left(\mathbb{E} \left[(1-w)\, g_1 + \mathbb{1}_{\{\mathrm{e}=1\}} \;\; (w + (1-w)\;\, g_2) \mid s, d = 1 \right] \right) \\
&= (1-0)\,(2(\lambda-s)\,\pi_I + (1-s)(1-\pi_I)) + \frac{\pi_I(1-s)}{2} \Big(0 + 2s(1-0) \Big) \\
&= -s^2\,\pi_I - s(1+\pi_I(1-\lambda)) + \lambda(1+\pi_I)
\end{aligned}$$

which is also easy to see by inspection that it is strictly decreasing in $s \in \mathbb{R}_+$. Logically, it must then be the case that his expected utility is strictly decreasing in savings for any $w \in (0,1)$.

Reversely, with a leading incumbent it is sufficient to show that his expected utility is strictly increasing in savings. Recall first that, by Lemma 2(b) his chances of reelection are strictly decreasing in the first period budget. If he would be purely office motivated and given a choice to save, he would then save everything. On the other hand, if he is purely legacy motivated, then his expected utility when he saves some amount $s \in \mathbb{R}_+$, his office motivation is degenerately high, and he keeps the control of the asset:

$$\begin{aligned}
\lim_{w\to 0}\left(\mathbb{E}\left[u_I|s,d=0\right]\right. &= \lim_{w\to 0}\left(\mathbb{E}\left[(1-w)g_1 + \mathbb{1}_{\{\mathrm{e=1}\}}\ \left(w+(1-w)\ g_2\right)|s,d=0\right]\right) \\
&= (1-s)(1+\pi_I) + \frac{(1-s)\pi_I}{2}\Big(2(1+s)\Big) + \left(1-\frac{1-s}{2}\right)\Big((1+s)(1+\pi_I)\Big) \\
&= \frac{1}{2}\left(s^2\left(1-\pi_I\right)+\left(3+5\,\pi_I\right)\right)
\end{aligned}$$

which is strictly increasing in savings. Similarly, if he privatizes at some price λ, then

$$\begin{aligned}
\lim_{w\to 0}\left(\mathbb{E}\left[u_I|s,d=1\right]\right. &= \lim_{w\to 0}\left(\mathbb{E}\left[(1-w)g_1 + \mathbb{1}_{\{\mathrm{e=1}\}}\ \left(w+(1-w)\ g_2\right)|s,d=1\right]\right) \\
&= (\lambda-s)(1+\pi_I) + \frac{(\lambda-s)\pi_I}{2}\Big(2s\Big) + \left(1-\frac{\lambda-s}{2}\right)\Big(s(1+\pi_I)\Big) \\
&= \frac{1-\pi_I}{2}\Big(s(s-\lambda)\Big) + \lambda(1+\pi_I) := \Delta^a(s)
\end{aligned}$$

from where it's easy to see that the it is a convex function in savings because $\partial^2\Delta^a(s)/\partial s^2 = 1-\pi_I > 0$. The optimal saving amount must be at a corner, but notice that saving all or nothing equals the same amount $\lambda(1+\pi_I)$, so he is indifferent at this degenerate case. Logically, it must then be the case that his expected utility is strictly increasing in savings for any $w \in (0,1)$. ■

1.8.12 Proof of Proposition 5.

Proof. We first need to compute the value of λ such that the incumbent is indifferent between selling and not when the elite employs threats, taking into account that he would save everything in the first period if he is leading and he would save nothing if trailing.

His expected utility from not selling would be

$$\begin{aligned}
\mathbb{E}\left[u_I \,|\, d=0,(\Omega^{\ddagger},0)\right] &= \mathbb{E}\left[(1-w)\,g_1 + \mathbb{1}_{\{\mathrm{e}=1\}}\;\;(w+(1-w)\;g_2)\,|d=0,(\Omega,0)\right] \\
&= \Pr(s=0)\Big((1-w)(1+\mu_0)+\frac{\mu_0}{2}\Big(w+2(1-w)\Big)\Big)\Big) \\
&\quad + \Pr(s=1)\Big(\Big(1-\frac{(1-\mu_1)}{2}\Big)\Big(w+4(1-w)\Big)\Big)\Big) \\
&= \frac{\pi_C(1+\pi_I)(3w-4)-2(1-w)+\pi_I(3-2w)}{2(1-\pi_C)}
\end{aligned}$$

and his expected utility from privatizing at some price λ would simply be

$$\begin{aligned}
\mathbb{E}\left[u_I \,|\, d=1,(\Omega^{\ddagger},0)\right] &= \mathbb{E}\left[(1-w)\,g_1 + \mathbb{1}_{\{\mathrm{e}=1\}}\;\;(w+(1-w)\;g_2)\,|d=1,(\Omega,0)\right] \\
&= w+\lambda(1-w)\Big(\Pr(g_1\in g_1^{+})2+\Pr(g_1\in g_1^{\varnothing})(1+\pi_I)\Big) \\
&= w+\lambda(1-w)(1+\pi_I)
\end{aligned}$$

and we recover the value of λ such that he is indifferent between selling and not be examining

$$\begin{aligned}
\mathbb{E}\left[u_I \,|\, d=0,(\Omega^{\ddagger},0)\right] =& \mathbb{E}\left[u_I \,|\, d=1,(\Omega^{\ddagger},0)\right] \\
\frac{\pi_C(1+\pi_I)(3w-4)-2(1-w)+\pi_I(3-2w)}{2(1-\pi_C)} =& \; w+\lambda(1-w)(1+\pi_I) \\
\Leftrightarrow \lambda = \frac{2+\pi_I(6-4w)-4w+\pi_C(5w-4+\pi_I(3w-4))}{2(1-w)(1+\pi_I)(1-\pi_C)} :=& \; \lambda^{\ddagger}(\pi_I,w\,|\,s,(\Omega^{\ddagger},0))
\end{aligned}$$

For the incumbent to sell, the elite must offer at least the above amount. We now compute elite's expected utility if they attack the incumbent, which is

$$
\begin{aligned}
\mathbb{E}[u_E|s,(\Omega^{\ddagger},1)] &= \Pr(s=0)\Big(2-\lambda^{\dagger}(\pi_C,w)\Big)+\Pr(s=1)\Big(2-\lambda^{\dagger}(1,w)\Big) \\
&= \left(\frac{1-\pi_I}{1-\pi_C}\right)(2-\lambda^{\dagger}(\pi_C,w))+\left(\frac{\pi_I-\pi_C}{1-\pi_C}\right)(2-\lambda^{\ddagger}(1,w)) \\
&= \left(\frac{1-\pi_I}{1-\pi_C}\right)(2-\lambda^{\dagger}(\pi_C,w))
\end{aligned}
$$

which incorporates the fact that $\lambda^{\ddagger}(1,w)=2$. The elite is indifferent between threatening and attacking if and only if

$$
\begin{aligned}
\mathbb{E}[u_E|s,(\Omega^{\ddagger},0)] &= \mathbb{E}[u_E|s,(\Omega^{\ddagger},1)] \\
2-\lambda^{\ddagger}(\pi_I,w|s,(\Omega^{\ddagger},0)) &= \left(\frac{1-\pi_I}{1-\pi_C}\right)(2-\lambda^{\dagger}(\pi_C,w))
\end{aligned}
$$

$$
\Leftrightarrow \pi_I = \frac{\substack{w^2(4+\pi_C(3\pi_C-4))-2w(6+\pi_C(2\pi_C-3))+8 \\ -\sqrt{(8+4w(w-3)+w\pi_C(6-4w+\pi_C(3w-4)))^2+8(w-1)(2+w(\pi_C-2)(4(w-1)+\pi_C(-8+w(12+w(\pi_C-6)))))}}}{4(w-1)(2+w(\pi_C-2))} := \tilde{\pi}_I(w|s)
$$

From where it is easy to check that

$$
\lim_{w\to 0}\frac{\partial \tilde{\pi}_I^a(w)}{\partial w} = \frac{\left(\sqrt{1+\pi_C}-\sqrt{2}\right)\Big(-2+\pi_C(-1+2\pi_C)\Big)}{4\sqrt{1+\pi_C}}
$$

which is strictly positive for any $\pi_C \in (0,1)$. Therefore, as before, this threshold must also be strictly increasing in $w \in (0,1)$.

Finally, it is easy to check that when the incumbent's legacy motivation becomes degenerately high, then $\lim_{w\to 0}\tilde{\pi}_I(w) = \sqrt{2(1+p-C)}-1 = \lim_{w\to 0}\tilde{\pi}_I(w|s)$. In addition, recall from the proof of Proposition 3 that $\lambda^{\ddagger}(\pi_I,w) > 1$ if and only if $\hat{w}(\pi_I) \in \Big(\frac{2\,\pi_I}{1+2\,\pi_I},1\Big)$

—otherwise, the incumbent would be willing to sell at any institutional reservation price. At the limit on the weight on office motivation (set at $\hat{w}(1) = 2/3$), we have that

$$\lim_{\substack{w \to 2/3 \\ \pi_C \to 0}} \Big(\tilde{\pi}_I(w) - \tilde{\pi}_I(w|s) \Big) = \sqrt{5}2 - \sqrt{7} \approx -0.146 < 0$$

$$\lim_{\substack{w \to 2/3 \\ \pi_C \to 1}} \Big(\tilde{\pi}_I(w) - \tilde{\pi}_I(w|s) \Big) = 0$$

which implies that $\tilde{\pi}_I(w) < \tilde{\pi}_I(w|s)$. That is, the elite employs threats for a larger set of parameter values when the incumbent can save relative to the case when he cannot save. As a corollary, it must be the case that the equilibrium selling price when the elite employs threats is higher when the incumbent save. ■

Chapter 2

The Stakes and Informativeness Trade-Off: Electoral Incentives to Implement Programmatic Transfers

Abstract

If a transfers policy is programmatic (it is transparent and non-manipulable), is it irrelevant for politicians' electoral fortunes? I show that the answer is no with a political agency model where politicians' competence is uncertain to all. In my setup, an incumbent can allocate a budget to public goods and transfers. These policies differ in one key dimension: the provision of public goods provision fluctuates more over time relative to transfers. When the incumbent increases the budget to public goods, two effects arise: his performance in office today reveals more information about his identity (an informativeness effect), and voters' anticipation of narrow transfers tomorrow increases the salience of political selection (a stakes effect). To the incumbent, these two effects move in opposing directions and, consequently, the strategic allocation of the budget helps him to advance his electoral fortunes.

2.1 Introduction

Welfare transfer policies generally share two crucial properties: the criteria for redistribution is transparent and its implementation is non-manipulable by office-holders. These features can be summarized into a single term: welfare transfers are programmatic. A representative example is Conditional Cash Transfers (CCTs), which consist of regular and predictable payments to *any* household that meets pre-defined and well-specified eligibility criteria (Ibarraran et al., 2017), with the societal objectives of providing income support and encouraging human capital investment.

In their idealized conceptual form, the particular nature of programmatic transfers seem to leave no room for electoral benefit to politicians. And yet, we see these programmes being implemented widely across countries with varying levels of economic development and can bear a non-trivial portion of a country's budget. For instance, Fiszbein and Schady (2009) document that *Bolsa Familia* program in Brazil has reached over 11 million households, with an allocated budget of 0.36% of the GDP by 2005 (around $5 billion); and, by the same year, *Bono de Desarrollo Humano* in Ecuador has reached over 40% of the population, with an allocated budget of 0.6% of the GDP (around $194 million).

We are then left with a puzzle: how can these policies be implemented if they seem to be irrelevant for policy-makers' electoral fortunes? This puzzle appears to be further reinforced in light of the existing causal evidence of the null effects that this type of programs have on the incumbent's vote share (see Green 2011; Imai, King and Velasco 2020), notwithstanding some of the commonly hypothesized mechanisms that could trigger electoral incentives for politicians to carry them out.[11]

This paper studies a probabilistic voting model with symmetric uncertainty (as in the career-concerns tradition), in which politicians can be of high or low competence. In my set-up, an incumbent politician can allocate a budget to public goods and programmatic transfers. These policies differ in one key dimension: transfers have a higher persistence of outcome relative to the provision of public goods. That is, once a transfers program is set-up, these provide relatively stable payments to beneficiaries, whereas public goods provision critically depends on the competence of the office-holder. Put differently, the provision of public goods fluctuates more over time relative to transfers.

In addition, in order to capture the idealized features that this type of transfers should have (see Stokes, Dunning and Nazareno 2013), I assume that voter eligibility for payments is based on a commonly-known exogenous income threshold and that, once the program is settled, it is non-manipulable by future office-holders in that eligible citizens would receive the benefits today and tomorrow, regardless of who is in power.

I show that when the incumbent increases the budget to public goods by reducing transfers, two effects arise. On the one hand, the incumbent's performance in office today would reveal more information about his underlying identity, which would thereby make voters take an electoral decision with updated beliefs about his competence. I call this an informativeness effect. On the other, the voters also anticipate that whoever is the

[11] One hypothesized mechanism is that incumbents may expect to claim credit for its implementation (De la O 2013, 11). But, conceptually, this seems to be at odds with its non-manipulability feature, as voters' electoral decision should internalise that transfers would continue regardless of who is in power —this is why Imai, King and Velasco (2020) contend "[w]hy voters would attribute responsibility when none exists is unclear" (714). Another is that incumbents may expect rewards if, as argued by Finan and Schechter (2012, 866), "receiving money engenders feelings of obligation" or reciprocity among beneficiaries.

office-holder tomorrow would administer a large budget for public goods. And since this provision depends on the office-holder's competence, voters will place a stronger weight on political selection, relative to other factors —such as valence; for instance, the candidates' charisma. I call this a stakes effect.

A key contribution of this paper is to show that the informativeness and the stakes effects move in opposite directions for incumbent politicians. To understand this assertion, take a leading politician; that is, a politician whose reputation (absent any additional information) is higher than his challenger's. On one side, he has incentives to reduce today's budget for the provision of public goods by increasing the size of transfers. By doing this, he would increase the chances that voters learn little about him and, thereby, keep his status as the leading candidate. On another side, the non-manipulability of transfers implies that tomorrow's budget for public goods would also shrink. But what good is it to hold a better reputation for competence today when competence will matter little for tomorrow's welfare? Increasing transfers would then attenuate the very source of the incumbent's electoral lead.

The reverse rationale holds for a trailing incumbent; that is, a politician whose reputation (absent any additional information) is lower than his challenger's. It is precisely because he holds a poorer reputation than his contender that increasing the budget for transfers can be valuable: he would prefer voters to reduce the weight they place on political selection. Yet, reducing the budget for public goods today would reduce his chances of turning the table around by showing that he is competent.

There is, thus, a trade-off for the incumbent politician when he chooses a budget allocation. Which of these two effects dominate in equilibrium? In general, I show, the stakes effect imposes itself over the informativeness effect. To see why, consider a leading incumbent. The very fact that he holds a good reputation means that his chances of performing poorly are relatively low. Why allow his fear of failure to bury his electoral lead on competence by increasing transfers? It is precisely because he is more likely to be competent than his challenger that he wants competence to be the first order priority in voters' electoral choice, and he can do this by increasing the budget for public goods.

Consider now a trailing incumbent. Although he could gamble on proving himself to be competent by way of an outstanding provision of public goods, this can easily backfire: a bad performance would make his electoral prospects even worse. Reducing the stakes of the election by allocating everything to transfers is a safe alternative.

But "in general" does not mean "always". There are cases where a trailing incumbent prefers the lottery associated with the informativeness effect. If the incumbent is just trailing against a challenger who is quite likely to be competent, then he would rather allocate everything to public goods and gamble on proving himself: after all, being just trailing implies that his chances of producing excellent results are very high.

There are also cases where the incumbent chooses a balance between transfer and public good, playing on both the informativeness and the stakes effects. If the incumbent is just leading against a challenger who is quite likely to be competent, then the chances of a poor performance must be high too: why risk it when he could play it safe? Indeed, a leading incumbent can find it optimal to balance the informativeness and the stakes effect: keep the stakes high, but just as high as for his performance not to be too informative about his identity.

This means that the implementation of transfers is a function of circumstances, especially the ex-ante difference in reputation between incumbent and challenger, with potentially subtle consequences detailed above. This simple idea also has theoretical implications for the empirical models that try to measure its electoral effects: we should treat the very implementation of a programmatic transfers program as an equilibrium object which, by its nature, should yield weakly positive effects on the incumbent's electoral fortunes.

2.2 Literature Review

Scholars have long studied politicians' strategic problem of choosing how much budget to allocate across public goods and transfers. A major strand of this literature have thought about this in the context of electoral competition: equilibrium allocations are the outcome of a political platform that maximises voters' utility (see Persson and Tabellini 1999). This is typically a world of prospective voting with few informational problems. But at the same time, when we think about policy-making in political economy, there is also a major strand of the literature that, building on a career-concerns framework (Holmström 1999), has studied incumbent's incentives to strategically allocate effort or resources when these provide information to voters about their competence (Persson and Tabellini 2002). From a purely theoretical standpoint, this paper rethinks the allocation problem across public good and transfers but from an informational standpoint.

To that end, I build on Ashworth, Bueno de Mesquita and Friedenberg (2017), who investigate a model in which a politician's type and effort (in my paper, a budget) interact in the production function of his performance in office, which triggers incentives to select an effort level so as to manipulate the probability distribution over observable statistics. I also build on Ashworth and Bueno de Mesquita (2006), who study career-concern type of model in which legislators need to divide resources across local goods and global public goods, and where at election time voters can extract information about legislators competence by observing the local public good but not the global public good (which they observe after the election). My framework is a combination of these two insights, with the incumbent's problem being how to allocate a budget across public goods and transfers, when these policies have different informational implications.

My model also builds on the agenda-setting and issue salience literatures. Scholars have studied before an incumbent's incentive to manipulate the scope of action of the next office-holder; for example, through strategic debt contraction (Persson and Svensson, 1989) or issue manipulation (Aragones, Castanheira and Giani 2015). Within this work, my model is closest to Milesi-Ferretti and Spolaore (1994). In their paper, policy-makers can have preferences over productive and unproductive spending. He shows that the incumbent policy-maker with preferences over unproductive spending can have incentives to tie the hands of tomorrow's office-holder: by collecting public resources inefficiently today, he gets to reduce the importance weight on spending tomorrow and, as a result, can increase his electoral prospects. My model is different in that the incumbent's choice of a transfers program allows him to simultaneously manipulate the information that is revealed about his competence today *and* the importance voters place on having competent leaders tomorrow.

Importantly, this paper also speaks to the distributive politics literature that studies politicians' incentives to strategically allocate government goods and services, so as to advance their political and electoral outlooks. This literature distinguishes between two modes of distributive strategies: programmatic versus non-programmatic policies. In its pure conceptual form, programmatic policies are (or should be) characterized by a set of key features: goods and services are allocated to some general class of voters, regardless of their geographical location (Golden and Min, 2013); the criteria for the selection of this class of voters is common-knowledge and it can be subject to public discussion (Stokes et al. 2013); and, once it is set, the program is non-manipulable by upcoming office-holders (Imai et al. 2020). From a normative viewpoint, some scholars claim that programmatic policies are what the "normal process of government" (Stokes et al. 2013, 9) should look like.

But things are often not well-behaved in politics, where we can often observe spending decisions that seem far from non-discretionary and transparent. This is the world of non-programmatic policies, where the vast majority of scholarly work is concentrated and which involves pork-barrel spending (Keefer and Kheman 2009), vote-buying (Schaffer and Schedler 2007), among others (see Golden and Min 2013).

However, there is an emerging empirical literature that examines the plausible electoral returns of programmatic policies. Some scholars have studied the returns of Brazil's CCT *Bolsa Familia* (Zucco Jr. 2013) and found positive effects. Others have focused on Mexico's CCT *PROGRESA* and found both null (Imai et al. 2020; Green 2011) and positive effects (De La O 2013), as well as Mexico's *Seguro Popular de Salud* and found null effects (Imai et al. 2020). From a theoretical standpoint, some literature has studied president-legislator incentives to pass a CCT (De La O 2015); a mayor's incentive to manipulate the implementation of an exogenous programmatic policy to advance his own electoral purposes (Frey 2020); or, somewhat more indirectly in a vote-buying setting, the aforementioned voters' feelings of reciprocity (Finan and Schechter 2012) with the incumbent in charge of the implementation of the transfers policy.

Among this literature, this paper is to some extent closest to Manacorda, Miguel and Vigorito (2011), who think about a model with rational though poorly informed voters "who are unaware of the quasi-random nature of the *PANES* targeting rule" (4) and, as such, beneficiaries interpret transfers as a signal of the government's preferences towards them. Their motivation for this assumption is that, under standard assumptions of fully rational and well-informed voters, citizens that "are on both sides of the [eligibility] threshold [of the quasi-random targeting of the *PANES* program] should hold the same views of the incumbent's competence" and, as a result, "their support for the incumbent should not be affected by their own personal transfer receipt" (4).

This paper does not argue against the latter possibility. Instead, it tries to show how, even in a world with voters that are fully rational, well-informed and forward-looking, the incumbent would still have electoral incentives to implement this type of programs. As such, if any of the existing hypothesized mechanisms are at play, these might provide even further incentives for incumbents to bring them to fruition. Put differently, this paper attempts to show that those alternative mechanisms are not necessary conditions for an incumbent to have electoral incentives to implement programmatic transfers.

Finally, my paper builds on the emerging literature of the Theoretical Implications of Empirical Models, which employs game-theoretic tools to examine and to rethink the counterfactuals that underlie experimental and quasi-experimental research designs (see Bueno De Mesquita and Tyson 2020; Izzo, Dewan and Wolton 2020). I add to this literature by laying out that the correct counterfactual for measuring the electoral effects of a policy of high persistence and low informativeness, would specify voters' behaviour with a policy of low persistence and high informativeness.

2.3 The model

I study a two-period ($t \in \{1, 2\}$) game between a continuum of voters $i \in [0, 1]$ and two politicians (J), an incumbent (I) and his challenger (C). In the first period, the incumbent can design a programmatic transfers policy which affects the per-period unit of budget that is otherwise used for the provision of public goods. At the end of the first period, each voter decides whether to retain the incumbent.

Politicians can be of "high" or "low" competence. The set of politicians' types is $\Theta = \{0, 1\}$, each standing for low and high types respectively. At the start of the game, a politician's type ($\theta_J \in \Theta$) is fixed but incompletely known to all players, who commonly believe that $\Pr(\theta_J = 1) = \pi_J \in (0, 1)$.

The policies available to the incumbent differ in a key dimension: the provision of public goods fluctuates more over time relative to transfers, as the former crucially depends on the competence of the office-holder. The provision of public goods (p_t) depends on a production technology and a random shock. The production technology indicates how public goods are created from money: it maps the available budget ($b_t \in \mathbb{R}_+$) and the underlying competence of the office-holder into an outcome.

In any period $t \in \{1, 2\}$, the provision of public goods is given by

$$p_t = b_t\,\theta_J + \eta_t \tag{1}$$

where η_t is the random shock, which is drawn from a uniform distribution on $[0, 1]$.

To capture in an stylized way the higher persistence of outcome of transfers, I assume that the budget allocated to this policy does not interact with the office-holder's competence and there are no random shocks. In addition, transfers are "programmatic" in two main aspects. The first is that, once it is settled, it is non-manipulable by upcoming office-holders: beneficiaries expect to receive the transfers throughout the game, independently of who is in power —an assumption that I later relax. The second is that the incumbent has narrow discretion in its design: although he can set the per-capita transfer that each beneficiary will receive, only an exogenous income threshold determines eligibility.

In the population, the distribution of income (y_i) is given by some increasing and continuous cumulative distribution function $G(y_i)$, with support on $\mathbb{R}_+$ and with an associated probability density function $g(y_i)$. Among voters, any one with an income $y_i \leq \tilde{y}$ will benefit from a per-capita transfer $T \in \mathbb{R}_+$, which size is determined by the incumbent under a balanced-budget constraint. A transfers policy is defined as

$$\mathbf{T} := \int_0^{\tilde{y}} T \,\mathrm{d}G(y_i)$$

As consumers, voters' have preferences over the consumption of private (c_i) and public goods (p_t). Voter i's utility is given by

$$u_{i,t} = p_t + c_i$$

where private consumption is given by a voter's disposable income $\left(c_i = y_i + \mathbb{1}_{\{y_i \leq \tilde{y}\}} T\right)$.

In addition to these payoffs from policy, I adopt a probabilistic voting framework to capture all other sources of utility derived from voting for a candidate. For simplicity, I assume that uncertainty operates only at the individual-level: each voter gets a payoff of $\sigma_{i,I}$ and $\sigma_{i,C}$ from voting for the incumbent and the challenger, respectively, both of which are drawn from a uniform distribution on $[0, 1]$. Accordingly, politicians are purely office-motivated in that they only care about maximising their share of votes.

The game proceeds as follows:

- **Period 1:**

   0. Nature draws all random variables;
   1. The incumbent chooses a budget of public goods provision ($b \in \mathbb{R}_+$) and, with what remains, he sets a programmatic transfers policy ($\mathbf{T}(b) = 1 - b$);
   2. Voters observe the incumbent's performance and elections are held.

