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Electoral Competition and Corruption: Theory and Evidence from India.*

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Abstract

In developing countries with weak enforcement, there is implicitly a large reliance on re-election incentives to reduce corruption. In this paper we extend existing models of post-election accountability with pure moral hazard to incorporate heterogeneous voters. In contrast to this existing literature, we show that electoral discipline is a weak instrument for improving accountability in a majoritarian voting system. More specifically, our model predicts that not only does corruption increase with competition under some conditions, but that the only type of corruption that is responsive to electoral competition is one where voters lose private benefits from the corruption, while corruption in public goods is not responsive. Consistent with these hypotheses, novel panel data on village level audits of one of India's largest rural public works program suggest a U-shaped relationship between electoral competition and corruption, and responsiveness of corruption only in the private benefits of the program to competition. Our findings highlight the importance of credible penalties and the need for policy interventions that reduce pilferage in the public component of welfare programs, which entail larger welfare losses to citizens.

KEYWORDS: Corruption, Electoral Competition, Audit, Accountability, Moral Hazard.
JEL CLASSIFICATION: D72, D82, H75, O43, C72.

1 Introduction

It is fairly well established that corruption is costly, both in terms of efficiency and equity in the provision of public services in developing countries (Olken and Pande (2012)). However, evidence suggests that if the political leadership is committed, corrupt institutions can change rapidly (Svensson (2005), Acemoglu and Jackson (2015)). If electoral competition is fair, and if voters care about honesty, they can punish corrupt incumbents by voting them out of office. Forward looking incumbents will then respond to these incentives by lowering corruption today (e.g., Ferraz and Finan (2011)). But does electoral competition always lead to lower corruption? We investigate this question in a context where legal sanctions for punishing the corrupt are not binding, yet there exists mandated exposure of corruption through audits of public expenditures.

Existing theoretical models of accountability either focus on pre-election competition where it is assumed that incumbents can commit to a platform and voters are heterogeneous on ideology (e.g. Besley et al. (2010), Polo (1998), Svaleryd and Vlachos (2009)) or on post-election accountability where there exist politician types with a representative voter (e.g. Persson and Tabellini (2000) Chapter 4 page 77, Ferraz and Finan (2011)). While the former set of models predict a negative relationship between levels of competition and corruption, the latter predict constant level of corruption that is related to the common reservation utility of voters. This paper innovates on two counts. First, neither politician commitment nor representative voting are realistic assumptions in low-income, ethnically diverse democracies. Thus we build a model that combines heterogeneous voters with politician moral hazard and no commitment to non-ideological platforms. Second, in contrast to the models that do relate competition and corruption, we find that competition is not always good - the uncertainty generated by very close elections can cause incumbents to increase corruption and also divert thefts to higher valued corruption in public goods. Consistent with our model's hypotheses, data from mandated audits of a large public program in India suggest that indeed, there is a non-monotonic relationship between competition and corruption and that corruption in the public goods component of public programs is unresponsive to competition.[1]

Our model captures the incentives of an incumbent in public office, deciding on her level of corruption, taking into account the inter-temporal trade off between higher present corruption and higher future potential corruption.[2] Specifically, the incumbent chooses how

[1]We describe these terms precisely later but briefly, corruption in public goods implies over reporting of expenditures while in private goods it involves under provision of goods or services due to voters.

[2]Persson et al. (1997) refer to the need to allow some graft by the politician as "power between elections"

much to "steal" from a public program of a fixed budget.[3] This theft is exposed through mandated audits and followed by elections in the next period. Elections take place between the incumbent and a challenger, who are assumed to be located on opposite sides of an ideological spectrum. The electorate votes on the basis of: (1) own ideology relative to the fixed ideology of the incumbent versus the challenger and (2) the predicted corruption level of the incumbent relative to the challenger (whose ideology is common knowledge but whose corruption level is uncertain). In an infinitely repeated game, we derive the stationary equilibrium level of theft by the incumbent while in office and show that too little or too much competition leads to higher levels of theft. This result is driven by incumbent behavior when the electoral bias is towards her.[4] On the other hand, if the electoral advantage is with the challenger, increases in competition have no impact on corruption.

The intuition behind our result is simple: when competition on ideology is very low, so that the incumbent faces a "safe" constituency, then she can get away with high corruption, while if she faces a constituency that is safe for the other candidate in the next election, reducing her own corruption has low net marginal benefits. When the seat is highly competitive (e.g., if there are many swing voters in the constituency) then the election result is close to random. In this case too, the incentives of the incumbent to reduce corruption levels before the election are lower. Thus it is only in the "intermediate" range of competition that corruption decreases as competition increases.

Further, we show that if the incumbent has a choice between theft that affects citizens personally (e.g., under provision of services that they are legally entitled to) and corruption that is more "public" in nature (e.g., over reporting of materials expenditures on a public road) and that affects citizens collectively, then corruption in the public good component is higher and less responsive to competition relative to theft in the publicly provided private goods. Intuitively, when legal sanctions against corruption are low or are not enforced, then electoral incentives imply that the politician will bias her corrupt behaviour in the activity which benefits her most for re-election.

We confirm the theoretical predictions using data we gathered on one of the largest public programs in India: the National Rural Employment Guarantee Act (NREGA) - a rights based program that aims to guarantee 100 days of annual work to rural households willing to volunteer adult labor to rural public works. As is true with most public programs

to prevent excessive looting.