- **Period 2:**

   1. The office-holder implements the transfers policy designed in the previous period ($\mathbf{T}(b) = 1 - b$) and provides public goods (with a budget $b \in \mathbb{R}_+$);

2. Payoffs are realized and the game ends.

The structure of the game is common knowledge. The office-holder's allocation of the budget is observed by all players. For simplicity and without loss of generality, I assume that voters vote sincerely and that when a voter is indifferent between the challenger and the incumbent, she elects the incumbent.

The solution concept is Perfect Bayesian Equilibrium in pure strategies. In a Perfect Bayesian Equilibrium, players' beliefs are derived by Bayes' rule on the equilibrium path; a voter optimally decides whether to reelect the incumbent, given her beliefs about the politicians' types and her valence shock; and the incumbent chooses a budget allocation optimally in anticipation of the voters' voting strategy.

Finally, the following definition will be useful for the analysis:

Definition: Leading and trailing incumbent. An incumbent is leading if the prior belief that he is competent is higher than the prior on the challenger ($\pi_I \geq \pi_C$); otherwise ($\pi_I < \pi_C$), he is trailing.

2.3.1 Comments on the model

There are two points worth stressing. The first relates to the higher persistence of outcome of transfers relative to the provision of public goods. Perhaps the most straightforward way to justify this assumption is to look at the policies' differences in their key obstacles for a successful implementation. In the case of Conditional Cash Transfers, which is a representative example of programmatic transfers, researchers identify as a key obstacle a country's "administrative capacity" as it can hinder "the speed with which information on compliance becomes available to trigger sanctions" (Fiszbein and Schady, 2009, 325).

We can contrast this obstacle of monitoring compliance with the problems present in infrastructure projects, which researchers argue to include "cost overruns, delays (...) failed procurement [and even] frequent design changes" that, under poor management, can result in them being "canceled or abandoned after significant up-front investment" (Beckers and Stegemann 2013). I interpret these differences in the nature of obstacles as a proxy of the inherent level of complexity that each task involves, with transfers being less convoluted and thereby less fluctuant over time than public goods provision.

The second point concerns the assumption that the implementation of transfers is non-manipulable by future office-holders. This assumption is made *precisely* because of the theoretical objectives of this paper: to show how, even if politicians are only able to implement programmatic transfers in their idealized shape, strategic incentives can emerge. Nonetheless, this assumption is stronger than needed. All results would hold under partial persistence of transfers: for instance, if it is politically too costly to withdraw transfers benefits from some share of citizens. I develop an extension that endogenizes the challenger's decision to agree or disagree with the continuity of a transfers policy.

2.4 Analysis

Working through backwards induction, in the second period the office-holder has no strategic options: he implements the transfers policy set by the previous administration (because programmatic transfers are persistent) and provides public goods. Thus, all the strategic tensions concentrate in the first period.

By the end of the first period and after observing the incumbent's performance in office, voters think about tomorrow with updated beliefs about his competence —which I denote by $\Pr(\theta_I = 1 \,|\, p_1) = \mu_I \in [0, 1]$. This posterior belief, together with the individual-level valence shock and the budget for public goods tomorrow, create the vote share of the candidates.

Voter i with income y_i votes for the incumbent if and only if

$$\mathbb{E}[u_{i,2} \,|\, \mu_I] + \sigma_{i,I} \geq \mathbb{E}[u_{i,2} \,|\, \pi_C] + \sigma_{i,C}$$

$$\tilde{\sigma}_i \leq b\,(\mu_I - \pi_C)$$

where $\tilde{\sigma}_i = \sigma_{i,C} - \sigma_{i,I}$. Given the distributional assumptions of valence and income in a population that consists of a mass of voters of size one, the incumbent's vote share is

$$\int_{y_i} \Pr\left(\tilde{\sigma}_i \leq b\,(\mu_I - \pi_C)\right) \mathrm{d}G(y_i) = F\big(b\,(\mu_I - \pi_C)\big)$$

where the right hand side represents the continuous cumulative distribution function of $\tilde{\sigma}_i$, which is a random variable resulting from the subtraction of the two valence shocks at the individual-level.

Remark 1. *The incumbent's vote share satisfies*

$$F\big(b\,(\mu_I - \pi_C)\big) = \begin{cases} \frac{1}{2} + b\,(\mu_I - \pi_C)\left(1 + \frac{b\,(\mu_I - \pi_C)}{2}\right) & \text{if} \quad \mu_I < \pi_C \\ \frac{1}{2} + b\,(\mu_I - \pi_C)\left(1 - \frac{b\,(\mu_I - \pi_C)}{2}\right) & \text{if} \quad \mu_I \geq \pi_C \end{cases}$$

Anticipating how his share of the votes emerge, from the incumbent's viewpoint the budget for public goods that he chooses *today* has a direct impact on his electoral fortunes *tomorrow*. To illustrate this, suppose that he would choose to allocate nothing to public goods ($b = 0$) and set a pervasive transfers program ($\mathbf{T}(0) = 1$). This will be our benchmark.

By Remark 1, it follows that voters will place a weight of zero on the importance of selecting good politicians: without a budget for public goods tomorrow, the candidates' ability is rendered trivial and the electoral outcomes would be purely determined by valence —a candidate's charisma, etc.

Suppose now that the incumbent would instead choose a positive budget for public goods today ($b > 0$) —and, thereby, he would reduce the size of the programmatic transfers policy ($\mathbf{T}(b) < 1$). Then, the relevance of political selection in voters' electoral decision would be amplified: the role of valence in the election is displaced by the candidates' expected performance in the policy arena.

I call this an stakes effect: the electoral effect of changing the weight that voters place on selecting competent politicians from what it would be when the incumbent allocates a budget of zero to public goods, to what it would be when he allocates a positive budget to public goods, holding the voters' beliefs fixed. Formally, we can define this by

$$\beta(0, b \,|\, \pi_I, \pi_C) = F\big(b(\pi_I - \pi_C)\big) - \frac{1}{2} \tag{2}$$

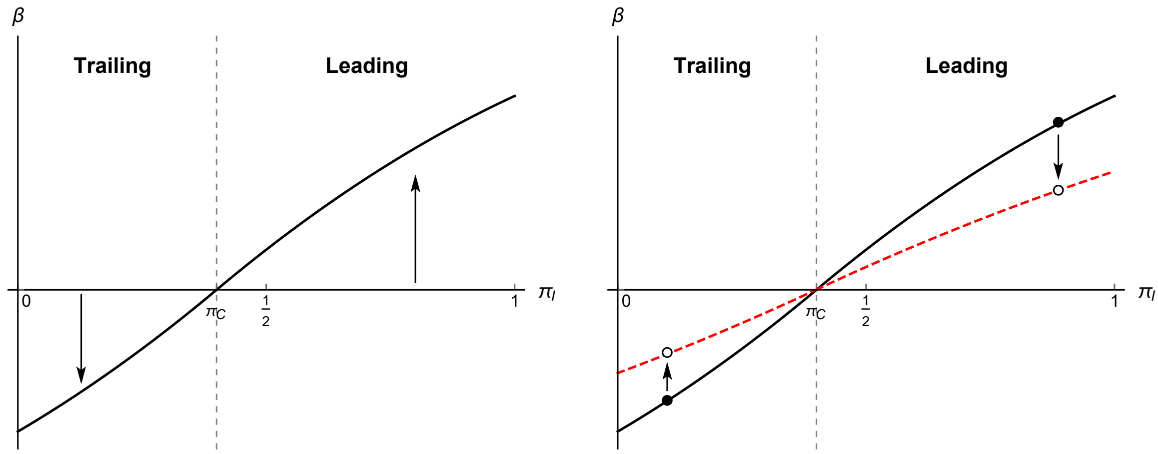
where implicit above is that the share of votes are equally split among the candidates when there is no budget for public goods tomorrow, as the distribution of valence in the population is symmetrical around zero. The incumbent's valuation of the stakes effect will be given by the sign of (2) —if the sign is positive (negative), then he benefits (is harmed) from the stakes effect.

Lemma 1. *Fix a budget for public goods provision ($b \in \mathbb{R}_+$). If $\pi_I < \pi_C$, then $\beta(0, b \,|\, \pi_I, \pi_C) < 0$; otherwise ($\pi_I > \pi_C$), then $\beta(0, b \,|\, \pi_I, \pi_C) > 0$.*

This lemma tells us that an incumbent's valuation of the stakes effect is utterly given by his electoral status with respect to his challenger. To see why this is the case, consider a leading incumbent. Everything else being equal, he wants to reap electoral rewards from having a gleaming reputation: he is more likely to be competent than his challenger, and he wants voters to make this a priority when they cast their ballot. As illustrated in Figure 2.1(a), the stakes effect must then be positive.

Moreover, the magnitude of this effect should be strictly increasing is his electoral lead, as voters would expect him to outperform his challenger in providing public goods. Put equivalently and as illustrated in Figure 2.1(b), to a leading incumbent the marginal effect of decreasing the budget allocated to public goods would be negatively evaluated, and the magnitude of this negative evaluation would grow along the extent of his electoral lead.

Figure 2.1: Electoral value of the stakes effect



(a) High stakes **(b)** Decreasing the stakes

Note. In both panels, the black line is $\beta(0, 1 \,|\, \pi_I, 2/5)$; in the right, the red dashed line is $\beta(0, 1/2 \,|\, \pi_I, 2/5)$.

Contrarily, a trailing incumbent has no incentives for political selection to matter more in the election by way of increasing the budget to public goods: he has a poorer reputation than his challenger, and he would therefore gain if this fact became irrelevant in voters' choice.

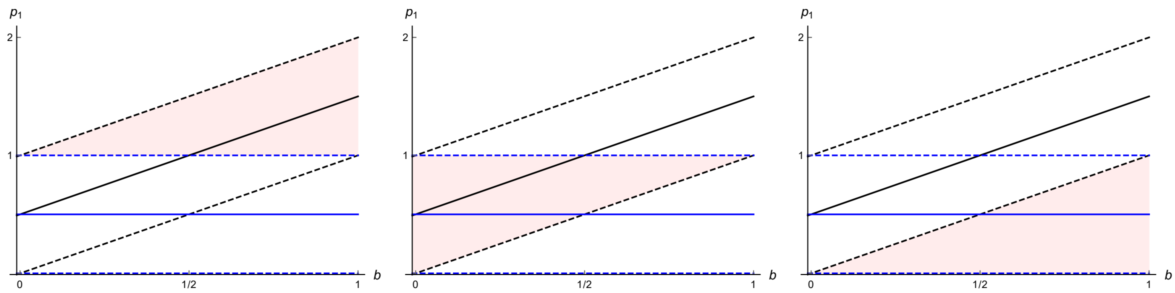
By decreasing the budget to public goods and, thereby, increasing the size of transfers, he can attenuate the very source of his electoral trail. As illustrated in Figure 2.1(a), the stakes effect must be negative. And the larger the extent of his electoral trail, the stronger his incentive to decrease the stakes of the election: as shown in Figure 2.1(b), the marginal effect of decreasing the budget for public goods is positive and its magnitude grows along the level of trail.

Naturally, increasing or decreasing the budget for public goods provision does not only have an stakes effect. From the incumbent's viewpoint, it also affects the way voters update about his underlying competence since it influences his first-period performance.

This induces an informativeness effect, to which I now turn to.

As in Izzo (2020), the learning process is stark: players learn everything or nothing about the incumbent, upon observing the first-period level of public goods provision. Formally, this happens because of the random shock being drawn from a uniform distribution.

Figure 2.2: Public goods and posterior beliefs



Full learning: Competent	No learning	Full learning: Incompetent
$\big(p_1 > 1\big)$	$\big(b \leq p_1 \leq 1\big)$	$\big(p_1 < b\big)$

Note. All points within the dashed black (blue) lines are outcomes that can be produced by a competent (incompetent) politician.

To understand how full learning is induced, consider the left panel of Figure 2.2. The set of outcomes in upper shaded area can never be produced by a low ability politician, even if the random shock takes its highest positive value. Therefore, an outcome in this area would induce a belief that he must be of high ability with certainty.

Similarly, a high ability politician can never produce outcomes in the shaded area of the right panel, even if the random shock takes its lowest negative value. An outcome in this area would induce a belief that he must be of high ability with certainty.

Finally, consider the set of outcomes in the shaded area of middle panel. These are outcomes that can be produced both by a competent and an incompetent incumbent.

Upon observing an outcome in this area, the voter learns nothing.

Lemma 2. *Each level of public goods provision induces the following posterior beliefs about the incumbent's competence:*

(a) If the level of public goods provision is high enough ($p_1 > 1$), then voters learn that the incumbent is of high ability with certainty ($\mu_I = 1$);

(b) If the level of public goods provision is neither too high nor too low ($b \leq p_1 \leq 1$), then voters learn nothing about the incumbent ($\mu_I = \pi_I$);

(c) If the level of public goods provision is low enough ($p_1 < b$), then voters learn that the incumbent is of low ability with certainty ($\mu_I = 0$).

To the incumbent, the fact that this policy is informative about his competence implies that the budget that he allocates it induces a lottery over vote shares: a budget for public goods induces a probability distribution over observable statistics (a performance level); each statistic induces a posterior belief about his underlying competence; and, by Remark 1, each posterior induces his share of votes at the end of the first period.

Lemma 3. *The budget allocated for public goods provision ($b \in \mathbb{R}_+$) induces a lottery over vote shares. This lottery has the following probability distribution:*

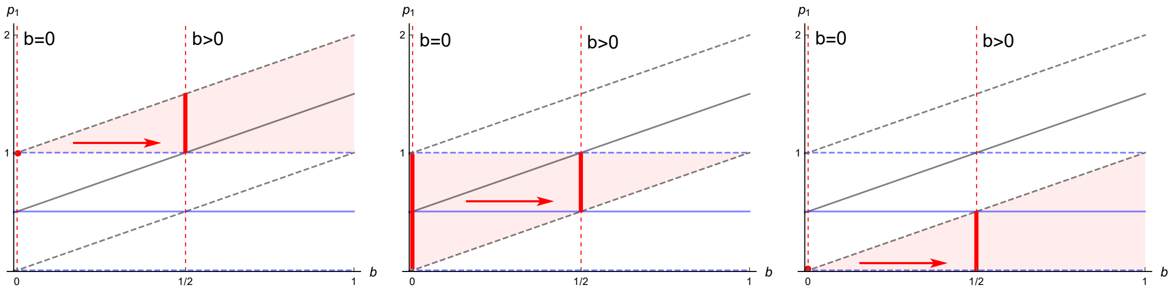
(a) With probability $\Pr(p_1 > 1) = \pi_I\, b$, his vote share is $F(b\,(1 - \pi_C))$;

(b) With probability $\Pr(b \leq p_1 \leq 1) = 1 - b$, his vote share is $F(b\,(\pi_I - \pi_C))$; and,

(c) With probability $\Pr(p_1 < b) = (1 - \pi_I)\, b$, his vote share is $1 - F(b\,\pi_C)$.

To illustrate this, consider the benchmark: the incumbent allocates nothing to public goods ($b = 0$) and sets a pervasive transfers program ($\mathbf{T}(0) = 1$). Indeed, this would result in a degenerate lottery in which players will learn nothing about him with probability one. As highlighted in Figure 2.3, all performance outcomes will fall within the area that induce no learning. By doing this, the incumbent can be certain that information revelation will not be the source of an electoral effect.

Figure 2.3: Budgets for public goods: Lottery over vote shares



Full learning: Competent	No learning	Full learning: Incompetent
$(p_1 < 1)$	$(b \leq p_1 \leq 1)$	$(p_1 < b)$

Note: In all panels, the thick red lines are the ex-ante possible levels of public goods provision that can be delivered by an incumbent, given some budget.

Suppose now that the incumbent would instead choose a positive budget for public goods ($b > 0$). Then, this lottery would be non-degenerate in that voters could learn his true identity with positive probability. The outcomes that would result in null learning shrink as we move from no budget ($b = 0$) to a positive budget ($b > 0$). The incumbent would then expect information revelation to be the source of an electoral effect since new information can accrue.

With these preliminaries, I am ready to define the informativeness effect: the electoral effect of changing the probability that voters learn about the incumbent's competence from what it would be when the incumbent does not allocate any budget to public goods, to what it would be when he allocates a positive budget to public goods, holding the respective budgets fixed. Formally, we can define this by

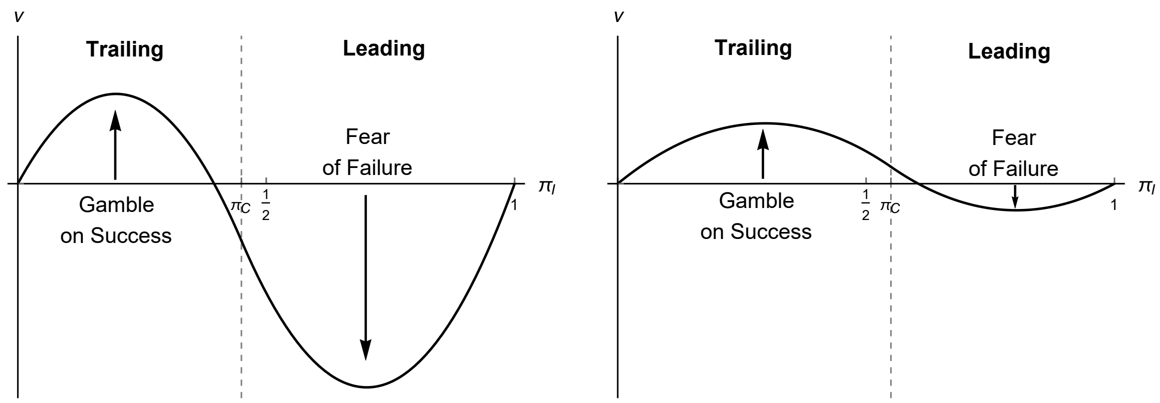
$$\nu(0, b \,|\, \pi_I, \pi_C) = \underbrace{\mathbb{E}^b_{\theta_I}\Big[F\big(b(\theta_I - \pi_C)\big)\Big]}_{\text{Lottery over votes shares}} - \underbrace{F\big(b(\pi_I - \pi_C)\big)}_{\text{No learning}} \tag{3}$$

where implicit above is that the electoral effect of the degenerate lottery (no budget for public goods and everything to transfers) is effectively zero, because no information would be revealed with certainty. The incumbent's valuation of this effect will be given by the sign of (3) —if the sign is positive (negative), then he benefits (is harmed) from the informativeness effect.

Lemma 4. *Fix a budget for public goods provision ($b \in \mathbb{R}_+$). Then, there exists a unique threshold $\pi^a_I(\pi_C) \in (0,1)$ increasing in $\pi_C \in (0,1)$ such that (i) $\nu(0, b \,|\, \pi_I, \pi_C) > 0$ if $\pi_I < \pi^a_I$, and (ii) $\nu(0, b \,|\, \pi_I, \pi_C) < 0$ if $\pi_I > \pi^a_I$.*

To start, consider a leading incumbent. Albeit being ahead of his contender, a very good performance in the provision of public goods can further his electoral advantage if he proves to be competent: he has incentives to gamble on a successful performance. But because it is a gamble, it can backfire: a poor performance could reveal that he is incompetent and, thereby, turn him into a trailing candidate; that is, he experiences fear of failure.

Figure 2.4: Electoral value of the informativeness effect



(a) Weak Challenger **(b)** Strong Challenger

Note. The black lines in the left and right panels are $\nu(0, 1 \,|\, \pi_I, 45/100)$ and $\nu(0, 1 \,|\, \pi_I, 55/100)$, respectively. The y-axis of both panels have the same scale.

The incumbent's valuation of the gamble will hinge on the voters' ex-ante assessment of the extent of his electoral lead and on how confident he is that he will not performing poorly. For example, consider the situation depicted in Figure 2.4(a) where the challenger is more likely to be incompetent than competent.

When the incumbent's electoral lead is narrow, his fear of failure dominates his incentives to gamble on success: being very close to his likely incompetent challenger, the incumbent evaluates that it is also more likely than not that he will not produce a good enough outcome. He fears losing his lead altogether if he opens up information revelation.

And notice that as the prior belief on the incumbent increases, his fear of failure still dominates. This happens not because the he does not increasingly expect to produce a good outcome, but because he assesses that there is little to gain by separating even further away from his challenger by proving to be competent: his growing electoral lead makes him want to play it safe. Overall, he evaluates the informativeness effect to be strictly negative.

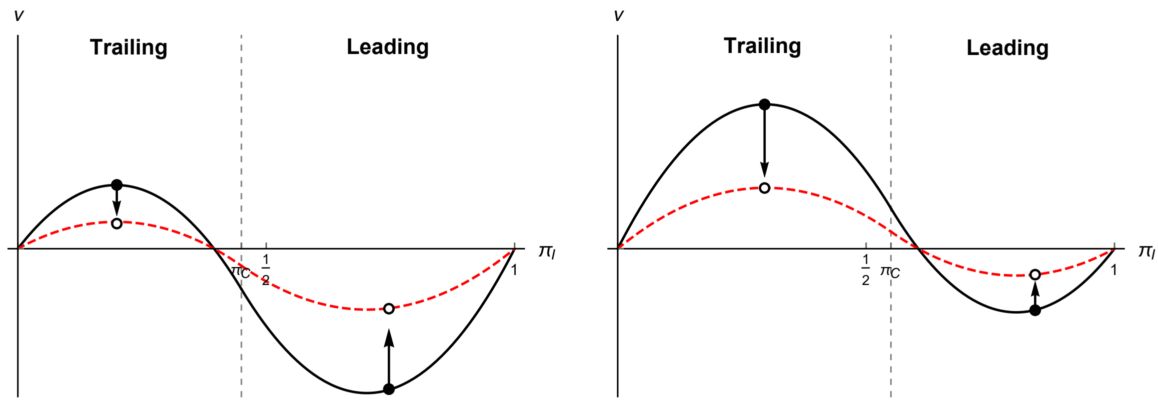
But this negative evaluation is not strict for any parameter configuration. Consider the situation depicted in Figure 2.4(b), where the challenger is more likely to be competent than incompetent. When the incumbent's lead is tight, he is now confident enough to prove himself: his incentives to gamble on success dominate his fear of failure, and hence he evaluates the informativeness effect to be positive. And, as before, as the prior belief that he is competent increases, his fear of failure overcomes as he would rather play it safe.

Let us now turn to the incentives of an incumbent who is electorally trailing. To him, information revelation provides him a way out his trail: his incentive to gamble on success must be very high and, thus, he must broadly positively evaluate the informativeness effect. Both panels of Figure 2.4 illustrate this, but with an intuitive caveat.

When both himself and his challenger are likely to be incompetent, then his fear of failure can overwhelm him when his electoral trail is tight. This is because he estimates a bad performance to be likely if he tries to prove himself, which would be unwarranted because his electoral distance is not too pronounced. He would rather conform with a slightly lower vote share than his challenger and play it safe.

With these insights, Figure 2.5 depicts an incumbent's estimate of the marginal effect of decreasing the informativeness of his performance —by way of increasing the budget allocated to transfers. Precisely because a leading incumbent experiences fear of failure, he positively evaluates increasing the budget to the transfers policy in order to reduce the amount of information revelation. In contrast, from the standpoint of a trailing incumbent, information revelation is what would allow him to demonstrate that he is more competent than his challenger: decreasing the budget to public goods is negatively evaluated since information revelation is what could allow him to turn his reputation around.

Figure 2.5: Marginal effect of decreasing the public goods budget



(a) Weak Challenger　　**(b)** Strong Challenger

Note. The red dashed lines in the left and right panels are $\nu(0, 1/2 \,|\, \pi_I, 45/100)$ and $\nu(0, 1/2 \,|\, \pi_I, 55/100)$, respectively. The y-axis of both panels have the same scale.

To summarize the analysis above, when the incumbent moves from allocating nothing to public goods ($b = 0$) to allocating a positive budget ($b > 0$), it has a total effect on his expected vote share, which I denote by $\tau(0, b \,|\, \pi_I, \pi_C)$. This total effect can be decomposed into an informativeness and a stakes effect. The incumbent's problem is to optimally set the budget that he allocates to the provision of public goods.

We can write the solution to his problem as choosing an allocation to public goods that maximises its total effect; that is, the incumbent solves

$$b^* \in \underset{b \in \mathbb{R}_+}{\arg\max} \;\; \tau(0, b \,|\, \pi_I, \pi_C)$$

From the insights of Lemma 1 and Lemma 4, we know that the informativeness and the stakes effects impose a trade-off to the incumbent because, to him, these two go in opposing directions. Take a leading incumbent. To him, the informativeness effect is positive: his fear of failure makes him value a marginal increase in transfers in order to keep his reputation untarnished; but the stakes effect is negative: what good is it to hold a better reputation for competence today when competence will matter little for tomorrow's welfare?

Informally, we can grasp this trade-off in terms of a popular saying: a leading incumbent knows that he cannot have the cake (decrease the budget to public goods by increasing transfers so as to keep his reputation untarnished) and eat it, too (reap electoral rewards from a gleaming reputation). Which of these two effects dominate in equilibrium?

Proposition 1. *Suppose that the incumbent is leading. Then, there exists a unique threshold* $\pi^\dagger(\pi_C) \in [\pi_C, 1)$ *decreasing in* $\pi_C \in (0,1)$ *such that*

(a) $b^*(\pi_I) \in (0,1)$ *and strictly increasing in* $\pi_I \in (\pi_C, 1)$ *if* $\pi_I \in (\pi_C, \pi^\dagger(\pi_C))$*; and,*

(b) $b^*(\pi_I) = 1$ *if* $\pi_I \geq \pi^\dagger(\pi_C)$.

Proposition 1(b) tells us that when the incumbent's electoral lead grows high enough, he would rather have the stakes of the election at its highest by allocating everything to public goods provision and nothing to transfers. This result is not obvious since we know, by Lemma 4, that the informativeness effect is broadly negative for him. Yet it turns out that, in equilibrium, he is willing to keep the stakes high and take the risk of losing his reputation.

He is better off with this decision because a high enough electoral lead implies a low enough probability that he performs poorly: his fear of failure is relatively small. Confident enough that his first-period performance will improve further voters' evaluation of his competence, he would rather have an election with high stakes.

However, Proposition 1(a) stresses that it is the electoral distance with his challenger which determines whether taking such a risk is warranted. A lower reputation implies a higher fear of failure which, in turn, generates incentives to decrease the informativeness of his performance in office even if it decreases the stakes of the election. Though, this can only happen when the expected competence of his challenger (π_C) is low enough. When this is the case, then the incumbent prefers a smooth allocation across transfers and public goods. This is illustrated in Figure 2.6(a): through a prudent allocation, he keeps the stakes of the election high but not too high so as to spoil his electoral fortunes by revealing too much information.

A direct implication is that as the prior on the challenger being competent decreases, it must be the case that for him to shut down entirely transfers the prior must be very high: the threshold condition ($\pi^{\dagger}(\pi_C)$) is thus decreasing on the prior on the challenger because his incentives to play it safe decrease accordingly.

The reverse rationale holds for a trailing incumbent. It is precisely because he holds a poorer reputation than his challenger that, with respect to the stakes effect, the marginal effect of increasing transfers would be valuable: he gets to push to the background voters' concern on selecting good politicians. Yet, with respect to the informativeness effect, the marginal effect of reducing the budget for public goods today would hinder his chances of turning the table around by proving to the electorate that he is more likely to be competent than this contender.

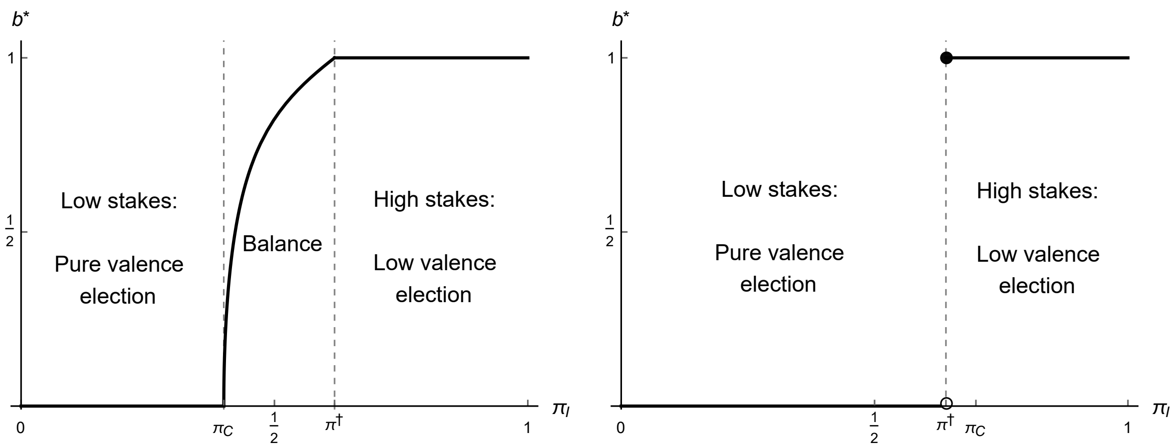
Proposition 2. *Suppose that the incumbent is trailing. Then, there exists a unique threshold* $\pi^{\ddagger}(\pi_C) \in (0, \pi_C)$ *increasing in* $\pi_C \in (0,1)$ *such that*

(a) $b^*(\pi_I) = 0 \quad$ *if* $\quad \pi_I < \pi^{\ddagger}$*; and,*

(b) $b^*(\pi_I) = 1 \quad$ *if* $\quad \pi_I \geq \pi^{\ddagger}$.

Proposition 2 tells us that, to a trailing incumbent, the optimal transfers policy is stark: either everything to transfers or everything to public goods. Moreover, it tells us that this decision depends on the acuteness of his electoral trail. To see why, suppose that he faces a challenger likely to be incompetent.

Figure 2.6: Equilibrium budget for public goods provision



(a) Weak challenger **(b)** Strong challenger

Note. In the left panel, $\pi_C = 2/5$ and $\pi^{\dagger} \approx 0.619$; and in the right panel, $\pi_C = 7/10$ and $\pi^{\ddagger} \approx 0.641$.

If this is the case, then he evaluates that the chances that he produces a good enough outcome must be low —he is even less likely to be competent than his contender after all.

Although he may not be confident enough to gamble on information revelation cutting his trail, he still was an easy way out: shutting down altogether the importance of selecting good politicians. Good bye, political selection; and welcome, valence-based electoral race.

Naturally, his incentive to shutdown political selection is intensified as his challenger becomes more likely to be competent. But only up to a point. This is the content of Proposition 2(b), which is depicted in Figure 2.6(b): when the challenger is likely to be competent and the incumbent's trail is tight enough, then he can find it optimal to put all of his coins on gambling on success. After all, under this situation he is also more likely to be competent and chances are that he gets to turn the table around. With a good enough outlook to prove himself, he is better off allocating everything to public goods provision and nothing to transfers.

2.5 Endogenous agreement with a transfers policy

As it was mentioned in a previous section, that transfers are non-manipulable once these are set-up is one of the key features for these to be programmatic. It is precisely this which, conceptually, should render an incumbent impotent from claiming credit for its implementation, as voters' electoral decision would internalise that they would receive payments regardless of who is in power. While it was a helpful assumption in the basic model to take this as a given, it can be seen as substantively problematic.

To address this concern, this section investigates conditions for an agreement of continuity of transfers to be possible among the candidates; that is, the conditions for a transfers policy set by the incumbent to endogenously achieve the status of "programmatic"

—as a corollary, in the absence of agreement such transfers policy would be conceptualised as "non-programmatic". To this end, I make two modifications to the model. Suppose now that the incumbent sets a transfers policy, after which the challenger credibly commits to continuing it or not if he is elected: $A \in \{0,1\}$, each standing respectively for reject and accept. And to keep things simple, suppose that the action space for the incumbent is to allocate the whole of unit of budget to either transfers or public goods: $\mathbf{T}(b) \in \{0,1\}$ —this would allow me to derive clean closed-form solutions. Everything else remains as before.

By Remark 1, we know that the if the incumbent exhausts the budget in the transfers policy and the challenger agrees, then they equally split the share of the votes: with no budget for public goods tomorrow, political selection is rendered trivial in voters' electoral decision —and, by assumption, the resulting valence shock is symmetrical around zero. The additional component that we need to derive in this section is the share of votes if the incumbent sets a transfers policy but the challenger decides to reject its continuity if he gets to be in office. Formally, suppose that the incumbent allocates everything to transfers and the challenger commits not to continue it if elected.

Proceeding backwardly and from the challenger's viewpoint, at the time of the election voter i with income y_i prefers to vote for the challenger if and only if

$$\begin{aligned} \mathbb{E}[u_{i,2} \,|\, \mu_I] + \sigma_{i,I} &\leq \mathbb{E}[u_{i,2} \,|\, \pi_C] + \sigma_{i,C} \\ \tilde{\sigma}_i &\geq \pi_C - \mathbb{1}_{\{y_i \leq \tilde{y}\}} \left(\frac{1}{G(\tilde{y})} \right) \end{aligned}$$

which incorporates that beneficiaries receive a per-capita amount satisfying the balanced-budget constraint $T\,G(\tilde{y}) = 1$. Given the distributional assumptions of valence and income in the population, the challenger's vote share would be equal to

$$\underbrace{\int_0^{\tilde{y}} \Pr\left(\tilde{\sigma}_i \geq \pi_C - \frac{1}{G(\tilde{y})}\right) \mathrm{d}G(y_i)}_{\text{Mass of eligible voters}} + \underbrace{\int_{\tilde{y}}^{\infty} \Pr\big(\tilde{\sigma}_i \geq \pi_C\big) \mathrm{d}G(y_i)}_{\text{Mass of ineligible voters}} \tag{4}$$

It is apparent that the decision not to uphold the continuity of transfers makes the challenger suffer among the mass of citizens eligible to become beneficiaries, as they would forsake receiving transfers if he gets to hold office. By inspection, it is also apparent that disagreement is positively evaluated by the mass of ineligible voters although this support depends itself in their expectation of his performance in public goods provision.

Lemma 5. *Suppose that the incumbent allocates all the budget to a transfers policy* ($\boldsymbol{T}(0) = 1$). *Then, there exists a unique threshold* $\hat{\pi}_C(G(\tilde{y})) \in (0, 1)$ *which is increasing in* $G(\tilde{y}) \in (0, 1)$ *such that*

(a) R=0 if $\pi_C > \hat{\pi}_C(G(\tilde{y}))$*; and,*

(b) R=1 if $\pi_C < \hat{\pi}_C(G(\tilde{y}))$*.*

This lemma tells us that refusing the continuity of transfers is optimal when the challenger's expected quality is high enough, and that this threshold is decreasing in the mass of non-eligible voters: as depicted in Figure 2.7(a), the higher the share of eligible voters, the higher the cost of disagreement and, hence, the higher the prior on the incumbent's competence must be in order for him to disagree to continue the transfers program if he gets to office.

Anticipating the challenger's optimal behaviour, the incumbent must decide whether to exhaust the budget in transfers. Suppose that the conditions are such that the challenger would disagree. To him, the stakes effect plays a strong role: if the challenger promises public good because the prior on his competence is high enough, then he can still decrease the stakes of the election by committing to transfers.

Proposition 3. *Suppose that the incumbent can only allocate the unit of budget either to transfers or to public goods provision. Then, there exists a unique threshold* $\hat{\pi}_I(\pi_C, G(\tilde{y})) \in (0,1)$ *which is increasing in* $G(\tilde{y}) \in (0,1)$ *and* $\pi_C \in (0,1)$*, such that*

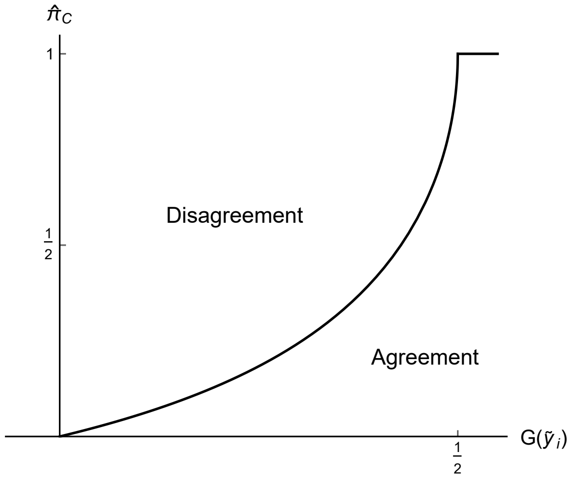
(a) $\boldsymbol{T}(0) = 1$ *if* $\pi_I < \hat{\pi}_I$*; and,*

(b) $\boldsymbol{T}(1) = 0$ *if* $\pi_I \geq \hat{\pi}_I$*.*

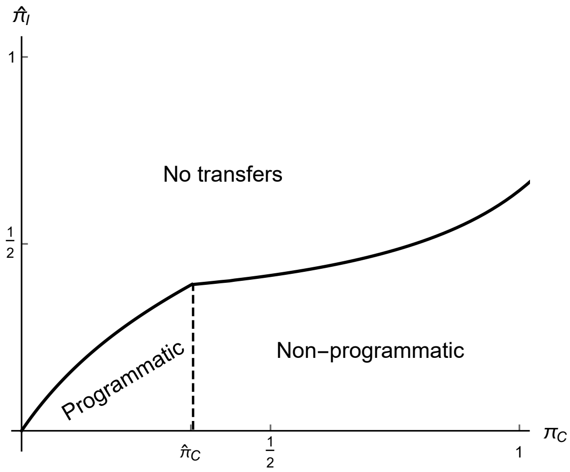
The incumbent then needs to evaluate if he is better off adopting a transfers policy, having it rejected by the challenger, and achieve a lower vote share than him; relative to not adopting it and participating in the election with voters perfectly learning his underlying identity by the end of the first period. When conditions in the electorate are such that the challenger would strictly prefer to reject the persistence of transfers, then the incumbent would only allocate the whole budget for public goods provision if the prior belief that he is competent is sufficiently high. Otherwise, he would rather propose transfers to cultivate his vote among the mass of eligible voters.

Figure 2.7(b) depicts the conditions under which programmatic transfers can emerge: the electoral competition must be among low competence candidates and the mass of eligible citizens must be high enough. When this is the case, the incumbent would not take the risk of gambling on success whereas the challenger anticipates that, by disagreeing, his support among ineligible voters would not high enough. But as the prior on the challenger's expected quality grows large enough, he would rather disagree —and, as a result, the transfers policy put forward by the incumbent would achieve a status of non-programmatic.

Figure 2.7: Endogenous agreement and type of transfers policy



(a) Agreement conditions



(b) Equilibrium type of program

Note. The parameter values in the right panel are $G(\tilde{y}) = 35\%$ which induces the threshold $\hat{\pi}_C \approx 0.32$.

By endogenizing the agreement with the non-manipulability of a transfers policy, these results suggest a political rationale for non-programmatic transfers to be widely observed in different settings. From the challenger's viewpoint, the first-period performance of the incumbent can reveal him to be incompetent, in which case he would get an edge by disagreeing with an electoral race of low stakes. That is, the challenger has incentives to gamble on the incumbent's failure and commit to public goods provision.

2.6 Theoretical Implications for Empirical Models

This paper puts forward a simple idea: the very decision to implement programmatic transfers is an equilibrium object. As such, observing the use of transfers should be indicative that they also expected to advance their fortunes. The correct counterfactual for when we see an action taken by an individual should be, therefore, what would have happened had he not taken such action at all.

Treatment 1. Capacity to implement a programmatic transfers policy. *What it measures:* The electoral effect of changing voters' decision from what it would be when an incumbent can implement a programmatic transfers policy, to what it would be when he cannot implement it.

Suppose that we had perfect data from a country composed by N municipalities, with N being very large. Suppose further that each municipality is identical: same incumbent (e.g. a mayor), challenger, and mass of voters. For each municipality, everything remains as in the main model. With each municipality being identical, the experimental ideal is straightforward: randomize the treatment across the municipalities. Let $\mathcal{D}_1 \in \{1, 0\}$ be the treatment status indicator for some incumbent politician, specifying whether he can (1) or cannot (0) employ transfers. Let the votes share received by an incumbent in some municipality be $F\big(b(\theta_I - \theta_C) \,|\, \mathcal{D}_1\big)$. For each municipality, the potential outcomes are

$$F\big(b(\theta_I - \theta_C) \,|\, \mathcal{D}_1\big) = \begin{cases} F\big(b(\theta_I - \theta_C) \,|\, 1\big) & \text{if Treated} \\ F\big(b(\theta_I - \theta_C) \,|\, 0\big) & \text{if Control} \end{cases}$$

After the randomization, all the incumbents in the treated municipalities would pursue the objective of choosing a transfers policy that maximises their expected vote share —while all incumbents in the control group would simply devote their budget to public goods provision. With the number of municipalities being very large and with all politicians in each municipality having the same expected quality, the average treatment effect would be

$$\delta = \mathbb{E}^{b^*}_{\theta_I}\big[F\big(b^*(\theta_I - \pi_C)\,|\,1\big)\big] - \mathbb{E}_{\theta_I}\big[F\big(\theta_I - \pi_C\,|\,0\big)\big]$$

$$\xrightarrow{p} \tau(0, b^*\,|\,\pi_I, \pi_C) - \tau(0, 1\,|\,\pi_I, \pi_C) \geq 0$$

Since we know that the equilibrium size of a transfers program is zero only in specific circumstances and it is strictly positive otherwise, then the average treatment effect must be weakly positive ($\delta \geq 0$). Intuitively, this stresses that a politician should be able to at least weakly push in his favor having larger menu of feasible policy options for a budget allocation.[12]

Although the experimental ideal that this paper puts forward may sound obvious ex-post, it is not so ex-ante: the effect that the literature measures is different, rooted in mechanisms such as feelings of reciprocity (Finan and Schechter 2012) or poorly informed voters (Manacorda et al. 2011). Given the effects that they want to isolate, scholars are rightly concerned with achieving one objective: creating balance in covariates among beneficiaries and non-beneficiaries.

[12]Indeed, this may be difficult to bring to the data. As such, it carries similar measurement problems with other equilibrium objects. For instance, while there is a vast theoretical literature that studies the effects of threats on political decisions (see Dal Bó and Di Tella, 2003; Wolton, 2020), this specific strategy imposes a hard bound on what empirical scholars can do because threats are never materialized in equilibrium.

Treatment 2. Becoming a beneficiary of a programmatic transfers policy. *What it measures:* The effect of changing voters' electoral decision from what it would be if they are the beneficiaries of a programmatic transfers policy, to what it would be if are not the beneficiaries of a programmatic transfers policy, holding the transfers policy fixed.

Suppose that we take a mass of voters from some municipality, and we randomly allocate each voter into one of two groups, $\mathcal{G} \in \{0, 1\}$, which means that the distribution of income and valence is the same in each. We now have two groups of voters with perfect covariate balance. Let $\mathcal{D}_2 \in \{1, 0\}$ be the treatment status indicator for a group, specifying whether they will benefit (1) or not (0) from a transfers policy, which has a total size of $\mathbf{T}\big(b^*\big)$ —which emphasizes that the size of the transfers program is determined in equilibrium. Let the votes share received by an incumbent in group $\mathcal{G}$ be $F\big(b^*(\theta_I - \theta_C) \,|\, \mathcal{D}_2\big)$. For each group, the potential outcomes are

$$F\big(b^*(\theta_I - \theta_C) \,|\, \mathcal{D}_2\big) = \begin{cases} F\big(b^*(\theta_I - \theta_C) \,|\, 1\big) & \text{if Treated} \\ F\big(b^*(\theta_I - \theta_C) \,|\, 0\big) & \text{if Control} \end{cases}$$

It is then easy to see that, for whatever performance level, the average treatment effect must be zero, independent of the experimental design and no matter how data is cut. This null effect is, indeed, found by some scholars —further, Imai et al. (2020) re-assessed a previous finding of positive effects in De La O (2012) and contended that, after data correction, null effects also ensue. Based on this model, these null effects are reassuring for the standard assumptions of voter rationality in the political economy literature.

2.7 Concluding remarks

In this paper, I uncover two mechanisms through which an incumbent politician can reap electoral rewards through strategically allocating the budget across public goods and programmatic transfers (in their idealized form). The first is an informativeness effect: decreasing the size of transfers increases the amount of information that is revealed about his identity. The second is an stakes effect: decreasing transfers increases the salience of selecting competent politicians. From the incumbent's viewpoint, these two effects go in opposing directions.

When the incumbent is electorally ahead of his challenger, then the informativeness effect is negative and the stakes effect is positive; and when he is electorally behind, then the stakes effect is negative and the informativeness effect is positive. The equilibrium transfers policy results from the optimal balance of these two effects: a leading incumbent increases the stakes of the election at the cost of losing his reputation, whereas a trailing incumbent decreases the stakes of the election at the cost of hindering his chances of proving himself to the electorate.

Empirically, the model suggests that we should treat the very implementation of a programmatic transfers program as an equilibrium object which, by its nature, should yield weakly positive effects on the incumbent's electoral fortunes. That is, this paper stresses how the random allocation of transfer to voters, conditional on transfers being implemented, is distinct from the random authority to implement transfers.

References

Aghion, Philippe, and Patrick Bolton. 1990. “Government domestic debt and the risk of default: a political-economic model of the strategic role of debt.” *Public debt management: theory and history*, 315.

Alesina, Alberto, and Guido Tabellini. 1990. “A positive theory of fiscal deficits and government debt.” *The Review of Economic Studies* 57 (3): 403-414.

Aragonès, Enriqueta, Micael Castanheira, and Marco Giani. 2015. “Electoral competition through issue selection.” *American Journal of Political Science* 59 (1): 71-90.

Ashworth, Scott, and Ethan Bueno de Mesquita. 2006. “Delivering the goods: Legislative particularism in different electoral and institutional settings.” *The Journal of Politics* 68 (1): 168-179.

Ashworth, Scott, Ethan Bueno de Mesquita, and Amanda Friedenberg. 2017. “Accountability and information in elections.” *American Economic Journal: Microeconomics* 9 (2): 95-138.

Ashworth, Scott, Ethan Bueno de Mesquita, and Amanda Friedenberg. 2019. “Information and incumbency”. Available at shorturl.at/prALW

Ashworth, Scott. 2012. “Electoral accountability: Recent theoretical and empirical work.” *Annual Review of Political Science* 15: 183-201.

Beckers, Frank, Nicola Chiara, Adam Flesch, Jiri Maly, Eber Silva, and Uwe Stegemann. 2013. "A risk-management approach to a successful infrastructure project." *McKinsey & Company Working Papers on Risk*. Available at shorturl.at/mtuNX

Biais, Bruno, and Enrico Perotti. 2002. "Machiavellian privatization." *American Economic Review* 92 (1): 240-258.

De Mesquita, Ethan Bueno, and Scott A. Tyson. 2020. "The commensurability problem: Conceptual difficulties in estimating the effect of behavior on behavior." *American Political Science Review* 114 (2): 1-17.

Dahlberg, Matz, and Eva Johansson. 2002. "On the vote-purchasing behavior of incumbent governments." *American political Science review* 96 (1): 27-40.

De Janvry, Alain, Frederico Finan, and Elisabeth Sadoulet. 2012. "Local electoral incentives and decentralized program performance." *Review of Economics and Statistics* 94 (3): 672-685.

De La O, Ana L. 2013. "Do conditional cash transfers affect electoral behavior? Evidence from a randomized experiment in Mexico." *American Journal of Political Science* 57 (1): 1-14.

Dewan, Torun, and Rafael Hortala-Vallve. 2019. "Electoral competition, control and learning." *British Journal of Political Science* 49 (3): 923-939.

Dixit, Avinash, and John Londregan. 1996. "The determinants of success of special interests in redistributive politics." *The Journal of Politics* 58 (4): 1132-1155.

Drazen, Allan, and Marcela Eslava. 2010. "Electoral manipulation via voter-friendly spending: Theory and evidence." *Journal of Development Economics* 92 (1): 39-52.

Finan, Frederico, and Laura Schechter. 2012. "Vote-buying and reciprocity". *Econometrica* 80 (2): 863-881.

Fiszbein, Ariel, and Norbert R. Schady. 2009. *Conditional cash transfers: reducing present and future poverty.* The World Bank. Available at shorturl.at/zJNRT.

Frey, Anderson. 2019. "Do Reelection Incentives Improve Policy Implementation? Accountability vs. Political Targeting". Available at shorturl.at/fhGHS

Eggers, Andrew C. 2017. "Quality-based explanations of incumbency effects." *The Journal of Politics* 79 (4): 1315-1328.

Folke, Olle, Shigeo Hirano, and James M. Snyder Jr. 2011. "Patronage and elections in US states." *American Political Science Review* 105 (3): 567-585.

Glazer, Amihai, and Susanne Lohmann. 1999. "Setting the agenda: Electoral competition, commitment of policy, and issue salience." *Public choice* 99 (3-4): 377-394.

Golden, Miriam, and Brian Min. 2013. "Distributive politics around the world." *Annual Review of Political Science* 16: 79-99.

Green, Tina. 2005. "Do social transfer programs affect voter behavior? Evidence from PROGRESA in Mexico, 1997–2000." *Unpublished Manuscript.* Berkeley: University of California.

Her Majesty Treasury. 2018. *The Green Book: appraisal and evaluation in central government.* Available at shorturl.at/ryzR6

Hicken, Allen. 2011. "Clientelism." *Annual review of political science* 14: 289-310.

Howell, Willian, and Stephane Wolton. 2018. "The Politician's Province." *Quarterly Journal of Political Science* 13 (2): 119-146.

Holmström, Bengt. 1999. "Managerial incentive problems: A dynamic perspective." *The review of Economic studies* 66 (1): 169-182.

Ibarraran, Pablo, Nadin Medellin, Ferdinando Regalia, Marco Stampini, Sandro Parodi, Luis Tejerina, Pedro Cueva, and Madiery Vasquez. 2017. *How conditional cash transfers work.* Washington: Inter-American Development Bank.

Imai, Kosuke, Gary King, and Carlos Velasco Rivera. 2020. "Do Nonpartisan Programmatic Policies Have Partisan Electoral Effects? Evidence from Two Large-Scale Experiments." *The Journal of Politics* 82 (2): 714-730.

Izzo, Federica. 2018. "With Friends Like These, Who Needs Enemies? A Model of Electorally Costly Dissent." Available at shorturl.at/eiGJP.

Izzo, Federica, Torun Dewan, and Stephane Wolton. 2020. "Cumulative Knowledge in the Social Sciences: The Case of Improving Voters' Information." Available at shorturl.at/fBVZ6

Keefer, Philip, and Stuti Khemani. 2009. "When do legislators pass on pork? The role of political parties in determining legislator effort." *American political Science review* 103 (1): 99-112.