[3]Although we use the word "steal" quite liberally, it should be more broadly interpreted as not just corruption by the incumbent but rather the corruption that is allowed to take place in her government.

[4]Median voter's ideology is in favour of the incumbent.

in developing countries, NREGA has also been besieged with apprehensions about theft and leakage of public funds (Afridi and Iversen (2014)). However, a major concern that plagues most studies on malfeasance in public programs is the lack of objective measures of corruption. A novel feature of the NREGA, distinct from previous workfare programs in India, is mandatory audits of projects implemented under the program. The Act envisages that competent audits will be organized at regular intervals at the village level. We construct panel data on irregularities reported in original audit reports in the state of Andhra Pradesh (AP), during 2006-10. Data on objective measures of corruption in the NREGA from almost 300 village councils are paired with information on elections to the position of village council headships in 2006 for a five year term. These village councils are responsible for planning and the subsequent execution of at least 50 percent of all NREGA works.

Using the margin of victory between the top two candidates in the elections as our measure of electoral competition, we show that the regularities in our data strongly support the theoretical predictions - when electoral bias is towards the incumbent, corruption responds non-monotonically to higher competition. At intermediate levels of competition we estimate that the number of irregularities decline to half the average number of total irregularities, while at high levels of competition, the number of irregularities double relative to the average. When the bias is against the incumbent, however, there is low responsiveness of corruption to competition. In line with the theory, we also find that pilferage from the public goods provided by the program (e.g., materials used for road construction) is less responsive to competition than the private goods (e.g., wages for labor).

Our theoretical model is the first to combine heterogeneous voters with no commitment on corruption platforms. Starting with Barro (1973) and Ferejohn (1986), most models of post-election accountability assume a homogeneous electorate. Voters are assumed to be able to coordinate and commit to a threshold level of corruption that they will accept. However in our set-up, which approximates reality more closely, the incumbent and challenger are from different parties and voters have ideological preferences. This feature allows us to investigate the relationship between electoral competition and corruption even in a model of post-election accountability. Furthermore, in contrast to the existing literature that does not discriminate between types of public programs, we model a more nuanced interaction between electoral competition and corruption, distinguishing between types of theft and the varying nature of their responsiveness to competition. We show that theft from government programs that provide pure public goods is less responsive to electoral competition than pilferage from publicly provided private goods. Finally we are able to provide empirical support for a non-monotonic relationship between electoral competition and corruption in public good provision within a country using an objective measure of corruption based on independent audits of a large public program in India.

Literature which focuses specifically on the relationship between corruption and electoral competition, is relatively small, and inconclusive. Thus e.g. Ferraz and Finan (2011) find that leakages are lower in Brazilian municipalities when incumbents have re-election incentives (first term mayors) compared to when they do not (last term mayors), and Svaleryd and Vlachos (2009) show both theoretically and empirically that rents are decreasing both as voter information increases and as competition increases in Swedish municipalities. Contrary to the above findings, Booth et al. (2011) show that electoral competition may not affect corruption at all, but rather change its nature - with higher competition, vote buying becomes more attractive than other types of rent seeking. Our paper contributes to the emerging view that in democracies with weak enforcement institutions (see, e.g., Sukhtankar and Vaishnav (2015) for the case of India), too high a level of electoral competition creates perverse incentives, not only in the selection of worse politicians (Aidt et al. (2011)) but also in creating worse incentives while in office. Banerjee and Pande (2007) argue in a two party model, that when there is an ethnically dominant group in a constituency, then the party representing this group has an electoral advantage which implies that it is possible to win even with candidates who are lower quality than the other party. Their argument is close to ours except that they rely on candidate selection for their results while we have a pure moral hazard model. Second, their model does not predict a U-shape in candidate quality, nor do they focus specifically on corruption.

Our results have some key policy implications. First, they point to the importance of improving voter awareness about the potential leakages in the public goods provided by government programs. In our context, the magnitude of the irregularities is almost three times larger in this component of the program we study relative to the private component. As our theoretical model predicts, electoral discipline incentivizes politicians to implement policies such as "smartcards" to biometrically identify beneficiaries of public programs, which may reduce leakages from the private benefits due to the electorate (e.g. wages for labor supplied to an NREGA project in Muralidharan et al. (2016)). However, interventions aimed at reducing theft in the public component of welfare programs in low income democracies have typically not been implemented at scale, even though such policies may have a large impact on total welfare loss to citizens. Second, the analysis, albeit indirectly, highlights the need for enhancing the credibility of an audit process through strict enforcement of legal penalties on the corrupt, rather than relying on elections to provide discipline.

The remainder of the paper is organized as follows: Section (2) describes the model and its predictions. Section (3) presents the institutional background of the NREGA, Section (4) presents the data and methodology, while Section (5) presents and Section (6) discusses the empirical findings. We conclude in Section (7).

2 Theoretical Model

2.1 The set up

We study a dynamic model of elections where corruption affects the winning probability of the incumbent. Our model captures a situation where there is an incumbent in office who is choosing her corruption level.[5]

In line with our empirical setting where corruption levels are revealed by mandated audits whose results are publicly announced, in the theoretical model we assume that the incumbent's corruption is perfectly observed by voters. Every election, the incumbent faces a challenger, who announces a platform on corruption that is randomly chosen from among the set of potential platforms. There is no commitment on corruption platforms. Because our focus is on incumbent moral hazard as a function of electoral competition, we deliberately keep the challenger's role passive (but see the Appendix for a model with symmetric parties). There are no term limits. Thus, our model is an infinite horizon game in discrete time, where each stage represents one term in office.

We now turn to the formal description of the model. There are two types of players in the game: candidates and voters, we discuss each one separately.

The Ideology Space:

There are two parties, L and R, located at opposite sides of the ideology[6] spectrum,

[5]Our definition of corruption is quite broad: it includes any illegal use of public funds for private benefit, e.g., nepotism, materials provided being of inferior quality, bribes, and embezzlement but it does not include targeted redistribution or vote buying which would positively affect the probability of winning. We refer to corruption as "theft", but it should be interpreted as theft for any of these purposes and not just for personal consumption. Later we distinguish between two types of corruption; one where citizens lose some private goods/services that they are entitled to get, as a result of the corruption as a result of the corruption (broadly -under provision of due services) and corruption in public goods, where citizens lose public benefits (broadly - over reporting of expenditures on pure public goods, such as roads).

[6]There is some debate about whether voters in Indian villages vote on party lines. However, most would agree that there is an element of caste based voting (see, e.g., Munshi and Rosenzweig (2015)) and the model can be re-interpreted accordingly. The model deals only with two parties but the results extend to situations with multiple parties. In this case the "challenger" can be interpreted as the strongest challenger to the incumbent, measured, e.g., by the runner up in the last election. In our data, about 70% of the incumbents

$[-1, 1]$. We assume that the ideology of Party L is -1 and that of Party R is 1. There is a continuum of voters distributed on the ideology space according to a cumulative distribution function F with median β. The median β represents the party preferences of the majority of voters. Both the sign and magnitude of β are important. When β is negative, Party L has the majority of voters on its side of the ideology spectrum, while when β is positive, Party L is the minority party. β also measures the level of competition: the closer it is to 0, the fiercer is the competition.

Candidates:

There is a continuum of potential candidates. Each potential candidate is characterized by two parameters: the party she belongs to (L or R) and her platform for corruption. In every period of the game two candidates participate: the incumbent and the challenger. Without loss of generality, we assume that the incumbent is from party L. The budget is normalised to size 1[7]and corruption $x_t \in [0, 1]$ is measured as "theft" from this fixed budget. At the beginning of each stage t the incumbent determines her corruption level x_t. Corruption becomes public knowledge due to mandated audits of public funds in the same period. The higher x_t, the more public funds are lost due to corruption. At the end of the stage a challenger from party R is chosen, and the challenger's platform, denoted by y_t, is determined. y_t is a random variable uniformly distributed in the interval $[0, 1]$. The challenger's platform is unknown before elections take place but all players know the distribution of possible platforms (see the timeline discussed later).

Potential candidates care about the present value of expected rents (we assume ego rents from office to be zero), so that the payoff of a candidate is

$$\sum_{t=1}^{\infty} \delta^{t-1} x_t \mathbf{1}_{\{\text{the candidate is in power at stage } t\}},$$

where $\delta \in [0, 1)$ is the incumbent's discount factor, which is common to all potential candidates.[8] This objective function captures the trade-off we discussed earlier between present and future corruption - the "golden goose effect" (Niehaus and Sukhtankar (2013)).[9]

are affiliated with two major political parties. On average, there were 2.9 candidates standing for an election in our sample.

[7]We assume the budget to be fixed as the analysis is at the village level in the empirical analysis. Tax decisions are not decentralised in our context and in many others.

[8]The incumbent can be thought of as putting in costly effort to prevent corruption in her office, with no loss of generality. Our results remain intact when the discount factor is incumbent-specific. In this case the relation between competition and corruption also varies between incumbents.

[9]We abstract from future ego rents from office, which would reduce the incentives to be corrupt, as it would not change the results qualitatively.

Voters:

Voters care about ideology and about corruption levels. Consider a voter j with ideal point $z_j \in [-1, 1]$. The voters' utility from voting for a candidate with ideology i who will set corruption level x in the coming term in office is

$$U_j(x, i) := -x - \gamma(z_j - i)^2. \tag{1}$$

where $\gamma \geq 0$ measures the weight voters put on ideology versus corruption. We assume that the more corrupt a candidate is, the lower the utility of a voter.[10]

While the ideology of a candidate is arguably known to voters, we assume there is no commitment on platforms, so the level of future corruption is not known.

We assume that voters simply take the maximum of the announced corruption platform and the last period corruption as a predictor for future corruption. Since the challenger has not been in office, the maximum is necessarily the platform itself. For the incumbent, voters can use the past observation of corruption levels to project future corruption level. Thus, in calculating the utility of voting for the incumbent, we assume that voters will use the corruption level of the incumbent in period t to project her corruption level at period $t+1$, if elected. We will solve for Markovian equilibria in the game, in which this assumption in fact holds.