Machado, Fabiana, Carlos Scartascini, and Mariano Tommasi. 2011. "Political institutions and street protests in Latin America." *Journal of Conflict Resolution* 55 (3): 340-365.

Manacorda, Marco, Edward Miguel, and Andrea Vigorito. 2011. "Government transfers and political support." *American Economic Journal: Applied Economics* 3 (3): 1-28.

Milesi-Ferretti, Gian Maria. 1995. "The disadvantage of tying their hands: on the political economy of policy commitments." *The Economic Journal* 105 (433): 1381-1402.

Milesi-Ferretti, Gian Maria, and Enrico Spolaore. 1994. "How cynical can an incumbent be? Strategic policy in a model of government spending." *Journal of Public Economics* 55 (1): 121-140.

Montagnes, Pablo, and Baur Bektemirov. 2018. "Political Incentives to Privatize." *The Journal of Politics* 80 (4): 1254-1267.

Persson, Torsten, and Guido Enrico Tabellini. 2002. *Political economics.* Cambridge, MA: MIT Press.

Petrocik, John R. 1996. "Issue ownership in presidential elections, with a 1980 case study." *American journal of political science*, 40 (3): 825-850.

Robinson, James, and Thierry Verdier. 2013. "The political economy of clientelism." *The Scandinavian Journal of Economics* 115 (2): 260-291.

Schaffer, Frederic Charles, and Andreas Schedler. (2007). "What is vote buying." In *Elections for sale: The causes and consequences of vote buying.* Ateneo de Manila University Press, 17-30.

Slough, Tara. 2019. "On Theory and Identification: When and Why We Need Theory for Causal Identification." Retrieved from shorturl.at/cstw3

Stokes, Susan. 2005. "Perverse accountability: A formal model of machine politics with evidence from Argentina." *American Political Science Review* 99 (3): 315-325.

Stokes, Susan. 2009. "Political Clientelism." In *The Oxford Handbook of Comparative Politics*. Oxford University Press.

Stokes, Susan, Thad Dunning, Marcelo Nazareno, and Valeria Brusco. 2013. *Brokers, voters, and clientelism: The puzzle of distributive politics*. Cambridge University Press.

Sun, Jessica, and Scott A Tyson. 2019. "Conflict as an Identification Strategy." Available at SSRN: https://ssrn.com/abstract=3258725

Tomasi, Arduino. 2020. "Merchants of Reputation: Privatization under Elites' Outside Lobbying." Available at SSRN: shorturl.at/dgzU5

Wolton, Stephane. (2020). "TIEM [Blog post]." Available at stephanewolton.com/about/tiem/

Zucco Jr, Cesar. 2013. "When Payouts Pay Off: Conditional Cash Transfers and Voting Behavior in Brazil 2002-10." *American Journal of Political Science* 57 (4): 810-822.

2.9 Appendix

2.9.1 Proof of Remark 1.

Proof. For simplicity, let X and Y be random variables with associated probability density functions $f_X(x)$ and $f_Y(y)$, respectively, both of which follow a standard uniform distribution. Let $S = X - Y$. The probability density function of S, denoted by $f_S(s)$ is given by the convolution of the densities of X and Y, as follows:

$$f_S(s) = \int_{\mathbb{R}} f_X(s+y) f_Y(y) \mathrm{d}y \tag{5}$$

where

$$f_X(s+y) = \begin{cases} 1 & \text{if } 0 \leq s+y \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

and

$$f_Y(y) = \begin{cases} 1 & \text{if } 0 \leq y \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

It is easy to see that $f_S(s) = 0$ if either $s \leq -1$ or if $s \geq 1$ —which follows form looking at the boundaries of the support of each random variable. We then focus at what happens in between -1 to 1. We can further breakdown the problem to (i) $-1 \leq s \leq 0$ and (ii) $0 \leq s \leq 1$. In both cases, for the integrand of equation (5) to be non-zero, we need in every case that $0 \leq y \leq 1$. We can then focus on

$$f_S(s) = \int_0^1 f_X(s+y)\mathrm{d}y$$

For part (i) we have that for the integrand to be non-zero, we need $s + y \geq 0$ which is equivalent to $y \geq -s$; that is,

$$\begin{aligned} f_S(s) &= \int_{-s}^1 f_X(s+y)\mathrm{d}y \\ &= \int_{-s}^1 1\mathrm{d}y \\ &= 1 + s \end{aligned}$$

That is, $f_S(s) = 1 + s$ for $-1 \leq s \leq 0$. For case (ii) we have that for the integrand to be non-zero, we need $s + y \leq 1$ which is equivalent to $y \leq 1 - s$; that is,

$$\begin{aligned} f_S(s) &= \int_0^{1-s} f_X(s+y)\mathrm{d}y \\ &= \int_0^{1-s} 1\mathrm{d}y \\ &= 1 - s \end{aligned}$$

That is, $f_S(s) = 1 - s$ for $0 \leq s \leq 1$. We have then that

$$f_S(s) = \begin{cases} 1 + s & \text{if } -1 \leq s \leq 0 \\ 1 - s & \text{if } \quad 0 \leq s \leq 1 \end{cases}$$

We can then derive the continuous cumulative function by integrating, which results in (i) for $-1 \leq s \leq 0$ we have

$$\begin{aligned} \int_{-1}^{s} f_S(t)\mathrm{d}t &= \int_{-1}^{s} (1+t)\mathrm{d}t \\ &= t + \frac{t^2}{2}\bigg|_{-1}^{s} \\ &= \frac{1}{2} + s + \frac{s^2}{2} \end{aligned} \tag{6}$$

and in (ii) for $0 \leq s \leq 1$, and carrying over the integration from before over its support, we have

$$\begin{aligned} \underbrace{\int_{-1}^{0} (1+t)\mathrm{d}t}_{\text{Carrying over}} + \int_{0}^{s} f_S(t)\mathrm{d}t &= \frac{1}{2} + \int_{0}^{s} (1-t)\mathrm{d}t \\ &= \frac{1}{2} + t - \frac{t^2}{2}\bigg|_{0}^{s} \\ &= \frac{1}{2} + s - \frac{s^2}{2} \end{aligned} \tag{7}$$

which finalises the proof for the properties that the incumbent's vote share satisfies.

Finally, it is easy to check that (6) is convex when $-1 \leq s \leq 0$ because its second derivative strictly positive; whereas (7) is concave when $0 \leq s \leq 1$ because its second derivative is negative. ■

2.9.2 Proof of Lemma 1.

Proof. By the distribution of the resulting valence shocks (or by inspection of Remark 1), we know that $F(0) = 1/2$. When the incumbent is leading, it must be the case that $\pi_I - \pi_C > 0$ and, hence, that $F\big(b(\pi_I - \pi_C)\big) > 1/2$. This proves that the stakes effect must be positive when the incumbent is leading. Even further, the stakes effect increases as he allocates a higher budget to public goods. But when the incumbent is trailing, we have that $\pi_I - \pi_C < 0$ and, hence, $F\big(b(\pi_I - \pi_C)\big) < 1/2$. This proves that the stakes effect must be negative when the incumbent is trailing. Similarly, increasing the budget would only further this negative effect. ■

2.9.3 Proof of Lemma 2.

Proof. Let $p_1^+ = \{p_1 : p_1 \geq 1\}$, $p_1^- = \{p_1 : p_1 \leq b\}$ and $p_1^\varnothing = \{p_1 : b \leq p_1 \leq 1\}$. Upon observing a level of public goods provision in $p_1 \in p_1^+$, Bayesian updating yields

$$\begin{aligned}\Pr\left(\theta_I = 1 | p_1 \in p_1^+\right) &= \frac{\Pr\left(p_1 \in p_1^+ | \theta_I = 1\right)\ \Pr(\theta_I = 1)}{\Pr\left(p_1 \in p_1^+ | \theta_I = 1\right)\ \Pr(\theta_I = 1) + \Pr\left(p_1 \in p_1^+ | \theta_I = 0\right)\ \Pr(\theta_I = 0)} \\ &= \frac{\Pr\left(p_1 \in p_1^+ | \theta_I = 1\right)\ \Pr(\theta_I = 1)}{\Pr\left(p_1 \in p_1^+ | \theta_I = 1\right)\ \Pr(\theta_I = 1) + 0\ \Pr(\theta_I = 0)} = 1\end{aligned}$$

The procedure is similar for the posterior induced by an outcome in $p_1 \in p_1^-$. Upon observing an outcome in $p_1 \in p_1^{\varnothing}$, Bayesian updating yields

$$
\begin{aligned}
\Pr\left(\theta_I = 1 \,|\, p_1 \in p_1^{\varnothing}\right) &= \frac{\Pr\left(p_1 \in p_1^{\varnothing} \,|\, \theta_I = 1\right)\, \Pr(\theta_I = 1)}{\Pr\left(p_1 \in p_1^{\varnothing} \,|\, \theta_I = 1\right)\, \Pr(\theta_I = 1) + \Pr\left(p_1 \in p_1^{\varnothing} \,|\, \theta_I = 0\right)\, \Pr(\theta_I = 0)} \\
&= \frac{\Pr\left(b + \eta_1 \leq 1\right)\, \pi_I}{\Pr\left(b + \eta_1 \leq 1\right)\, \pi_I + \Pr\left(\eta_1 \geq b\right)\, \left(1 - \pi_I\right)} \\
&= \frac{\Pr\left(\eta_1 \leq 1 - b\right)\, \pi_I}{\Pr\left(\eta_1 \leq 1 - b\right)\, \pi_I + \left(1 - \Pr\left(\eta_1 \leq b\right)\right)\left(1 - \pi_I\right)} \\
&= \frac{(1 - b)\, \pi_I}{(1 - b)\, \pi_I + (1 - b)\,(1 - \pi_I)} \\
&= \pi_I
\end{aligned}
$$

which completes the proof. ■

2.9.4 Proof of Lemma 3.

Proof. Recall first the definitions for the three set of outcomes to which a posterior belief is associated: the set $p_1^+ = \{p_1 : p_1 \geq 1\}$ induces full learning that the incumbent is of high ability; the set $p_1^- = \{p_1 : p_1 \leq b\}$ that he is of low ability with certainty; and the set $p_1^{\varnothing} = \{p_1 : b \leq p_1 \leq 1\}$ leads to no learning. Given that the budget and the incumbent's type are complements in the production function, we have that

$$
\begin{aligned}
\Pr(p_1 \in p_1^+) &= \Pr(b\,\theta_I + \eta_1 \geq 1) \\
&= \Pr(\theta_I = 1)\, \Pr(b + \eta_1 \geq 1) + \Pr(\theta_I = 0)\, \Pr(\eta_1 \geq 1) \\
&= \pi_I\, \left(1 - \Pr(\eta_1 \leq 1 - b)\right) + (1 - \pi_I)\, 0 \\
&= \pi_I\, b
\end{aligned}
$$

Similarly, notice that

$$
\begin{aligned}
\Pr(p_1 \in p_1^-) &= \Pr(b\,\theta_I + \eta_1 \leq b) \\
&= \Pr(\theta_I = 1)\ \Pr(b + \eta_1 \leq b) + \Pr(\theta_I = 0)\ \Pr(\eta_1 \leq b) \\
&= (1 - \pi_I)\, b
\end{aligned}
$$

Finally, by the law of total probability, $\Pr(p_1 \in p_1^{\varnothing}) = 1 - \Pr(p_1 \in p_1^+) - \Pr(p_1 \in p_1^-) = 1 - b$, which completes the proof. ∎

2.9.5 Proof of Lemma 4.

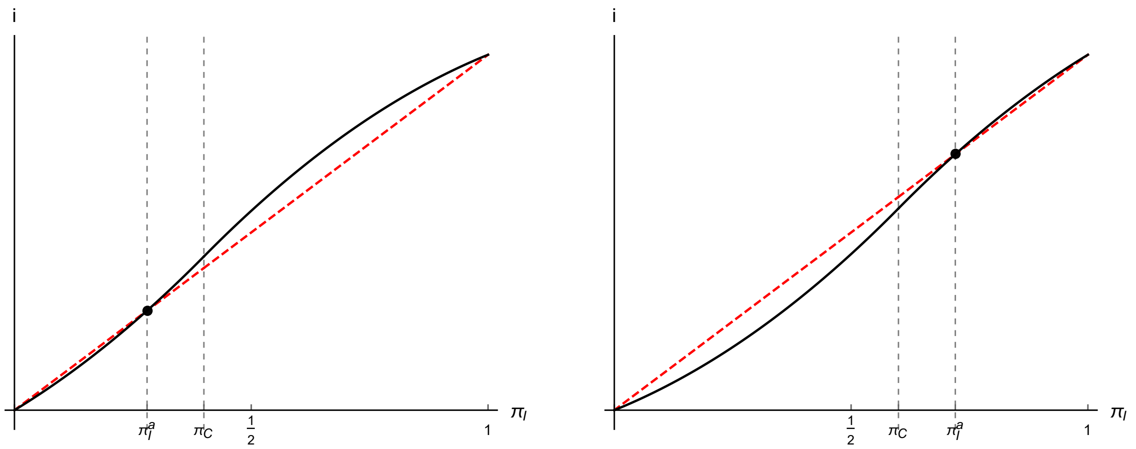
Proof. This lemma follows from the incumbent's vote share function is non-linear in the space of voters' posterior beliefs. I first provide a formal intuition and then I derive explicit results. Notice by inspection of Remark 1, that when the challenger is almost surely incompetent, then the incumbent's vote share function is strictly concave along voters' beliefs about his identity. By Jensen's inequality, we know that

$$F\big(b(\pi_I)\big) \geq \pi_I\, F\big(b\big) + (1 - \pi_I)\, F\big(0\big) \tag{8}$$

for any $\pi_I \in (0, 1)$. That is, the informativeness effect must be negative: the incumbent is better off playing it safe because his electoral distance with his challenger is considerable enough. And when the challenger is almost surely competent, then the incumbent's vote share function is strictly convex. By Jensen's inequality, we know that the inequality in (8) simply reverses: the informativeness effect must be weakly positive, so the incumbent is better off gambling on success. Putting these two cases together, we formally derive the results in Lemma 4 by applying the Intermediate Value Theorem: there must exist a value on the prior belief on the incumbent, as a function of that of the challenger, which determines the sign of the informativeness effect.

To derive explicit closed-form solutions, we have to look separately for the cases when the prior of the challenger is below a half or above a half. A graphical intuition for this is given in Figure 2.8 below.

Figure 2.8: Illustration: Closed-form solutions for the informativeness effect



(a) Weak challenger **(b)** Strong challenger

Note. In both panels, the black line is the incumbent's vote share absent learning, whereas the red dashed line are the lottery over vote shares. Parameter values: $\pi_C = 4/10$ (left panel); $\pi_C = 6/10$ (right panel); $b = 1$ (both panels).

Notice first that

$$\begin{aligned} \mathbb{E}^b_{\theta_I}\Big[F\big(b(\theta_I - \pi_C)\big)\Big] &= F\big(b(\pi_I - \pi_C)\big) \\ b\,\pi_I\,F\big(b(1-\pi_C)\big) + b\,(1-\pi_I)\,F\big(-b\pi_C\big) + (1-b)\,F\big(b(\pi_I-\pi_C)\big) &= F\big(b(\pi_I - \pi_C)\big) \\ \pi_I F\big(b(1-\pi_C)\big) + (1-\pi_I)F\big(b(1-\pi_C)\big) &= F\big(b(\pi_I - \pi_C)\big) \quad (9) \end{aligned}$$

By inspection of Figure 8(a), whenever the challenger is weak ($\pi_C < 1/2$), the right hand side of (9) intersects the incumbent's expected share of votes when beliefs are fixed and he is trailing; that is,

$$\begin{aligned}
\pi_I\left(\frac{1}{2}+b\,(1-\pi_C)\left(1-\frac{b\,(1-\pi_C)}{2}\right)\right)&+(1-\pi_I)\left(\frac{1}{2}+b\,(-\pi_C)\left(1+\frac{b\,(-\pi_C)}{2}\right)\right)\\
&=\frac{1}{2}+b\,(\pi_I-\pi_C)\left(1+\frac{b\,(\pi_I-\pi_C)}{2}\right)\\
\pi_I\left((1-\pi_C)\left(1-\frac{b\,(1-\pi_C)}{2}\right)\right)&+(1-\pi_I)\left((-\pi_C)\left(1+\frac{b\,(-\pi_C)}{2}\right)\right)\\
&=(\pi_I-\pi_C)\left(1+\frac{b\,(\pi_I-\pi_C)}{2}\right)\\
&\Leftrightarrow \pi_I=4\,\pi_C-2(\pi_C)^2-1:=\pi_I^q(\pi_C)
\end{aligned}$$

where the last line follows after some algebra. And notice that $\pi_I^q(\pi_C)$ is strictly increasing in π_C because $\partial\pi_I^q(\pi_C)/\partial\pi_C = 4(1-\pi_C)$, which is positive for any $\pi_C \in (0,1)$.

Proceeding similarly, by inspection of Figure 2.8(b), whenever the challenger is strong ($\pi_C > 1/2$), the right hand side of (9) intersects the incumbent's expected share of votes when beliefs are fixed and he is leading; that is,

$$\begin{aligned}
\pi_I\left((1-\pi_C)\left(1-\frac{b\,(1-\pi_C)}{2}\right)\right)&+(1-\pi_I)\left((-\pi_C)\left(1+\frac{b\,(-\pi_C)}{2}\right)\right)\\
&=(\pi_I-\pi_C)\left(1-\frac{b\,(\pi_I-\pi_C)}{2}\right)\\
&\Leftrightarrow \pi_I=2\,(\pi_C)^2:=\pi_I^w(\pi_C)
\end{aligned}$$

from where it's easy to see that $\pi_I^w(\pi_C)$ is increasing in $\pi_C \in (0,1)$. We can then define, consistently with Lemma 4, the threshold value as

$$\pi_I^a(\pi_I) = \begin{cases} 4\,\pi_C - 2(\pi_C)^2 - 1 & \text{if } \pi_C < 1/2 \\ 2\,(\pi_C)^2 & \text{if } \pi_C \geq 1/2 \end{cases}$$

which completes the proof. ■

2.9.6 Statement and proof of Remark 2.

Remark 2. *The total effect of allocating a positive budget for public goods provision can be decomposed into an informativeness and a stakes effect.*

Proof. The incumbent evaluates the impact that a transfers program has on his expected utility. Therefore, we are looking at

$$\begin{aligned}
\tau(0, b \,|\, \pi_I, \pi_C) &= \mathbb{E}[u_I|b] - \mathbb{E}[u_I|0] \\
&= b\,\pi_I\, F\big(b(1-\pi_C)\big) + b\,(1-\pi_I)\, F\big(-b\pi_C\big) + (1-b)\, F\big(b(\pi_I - \pi_C)\big) - \frac{1}{2} \\
&= b\,\pi_I\, F\big(b(1-\pi_C)\big) + b\,(1-\pi_I)\, F\big(-b\pi_C\big) + (1-b)\, F\big(b(\pi_I - \pi_C)\big) - \frac{1}{2} \\
&\qquad + F\big(b(\pi_I - \pi_C)\big) - F\big(b(\pi_I - \pi_C)\big) \\
&= \underbrace{\Big(\mathbb{E}^b_{\theta_I}\big[F\big(\theta_I - \pi_C\big)\big] - F\big(b(\pi_I - \pi_C)\big)\Big)}_{\text{Informativeness effect}} - \underbrace{\left(F\big(b(\pi_I - \pi_C)\big) - \frac{1}{2}\right)}_{\text{Stakes effect}}
\end{aligned}$$

■

2.9.7 Proof of Proposition 1.

Proof. To find the optimal allocation for public goods, I look for first order conditions. Notice that

$$\begin{aligned}
\frac{\partial \tau(0, b \,|\, \pi_I, \pi_C)}{\partial b} &= \frac{\partial}{\partial b}\left(\left(\mathbb{E}^b_{\theta_I}\left[F\big(\theta_I - \pi_C\big)\right] - F\big(b(\pi_I - \pi_C)\big)\right) - \left(F\big(b(\pi_I - \pi_C)\big) - \frac{1}{2}\right)\right) \\
&= \frac{\partial}{\partial b}\left(b\pi_I \left(\frac{1}{2} + b\,(1-\pi_C)\left(1 - \frac{b\,(1-\pi_C)}{2}\right)\right)\right) \\
&\quad + \frac{\partial}{\partial b}\left(b(1-\pi_I)\left(\frac{1}{2} + b\,(-\pi_C)\left(1 + \frac{b\,(-\pi_C)}{2}\right)\right)\right) \\
&\quad + \frac{\partial}{\partial b}\left((1-b)\left(\frac{1}{2} + b\,(\pi_I - \pi_C)\left(1 - \frac{b\,(\pi_I - \pi_C)}{2}\right)\right)\right) \\
&= \frac{\pi_I\big(1 + b\big(1-\pi_C\big)\big(4 - 3\,b\,(1-\pi_C)\big)\big)}{2} + \frac{(1-\pi_I)\big(1 - b\,\pi_C\big)\big(1 - 3\,b\,\pi_C\big)}{2} \\
&\quad - 1 + \frac{(1 + b(\pi_I - \pi_C))^2}{2} + (1-b)(\pi_I - \pi_C)\big(1 - b(\pi_I - \pi_C)\big) \\
&= -b^2\left(\frac{-3(1-\pi_I)\,(\pi_I - (\pi_C)^2)}{2}\right) - b(\pi_I - \pi_C)^2 + (\pi_I - \pi_C) := \Delta(b, \pi_I, \pi_C)
\end{aligned}$$

Consider the two following cases which are possible to verify by inspection:

$$\lim_{\pi_I \to 1} \Delta(1, \pi_I, \pi_C) = \pi_C\big(1 - \pi_C\big) > 0 \tag{10}$$

$$\lim_{\pi_I \to \pi_C} \Delta(1, \pi_I, \pi_C) = \frac{3\pi_C(1-\pi_C)(2\pi_C - 1)}{2} > 0 \Leftrightarrow \pi_C > \frac{1}{2} \tag{11}$$

From (10) and (11) follows that when the incumbent allocates everything to public goods and he is marginally leading against a challenger that is more likely than not to be competent ($\pi_C > 1/2$), then $\Delta(1, \pi_I, \pi_C) > 0$ for any $1/2 < \pi_C < \pi_I < 1$; otherwise ($\pi_C < 1/2$), then $\lim_{\pi_I \to \pi_C} \Delta(1, \pi_I, \pi_C) < 0$.

By the Intermediate Value Theorem, it then follows that there must exist some

$\pi^{\dagger}(\pi_C) \in [\pi_C, 1/2)$ such that $\Delta(1, \pi^{\dagger}(\pi_C), \pi_C) = 0$. And because we know that when the prior on the challenger becomes high enough then the incumbent would rather allocate everything to public goods, it must be the case that $\pi^{\dagger}(\pi_C)$ is decreasing in $\pi_C \in (0, \pi_I)$.

Furthermore, it is easy to verify that $\Delta(0, \pi_I, \pi_C) = \pi_I - \pi_C > 0$. We then have the following results. First, if $1/2 < \pi_C < \pi_I < 1$ or if $0 < \pi_C < \pi^{\dagger} < \pi_I \leq 1/2$, then $\Delta(1, \pi_I, \pi_C) > 0$ and the solution must therefore be a corner: the incumbent allocates everything to public goods.

Second, if $0 < \pi_C < \pi_I < \pi^{\dagger} \leq 1/2$, then $\Delta(1, \pi_I, \pi_C) < 0$ and, by the Intermediate Value Theorem, there must exist some $b^*(\pi_I) \in (0, 1)$ such that $\Delta(b^*(\pi_I), \pi_I, \pi_C) = 0$. And since we know that as the prior on the incumbent grows large enough ($\pi_I > \pi^{\dagger}$) he prefers to allocate everything to public goods, then it must be that $b^*(\pi_I)$ is increasing in $\pi_I \in [\pi_C, 1)$.

Additionally, notice that

$$
\begin{aligned}
\lim_{\pi_I \to \pi_C} \left(\frac{\partial^2 \tau(0, b \,|\, \pi_I, \pi_C)}{\partial b^2} \right) &= \lim_{\pi_I \to \pi_C} \Big((\pi_C)^2 (6b(1 - \pi_I) - 1) + 2\pi_I \pi_C - \pi_I(\pi_I + 3b(1 - \pi_I)) \Big) \\
&= \underbrace{3b\pi_C(1 - \pi_C)}_{>0}(2\pi_C - 1) > 0 \Leftrightarrow \pi_C > \frac{1}{2}
\end{aligned}
$$

This tells us that $\tau(0, b \,|\, \pi_I, \pi_C)$ is strictly convex in b when $\pi_C > 1/2$, in which case the solution must thereby be a corner: the incumbent allocates everything to public goods whenever $\pi_C > 1/2$. And a necessary condition for interior solutions is for $\pi_C < 1/2$, as then $\tau(0, b \,|\, \pi_I, \pi_C)$ would strictly concave in b. With some abuse of notation, we have that

$$
b^*(\pi_I) = \begin{cases} b^*(\pi_I) \in (0,1) & \text{if } 0 < \pi_C < \pi_I < \pi^\dagger < 1/2 \\ \\ 1 & \text{if } \pi_I \geq \pi^\dagger \end{cases}
$$

We can recover a closed-form solution by setting $\Delta(b, \pi_I, \pi_C) = 0$, which yields

$$
b^* = \frac{-(\pi_I - \pi_C)^2 + \sqrt{(\pi_I - \pi_C)\left((\pi_I)^3 - 3(\pi_I)^2(2+\pi_C) + \pi_I\left(6 + 15(\pi_C)^2\right) - (\pi_C)^3 - 12(\pi_C)^2\right)}}{3(1-\pi_I)\left(2(\pi_C)^2 - \pi_I\right)}
$$

which is used for comparative statics of Figure 6(a). This completes the proof. ■

2.9.8 Proof of Proposition 2.

Proof. To find the optimal allocation for public goods, I look for first order conditions.