Election Mechanism:

Elections take place between the incumbent and the challenger. The incumbent's projected corruption level is x_t, and the challenger's platform is y_t. Each voter votes according

[10] This assumption can be challenged if (a) some voters may benefit from corruption if the form that corruption takes is nepotism and (b) when institutions of public service delivery are weak as in many developing countries, voters may deliberately prefer to vote for corrupt politicians who are known to "get things done" (Vaishnav (2017)). Unlike Booth et al. (2011) who study how favouritism works when the program has targeted beneficiaries, in our empirical setting the program is demand driven and all households are eligible. Second, suppose it is true that corruption may benefit some voters at the expense of others, i.e., there is a second dimension of heterogeneity among voters depending on whether they are positively or negatively influenced by corruption. However, voters who benefit are likely to be friends and relatives of the incumbent, arguably a small minority in the village and likely to favour the incumbent on the ideological dimension, i.e., to the left of the median voter on the ideology spectrum. This is equivalent to having a group of partisan voters who favour the incumbent no matter what her corruption level is. It is enough to assume that this partisan group of voters is sufficiently small that the outcome of elections still depends on how other voters are affected by corruption. See e.g. Besley et al. (2010) for such a model, very similar to ours. The evidence for (b) is mixed at best, see, e.g., Dutta (2014) and Fisman et al. (2017) who show that voters punish corruption. Moreover, (b) is most plausibly driven by the effect of corruption as a signal of competence, but is less likely to hold when voters are directly negatively affected by corruption.

to her utility function: voter j whose ideal point is z_j votes for the incumbent if and only if

$$-x_t - \gamma(z_j + 1)^2 \geq -y_t - \gamma(z_j - 1)^2. \tag{2}$$

Voter z votes for the incumbent if and only if $z < \frac{y_t - x_t}{4} = \tilde{z}$, where $\tilde{z}$ defines the cutpoint such that all voters with $z < \tilde{z}$ vote for the incumbent and all voters with $z > \tilde{z}$ vote for the challenger. The incumbent wins if and only if the median voter votes for her, that is, if $\beta < \tilde{z}$.

Therefore, the incumbent wins the elections if

$$x_t + \gamma(\beta + 1)^2 < y_t + \gamma(\beta - 1)^2, \tag{3}$$

while the challenger wins if[11]

$$x_t + \gamma(\beta + 1)^2 > y_t + \gamma(\beta - 1)^2. \tag{4}$$

Note that $x_t + \gamma(\beta+1)^2 < y_t + \gamma(\beta-1)^2$ if and only if $x_t + 4\gamma\beta < y_t$. Since y_t is uniformly distributed in $[0, 1]$, the probability that the incumbent wins elections is given by

$$\theta_\beta(x_t) := \begin{cases} 1 & x_t + 4\gamma\beta \leq 0, \\ 1 - x_t - 4\gamma\beta & 0 \leq x_t + 4\gamma\beta \leq 1, \\ 0 & 1 \leq x_t + 4\gamma\beta. \end{cases} \tag{5}$$

The function above shows that when $\gamma\beta < -\frac{1}{4}$, the incumbent wins the election for sure, even if the theft is maximum. Similarly, if $\gamma\beta > \frac{1}{4}$ then the incumbent can never win the election, even if the theft is minimum. It is in the intermediate range of $\gamma\beta$ that the level of theft x_t can affect the probability of winning.[12]

Note that the parameter γ can either amplify the effect of β (when $\gamma > 1$) or reduce the effect of β (when $\gamma < 1$). Clearly when ideology is not important, $\gamma \to 0$, then elections are decided only on corruption. When ideology is very important then corruption does not matter at all.

From now on we assume $\gamma = 1$, but the qualitative results would not change with different γ, only the effect of competition on corruption would be larger or smaller depending on γ.

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[11]Since y_t has the uniform distribution, the case $-x_t - \gamma(z_j + 1)^2 = -y_t - \gamma(z_j - 1)^2$ has probability 0, hence ignored.

[12]More formally, the function $x_t \mapsto \theta_\beta(x_t)$ is piecewise linear and is composed of two parts: if $\beta \leq 0$ then the inequality $1 \leq x_t + 4\gamma\beta$ cannot hold, hence this function is composed of the top two inequalities in equation (5), while if $\beta \geq 0$ then the inequality $x_t + 4\gamma\beta \leq 0$ cannot hold, and therefore the function is composed of the bottom two inequalities in equation (5).

The Timeline of the Game

The timeline of the game is as follows. At every stage $t = 1, 2, \ldots$,

- The incumbent candidate chooses a level of corruption x_t.
- The corruption platform y_t of the challenger is chosen uniformly from the interval $[0, 1]$, independently of past play.
- Voters observe x_t, the actual corruption of the incumbent and y_t, the platform of the challenger, and elections take place.
- An incumbent who was voted out of office returns to the pool of candidates of her party. Since there are a continuum of candidates, the loser effectively leaves the game.

We denote by T the stage in which the incumbent loses power. Note that T is a stopping time, which may be infinity. The lifetime discounted payoff to the incumbent is

$$E\left[\sum_{t=1}^{T} \delta^{t-1} x_t\right].$$

The decision problem of any new incumbent from party L is equivalent to the decision problem of the incumbent at stage $t = 1$. The decision problem of a new incumbent from party R is also equivalent to the decision problem of the incumbent at stage $t = 1$, except that her margin is $-\beta$ rather than β. To understand the equilibrium behavior, it is therefore enough to consider the decision problem of the incumbent at stage 1, for any $\beta \in [-1, 1]$.

2.2 Equilibrium Analysis

The solution concept that we study is subgame perfect equilibrium. We note that the only player who makes decisions in our model is the incumbent candidate, hence the game is reduced to a Markov decision problem with two states: the initial state, where the incumbent is in office, and a second, absorbing state, where the incumbent loses power. The decision problem is stationary, hence by Blackwell (1962) (or Puterman (2014) more recently) the incumbent has a stationary optimal policy. That is, there is a fixed optimal amount per period that the incumbent steals until she is voted out of office and the decision problem terminates.

For every $x \in [0, 1]$ denote by σ_x the stationary strategy in which the incumbent steals x at every period until she loses office. Since the probability that the incumbent who steals x wins elections is $\theta_\beta(x)$, the probability that under σ_x the incumbent is in office at stage

t is $(\theta_\beta(x))^{t-1}$. It follows that the total expected discounted payoff of the incumbent when she uses the stationary strategy σ_x is

$$v_\beta(x) := \sum_{t=1}^{\infty} \delta^{t-1} x(\theta_\beta(x))^{t-1} = \frac{x}{1-\delta\theta_\beta(x)} \tag{6}$$

We look for the corruption level $x^*_\beta \in [0,1]$ that maximizes the total expected discounted payoff $v_\beta(x)$.

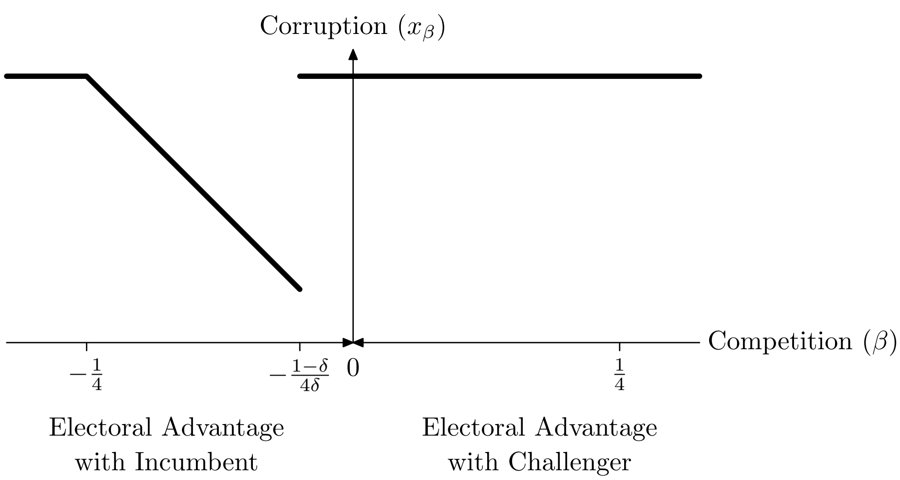
Claim 1 below summarizes the analysis.

Claim 1 *The optimal level of corruption for the incumbent is given by (see Figure 1):*

- *If* $\beta \leq -\frac{1}{4}$, *then* $x^*_\beta = 1$.
- *If* $-\frac{1}{4} \leq \beta \leq -\frac{1-\delta}{4\delta}$, *then* $x^*_\beta = -4\beta$.
- *If* $-\frac{1-\delta}{4\delta} \leq \beta$, *then* $x^*_\beta = 1$.

When $\beta = -\frac{1-\delta}{4\delta}$, the incumbent is indifferent among all corruption levels in the interval $[-4\beta, 1]$.

Figure 1: Optimal corruption for different levels of electoral competition



The proof of this result is in the Appendix. Intuitively, when $\beta < -\frac{1}{4}$, the incumbent has a large share of partisan voters who support her (i.e., she is in a safe seat), and she can steal the whole pot without reducing the probability of winning.

At the opposite extreme, when the advantage is with the challenger ($\beta > 0$), the incumbent cannot guarantee winning the election even if corruption level is at its minimum. It turns out that in this case, the immediate gain from increasing corruption outweighs the loss of future profits due to a lower probability of winning, hence the incumbent steals the maximal amount she can. XX EILON CHECK Even with the maximal corruption, the incumbent wins the election for sure.XX Similar behavior occurs when the electoral competition is very stiff ($\beta < 0$ but close to 0), though in this case the incumbent's probability of winning is small yet positive.

In the intermediate range, however, when the advantage is with the incumbent yet the margin is neither too high nor too low, corruption falls as competition increases. Since the advantage is with the incumbent, if her corruption level is at a minimum, then the median voter surely votes for the incumbent and she will win elections. As the incumbent's level of corruption increases, more voters vote for the challenger, yet as long as the median voter votes for her, the incumbent will certainly win. There is some maximal level of corruption, which depends on the margin β, below which the median voter will vote for incumbent, even if the reputation of the challenger is that of perfect honesty. Claim 1 states that this maximal level is the optimal corruption level of the incumbent. In particular, this optimal level decreases as competition ($|\beta|$ decreases) increases, and it ensures that the incumbent remains in power.

Figure 1 shows how competition and corruption are related. The discontinuity at $\beta = -\frac{1-\delta}{4\delta}$ is an artefact of the modelling choice, where the function that describes the probability of winning is piecewise linear.[13]

The main take away from the figure is the U-shaped relationship between competition and corruption on the left-hand side of Figure 1 (electoral advantage with the incumbent), and the complete unresponsiveness of corruption to competition in the right-hand side of Figure 1 (electoral advantage with the challenger).[14]

Remark 1 *So far we measured competition by the distance of the ideology of the median voter from the midpoint of the ideology distribution which is zero. In our empirics we use the expected margin of victory as a proxy for our measure of competition. In the Appendix, Section A.2, we show that the expected margin of victory is positively monotonically related to* $|\beta|$. *This implies that qualitatively the results of Claim 1 hold, whether competition is measured by the ideology of the median voter or by the expected margin of victory.*

Second, the key driving force for the result that highly competitive elections lead to higher corruption is the uncertainty generated by competitive elections. To illustrate this point,

[13]This follows from our assumption of a uniform distribution on the challenger's platform. While the result is likely to hold for other distributions, the computations become much more complicated. We follow other models in the literature which also make this assumption.