Notice first that

$$
\begin{aligned}
\frac{\partial \tau(0, b \,|\, \pi_I, \pi_C)}{\partial b} &= \frac{\partial}{\partial b}\left(\left(\mathbb{E}^b_{\theta_I}\left[F\big(\theta_I - \pi_C\big)\right] - F\big(b(\pi_I - \pi_C)\big)\right) - \left(F\big(b(\pi_I - \pi_C)\big) - \frac{1}{2}\right)\right) \\
&= \frac{\partial}{\partial b}\left(b\pi_I\left(\frac{1}{2} + b\,(1-\pi_C)\left(1 - \frac{b\,(1-\pi_C)}{2}\right)\right)\right) \\
&\quad + \frac{\partial}{\partial b}\left(b(1-\pi_I)\left(\frac{1}{2} + b\,(-\pi_C)\left(1 + \frac{b\,(-\pi_C)}{2}\right)\right)\right) \\
&\quad + \frac{\partial}{\partial b}\left((1-b)\left(\frac{1}{2} + b\,(\pi_I - \pi_C)\left(1 - \frac{b\,(\pi_I - \pi_C)}{2}\right)\right)\right) \\
&= \frac{\pi_I\big(1 + b\big(1-\pi_C\big)\big(4 - 3\,b\,(1-\pi_C)\big)\big)}{2} + \frac{(1-\pi_I)\big(1 - b\,\pi_C\big)\big(1 - 3\,b\,\pi_C\big)}{2} \\
&\quad - 1 + \frac{(1 - b(\pi_I - \pi_C))^2}{2} - (1-b)(\pi_I - \pi_C)\big(1 - b(\pi_I - \pi_C)\big) \\
&= -b^2\left(\frac{3\pi_I\,(1 + \pi_I + 2(\pi_C)^2 - 4\,\pi_C)}{2}\right) - b(\pi_I - \pi_C)^2 + (\pi_I - \pi_C) := \hat{\Delta}(b, \pi_I, \pi_C)
\end{aligned}
$$

Proceeding similarly as before, it is possible to verify by inspection that

$$\lim_{\pi_I \to 0} \hat{\Delta}(1, \pi_I, \pi_C) = -\pi_C(1-\pi_C) < 0 \tag{12}$$

$$\lim_{\pi_I \to \pi_C} \hat{\Delta}(1, \pi_I, \pi_C) = \frac{3\,\pi_C\,(1-\pi_I)(2\,\pi_C - 1)}{2} > 0 \Leftrightarrow \pi_C > \frac{1}{2} \tag{13}$$

From (12) and (13) follows that when the incumbent allocates everything to public goods and he is marginally trailing against a challenger that is more likely than not to be incompetent ($\pi_C < 1/2$), then $\hat{\Delta}(1, \pi_I, \pi_C) < 0$ for any $0 < \pi_I < \pi_C < 1/2$; otherwise ($\pi_C > 1/2$), then $\lim_{\pi_I \to \pi_C} \hat{\Delta}(1, \pi_I, \pi_C) > 0$. By the Intermediate Value Theorem, it then follows that there must exist some $\pi^{\ddagger} \in [1/2, \pi_C)$ such that $\hat{\Delta}(1, \pi^{\ddagger}, \pi_C) = 0$. For the inverse reasons as above, because we know that when the prior on the challenger becomes high enough and the incumbent's trail is sufficiently narrow, then he would rather allocate everything to public goods, it must be the case that $\pi^{\ddagger}(\pi_C)$ is increasing in $\pi_C \in (\pi_I, 1)$.

Furthermore, it is easy to verify that $\hat{\Delta}(0, \pi_I, \pi_C) = \pi_I - \pi_C < 0$. We then have the following results. First, if $0 < \pi_I < \pi_C < 1/2$ or if $1/2 < \pi_I < \pi^{\ddagger} < \pi_C$, then $\hat{\Delta}(1, \pi_I, \pi_C) < 0$ and the solution must therefore be a corner: the incumbent allocates everything to transfers. Second, if $1/2 < \pi^{\ddagger} < \pi_I < \pi_C$, then $\hat{\Delta}(1, \pi_I, \pi_C) > 0$ and, by the Intermediate Value Theorem, there must exist some $b^*(\pi_I) \in (0, 1)$ such that $\hat{\Delta}(b^*(\pi_I), \pi_I, \pi_C) = 0$. And since we know that as the prior on the incumbent grows large enough ($\pi_I > \pi^{\ddagger}$) he prefers to allocate everything to public goods, then it must be that $b^*(\pi_I)$ is increasing in $\pi_I \in [\pi^{\ddagger}, \pi_C)$.

Additionally, notice that

$$\lim_{\pi_I \to \pi_C} \left(\frac{\partial^2 \tau(0, b \,|\, \pi_I, \pi_C)}{\partial b^2} \right) = \lim_{\pi_I \to \pi_C} \Big(2\pi_I \pi_C (6\, b - 1) - (\pi_C)^2 (6b\pi_I - 1) + \pi_I(\pi_I - 3b(1 + \pi_I)) \Big)$$
$$= \underbrace{3\, \pi_I \,(1 - \pi_C)}_{>0} (2\pi_C - 1) > 0 \Leftrightarrow \pi_C > \frac{1}{2}$$

which is precisely the condition derived for $b^*(\pi_I)$. Therefore, this tells us that $\tau(0, b \,|\, \pi_I, \pi_C)$ is strictly convex in b when $\pi_I > \pi^\ddagger$. The solution must thereby be a corner: the incumbent allocates everything to public goods whenever $\pi_I > \pi^\ddagger$.

Finally, we can pin down the value on π_I such that the incumbent prefers to allocate everything to public goods instead of everything to transfers by looking at

$$\mathbb{E}[u_I|1] \geq \mathbb{E}[u_I|0]$$
$$\pi_I \, F\big(1 - \pi_C\big) + (1 - \pi_I)\, F\big(- \pi_C\big) \geq \frac{1}{2}$$
$$\pi_I \left(\frac{1}{2} + (1 - \pi_C) \left(1 - \frac{1 - \pi_C}{2} \right) \right) + \pi_I \left(\frac{1}{2} + (1 - \pi_C) \left(1 - \frac{1 - \pi_C}{2} \right) \right) \geq \frac{1}{2}$$
$$\Leftrightarrow \pi_I \geq \frac{\pi_C(2 - \pi_C)}{1 - 2\pi_C(1 - \pi_C)} := \pi^\ddagger(\pi_C)$$

from where it's easy to see that that the first derivative is positive, which further confirms that $\pi^\ddagger(\pi_C)$ is increasing in π_C. This concludes the proof. ■

2.9.9 Proof of Lemma 5.

Proof. Suppose that the incumbent allocates a budget $b \in \mathbb{R}_+$ to public goods and $\mathbf{T}(b) = 1 - b$ to transfers. Let the challenger's share of votes from disagreeing with the continuity of transfers, given some posterior belief μ_I about the incumbent, be defined as

$$
\begin{aligned}
\alpha(\mu_I, b) &= \int_0^{\tilde{y}} \Pr\left(\tilde{\sigma}_i \leq \left(\pi_C - b\,\mu_I\right) - \left(\frac{1-b}{G(\tilde{y})}\right)\right) \mathrm{d}G(y_i) + \int_{\tilde{y}}^{\infty} \Pr\bigl(\tilde{\sigma}_i \leq \pi_C - b\,\mu_I\bigr)\mathrm{d}G(y_i) \\
&= G(\tilde{y})\,F\left(\left(\pi_C - b\,\mu_I\right) - \left(\frac{1-b}{G(\tilde{y})}\right)\right) + (1 - G(\tilde{y}))F\bigl(\left(\pi_C - b\,\mu_I\right)\bigr)
\end{aligned}
$$

We can write his difference in expected vote shares between agreeing and disagreeing as $\Delta(b, 1)$ where the arguments imply that if he agrees then he upholds the allocation $b > 0$ set by the incumbent, and if he disagrees he promises $b = 1$ if elected. Then,

$$
\begin{aligned}
\Delta(b, 1) = b\pi_I\bigl(F(b(1-\pi_C)) - \alpha(1, b)\bigr) + b(1-\pi_I)\bigl(F(b(-\pi_C)) - \alpha(0, b)\bigr) \\
+ (1-b)\Bigl(F(b(\pi_I - \pi_C)) - \alpha(\pi_I, b)\Bigr)
\end{aligned}
$$

Notice first that $\Delta(1, 1) = 0$ trivially —because then there is no transfers policy to agree or disagree with. Additionally, notice that if the incumbent allocates nothing to public goods, then

$$
\begin{aligned}
\Delta(0, 1) &= \frac{1}{2} - \alpha(\pi_I, 0) \\
&= \frac{1}{2} - \Bigl(G(\tilde{y})\,\underbrace{F\left(\pi_C - \left(\frac{1}{G(\tilde{y})}\right)\right)}_{<1/2} + (1 - G(\tilde{y}))F\bigl(\pi_C\bigr)\Bigr)
\end{aligned}
$$

where the incumbent is strictly disadvantaged among the mass of eligible voters because $\pi_C \in (0, 1)$ and $G(\tilde{y}) \in (0, 1)$ imply that $\pi_C < 1/G(\tilde{y})$. In addition, it is easy to check that $\lim_{\pi_C \to 0} \Delta(0, 1) > 0$ as the incumbent would only impose himself a loss of votes share among eligible voters if he were to disagree. Further, notice that

$$\begin{aligned}
\lim_{\pi_C \to 1} \Delta(0,1) &= \frac{1}{2} - \left(G(\tilde{y})F\left(1 - \left(\frac{1}{G(\tilde{y})}\right)\right) + (1 - G(\tilde{y}))\right) \\
&= \frac{1}{2}\left(3 - \frac{1}{G(\tilde{y})}\right) - G(\tilde{y}) \\
&> 0 \Leftrightarrow G(\tilde{y}) > \frac{1}{2}
\end{aligned}$$

From which follows (1) that when the incumbent is almost surely competent, then a necessary condition for him to agree is for the mass of eligible voters to be the majority; and (2) that if less than the majority is eligible to receive transfers, then $\lim_{\pi_C \to 0} \Delta(0,1) > 0$ and $\lim_{\pi_C \to 1} \Delta(0,1) < 0$ imply that there exists a threshold $\pi^1 \in (0,1)$ on the prior on the challenger such that $\Delta(0,1 \,|\, \pi_C = \pi^1) = 0$.

Finally, an additional implication is that if less than half of the population is eligible, it must be the case that his share of votes among the eligible mass is zero since then it must be that $1/G(\tilde{y}) > 1$. Assuming that $G(\tilde{y}) < 1/2$, we can then recover closed-form solutions by examining

$$\begin{aligned}
\Delta(0,1) = \frac{1}{2} - \big(1 - G(\tilde{y})\big)\left(\frac{1}{2} + \pi_C\Big(1 - \frac{\pi_C}{2}\Big)\right) &\geq 0 \\
\frac{1}{2} + \pi_C\Big(1 - \frac{\pi_C}{2}\Big) &< \frac{1}{2\big(1 - G(\tilde{y})\big)} \\
\Leftrightarrow \pi_C < 1 - \sqrt{\frac{1 - 2\,G(\tilde{y})}{1 - G(\tilde{y})}} &:= \hat{\pi}_C(G(\tilde{y}))
\end{aligned}$$

which is easy to see that is increasing in $G(\tilde{y})$ – intuitively, it increases the cost of disagreeing with the continuity of transfers. ■

2.9.10 Proof of Proposition 3.

Proof. Assume throughout this proof that $G(\tilde{y}) < 1/2$. To start, consider the case when $\pi_C < \hat{\pi}_C(G(\tilde{y}))$ so that the challenger would agree with the transfers program. We can write the incumbent's difference in expected vote shares between everything to transfers and everything to public goods as

$$\hat{\Delta}(\pi_I, \pi_C) = \frac{1}{2} - \Big(\pi_I\, F(1-\pi_C) + (1-\pi_I)\, F(-\pi_C)\Big)$$

And notice that

$$\begin{cases} \lim\limits_{\pi_I \to 0} \hat{\Delta}(\pi_I, \pi_C) = \frac{1}{2} - F(-\pi_C) & > 0 \\ \lim\limits_{\pi_I \to 1} \hat{\Delta}(\pi_I, \pi_C) = \frac{1}{2} - F(1-\pi_C) & < 0 \end{cases}$$

where the first part follows because we know that $F(-\pi_C) < 1/2$ for any positive π_C —when the incumbent is almost surely incompetent, then his expected vote share by allocating everything to public goods is less than a half. And where the second part follows because we know that $F(1-\pi_C) > \frac{1}{2}$ for any $\pi_C < 1$.

By the Intermediate Value Theorem, there must exist some $\hat{\pi} \in (0,1)$ such that $\hat{\Delta}(\hat{\pi}_I, \pi_C) = 0$. We can recover closed-form solutions by examining

$$\begin{aligned} &\frac{1}{2} - \Big(\pi_I\, F(1-\pi_C) + (1-\pi_I)\, F(-\pi_C)\Big) > 0 \\ &\quad -\frac{(\pi_I)^2}{2} + \pi_I\left((\pi_C)^2 - \pi_I - \frac{1}{2}\right) + \pi_C > 0 \\ &\qquad\qquad\qquad\qquad \Leftrightarrow \pi_I < \frac{\pi_C(2-\pi_C)}{1+2\pi_C(1-\pi_C)} := \hat{\pi}(\pi_C) \end{aligned}$$

Finally, suppose by contradiction that this threshold is decreasing in π_C; then, it must be that

$$
\begin{aligned}
\frac{\partial \hat{\pi}(\pi_C)}{\partial \pi_C} &< 0 \\
\frac{2\big(\pi_C^2 - \pi_C + 1\big)}{\big(1 + 2\,\pi_C\,(1 - \pi_C)\big)^2} &< 0 \\
\leftrightarrow \pi_C^2 - \pi_C + 1 &< 0
\end{aligned}
$$

which cannot be true because $\pi_C \in (0, 1)$. Hence, the threshold must be increasing in π_C.

Consider now the case where $\pi_C > \hat{\pi}_C(G(\tilde{y}))$, so that the challenger would disagree with the transfers program. We can write the incumbent's difference in expected vote shares between everything to transfers and everything to public goods as

$$
\hat{\Delta}(\pi_I, \pi_C) = \Big(G(\tilde{y}) + (1 - G(\tilde{y}))F\big(-\pi_C\big)\Big) - \Big(\pi_I\,F(1 - \pi_C) + (1 - \pi_I)\,F(-\pi_C)\Big)
$$

Notice first that

$$
\begin{aligned}
\lim_{\pi_I \to 0} \hat{\Delta}(\pi_I, \pi_C) &= \Big(G(\tilde{y}) + (1 - G(\tilde{y}))F\big(-\pi_C\big)\Big) - F\big(-\pi_C\big) \\
&= G(\tilde{y})\Big(1 - F(\pi_C)\Big) > 0
\end{aligned}
$$

Naturally, being it almost certain that he is incompetent, he would rather cultivate his vote among the mass of eligible voters. Notice second that we can write

$$\lim_{\substack{\pi_I \to 1 \\ \pi_C \to 0}} \hat{\Delta}(\pi_I, \pi_C) = \Big(G(\tilde{y})F(1) + (1 - G(\tilde{y}))F\big(0\big)\Big) - F\big(1\big) < 0 \qquad \text{(By Jensen's inequality)}$$

$$\lim_{\substack{\pi_I \to 1 \\ \pi_C \to 1}} \hat{\Delta}(\pi_I, \pi_C) = \Big(G(\tilde{y})F(1) + (1 - G(\tilde{y}))F\big(-1\big)\Big) - \frac{1}{2} < 0$$

where the second case follows from the discussion of Lemma 5. Since $\lim_{\pi_I \to 0} \hat{\Delta}(\pi_I, \pi_C) > 0$ and $\lim_{\pi_I \to 0} \hat{\Delta}(\pi_I, \pi_C) < 0$, by the Intermediate Value Theorem we know that there must exist some $\hat{\pi}_I(\pi_C)$ such that $\hat{\Delta}(\hat{\pi}_I, \pi_C) = 0$. We can recover closed-form solutions by examining

$$\begin{aligned}
0 &< G(\tilde{y}) + (1 - G(\tilde{y}))\left(\frac{1}{2} - \pi_C\Big(1 - \frac{\pi_C}{2}\Big)\right) \\
&\quad - \left[\pi_I \left(\frac{1}{2} + (1 - \pi_C)\Big(1 - \frac{(1 - \pi_C)}{2}\Big)\right) + (1 - \pi_I)\left(\frac{1}{2} - \pi_C\Big(1 - \frac{\pi_C}{2}\Big)\right)\right] \\
&< \frac{\pi_I\Big(2(\pi_C)^2 - 2\,\pi_C - 1\Big) - G(\tilde{y})\Big((\pi_C)^2 - 2\,\pi_C - 1\Big)}{2} \\
\Leftrightarrow \pi_I &< \frac{G(\tilde{y})\Big((\pi_C)^2 - 2\,\pi_C - 1\Big)}{2\,(\pi_C)^2 - 2\,\pi_C - 1} := \hat{\pi}_I(\pi_C)
\end{aligned}$$

which is naturally increasing in π_C —as the rewards from proving to be competent decrease. With some abuse of notation, we can then summarize these insights as follows:

$$\hat{\pi}_I(\pi_C) = \begin{cases} \dfrac{\pi_C(2 - \pi_C)}{1 + 2\pi_C(1 - \pi_C)} & \text{if } \pi_C < \hat{\pi}_C(G(\tilde{y})) \\[2ex] \dfrac{G(\tilde{y})\Big((\pi_C)^2 - 2\,\pi_C - 1\Big)}{2\,(\pi_C)^2 - 2\,\pi_C - 1} & \text{if } \pi_C > \hat{\pi}_C(G(\tilde{y})) \end{cases}$$

which completes the proof —while it stresses the additional insight that when the incumbent expects his challenger to disagree, the threshold is also increasing in $G(\tilde{y})$, as it increases his support among the mass of eligible voters. $\blacksquare$

Chapter 3

Brains or Muscles?
A Political Economy of Tax Evasion

Abstract

A wealthy citizen wants to get away with tax evasion, a risky practice that can trigger audits resulting in sanctions. To reduce the chances of being audited, he can invest in the complexity of his evasion scheme —which we call "brains". The probability that an audit results in a sanction depends on the effort exerted by an investigator. To reduce the effort that she exerts, the citizen can commit to delivering punishments —which we call "muscles". We show that there exists a threshold in the quality of institutions below which muscles and brains are complements and above which they are substitutes. The citizen's equilibrium strategies yield a testable prediction: estimates of offshore tax evasion display an inverted U-shape along the quality of institutions. We provide evidence of this finding by building a panel dataset of estimated offshore wealth by individuals for 37 countries between 2002 to 2016.

3.1 Introduction

Tax evasion remains a persistent political and economic problem, despite the actions of countries and international organizations to fight against those who actively seek to neglect their taxation responsibilities. Among the several tactics used to evade taxes, evidence shows that global offshore wealth has substantially increased in the last forty years, as its magnitude added up to USD 190 billion in 2014 (Zucman 2015). Clearly, the missing tax revenue is to the detriment of the rest of the population. Furthermore, Alstadsaeter, Johannesen and Zucman (2019) show that almost its entirety comes from the citizens at the very top of the wealth distribution. How are these wealthy citizens able to get away with it?

This paper attempts to shed new lights on this question by bridging two theoretical literatures: one concerned with how tax evaders can manipulate the probability of being caught (see Slemrod and Yitzhaki 2002), and one which studies the distortions in the actions of a public official caused by the very capacity of some pressure groups to deliver punishments (see Dal Bó 2006). This connection matters in practice as demonstrated by the negative consequences that some journalists suffered after the publication of "The Panama Papers", a complex tax evasion scandal uncovered by a team of 107 media organizations in over 80 countries, resulting in USD 1.3 billion recovered by tax authorities (McGoey 2021).

For instance, one disturbing retaliation was against the Maltese journalist Daphne Caruana Galizia, who was assassinated on October 16, 2017, with a bomb planted in her car (Pace 2017).[13] In addition to being involved in bringing "The Panama Papers" into light, in the months prior to her assassination she was also digging into Malta's "Golden Visas", a citizenship-by-investment program that she suspected was rife with bribery and kickbacks as it was attractive to tax evaders worldwide (Giles 2019). One of the main suspects for her homicide is one of Malta's most important businessman, who was deeply involved in the former evasion scandal, was apprehended while allegedly trying to flee Malta in his private yacht (Wesel 2019).

Indeed, these negative consequences of exposing tax evaders are not only suffered by investigative journalists. There exists evidence that official tax inspectors can also experience costs from bringing them to justice. For example, Finckenauer and Voronin (2001, 22) have argued that "blackmail, threats, violence, and corruption involving tax inspectors and the tax police are commonplace throughout Russian" by the hand of criminal organizations that operate in partnership with businessmen.

To make sense of how these two strategies interact, we study a stylised model where a wealthy and influential citizen can take actions to avoid being audited and sanctioned in his evasion of taxes. In our framework, the stronger the fiscal institutions in place, the better the tax enforcement capacity and, thereby, the higher the chances that a tax evader gets audited. To reduce the likelihood of being investigated, we assume that the citizen can invest in the complexity of his evasion scheme, which can include tactics such as having his taxable wealth hidden offshore. We refer to this type of strategy as "brains" —which we can further think of as a concealment technology as in Cremer and Gahvari

[13]See Fitzgibbon (2016) for an account of the threats against journalists that uncovered "The Panama Papers".

(1994).[14]

In addition, we assume that an audit does not directly lead to an indictment. Conditional on an audit being triggered, sanctions only accrue if an investigator (who can be a journalist or a public official) finds hard evidence about the citizen's attempted tax evasion. The probability that an investigator finds hard evidence depends on the effort that she chooses to exert. In order to reduce her effort, the citizen can commit to delivering a punishment, such as legal harassment or smear campaigns. We refer to this type of strategy as "muscles".[15] As in Dal Bó, Dal Bó and Di Tella (2006), we assume that the harm induced by some level of punishment depends on the institutional protections surrounding the investigator: the better the legal institutions in place, the lower the harm that retaliations would impose against the investigator.

By allowing the citizen to engage in both types of strategies, our model produces a key comparative static that we then take to the data: estimates of tax evasion through offshoring wealth display an inverted U-shape along the quality of institutions of a country. The key driver for this result are the non-monotonic marginal returns to the citizen's investment in muscles. When there is a poor quality of institutions, the citizen finds it optimal to increasingly invest in muscles as the harm that these would impose on the investigator is high. But as institutions become better, the effectiveness of muscles decrease for the reason that there are improved protections surrounding the investigator

[14] In Cremer and Gahvari (1994), the investment in a "concealment technology" could also include bribery of the tax police. Because we are, unlike them, introducing an investigator that has a role only after an audit is triggered, we think of this technology purely in terms of the complexity in the evasion scheme.

[15] As extensively argued by Dal Bó and Di Tella (2003, 1124-1125), pressure groups "have a whole range of actions available to them that lie between giving them money and killing them", which often includes "accusations related to some real or fictitious crimes" or simply "a costly legal harassment".

—and the citizen would rather make his evasion scheme increasingly complex to avoid being audited in the first place.

In order to bring these theoretical insight to the data, we building a panel dataset of estimated offshore wealth by individuals for 37 countries between 2002 to 2016, and an index of rule of law that proxies for the enforcement of contracts, property rights, the police and the courts. As we argue later, we believe this dependent variable to be appropriate because of the way in which we conceptually think about the citizen's investment in brains. We show that the predicted relationship is robust to different empirical specifications and a battery of controls.

As such, this paper also contributes to the literature that investigates the determinants of tax evasion, which include tax morale (Dell'Anno 2001), tax burden and corruption (Torgler 2005) and the effects of institutional quality in the shadow economy (Torgler and Schneider 2009). And, perhaps more importantly, it contributes to the literature concerned with the determinants of international tax evasion, which has previously found that higher tax burden is positively associated with evasion via tax havens (Kemme, Parikh and Steigner 2017).

3.2 The Workhorse Model

We study a three-stage game between a citizen (E) and an investigator (I).[16] The citizen can evade a unit of money which is taxable at a rate $\tau \in (0, 1)$. Evasion is a risky practice

[16] We think rather broadly about investigator; that is, conceptually it can be an official tax inspector or an investigative journalist. We reserve the pronouns "he" for the citizen, "she" for the investigator.

in that it may trigger an investigation (or an audit) that results in sanctions. We assume that the citizen's action space with respect to evasion is discrete, $h \in \{0, 1\}$, each standing for evading nothing and everything, respectively. This discrete action space is adopted for simplicity. As we argue in a later section, our core results continue to hold if we allow the citizen to choose how much to evade.