[14]Of course the exact thresholds depends on parameters like γ, δ which we cannot measure in the data.

suppose that the challenger's platform is not uniformly distributed in $[0,1]$*, but rather in the smaller interval* $[1/2-\eta, 1/2+\eta]$*, for some* $\eta \in (0,1/2]$*. Thus, the smaller* η*, the less is the uncertainty in the election. In this case a U-shape obtains for* $\eta \geq \frac{\delta}{4-2\delta}$*, that is, for higher uncertainly levels.*

Third, it may seem that our model assumptions on the asymmetric role of incumbent and challenger are driving the results. In the Appendix Section A.5 we present a model where two parties announce corruption platforms simultaneously. Parties and voters are strategic players. In this model we derive the U-shape again.

2.3 The nature of corruption

The budget available to incumbents may be allocated to different types of public programs. Some of these provide private benefits to individual citizens directly (e.g., employment, food security, school meals, etc.) and are in the nature of private goods, while others provide collective benefits (e.g., investments in infrastructure such as road construction) and are in the nature of public goods. In this section, we divide the total budget that can be stolen by the incumbent into a "private goods" component and a "public goods" component, each of which has a separate budget.

As before, total corruption is denoted by x_t. Denote by $x_t^{\text{pub}} \in [0, \frac{1}{2}]$ and $x_t^{\text{pvt}} \in [0, \frac{1}{2}]$ the public and private amounts[15] that the incumbent steals at stage t, so that $x_t = x_t^{\text{pub}} + x_t^{\text{pvt}}$.

We assume that voters view corruption in the two types of components differently: they care more about theft when it affects the provision of pure private goods than when it affects the provision of pure public goods.[16] The utility that voter j assigns to an incumbent with ideology i and platforms $(x_t^{\text{pub}}, x_t^{\text{pvt}})$ is

$$U_j(x_t^{\text{pub}}, x_t^{\text{pvt}}, i) := -\alpha^{\text{pub}} x_t^{\text{pub}} - \alpha^{\text{pvt}} x_t^{\text{pvt}} - (z_j - i)^2, \tag{7}$$

where $\alpha^{\text{pub}} \geq 0$ and $\alpha^{\text{pvt}} \geq 0$ are coefficients that represent the weights that voters attach to each type of corruption, and z_j is voter's j ideal point in the ideology space. The weights

[15] The bounds on each part are taken to be symmetric, but results do not change if we assume asymmetric bounds for the two components.

[16] We model the distinction between the two types of corruption as a taste based one. Although it may be more natural to assume that voters have to incur some costs to be aware of corruption that affects them privately or publicly, in our model we assume that corruption is fully observed by voters. However the taste based distinction between private and public goods is analogous to assuming that the net benefits of monitoring are higher in the case of private good than public good in a generalised version where corruption is not perfectly observed. In our empirics therefore we focus on the distinct forms of corruption in private and public goods.

can be interpreted as the marginal net benefit of preventing corruption in each component. The utility that the voter assigns to a challenger with ideology i and platform y_t is

$$U_j(y_t, i) := -y_t - (z_j - i)^2. \tag{8}$$

The model we presented in Section (2.1) is equivalent to the present model with $\alpha^{\text{pub}} = \alpha^{\text{pvt}} = 1$.

As mentioned above, we assume that voters care more about the private component, hence $\alpha^{\text{pvt}} > \alpha^{\text{pub}}$. To be able to compare the results when corruption has two components to the situation when it has a single component, we must have $\alpha^{\text{pvt}} + \alpha^{\text{pub}} = 2$ (since $\frac{1}{2}\alpha^{\text{pvt}} + \frac{1}{2}\alpha^{\text{pub}} = 1$), which implies that $\alpha^{\text{pub}} < 1 < \alpha^{\text{pvt}}$. Thus, higher weight on one component implies a lower weight on the other, capturing a limited attention constraint on voters. As in Section 2.1, the decision problem reduces to a Markov decision problem with two states, hence the optimal strategy is stationary and denoted by $(x_\beta^{\text{pub}}, x_\beta^{\text{pvt}})$.

The total expected discounted payoff of the incumbent when she uses the stationary strategy $(x^{\text{pub}}, x^{\text{pvt}})$ is given by

$$v_\beta(x^{\text{pub}}, x^{\text{pvt}}) := \frac{x^{\text{pub}} + x^{\text{pvt}}}{1 - \delta\theta_\beta(x^{\text{pub}}, x^{\text{pvt}})}, \tag{9}$$

where $\theta_\beta(x^{\text{pub}}, x^{\text{pvt}})$ is the probability of winning the election. Since the expression for $\theta_\beta(x^{\text{pub}}, x^{\text{pvt}})$ is analogous to equation (5), we omit it here for brevity, but it is available in the Appendix. We look for corruption levels $(x_\beta^{\text{pub}}, x_\beta^{\text{pvt}}) \in [0, \frac{1}{2}]^2$ that maximize the total expected discounted payoff. Clearly, if the incumbent is impatient, then she steals the maximal possible amount as long as she is in office. When the discount factor is in a more plausible region, however, we show in Claim 2 below that the private component of corruption is more responsive to electoral competition than the public component and indeed follows a U-shape.[17]

We need the following definitions. A function $\beta \mapsto f(\beta)$ has a *U-shape* if there are $\beta_0 < \beta_1$ such that f is constant for every $\beta < \beta_0$ and every $\beta > \beta_1$, and is monotonic decreasing in the interval $[\beta_0, \beta_1]$. We divide the predicted behavior into two cases: the electoral advantage is with the incumbent (the *negative region* $\beta \in [-1, 0]$) or with the challenger (the *positive region* $\beta \in [0, 1]$).