The probability that an audit against the citizen is triggered depends on his decision to evade, on the complexity of his evasion scheme, and on the quality of institutions. Formally, let $a \in \{0, 1\}$ be the event space that capture whether an investigation happens $(a = 1)$ or not $(a = 0)$. We assume that

$$\Pr\big(a = 1\big) = \lambda \times (1 - b) \times h$$

where $\lambda \in (0, 1)$ represents the quality of institutions, and where $b \in [0, 1]$ represents the citizen's investment in the complexity of the evasion scheme, with low values capturing a poor evasion scheme, such as dealing in cash and not giving receipts, and high values capturing complex schemes such as offshoring wealth. We refer to b as investment in "brains". While the quality of institutions is exogenous, the citizen's investment in brains is endogenously chosen.

An investigation about tax evasion does not directly lead to a sanction. This only happens if the investigator is able to find hard evidence. By exerting effort $e \in [0, 1]$, the inspector gets a message $\sigma \in \{0, 1\}$, each standing for hard evidence not being found $(\sigma = 0)$ and found $(\sigma = 1)$. The probability of finding hard evidence is given by

$$\Pr(\sigma = 1) = e$$

Hard evidence leads directly to the citizen being sanctioned. As in the canonical formulation of Alligham and Sandmo (1972), after an indictment the citizen would have to pay his due taxes at a penalty rate $\theta \in (\tau, 1)$. To deter the investigator from exerting effort, the citizen can also invest in "muscles", $m \in [0, 1]$, as a form of punishment in the event of a sanction. The cost that muscles impose on the investigator depends on the institutions in place to protect her, which is given by

$$-\underbrace{(1-\lambda)}_{\substack{\text{Institutional}\\ \text{protections}}} \times m$$

which captures that the better the quality of institutions, the lower the harm that some level of punishment would impose on the investigator.

The citizen's payoff depends on his evasion choice and on his investment in brains and muscles, which we can write as follows

$$u_E = (1-h) \times \Big(1-\tau\Big) + h \times \left\{ \begin{array}{cc} 1 & \text{if not sanctioned} \\ 1-\theta & \text{otherwise} \end{array} \right\} - \frac{b^2}{2} - \frac{m^2}{2}$$

The investigator derives utility from bringing tax evaders to justice. Her payoff is given by

$$u_I = \left\{ \begin{array}{cc} 1-(1-\lambda)\times m & \text{if she finds hard evidence} \\ 0 & \text{otherwise} \end{array} \right\} - \frac{e^2}{2}$$

The game proceeds as follows:

Stage 1. The citizen chooses whether to evade or not, as well as his investment in brains and muscles.

Stage 2. Nature determines whether the citizen's behaviour triggers suspicion of tax evasion. If no suspicions arise, then the citizen is not indicted, payoffs are realized and the game ends; otherwise, the game moves to the next stage.

Stage 3. The investigator exerts effort to find hard evidence about the citizen's tax evasion. If hard evidence is found, then the citizen is indicted, payoffs are realized and the game ends; otherwise, no indictment happens, payoffs are realized and the game ends.

The structure of the game is common knowledge. The solution concept employed is Subgame Perfect Nash Equilibrium. In a Subgame Perfect Nash Equilibrium, (i) the investigator optimally chooses her effort in searching for hard evidence, given the citizen's investment in muscles; and (ii) the citizen optimally makes his choices of evasion and investment in brains and muscles, in anticipation of the investigator's equilibrium effort and the exogenous probability of being investigated.

3.2.1 Comments on the model

There are three points worth stressing. The first is that it is possible to conceptually distinguish between the role of institutions with respect to detection of the citizen's tax evasion and the protections surrounding the investigator. As in Besley and Persson (2011), we could think of the former as the state fiscal capacity to administer, monitor and enforce taxation, and about the latter as the state legal capacity to "provide regulation and legal services such as the protection of property rights or the enforcement of contracts" (6). In our modelling choices, however, we are assuming that these two capabilities are strongly correlated. As extensively argued by Besley and Persson (2011), fiscal and legal capacity tend to be complements since "investments in one aspect of the state reinforce the motives to invest in the other" (15).

The second regards a possible correlation between the tax and the penalty rate with the quality of institutions; that is, it may well be the case that both $\text{corr}(\lambda, \tau) > 0$ and $\text{corr}(\lambda, \theta) > 0$. For instance, this could happen if better (worse) institutions are more (less) responsive to the interests of the population. Our main model assumes that these rates are flat in order to avoid complications with respect to the particulars of such correlations. Nevertheless, we show in the Appendix that this choice does not affect any of the core results.

Finally, we want to stress that the discretization of the citizen's tax evasion space is an artifact that allows us to bring to the front the brains and muscles mechanisms, while still giving the citizen the choice to evade or not. Were the size of evasion continuous, the model would capture Yitzhaki's (1987) extension of the canonical paper of Allingham and

Sandmo (1972) as it would imply an endogenisation of the probability of being audited through the amount of tax evaded. As we mentioned earlier, we allow for this possibility as an extension in the Appendix and show through simulations that our core results persist.

3.2.2 Analysis

First, note that if the citizen chooses not to evade, then there would be no gains from investing in brains or muscles and his expected utility would simply be equal to $(1-\tau)$. But if he chooses to evade, then he needs to optimally decide how much to invest in brains and muscles, in anticipation of the chances of being audited and the investigator's effort to uncover hard evidence.

In the event of an audit, the effort that the investigator would exert is directly affected by the punishment that indicting the citizen would induce. Formally, she chooses

$$e^* \in \underset{e\in[0,1]}{\arg\max} \quad e \times \Big(1-(1-\lambda)\times m\Big) - \frac{e^2}{2} \tag{1}$$

It is straightforward to see that, given some level of muscles $m \in [0,1]$, her effort is increasing in the quality of institutions ($\lambda \in (0,1)$) because this attenuates the harm it would impose; and, given some quality of institutions, her effort is decreasing in muscles.

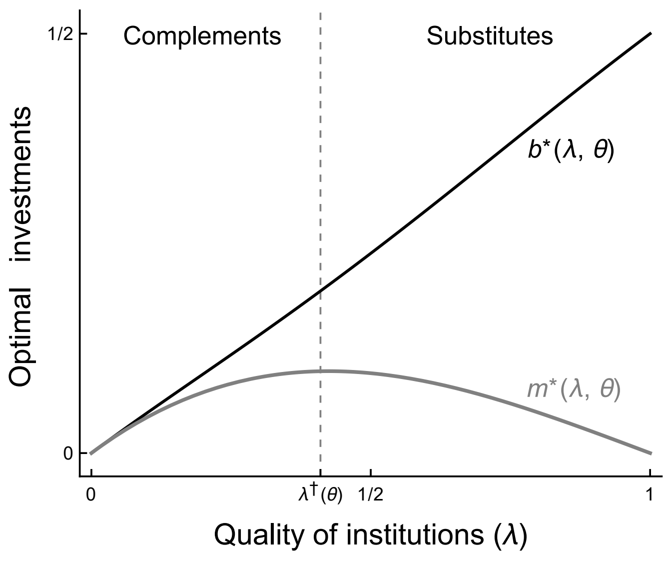
Lemma 1. *Suppose that the citizen engages in tax evasion ($h = 1$). Then, there exists a unique threshold $\lambda^{\dagger}(\theta) \in (0,1)$, decreasing in $\theta \in (0,1)$, such that the following holds on the equilibrium path:*

(a) If $\lambda \leq \lambda^{\dagger}(\theta)$, brains and muscles are complements, with $\dfrac{\partial\, b^{*}(\lambda,\theta)}{\partial\lambda}, \dfrac{\partial\, m^{*}(\lambda,\theta)}{\partial\lambda} > 0.$

(b) If $\lambda > \lambda^{\dagger}(\theta)$, these are substitutes, with $\dfrac{\partial\, b^{*}(\lambda,\theta)}{\partial\lambda} > 0$ *and* $\dfrac{\partial\, m^{*}(\lambda,\theta)}{\partial\lambda} < 0.$

To understand the insights from Lemma 1, suppose that the quality of institutions is very low. Then, from the citizen's viewpoint the direction of the effects of brains or muscles investments coincides. Since a low quality of institutions imply an already low chance that an investigation is triggered, investing in brains could further push this probability down. At the same time, it also implies that institutional protections surrounding the investigator are deficient: in the unlikely case that an investigation happens, investing in muscles could be an effective deterrent for the investigator's incentives to exert effort.

Figure 3.1: Equilibrium investment in brains and muscles



Note. The black (gray) line graphs the optimal investment in brains (muscles), with $\theta = 1/2$ which induces the threshold $\lambda^{\dagger}(\theta) \approx 0.42$.

Given that the investments in brains and muscles are convexly costly, the citizen finds it optimal to balance his expenditures across both strategies. As depicted in Figure 1, below some threshold in the quality of institutions, brains and muscles are complements to the citizen.

But as the quality of institutions grows large enough, the increasing institutional protections surrounding the investigator make an investment in muscles progressively ineffective; that is, the returns from this strategy become a poor deterrent to the investigator's incentive to exert effort to uncover hard evidence. In turn, the citizen would rather place his coins in not having an investigation being triggered in the first place: this is, to him, the safest way to avoid being sanctioned from his evasion of taxes. As shown in Figure 1, above some threshold in the quality of institutions, brains and muscles thereby become substitutes to the citizen.

Another insight in Lemma 1 is the effect that an increase in the penalty rate has on the before-mentioned threshold: it increases the range of values for which brains progressively offsets muscles. Indeed, a higher penalty rate pushes the citizen towards the safer strategy of avoiding to be audited in the first place, relative to the alternative of increasing muscles to reduce the chances that the investigator uncovers hard evidence even if he is audited. But this is not the only effect that results after an increase in the penalty rate.

Lemma 2. *If the citizen engages in tax evasion* $(h = 1)$*, then for any* $\tau < \theta^a < \theta^b < 1$*, the following inequalities hold:* $b^*(\lambda, \theta^b) > b^*(\lambda, \theta^a)$ *and* $m^*(\lambda, \theta^b) > m^*(\lambda, \theta^a)$*.*

The above lemma tells us that an increase in the sanction following an indictment also increases the incentives for the citizen to invest a higher amount *both* on brains and muscles. This would further reduce the risk of engaging in evasion. This implies that although there is a quicker substitution between brains and muscles, the intensity of the punishment directed towards the investigator would hike. As we can expect, the effects that follow an increase in the penalty rate should decrease overall the incentives of engaging in tax evasion altogether because it becomes both riskier and more expensive.

Proposition 1. *There exists a unique threshold $\lambda^{\ddagger}(\theta) \in (0,1)$, decreasing in $\theta \in (\tau, 1)$, such that the following holds on the equilibrium path:*

(a) If $\lambda \leq \lambda^{\ddagger}(\theta)$, then the citizen engages in tax evasion ($h = 1$) and invests $b^{*}(\lambda, \theta) > 0$ in brains and $m^{*}(\lambda, \theta) > 0$ in muscles.

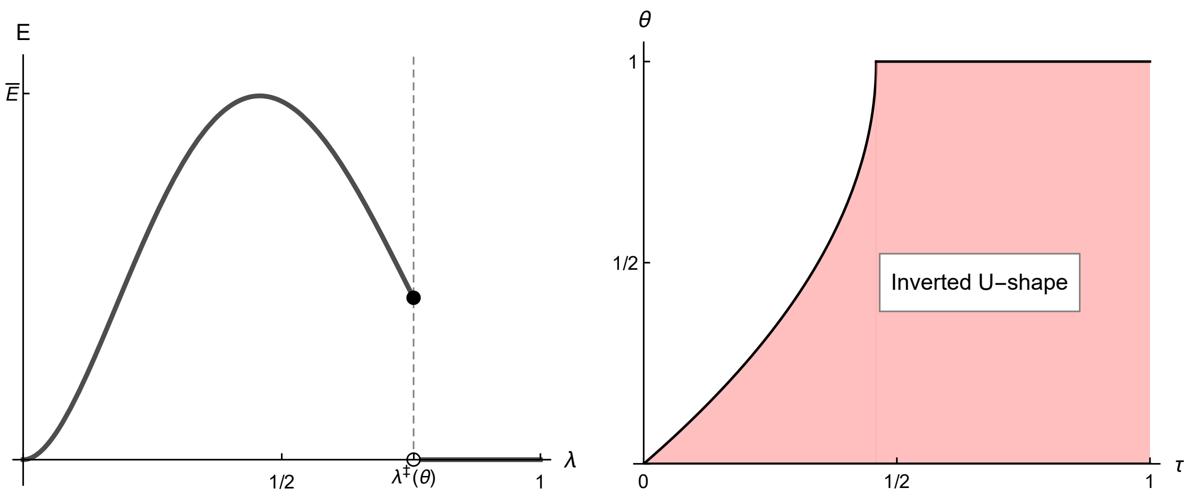
(b) If $\lambda > \lambda^{\ddagger}(\theta)$, then the citizen does not engage in tax evasion ($h = 0$) and invests nothing in brains and muscles.

With these theoretical insights, we can pose the following question: What do we estimate when we try to estimate tax evasion by the wealthy? In our framework, this is a mixture of two key quantities: the success of the state fiscal capacity in detecting possible tax evasion, despite a citizen's investment in the complexity of his evasion scheme; and the failure of the state legal capacity to provide enough protections to investigators (journalists, tax police, etc) to counteract a citizen's retaliation investments.

To understand this, we can start by examining the effect that the citizen's investment in muscles has on the effort that the investigator exerts. As illustrated in Figure 1, whenever the quality of institutions is not too high ($\lambda \leq \lambda^{\dagger}(\theta)$), expenditures on punishment are increasing along this measure which have a starting point at zero (with no retaliation). In turn, this implies that the effort exerted by the investigator starts at a high value since she expects a negligible punishment (because $\lim_{\lambda \to 0} m^*(\lambda, \theta) = 0$) and strictly decreases thereafter as institutions become better (because $\lim_{\lambda \to \lambda^{\dagger}(\theta)} m^*(\lambda, \theta) > 0$).

By a similar reasoning, when the institutional quality becomes high enough ($\lambda > \lambda^{\dagger}(\theta)$), the strict decrease on the expenditures on retaliation along such variable (recall that it is substituted by a higher investment in brains) entails an increase in the effort that the investigator chooses to utilize (because $\lim_{\lambda \to 1} m^*(\lambda, \theta) = 0$). Put equivalently, the non-monotonic (U-shaped) equilibrium investments in muscles gives rise to a non-monotonic (inverted U-shaped) equilibrium effort by the investigator.

Figure 3.2: Equilibrium effects of the citizen's strategies



Estimated tax evasion
$\lambda\left(1 - b^*(\lambda, \theta)\right)\left(1 - e^*\left(\lambda, m^*(\lambda, \theta)\right)\right)$

Sufficient conditions
$\lambda^{\dagger}(\theta) < \lambda^{\ddagger}(\theta)$

Note. On the right panel, the highest estimated tax evasion is given by $\overline{E} \approx 0.014$; and the tax and penalty rates are $\tau = 2/10$ and $\theta = 3/10$, which induce $\lambda^{\ddagger}(\theta) \approx 0.75$.

The implication of the investigator's equilibrium effort is that her probability of successfully uncovering evidence of tax evasion will be at its lowest at intermediate levels of the quality of institutions, precisely because the institutional protections that surround her do not sufficiently attenuate the citizen's retaliation in the event of an indictment. But the investigator does not always examine unlawful behaviour by the citizen; she only investigates those that are detected, which is affected by the citizen's optimal investment in brains. Put differently, from an ex-ante standpoint a proportion of tax evasion attempts would go unnoticed, which would downwardly bias the true evasion endeavour of a citizen.

As illustrated in the right panel of Figure 2, the interaction of these two aspects (the proportion of detected cases *and* the proportion of investigated cases for which hard evidence is not uncovered) yields a theoretical expectation that we can take to the data: estimated tax evasion displays an inverted U-shape along the quality of institutions. This prediction comes with the caveat that it holds as long as the difference between the tax and penalty rate is not too high.

Remark 1. *If $\tau > 1/2$, or if $\tau \leq 1/2$ and $\theta \in (\tau, 1 - \sqrt{1 - 2\,\tau})$, then $\lambda^{\dagger}(\theta) < \lambda^{\ddagger}(\theta)$.*

Remark 1 gives sufficient (and not necessary) conditions for the estimates of tax evasion to display the aforementioned shape, which are illustrated in the right panel of Figure 2. Although these conditions are sufficient, it is easy to see that the expected relationship holds for a wide range of values. If we were to examine necessary conditions, the set of values for which the relationship holds grows larger. For instance, for a tax rate of 13%, Remark 1 states that it is sufficient for the penalty rate to be lower than 14% for the relationship to hold. However, as we show in the Appendix, a back of the envelope calculation shows that the inverted U-shape holds for any penalty rate lower than 31%.

Finally, note that because of the way in which we conceptualise an investment in brains, we can substantively think of these estimates in terms of offshore tax evasion for the reason that, by Lemma 1, the complexity of the evasion scheme is strictly increasing along the quality of institutions.

3.3 The Data

To bring the theoretical prediction to the data, our key dependent variable utilises estimates of offshore wealth in international financial centers by individuals for 37 countries between 2002 and 2016, computed by the European Commission (2019).[17] To the best of our knowledge, this study contains the most recent and comprehensive estimates of offshore tax evasion that can be found in the literature.[18] To the extent that the applied computational method does not account for life insurance contracts, cash money and real estates, as well as not capturing the growing practice of dual fiscal residency, these should be thought as lower bound estimates.[19]

The time period for our empirical analysis merits a further note. While many attempts have been made to reduce the importance of tax heavens, especially during the financial crisis started in 2008, the results of these endeavours have not been substantial as to pose

[17]For the list of countries included in the analysis, see the Appendix. In the choice of estimates of tax evasion, we maximize the number of country-year observations.

[18]In order to calculate these estimates, the document by the European Commission (2019) employs a method first developed by Zucman (2013), which hinges on the global discrepancy between international portfolio assets and liabilities. The particulars of this method, based on macroeconomic statistics, make it very unlikely that a measurement error would be heterogeneous across countries. The EU document also contains alternative, though less comprehensive, estimates (Table 3.1).

[19]As argued in the European Commission document, strategies to evade taxes through offshoring usually involve the creation of anonymous shell companies in countries with lax regulations.

threats to our analysis. Indeed, as Johannensen and Zucman (2014) shows, the main effect of the bilateral treaties between G20 countries and tax havens have been that tax evaders have shifted to countries that were not covered by these agreements. Given that these estimates regard all international financial centers, we do not think that the recent efforts by governments consistently diminish the relevance of our empirical specification, beyond the inclusion of year fixed effects.

Table 3.1: Descriptive Statistics

	Obs.	Mean	Std. Dev	Min	Max
Tax Evasion	555	3.28	1.66	0.63	7.26
Rule of Law	555	1.05	0.30	0.08	1.38
Top Tax Rate	555	0.32	0.09	0.10	0.49
Top 1% Income	535	0.11	0.04	0.06	0.23
Stability	555	1.12	0.24	0.21	1.41
GDP	555	12.96	1.77	9.22	16.66
Inflation	555	2.06	0.30	1.40	3.01
Wealth	409	2.30	0.96	0	4.46
Press Freedom	235	33.92	1.42	29.99	36.63

Note. All variables are log-normalized and winsorized at the 1% to account for outliers.

The key explanatory variable to proxy for the quality of institutions comes from the rule of law index found in World Bank's *Worldwide Governance Indicators*. This index measures the "perceptions on the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence" (Kaufmann, Kraay and Mastruzzi 2010, 4). Methodologically, it is a standardized latent measure based on a model of thirty-two variables related to the rule of law.[20]

In Table 3.1, we list all the variables to be utilized in the empirical analysis. Among these, we include a set of controls that could arguably be associated with individuals' incentives to engage in offshoring their taxable wealth. The variable *Top Tax Rate*, constructed mainly from the *Comparative Income Taxation Database* (Genovese, Scheve and Stasavage 2016), measures the highest marginal tax rate for individuals. This could capture incentives for the wealthiest citizens to evade more as the tax rate increase (see Torgler 2005).

We would also like to take into account the empirical evidence about the strong association between wealth inequality and tax evasion (Alstadsaeter, Johannesen and Zucman 2019). Unfortunately, reliable estimates of wealth inequality exist only for a handful of countries. To partially account for this, we include the variable *Top 1% Income*, which comes from the *World Income Inequality Database* and which measures the share of the top one percent of the income distribution.[21]

In addition, since it is also likely that evasion incentives arise from uncertainty concerns regarding regime changes from popular uprisings, we include the variable *Stability* which is an index found in the The World Bank's *Worldwide Governance Indicators*, and it

[20] Although there exists some criticism surrounding this index, Versteeg and Ginsburg (2017) show that it is highly correlated with alternative measures. As they write, "indicators created by the [Worldwide Governance Indicators], the Heritage Foundation, and the [World Justice Project] are almost identical, with their pair-wise correlations all exceeding 0.95" (102). Our preference towards the Worldwide Governance Indicators is due to data availability and methodological reasons. On the former, data from the World Justice Project is available only since 2012 and it is comparable across years since 2015; and, on the latter, the Heritage Foundation's index heavily relies on assessments by country experts.

[21] In the Appendix, we also conduct the empirical analysis using estimates of total net private from the *World Income Inequality Database*. We do not include it in our main analysis for two reasons. First, because it is only available for a smaller number of countries relative to the variable *Top 1% Income*. And, second, it is very highly correlated with GDP.

measures the "perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism." Controlling for this variable would further avoid to confound the effect of our measure of rule of law with one specifically related to threats to the political stability of the country, since these threats do not play a clear role in the brains-muscles mechanisms highlighted in our theoretical model.[22]

Finally, we would also want to account for the effects that the economic characteristics of a country may have on our dependent variable. As shown by some scholars (Crane and Nourzad 1986; Caballé and Panadés 2004), there is a positive association between the inflation rate and aggregate evasion. Our variable *Inflation*, which comes from the OECD database, accounts for this. Using data from The World Bank's *Worldwide Development Indicators*, we also include Gross Domestic Product (GDP).

Certainly, the choice of control variables is constrained by data limitations of countries with poor or medium institution quality, for which is more difficult to find reliable statistics. Given this constraint, we believe that we control for the most important alternative channels. As such, we interpret the rule of law variable as an umbrella measure that captures impartiality and non-arbitrariness of institutions, including tax institutions.

[22] An additional institutional variable which can affect incentives to evade is the freedom of press. We do not include it in our main analysis because of data availability limitations. Nonetheless, we include in the Appendix results with a measure of *Press Freedom*, which comes from the *World Press Freedom Index* compiled by Reporters Without Borders.

3.3.1 Empirical Analysis

In order to test the prediction of the theoretical model previously outlined, our main empirical specification is an ordinary least squares (henceforth, "OLS") panel specification with country and year fixed effects. Indeed, the inclusion of country fixed effects is crucial given the potential role of long-run factors that create favorable conditions for evasion in some countries (but perhaps not in others) many decades before the period of the study. The inclusion of year fixed effects instead captures common trends across panels, potentially related to international efforts to combat tax evasion. With a slight abuse of notation in the vector of controls, our empirical specification is

$$ln(Y_{j,t}) = \alpha_j + \beta_t + \gamma \ \ln(\text{Rule of Law}_{j,t}) + \delta \ \ln(\text{Rule of Law}_{j,t})^2 + \eta \ \ln(X_{j,t}) + \epsilon_{j,t},$$

where for each country j at year t, $\mathrm{Y_{j,t}}$ is the amount of offshore wealth; α_t is the set of country fixed effects; β_t is the set of year fixed effects; $\text{Rule of Law}_{\mathrm{j,t}}$ is the value of Rule of Law; $\mathrm{X_{j,t}}$ is the vector of controls specified in Table 3.1; and $\epsilon_{j,t}$ is the error term.

Our theoretical expectation is for the coefficient γ to be positive and the coefficient δ to be negative, as it would imply an inverted-U shape of our dependent variable along our measure of institutional quality. The main regression results are shown in Table 3.2. In the first column, we start by regressing our dependent variable on the rule of law measure and its squared value. We observe that the relationship confirmed our expectations, both in direction and in statistical significance.[23]

[23] For all the specifications of Table 3.2, note that the marginal effect of our explanatory variable on our dependent one will be equal to $\partial \ln(Y)/\partial \ln(\text{Rule of Law}) = \gamma + 2\,\delta \ \ln(\text{Rule of Law})$, where we dropped the subscripts for simplicity. This implies two things. First, that the effect of a percentage change of

Table 3.2: Panel regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rule of Law	6.08***	3.51*	6.06***	6.03***	5.92***	6.13***	3.52**
	(1.90)	(1.83)	(1.90)	(1.96)	(1.88)	(1.96)	(1.77)
Rule of Law^2	-3.00***	-2.03**	-3.00***	-2.97***	-2.98***	-3.02***	-2.01**
	(0.96)	(0.84)	(0.96)	(1.01)	(0.95)	(0.99)	(0.83)
GDP		1.16***					1.14**
		(0.45)					(0.46)
Stability			0.04				-0.18
			(0.28)				(0.33)
Inflation				-0.04			-0.07
				(0.13)			(0.09)
Top Tax Rate					-1.35**		-0.57
					(0.69)		(0.72)
Top 1% Income						0.99	0.47
						(1.78)	(1.59)
Fixed Effects	X	X	X	X	X	X	X
Observations	555	555	555	555	555	555	555
R^2 (within)	0.48	0.55	0.48	0.48	0.49	0.48	0.56

Note. Standard errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Moreover, columns 2 to 6 include other time-varying controls one by one, as we have reasonable theoretical reasons to believe they may influence our dependent variable in a country. Across these columns, only GDP and Top Tax Rate (the highest marginal tax rate) display explanatory power.[24] Column 7 shows our preferred empirical specification,

our rule of law measure on offshore evasion will depend on its starting value. Additionally, it implies that the effect of a percentage change in our explanatory variable on offshore evasion can have a positive or a negative direction: when the rule of law measure is lower than 0.8756, the effect would be positive; and when it is higher than such value, the effect would be negative. In effect, this is simply a solution to $\partial \ln(Y)/\partial \ln(\text{Rule of Law}) = 0$. One standard deviation above this value of the main independent variable would lead to a 18 percent decrease in tax evasion and one standard deviation; one standard deviation below

[24] As shown in the Appendix, including the squared value of GDP so as to resemble the rule of law variable, does not affect any results.

including all controls. It is interesting to note that in this case only GDP remains statistically significant. More importantly, across all these alternative specifications the relationship between rule of law and tax evasion is aligned with our theoretical expectations and remains statistically significant.[25]

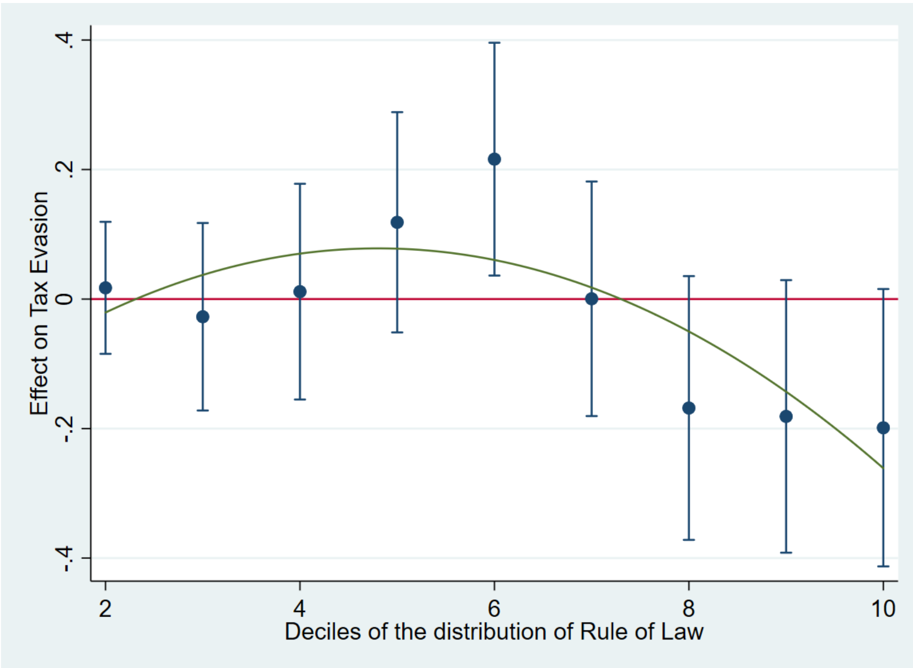
As explained above, the specification exploits within country variation in the rule of law. This choice might raise some concerns related to a potential effect capturing not substantial variation in the main variables. We first address these concerns graphically; Figure 3.4 and 3.5 in the Appendix show that the variation within countries for tax evasion and rule of law index is surely not negligible. Then, we perform the test proposed in Aronow and Samii (2015) to understand the heterogeneity of the results in a traditional "average-effect" OLS model. We find that the effective sample for which the effect of rule of law on tax evasion is not negligible, and it is not much different from the nominal sample of 37 countries.

More precisely, only 11 countries have small or trivial weights in the contribution to the average effect (with mean weight per country equal to 0.027 and median weight 0.016). Interestingly, the top 6 contributing countries, with values more than twice the mean weight, are Hungary, Brazil, India, Greece, Croatia and Malta. As a minor point, the inclusion of time and country fixed effects do not change much neither the significance nor the magnitude of the coefficients (see Table 3.5 in the Appendix). We interpret this as a further indication that the within country variation is sufficient to deliver accurate estimates.

[25] Table 3.4 in the Appendix replicates the same strategy by including (one at a time) a measure of press freedom and a proxy of private net wealth, and we show that results continue to hold —although, as mentioned before, including this variables reduces the sample size due to data availability.

Additionally, it can be difficult to substantively interpret what a smooth continuous increase (or decrease) of our rule of law measure exactly entails. As explained in a previous section, this is due to this index being a standardized latent measure based on a model of thirty-two variables. As such, a within country unit change in this variable could be caused by a number of different factors that may not sufficiently capture our theorized mechanisms.

Figure 3.3: Deciles of Rule of Law on Tax Evasion



We address this concern by breaking up this continuous measure into deciles, for the reason that an across-decile movement is likely to require an overall change in a large number of the variables that comprise this index. As illustrated in Figure 3.3, when replicating the full model with this new approach, the theorized inverted-U shape persists.

[25]More precisely, we calculate the deciles according to the in-sample distribution of the index of rule of law, and we carry out the same exercise for our *Stability* control variable. The corresponding regression table can be found in Table 3.6 of the Appendix.

3.3.2 Robustness Checks

To study the robustness of our previous results, we first consider alternative correlational structures of standard errors. In order to check for the possibility of autocorrelation of the errors, we employ a Prais-Winsten estimation to allow for first-order autocorrelation coefficients for each country. The results, shown in the second column of Table 3.3, further confirms our findings. As a comparison, the first column displays our earlier results for the full model.

Table 3.3: Robustness results

	(OLS)	(Prais-Winsten)	(Blundell-Bond)
Rule of Law	3.52^{**}	1.64^{*}	2.48^{*}
	(1.77)	(0.89)	(1.49)
Rule of Law^2	-2.01^{**}	-1.14^{**}	-1.24^{*}
	(0.83)	(0.45)	(0.75)
L.Tax Evasion			0.63^{***}
			(0.08)
Fixed Effects	X	X	X
Controls	X	X	X
Observations	555	555	518

Note. Standard errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The second robustness check contemplates a potential persistent nature of tax evasion. Put differently, our preferred earlier specification assumes that the drivers of our dependent variable, which are omitted in the error term, are not correlated with past and future measures of rule of law. This assumption may be violated if, for example, present evasion affects future evasion via an increase in the institutional efforts to fight it, or via legal reforms. To attend this possibility, we employ a system Generalized Method of Moments to account for a dynamic structure of the panel data. More specifically, we use the estimator developed by Blundell and Bond (1998), which includes lagged differences of the dependent variable as instruments for the level equation.

As shown in the third column of Table 3.3, our main findings do not qualitatively change with the inclusion of the lagged evasion variable. It is also important to note that past evasion has a strongly significant positive effect on present evasion, confirming the hypothesized persistent nature of evasion patterns. Overall, Table 3.3 shows that our results are robust to alternative empirical specifications.

We make use of alternative estimates of tax evasion by the IMF in order to increase the number of countries. This data is available only for 2016. The corresponding regression in Table 3.7 confirms the U-shaped relationship between amount of evasion and rule of law index, even if significance disappears when all controls are included. For year 2016, World Justice Network provides estimates of rule of law for almost two hundred countries. We then use them as an alternative main independent variable, instead of the World Bank ones, and shows that the results are unaffected. Overall, these empirical exercises demonstrate that the theoretical prediction is supported by any available estimates of dependent and main explanatory variable. [26]

Finally, we acknowledge that evasion methods could potentially spillover across countries. This practice could potentially bias the results. To account for this, we substitute

[26] We are not concerned about the loss of significance for these regressions with all controls, given the substantially smaller sample and the above-mentioned problem of data availability for countries with poor and medium level of quality of institutions.

regional fixed effects for country fixed effects in our preferred regression.[27] Table 3.4 in the Appendix shows that the coefficients are even more precisely defined in this alternative specification.

Lastly, we recognize that the destination countries of offshore wealth are international financial centers (for a complete list, see European Commission 2019). As such, being at the receiving end might influence the incentives of a country's fight against tax evasion in complex fashions, potentially having an effect on the amount of evasion of its citizens. For this reason, we run the entire analysis excluding Luxembourg, the only country being a financial center in the sample, and find that our results remain unaffected.

3.4 Conclusion

The negative consequences against some investigative journalists involved in the publication of "The Panama Papers" have shown that exposing tax evaders may be risky for investigators. In turn, these potential costs affects the incentives of investigators in the search for evidence of wrongdoing. This calls for new ways of theorizing about tax evasion tactics. To do so, we develop a stylised model where wealthy and influential citizens can affect their chances of being caught and sanctioned by investing in brain (the complexity of the their evasion scheme) and muscles (punishments against investigators). We then obtain a key theoretical insight that we take to the data: estimates of offshore tax evasion display an inverted U-shape along the quality of institution. The empirical test of this model relies on country estimates of the aggregate amount of offshore tax

[27] Given the data available, we aggregate the countries in the following regions: Northern Europe, Southern Europe, Western Europe, Eastern Europe, America, Asia and a residual group.

evasion by individuals and a country index of rule of law. We show that the predictions of the theoretical model hold after taking into account a vector of controls and, furthermore, that these are robust to specifications that allow for the possibility of autocorrelation of standard errors and a dynamic structure of the panel data.

References

Alstadsæter, Annette, Johannesen, Niels, and Zucman, Gabriel. 2019. "Tax evasion and inequality." *American Economic Review* 109(6): 2073-2103.

Blundell, Richard, and Bond, Stephen. 1998. "Initial conditions and moment restrictions in dynamic panel data models." *Journal of Econometrics* 87(1): 115-143.

Caballé, Jordi, and Panadés, Judith. 2004. "Inflation, tax evasion, and the distribution of consumption." *Journal of Macroeconomics* 26(4): 567-595.

Crane, Steven, and Nourzad, Farrokh. 1986. "Inflation and tax evasion: An empirical analysis." *The Review of Economics and Statistics* 68(2): 217-223.

Cremer, Helmuth, and Gahvari, Firouz. 1994. "Tax evasion, concealment and the optimal linear income tax." *The Scandinavian Journal of Economics* 96(2): 219-239.

Dal Bó, Ernesto, and Di Tella, Rafael. 2003. "Capture by threat." *Journal of Political Economy* 111(5): 1123-1154

Dal Bó, Ernesto, Dal Bó, Pedro, and Di Tella, Rafael. 2006. "" Plata o Plomo?": Bribe and punishment in a theory of political influence." *American Political Science Review* 100(1): 41-53.

Dal Bó, Ernesto. 2006. "Regulatory capture: A review." *Oxford review of economic policy* 22(2): 203-225.

Dell'Anno, Roberto. 2009. "Tax evasion, tax morale and policy maker's effectiveness." *The Journal of Socio-Economics* 38(6): 988-997.

European Commission. 2019. "Estimating International Tax Evasion by Individuals". *Taxation Papers 76, Directorate General Taxation and Customs Union* 76.

Finckenauer, James, and Voronin, Yuri. 2001. *The threat of Russian organized crime.* Washington, D.C.: National Institute of Justice.

Fitzgibbon, Will. "Panama Papers journalists around the globe are being threatened", *Pointer*, December 1, 2016, https://www.poynter.org/news-release/2016/panama-papers-journalists-around-the-globe-are-being-threatened/

Giles, Christopher. "Malta's 'golden passports': Why do the super-rich want them?", *BBC Reality Check*, December 4, 2019, https://www.bbc.com/news/world-europe-50633820

Genovese, Federica, Kenneth Scheve, and David Stasavage. 2016. "Comparative Income Taxation Database." [Computer file]. Stanford, CA: Stanford University Libraries. http://data.stanford.edu/citd.

International Monetary Fund (IMF). 2018. Database. Fiscal Monitor: Capitalizing on Good Times. Washington, April.

Kemme, David, Parikh, Bhavik, and Steigner, Tanja. 2017. "Tax havens, tax evasion and tax information exchange agreements in the OECD." *European Financial Management* 23(3): 519-542.

Kaufmann, Daniel, Kraay, Aart, Mastruzzi, Massimo. 2010. "The Worldwide Governance Indicators: A Summary of Methodology, Data and Analytical Issues." *World Bank Policy Research*, Working Paper No. 5430. http://ssrn.com/abstract=1682130.

Luttmer, Erzo, and Singhal, Monica. 2014. "Tax morale." *Journal of Economic Perspectives* 28(4): 149-68.

McGoey, Sean. "Panama Papers revenue recovery reaches $ 1.36 billion as investigations continue", *International Consortium of Investigative Journalists*, April 6, 2021, https://www.icij.org/investigations/panama-papers/panama-papers-revenue-recovery-reaches-1-36-billion-as-investigations-continue/

OECD (2021), Inflation (CPI) (indicator). doi: 10.1787/eee82e6e-en (Accessed on 25 March 2021)

Pace, Roderick. "Will the assassination of Daphne Caruana Galizia lead to wholesale institutional reform in Malta?", *LSE European Politics and Policy (EUROPP)*, November 7, 2017, https://blogs.lse.ac.uk/europpblog/2017/11/07/assassination-of-daphne-caruana-galizia-malta-politics/

Slemrod, Joel, and Yitzhaki, Shlomo. 2002. "Chapter 22: Tax avoidance, evasion, and administration." In *Handbook of public economics*, Vol. 3: 1423-1470. Elsevier B.V.

The World Bank. 2021. *Worldwide Governance Indicators.* https://databank.worldbank.org/source/worldwide-governance-indicators

Torgler, Benno. 2005. "Tax morale in Latin America." *Public Choice* 122(1-2): 133-157.

Torgler, Benno, and Schneider, Friedrich. 2009. "The impact of tax morale and institutional quality on the shadow economy." *Journal of Economic Psychology* 30(2): 228-245.

Versteeg, Mila, and Ginsburg, Tom. 2017. "Measuring the rule of law: a comparison of indicators." *Law & Social Inquiry* 42(1): 100-137.

Wesel, Barbara. "Muerte y corrupción en Malta: como una película de la mafia", *Deutsche Welle*, December 2, 2019, https://www.dw.com/es/muerte-y-corrupci%C3%B3n-en-malta-como-una-pel%C3%ADcula-de-la-mafia/a-51505841

Yitzhaki, Shlomo. "On the excess burden of tax evasion." *Public Finance Quarterly* 15(2): 123-137.

Zucman, Gabriel. 2013. "The Missing Wealth of Nations: Are Europe and the U.S. Net Debtors or Net Creditors?" *The Quarterly Journal of Economics* 128(3): 1321–64.

Zucman, Gabriel. 2015. *The hidden wealth of nations: The scourge of tax havens.* University of Chicago Press.

3.6 Appendix

The Theory

3.6.1 Proof of Lemma 1.

Proof. We start by noting that the investigator's equilibrium effort is given by the first order condition for (1), which straightforwardly yields $e^* = 1 - (1-\lambda)m$.[28] If $h = 1$, the citizen's problem is a solution to

$$b^*, m^* \in \underset{b,m\in[0,1]}{\arg\max}\ \lambda(1-b)\Big(e^*(\lambda,m)(1-\theta) + (1-e^*(\lambda,m))\Big) + (1-\lambda(1-b)) - \frac{b^2}{2} - \frac{m^2}{2} \tag{2}$$

By plugging in the investigator's equilibrium effort, let

$$\begin{aligned}\Gamma(b,m) :=& \lambda(1-b)\Big((1-(1-\lambda)\,m)(1-\theta) + (1-(1-(1-\lambda)\,m))\Big) \\ &+ (1-\lambda(1-b)) - \frac{b^2}{2} - \frac{m^2}{2}\end{aligned}$$

From the first-order conditions $\partial\Gamma(b,m)/\partial b = 0$ and $\partial\Gamma(b,m)/\partial m = 0$, we can recover

$$b^*(\lambda,\theta) = \frac{\theta\lambda\left(-1+\lambda\theta(1-\lambda)^2\right)}{-1+\theta^2\lambda^2(1-\lambda)^2}$$

$$m^*(\lambda,\theta) = \frac{\theta(1-\lambda)\lambda(\theta\lambda-1)}{-1+\theta^2\lambda^2(1-\lambda)^2}$$

Notice that

$$\lim_{\lambda\to 0}\frac{\partial b^*(\lambda,\theta)}{\partial\lambda} = \lim_{\lambda\to 0}\left(\frac{\theta(1-\theta\lambda(1-\lambda)(2-\lambda(4+\theta)+3\theta\lambda^2)))}{(-1+\theta^2(1-\lambda)^2\lambda^2)^2}\right) = \theta > 0$$
$$\lim_{\lambda\to 1}\frac{\partial b^*(\lambda,\theta)}{\partial\lambda} = \lim_{\lambda\to 1}\left(\frac{\theta(1-\theta\lambda(1-\lambda)(2-\lambda(4+\theta)+3\theta\lambda^2)))}{(-1+\theta^2(1-\lambda)^2\lambda^2)^2}\right) = \theta > 0$$

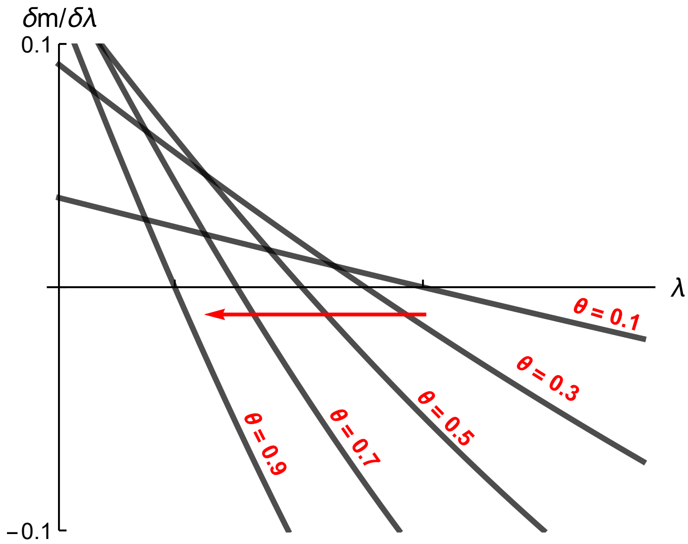
[28] This follows simply from $\dfrac{\partial}{\partial e}\left(e \times \Big(1-(1-\lambda)\,m\Big) - \dfrac{e^2}{2}\right) = 0$.

thus, $\partial b^*(\lambda,\theta)/\partial\lambda$ is strictly increasing in λ. Similarly, notice that

$$\lim_{\lambda\to 0}\frac{\partial m^*(\lambda,\theta)}{\partial\lambda}=\lim_{\lambda\to 0}\left(\frac{\theta+\theta\lambda(-2+\theta(-2+\lambda(3+\theta(1-\lambda)^2(1+\lambda(-2+\theta\lambda)))))}{(-1+\theta^2(1-\lambda)^2\lambda^2)^2}\right)=\theta>0$$
$$\lim_{\lambda\to 1}\frac{\partial m^*(\lambda,\theta)}{\partial\lambda}=\lim_{\lambda\to 1}\left(\frac{\theta+\theta\lambda(-2+\theta(-2+\lambda(3+\theta(1-\lambda)^2(1+\lambda(-2+\theta\lambda)))))}{(-1+\theta^2(1-\lambda)^2\lambda^2)^2}\right)=-\theta(1-\theta)<0$$

therefore, by the Intermediate Value Theorem, there must exist some $\lambda^\dagger(\theta)\in(0,1)$ such that: if $\lambda\leq\lambda^\dagger(\theta)$, then $\partial m^*(\lambda,\theta)/\partial\lambda>0$; otherwise ($\lambda>\lambda^\dagger(\theta)$), then $\partial m^*(\lambda,\theta)/\partial\lambda<0$. We conduct simulations to provide a graphical proof that $\partial\lambda^\dagger(\theta)/\partial\theta<0$:

Solutions to $\partial m^*(\lambda,\theta)/\partial\lambda=0$ at different penalty rates



Finally, we argued in the main body of the text that results hold if we were to assume $\text{corr}(\lambda,\theta)>0$ instead of a flat penalty rate. To show this, suppose that the penalty rate is now increasing along the quality of institutions as $\theta(\lambda)=\tilde{\theta}(1+\lambda)$. We choose this specific functional as, we think, it is the simplest formulation to preserve tax evasion as a risky practice; for instance, it ensures that $\theta(0)>0$. We need, however, to impose $\tilde{\theta}\in(0,1/2)$

so that $\theta(1) < 1$.

Proceeding as before,

$$\lim_{\lambda\to 0}\frac{\partial b^*(\lambda,\theta(\lambda))}{\partial\lambda} = \lim_{\lambda\to 0}\left(\frac{\tilde{\theta}\lambda(1+\lambda)(-1+\tilde{\theta}(1-\lambda)^2\lambda(1+\lambda))}{-1+\tilde{\theta}^2\lambda^2(1-\lambda^2)^2}\right) = \tilde{\theta} > 0$$
$$\lim_{\lambda\to 1}\frac{\partial b^*(\lambda,\theta(\lambda))}{\partial\lambda} = \lim_{\lambda\to 1}\left(\frac{\tilde{\theta}\lambda(1+\lambda)(-1+\tilde{\theta}(1-\lambda)^2\lambda(1+\lambda))}{-1+\tilde{\theta}^2\lambda^2(1-\lambda^2)^2}\right) = 3\,\tilde{\theta} > 0$$

thus, $\partial b^*(\lambda,\theta(\lambda))/\partial\lambda$ is strictly increasing in λ. Furthermore,

$$\lim_{\lambda\to 0}\frac{\partial m^*(\lambda,\theta(\lambda))}{\partial\lambda} = \lim_{\lambda\to 0}\left(\frac{\tilde{\theta}\lambda(1-\lambda^2)(-1+\tilde{\theta}\lambda(1+\lambda))}{-1+\tilde{\theta}^2\lambda^2(1-\lambda^2)^2}\right) = \tilde{\theta} > 0$$
$$\lim_{\lambda\to 1}\frac{\partial m^*(\lambda,\theta(\lambda))}{\partial\lambda} = \lim_{\lambda\to 1}\left(\frac{\tilde{\theta}\lambda(1-\lambda^2)(-1+\tilde{\theta}\lambda(1+\lambda))}{-1+\tilde{\theta}^2\lambda^2(1-\lambda^2)^2}\right) = 2\,\tilde{\theta}(2\,\tilde{\theta}-1)$$

and since $\tilde{\theta} < 1/2$, then the latter equation must be negative. Using the Intermediate Value Theorem, we have the same results as before when the penalty rate was flat.