[17] What are plausible discount rates in our setting? Recent work on uncovering personal discount rates in large samples (see Warner and Pleeter (2001), Brown et al. (2010), and the references therein) has documented annual discount rates between 0.1 and 0.2 (with corresponding discount factors between 0.8 and 0.9). Based on these estimates the discount factor for a five-year term should be between 0.4 and 0.6. In the Appendix we show that $\delta_0 < \delta_1 < \delta_1$ corresponds to these discount factors. For these reasons, we focus on this result in our empirical section.

Claim 2 *Set* $\delta_0 := \frac{2}{4+\alpha^{\text{pvt}}-\alpha^{\text{pub}}}$. *If* $\alpha^{\text{pub}} \leq \frac{1}{3}$ *set* $\delta_1 := \frac{2}{2+\alpha^{\text{pvt}}}$, *while if* $\alpha^{\text{pub}} > \frac{1}{3}$ *set* $\delta_1 := \frac{2}{2+\alpha^{\text{pub}}}$. *For every* $\delta \in [\delta_0, \delta_1]$ *the optimal level of corruption* $(x_\beta^{\text{pub}}, x_\beta^{\text{pvt}})$ *is as follows:*

- *The optimal level of corruption from the public good is* $x_\beta^{\text{pub}} = \frac{1}{2}$.
- *If the electoral advantage is with the incumbent,* x_β^{pvt} *has a U-shape.*
- *If the electoral advantage is with the challenger,* $x_\beta^{\text{pvt}} = \frac{1}{2}$.

In the interval $[\delta_0, \delta_1]$ we basically replicate our results in Claim 1 for corruption in the private component. It is the corruption in the private component which voters care more about, which has a U-shaped relationship with competition when electoral advantage is with the incumbent and is unresponsive when the electoral advantage is with the challenger. The public component is higher than the private component and is unresponsive to competition. The intuition behind this result is that since public and private corruption are imperfect substitutes for voters, for any given total amount of theft from the budget, it is always weakly better for the incumbent to steal from the public component, so that voters are less affected. This logic implies that (in this range of discount factors) *all* of the public component of the budget will be stolen first. The remaining budget of $\frac{1}{2}$ will then be optimised according to β - the intuition for this part is exactly the same as in Claim 1 and is driven by the incumbent's inter-temporal tradeoff.

As δ increases, the incumbent cares more about the future relative to present. We will see in the proof of Claim 2 that this manifests in the private component becoming non-increasing in competition, in both positive and negative regions. Details appear in the Appendix.

Below we summarize our main findings from the model:

1. When electoral bias is towards the incumbent, corruption follows a U-shape: corruption level is high when competition is either very low or very high, while in the intermediate range corruption is decreasing with competition.

2. When electoral bias is against the incumbent, corruption remains high regardless of competition.

3. The magnitude of corruption in the public component is never lower than in the private component, and for a wide range of parameters it is strictly higher.

4. For a wide range of parameters, the U-shape in corruption relative to competition is driven by the private component of corruption.

In addition, the main driving force in our model is moral hazard rather than selection or vote buying. While selection and vote buying can explain why stiff competition leads to more corruption (Aidt et al. (2011), Booth et al. (2011)), it is harder to justify the U-shape without adding moral hazard.

Before we take the model to the data, we will discuss briefly, why the empirical setting is well suited to the model. In subsequent sections we study leakages (theft) from corruption in a large public works program in a Southern state in India. The program was started in 2006 when a correspondingly large budget was provided to the state government to implement the program. A key link in the implementation was the village chief who is elected every 5 years and was already incumbent when the program started. As in our model, the program has both private and public components of leakages. State wide audits were also started simultaneously from 2006, and the findings of audits were made public at hearings. The legal penalties for corruption are minimal. There is electoral competition between two major parties most of the time. In the next sections, we describe in detail the empirical setting and results.

3 Background: The National Rural Employment Guarantee Program

The National Rural Employment Guarantee Act (Ministry of Rural Development, Government of India (2005)) mandates the provision of 100 days of manual work on publicly funded projects to rural households in India. The Act envisions a rights based approach - rural adults can demand work at a mandated minimum wage. The program was initially implemented in the country's poorest 200 districts in February 2006, with 130 additional districts added in the next stage (2007) and national coverage thereafter (2008). As of 2011-12, when our data were collected, the Act provided employment to almost 40 million households at an annual expenditure of more than $8 billion, making it one of the most ambitious poverty alleviation programs in India to date.

While the primary objective of the program is social protection through the provision of employment, it also aims to create durable assets for the community, as a whole, and for socio-economically disadvantaged individuals (e.g., irrigation canals, ponds for water conservation, development of land for cultivation by socially disadvantaged groups and other rural infrastructure). Thus, unlike the typical government transfer programs which either provide public goods (e.g., road construction) or private goods (e.g., subsidized foodgrains and school meals), the NREGA is unique in delivering both types of goods. The program stipulates that at least 60 percent of the program expenditures be on labor (viz., wage payments, a private good) and the remainder on the materials used for the rural infrastructure projects (public goods). Another novel feature of the NREGA, unlike all other public programs in India, is mandated audits of program expenditures at the village level.