3.6.2 Proof of Lemma 2.

Notice first that

$$\lim_{\theta\to 0}\frac{\partial b^*(\lambda,\theta)}{\partial\theta} = \lim_{\theta\to 0}\left(\frac{\lambda(1-2\theta(1-\lambda)^2\lambda+\theta^2(1-\lambda)^2)\lambda^2}{(-1+\theta^2(1-\lambda)^2\lambda^2)^2}\right) = \lambda > 0$$
$$\lim_{\theta\to 1}\frac{\partial b^*(\lambda,\theta)}{\partial\theta} = \lim_{\theta\to 1}\left(\frac{\lambda(1-2\theta(1-\lambda)^2\lambda+\theta^2(1-\lambda)^2)\lambda^2}{(-1+\theta^2(1-\lambda)^2\lambda^2)^2}\right) = \frac{\lambda(1-(2-\lambda)\lambda(1-\lambda)^2)}{\underbrace{(-1+(1-\lambda)^2\lambda^2)^2}_{>0}}$$

where the second equality is negative if and only if $1-(2-\lambda)\lambda(1-\lambda)^2 < 0$. But since (a) $\lim_{\lambda\to 0}(1-(2-\lambda)\lambda(1-\lambda)^2) = 1$; (b) $\lim_{\lambda\to 1}(1-(2-\lambda)\lambda(1-\lambda)^2) = 1$; and (c)

$\partial((2-\lambda)\lambda(1-\lambda)^2)/\partial\lambda = 0$ at $\lambda = \frac{1}{2}(2-\sqrt{2}) > 0$, then it must be the case that $1-(2-\lambda)\lambda(1-\lambda)^2 > 0$. Thus, $\partial b^*(\lambda,\theta)/\partial\theta > 0$, from which follows that if $\theta^b > \theta^a$, then $b^*(\lambda,\theta^b) > b^*(\lambda,\theta^a)$. For the case of muscles, let $\Delta(\theta^a,\theta^b) := m^*(\lambda,\theta^b) - m^*(\lambda,\theta^a)$. Notice first that if $\theta^a \approx \theta^b$, then $\Delta(\theta^a,\theta^b) \approx 0$. Additionally, note that

$$\lim_{\substack{\theta^b\to 1\\ \theta^a\to 0}} \Delta(\theta^a,\theta^b) = \frac{\overbrace{\lambda(1-\lambda)^2}^{>0}}{1-\lambda^2(1-\lambda^2)}$$

for the latter equality to be negative, it must be the case that $1-\lambda^2(1-\lambda^2) < 0$, which implies that either: (a) $\lambda < \frac{1}{2}(1-\sqrt{5}) \approx -0.618$, which is a contradiction because $\lambda > 0$; or (b) $\lambda > \frac{1}{2}(1+\sqrt{5}) \approx 1.618$, which is a contradiction because $\lambda < 1$. This completes the proof. ■

3.6.3 Proof of Proposition 1.

Proof. It is straightforward to see that if the citizen does not engage in evasion, then it is optimal for him not to invest in brains or muscles. Let the difference in expected utility between engaging ($h = 1$) and not engaging ($h = 0$) in evasion be defined as

$$\begin{aligned}\tilde{\Delta}(1,0) :&= \Gamma(b^*(\lambda,\theta), m^*(\lambda,\theta)) - (1-\tau)\\ &= \frac{-2+\theta\lambda(2-\theta(2-\lambda)\lambda^2)}{2(-1+\theta^2(1-\lambda^2)\lambda^2)} - (1-\tau)\end{aligned}$$

Notice first that $\lim_{\lambda\to 0}\tilde{\Delta}(1,0) = \tau > 0$ and, second, that

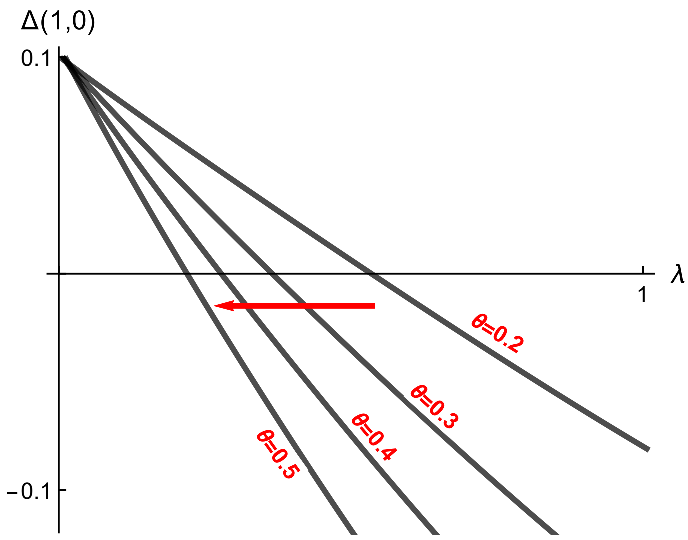
$$\lim_{\lambda\to 1}\tilde{\Delta}(1,0) = \frac{\theta^2}{2} - \theta + \tau = \frac{1}{2}\left(\theta^2 - 2\theta + 2\tau\right) \tag{3}$$

With respect to (4), notice that as $\theta \to \tau$, then $\lim_{\lambda \to 1} \tilde{\Delta}(1,0) = \theta^2/2 > 0$. Additionally, note that we can rewrite (4) as $\frac{1}{2}\big((\theta-1)^2 + 2\tau - 1\big)$. This rewriting makes it easy to see that if $\tau > 1/2$, then $\lim_{\lambda \to 1} \tilde{\Delta}(1,0) > 0$ because $(\theta-1)^2 + 2\tau - 1 > 0$. If this is the case, then $\tilde{\Delta}(1,0) > 0$ for any parameter specification. However, if $\tau < 1/2$, then for (4) to be positive, we need $(\theta-1)^2 + 2\tau - 1 > 0$ which has two solutions: (a) $\theta > 1 + \sqrt{1-2\tau}$ or (b) $\theta < 1 - \sqrt{1-2\tau}$. Condition (a) cannot hold because it would imply having $\theta > 1$, which is unfeasible. On the other hand, condition (b) can hold for any $\tau \in (0, 1/2)$ as it would satisfy having $\theta \in (0,1)$. To summarize, we have that if $\theta < 1 - \sqrt{1-2\tau}$, then $\lim_{\lambda \to 1} \tilde{\Delta}(1,0) > 0$. Thus, the citizen would strictly prefer to engage in evasion. Intuitively, the penalty rate is low enough for the citizen to take the risk. However, if $\theta > 1 - \sqrt{1-2\tau}$, then $\lim_{\lambda \to 1} \tilde{\Delta}(1,0) < 0$. And by the Intermediate Value Theorem, under the latter conjecture then there must exist some $\lambda^{\ddagger}(\theta) \in (0,1)$ such that: if $\lambda < \lambda^{\ddagger}(\theta)$, then $\tilde{\Delta}(1,0) > 0$ and the citizen prefers to engage in evasion; otherwise ($\lambda > \lambda^{\ddagger}(\theta)$), then $\tilde{\Delta}(1,0) < 0$ and the citizen prefers not to engage in evasion. Finally, as before, we conduct simulations to provide a graphic proof that $\partial\lambda^{\ddagger}(\theta)/\partial\theta < 0$, fixing an arbitrary $\tau = 1/10$:

Finally, as in the Proof of Lemma 1, we here allow $\text{corr}(\lambda, \theta) > 0$ instead of a flat penalty rate, with $\theta(\lambda) = \tilde{\theta}(1+\lambda)$. And, also, for $\text{corr}(\lambda, \tau) > 0$, with $\tau(\lambda) = \tilde{\tau}(1+\lambda)/2$ and $\tilde{\tau} < 2\tilde{\theta}$, so that $\theta(\lambda) > \tau(\lambda)$. It is easy to check that the following continues to hold: $\lim_{\lambda \to 0} \tilde{\Delta}(1,0|\tau(\lambda), \theta(\lambda)) = \tilde{\tau}/2 > 0$. Second, we now have

$$\lim_{\lambda \to 1} \tilde{\Delta}(1,0|\tau(\lambda), \theta(\lambda)) = \tilde{\tau} - 2\,\tilde{\theta}\,(1-\tilde{\theta}) \tag{4}$$

Solutions to $\tilde{\Delta}(1,0) = 0$ at different penalty rates



from where we can recover the conditions for which $\tilde{\tau} - 2\,\tilde{\theta}\,(1+\tilde{\theta}) > 0$ as follows.

$$\tilde{\tau} - 2\,\tilde{\theta}\,(1-\tilde{\theta}) > 0 \quad \leftrightarrow \quad \left(\tilde{\theta} - \frac{1}{2}\right)^2 - \frac{1}{4} + \frac{\tilde{\tau}}{2} > 0 \tag{5}$$

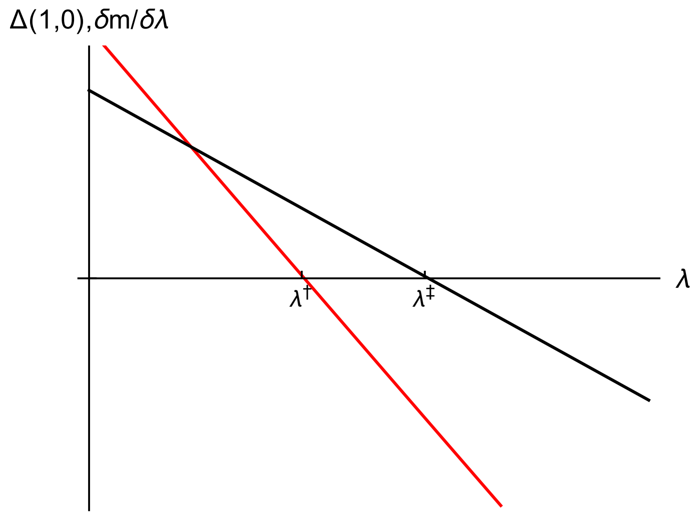
where (5) straightforwardly holds whenever $\tilde{\tau} > 1/2$, which would require $\tilde{\theta} > 1/4$. When $\tilde{\theta} > 1/4$ but $\tilde{\tau} < 1/2$, then we find solutions for (5), which has two: (i) $\tilde{\theta} > \frac{1}{2}\left(1+\sqrt{1-2\,\tilde{\tau}}\right)$ and (ii) $\tilde{\theta} < \frac{1}{2}\left(1-\sqrt{1-2\,\tilde{\tau}}\right)$. Solution (i) is not feasible as $\tilde{\theta} \in (1, 1/2)$, but condition (ii) can indeed hold. Thus, if $\tilde{\theta} > 1/4$ and $\tilde{\tau} > 1/2$, or if $\tilde{\tau} < 1/2$ and $\tilde{\theta} < \frac{1}{2}\left(1-\sqrt{1-2\,\tilde{\tau}}\right)$, then $\lim_{\lambda\to 1} \tilde{\Delta}(1,0|\tau(\lambda),\theta(\lambda)) > 0$ and the citizen would strictly prefer to engage in evasion. And if $\tilde{\tau} < 1/2$ but $\tilde{\theta} > \frac{1}{2}\left(1-\sqrt{1-2\,\tilde{\tau}}\right)$, then $\lim_{\lambda\to 1} \tilde{\Delta}(1,0|\tau(\lambda),\theta(\lambda)) < 0$. Using the Intermediate Value Theorem, we recover similar results as with a flat penalty rate. ■

3.6.4 Proof of Remark 1.

Proof. Recall from the proof of Proposition 1 that if $\tau > 1/2$, then for any parameter specification we have that $\tilde{\Delta}(1,0) > 0$ and the citizen prefers to engage in evasion. In this case, $\lambda^{\dagger}(\theta) < \lambda^{\ddagger}(\theta)$ since the latter would be strictly greater than one. However, if $\tau < 1/2$, then there exists some $\lambda^{\ddagger}(\theta) \in (0,1)$ whenever the penalty rate is too high: $\theta > 1 - \sqrt{1-2\tau}$. The sufficient conditions for $\lambda^{\dagger}(\theta) < \lambda^{\ddagger}(\theta)$ would therefore imply having $\theta \in (\tau, 1 - \sqrt{1-2\tau})$ as any penalty rate in such range would guarantee $\tilde{\Delta}(1,0) > 0$.

We also noted in the main text that the range of values for which the prediction of an inverted U-shape holds is, naturally, larger than those provided by the sufficient conditions. The working example in the text was to set a tax rate $\tau = 0.13$. The sufficient condition implies that this shape of the estimates hold for any $\theta < 1 - \sqrt{1-2(0.13)} \approx 0.1397$. However, we here illustrate graphically the thresholds induced when we set $\theta = 0.31$, which are $\lambda^{\dagger}(\theta) \approx 0.456$ and $\lambda^{\ddagger}(\theta) \approx 0.459$.

Induced thresholds at a penalty rate $\theta = 0.31$



Finally, allowing $\mathrm{corr}(\lambda, \theta) > 0$ and $\mathrm{corr}(\lambda, \tau) > 0$ instead of a flat penalty rate, from the results of the previous section we can express a strict sufficient condition as $\tilde{\theta} < \frac{1}{2}\Big(1 - \sqrt{1 - 2\,\tilde{\tau}}\Big)$ with $\tilde{\tau} < 1/2$.

■

3.6.5 Extension: Continuous evasion space.

In this section we allow for a continuous evasion space. The only difference from the workhorse model is that the citizen chooses some $h \in [0, 1]$. everything else remains the same. The citizen now needs to solve a triple optimization problem, which results in some vector $(h^*(\lambda, \tau, \theta), b^*(\lambda, \tau, \theta), m^*(\lambda, \tau, \theta))$. To start, let

$$\tilde{\Gamma}(h, b, m) := (1 - h)(1 - \tau) + h\Bigg(\lambda(1 - b)\Big((1 - (1 - \lambda)\, m)(1 - \theta)h + (1 - (1 - (1 - \lambda)\, m))h\Big) \\ + (1 - \lambda(1 - b))h\Bigg) - \frac{b^2}{2} - \frac{m^2}{2}$$

By taking the first order conditions for each parameter, we recover

$$\begin{aligned}
\frac{\partial \tilde{\Gamma}(h, b, m)}{\partial h} : &\qquad h = \frac{\tau}{2(1 - b)\theta\lambda(1 - m(1 - \lambda))} \\
\frac{\partial \tilde{\Gamma}(h, b, m)}{\partial b} : &\qquad b = h^2\theta\lambda(1 - m(1 - \lambda)) \\
\frac{\partial \tilde{\Gamma}(h, b, m)}{\partial m} : &\qquad m = h^2\lambda\theta(1 - b)(1 - \lambda)
\end{aligned}$$

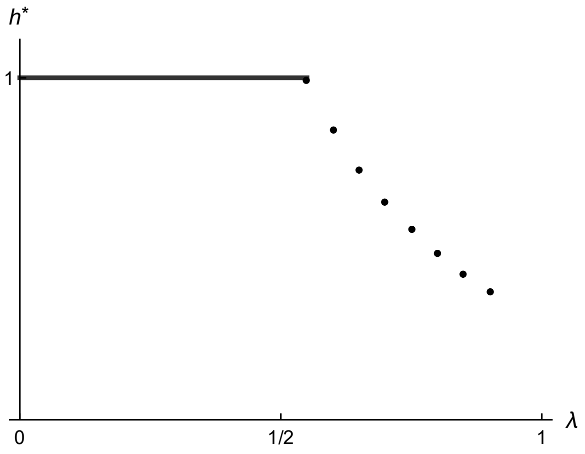
Given our purpose of showing that results should continue to hold under a continuous evasion choice, we conduct simulations using the software Wolfram Mathematica. The code is available both at request and at this public web link: https://www.dropbox.com/s/158tijkxsuj7mxx/Simulations-Open%20Mathematica%20code.nb?dl=0. Before jumping into that, notice that when the quality of institutions is degenerately low, the citizen would have incentives to evade everything. Formally, we have that

$$
\begin{aligned}
\lim_{\lambda\to 0}\left(\frac{\tau}{2(1-b)\theta\lambda(1-m(1-\lambda))}\right) &= \lim_{\lambda\to 0}\left(\frac{1}{\lambda(1-m(1-\lambda))}\times\frac{\tau}{2(1-b)\theta}\right)\\
&= \frac{\tau}{2(1-b)\theta}\lim_{\lambda\to 0}\left(\frac{1}{\lambda(1-m(1-\lambda))}\right)\\
&= \frac{\tau}{2(1-b)\theta}\left(\lim_{\lambda\to 0}\frac{1}{\lambda}\right)\left(\lim_{\lambda\to 0}\frac{1}{1-m(1-\lambda)}\right)\\
&= \underbrace{\frac{\tau}{2(1-b)\theta}\left(\frac{1}{1-m}\right)}_{>0}\left(\lim_{\lambda\to 0}\frac{1}{\lambda}\right)
\end{aligned}
$$

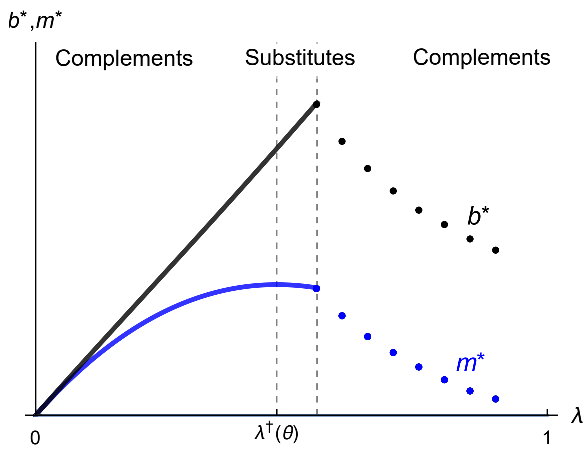
and since we are naturally looking at the limit from the right ($\lambda\to 0^+$), that $\lim_{\lambda\to 0^+}\frac{1}{\lambda}=\infty$; and, thereby, the entire limit at hand goes to infinity. Under some value of λ close to zero, the optimization problem collapses to the analysis of Proposition 1. This is an important point for the simulations, as there are inputted values for which no solutions are recovered when the quality of institutions is low enough. In these cases, what operates are the mechanisms of the main body of the text.

There are two insights that emerge from the above simulations. The first is intuitive: the equilibrium amount of tax evasion is strictly decreasing along the quality of institutions. The second, less obvious, are the subtleties across brains and muscles; in particular, the

Simulations of the equilibrium strategies



Evasion amount

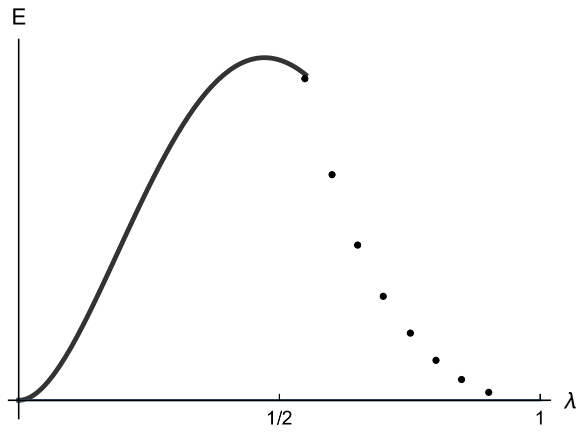


Brains and muscles

Note. The parameter values are $\tau = 0.2$ and $\theta = 0.21$. The generation of solutions included a range from $\lambda = 0.1$ to $\lambda = 0.95$, with steps of 0.05. These are graphed by the points in both panels. Because no solutions were found for $\lambda < 0.55$, it implied citizen's incentives to set $h = 1$; and since we have closed-form solutions for these optimal investments, these are the smooth lines in both panels.

right panel shows that (a) these strategies are complements at the extremes, but (b) these can still be substitutes precisely at intermediate levels of the quality of institutions. What remains is, indeed, putting together our theoretical quantity of interest. As illustrated below, our theoretical expectations continue to hold.

Simulations: Estimated tax evasion



$$\lambda\, h^*(\lambda, \tau, \theta)\,\big(1 - b^*(\lambda, \theta)\big)\,\big(1 - e^*\big(\lambda, m^*(\lambda, \theta)\big)\big)$$

Note. The parameter values are the same as before. The output involves simply putting together the inputs obtained from the vector of optimal investments in brains and muscles, as well as the size of the evasion.

Finally, it is important to note that, through a simulation exercise, it is possible to obtain that the range of values for which brains and muscles are substitutes holds only if the penalty rates are not too high; if these are, then strategies are only complements. This can be the case if, for instance, we choose arbitrarily move from the chosen $\theta = 0.21$ to $\theta = 0.6$. Nevertheless, this has no effect on the inverted U-shape of the estimates of tax evasion, as the optimal investments in brains and muscle display still an inverted V-shape.

The Empirics

The dataset and .do file are available both at request and at (i) the dataset: https://www.dropbox.com/s/ywmm46kzsrhadjw/Evasion%202021%20clean.dta?dl=0 and (ii) the .do file: https://www.dropbox.com/s/qfaes3w1p84cp2b/Do%20polished.do?dl=0.

3.6.6 Additional Empirical Analyses

Figure 3.4: Tax Evasion variable for all countries in sample

Figure 3.5: Rule of Law index variable for all countries in sample

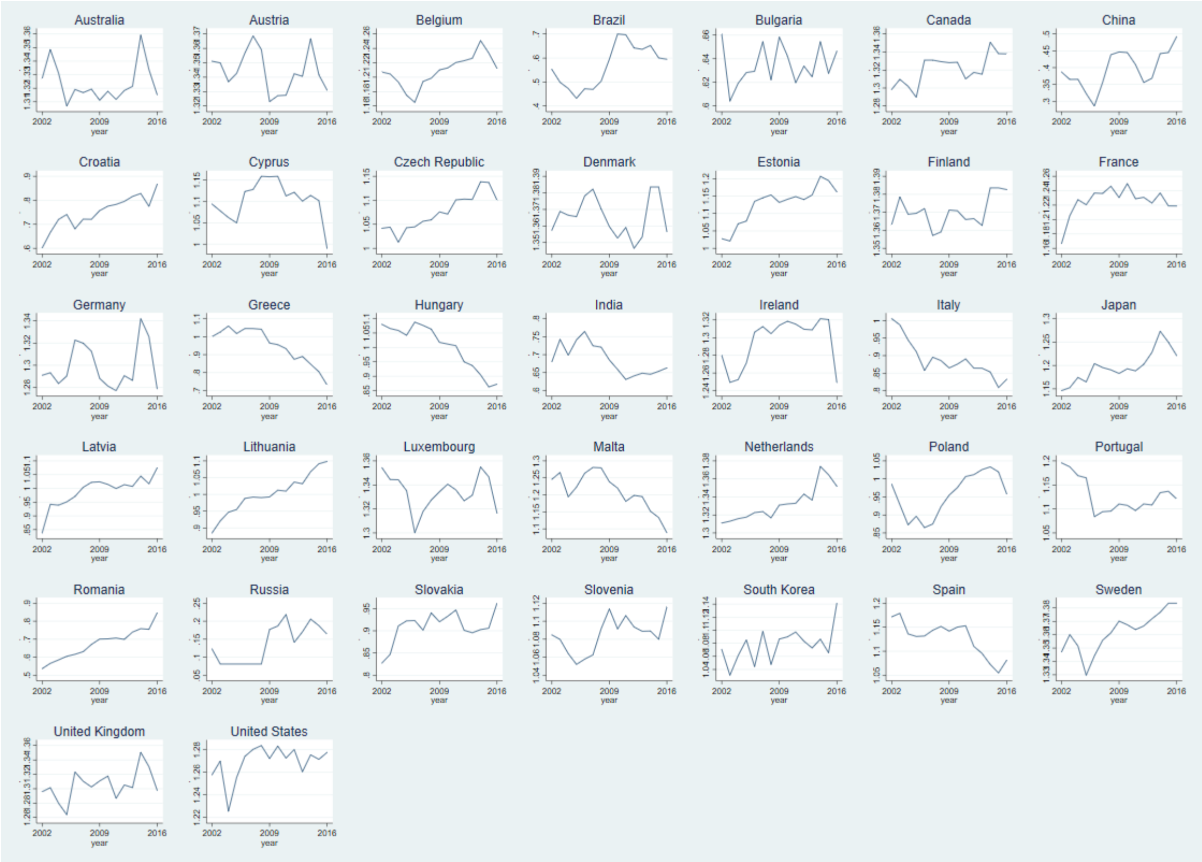


Table 3.4: Additional Controls and Regional Fixed Effects

	(1)	(2)	(3)	(Regions)
Rule of Law	5.89***	8.65***	7.44***	2.47***
	(1.97)	(0.98)	(2.24)	(0.91)
Rule of Law^2	-2.89***	-3.46***	-2.99**	-1.43**
	(1.02)	(0.68)	(1.17)	(0.56)
Press Freedom	-0.11		-0.26	
	(0.08)		(0.17)	
Private Wealth		0.01	0.01	
		(0.03)	(0.02)	
Controls			X	X
Country Fixed Effects	X	X	X	
Region Fixed Effects				X
Year Fixed Effects	X	X	X	X
Observations	409	235	197	555
R^2 (within)	0.51	0.52	0.61	0.55

Standard errors clustered at the country level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.5: Main Regression with and without Fixed Effects

	(FEs)	(No FEs)	(FEs)	(No FEs)
Rule of Law	6.08***	5.72***	3.52**	2.63**
	(1.90)	(1.82)	(1.77)	(1.26)
Rule of Law^2	-3.00***	-2.47**	-2.01**	-1.34**
	(0.96)	(1.06)	(0.83)	(0.66)
Controls			X	X
Country Fixed Effects	X		X	
Year Fixed Effects	X		X	
Observations	555	555	555	555
R^2 (within)	0.48	0.09	0.56	0.46

Standard errors clustered at the country level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.6: Regression results with deciles

	(1)
Deciles Rule of Law 2.	0.02
Deciles Rule of Law 3.	-0.03
Deciles Rule of Law 4.	0.01
Deciles Rule of Law 5.	0.12
Deciles Rule of Law 6.	0.22
Deciles Rule of Law 7.	0.00
Deciles Rule of Law 8.	-0.17
Deciles Rule of Law 9.	-0.18
Deciles Rule of Law 10.	-0.20
Deciles Stability 2.	0.31*
Deciles Stability 3.	0.27
Deciles Stability 4.	0.17
Deciles Stability 5.	0.21
Deciles Stability 6.	0.21
Deciles Stability 7.	0.18
Deciles Stability 8.	0.19
Deciles Stability 9.	0.24
Deciles Stability 10.	0.32
GDP	-0.30
GDP^2	0.05
Top Tax Rate	-0.62
Inflation	-0.16
Top 1% Income	-1.28
Observations	433

Standard errors clustered at the country level are omitted from the table.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.7: Alternative Dependent and Main Independent Variables in 2016

	(WB)	(WB)	(WJP)	(WJP)
Rule of Law	3.53***	1.25	34.98***	16.08
	(1.00)	(1.57)	(11.58)	(10.17)
Rule of Law^2	-1.44***	-0.07	-37.25***	-15.46
	(0.55)	(0.72)	(12.18)	(11.17)
Controls		X		X
Observations	162	123	99	81
R^2	0.05	0.15	0.05	0.22

Note. WB stand for World Bank and WJP stand for World Justice Project.
Data comes form IMF estimates of the amount of individual tax evasion by country in 2016.
Robust standard errors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.6.7 List of countries in the sample

1. Australia
2. Austria
3. Belgium
4. Brazil
5. Bulgaria
6. Canada
7. China
8. Croatia
9. Cyprus
10. Czech Republic
11. Denmark
12. Estonia
13. Finland
14. France
15. Germany
16. Greece
17. Hungary
18. India
19. Ireland
20. Italy
21. Japan
22. Latvia
23. Lithuania

24. Luxembourg
25. Malta
26. Netherlands
27. Poland
28. Portugal
29. Romania
30. Russia
31. Slovakia
32. Slovenia
33. South Korea
34. Spain
35. Sweden
36. United Kingdom
37. United States