Grass roots institutions, i.e., directly elected village, sub-district, and district level governments (or panchayats) under India's decentralized system of governance (the Panchayati Raj system conceived by the 73rd amendment to the Indian constitution in 1992) have a leading role in the planning and implementation of NREGA works. In particular, the portfolio of projects to be implemented under the program has to be prepared by and follow the priority expressed by an assembly of residents of a village council or Gram Panchayat (GP), a collection of 3-4 villages. The leader of the GP, the sarpanch, is directly elected by its adult residents and holds the overall responsibility for decisions made by the GP. Further, at least 50 percent of the NREGA projects have to be implemented by the GP (and the remainder by the upper two tiers of the panchayat). We will empirically validate the predictions of our theory using data on elections to the position of the GP head (henceforth, sarpanch) and the implementation of the NREGA at the GP level.

3.1 The administration of NREGA projects in Andhra Pradesh

This paper uses data from the state of Andhra Pradesh (AP) for the period 2006 to 2010.[18] As of 2011, AP was India's fifth largest state in terms of population (Ministry of Home Affairs, Government of India (2015)) and among the leading states in NREGA implementation due to consistently high generation of NREGA employment.

Our model assumes that audits are independent from political influence and are honest - this is held up in our case study. AP has vested the audit responsibility within an autonomous arm of its Department of Rural Development, viz., the Society for Social Audits, Accountability and Transparency (SSAAT). The SSAAT is headed by a non-partisan, social activist and it has conducted regular and systematic audits of NREGA projects since the inception of NREGA in 2006. The state claims to maintain high levels of accountability and transparency in program implementation.[19] Following the AP model, mandated audits are now being conducted regularly across the country by the Ministry of Rural Development (MoRD).[20]

[18] In 2014 Andhra Pradesh was bifurcated into two separate states - Andhra Pradesh and Telangana.

[19] For a fuller account of the genesis and evolution of AP's social audit model, see Aiyar et al. (2013).

[20] To view the schedule of audits across the country see: `http://mnregaweb4.nic.in/netnrega/`

Before turning to the design and conduct of the audits, we discuss here the role of GPs in NREGA implementation in AP. The GP maintained a crucial role in managing and executing NREGA projects during the period of our study.[21] First, the Gram Rozgar Sevak or the Field Assistant (FA), a resident of the GP who assists the village council in NREGA implementation, is appointed on the recommendation of the village council. The FA represents the direct interface of beneficiary households with the program, e.g., maintaining labor records at worksites. Second, the sarpanch selected suppliers of the material inputs to projects implemented under the program and was therefore well positioned to fudge material expenditures in connivance with the technical staff (viz., Assistant Engineers, Technical Assistants, and/or the suppliers) as suggested by anecdotal evidence from the field. The village council and its leader, thus, are accountable for efficient program implementation and the labor and material expenditures on the NREGA projects. Given the scale of the NREGA program, the annual availability of public funds at the grassroots level for public programs increased almost three-fold (from approximately Rs. 50,000 million in 2005 to more than Rs. 140,000 million in 2006 (Afridi (2008)), following the passing of the Act.[22] Consequently, the potential magnitude of pilferage from public funds rose dramatically, as well.

3.2 The audit process in AP

The NREGA audit process combines a top-down approach with grassroots, beneficiary participation.[23] The first step in conducting the audit of NREGA projects is a notification to the relevant sub-district (henceforth, mandal) office with reference to the Right to Information obligations and requesting unrestricted access to the records on wage and materials payments by the state's lndependent audit body.[24] A team, comprising professional and independent auditors, conduct a two-day workshop on NREGA rights and regulations and on how to conduct the audits. Following the training, audits are organized in all GPs of the mandal over a week. In each GP, official labor expenses are verified by visiting laborers

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`SocialAudit/SA_home.aspx`.

[21]Through a Government of Andhra Pradesh order in December 2007, the administrative functions relating to the implementation of all projects under the NREGA were devolved to Panchayati Raj institutions (G.O. Ms. No. 571) (`www.rd.ap.gov.in`).

[22]The exchange rate in 2006 was $1=INR 45.

[23]As Aiyar and Kapoor Mehta (2015) point out, the audit process in AP resembles a top down audit more than a bottom-up approach.

[24]The Right to Information Act was enacted in 2005 and enabled access to official records by the audit team.

listed in the worksite logs. Complaints by individuals or groups of beneficiaries and those discovered by the professional auditors are recorded and attested using a standardized audit report template.[25] For verification of material expenditure, the audit team is mandated to undertake worksite inspections. Since the verification of material expenditure is typically perceived to be more complex and demanding, the worksite inspections are usually carried out by the professional auditors in the team.

Once the audits of all GPs have been completed, a mandal level public hearing to discuss the audit findings is organized with mandatory attendance for all implementing officials. Those present often include wage seekers from the villages in the mandal, the audit team, key implementing officials, members of the vigilance cell, elected representatives and a district-level ombudsman (Aiyar et al. (2013)). Complaints are read out, testimonies verified, and accused officials given an opportunity to defend themselves. The scope for frivolous complaints is therefore minimal, if at all. The SSAAT has created checks and balances within the audit process such that the auditors do not get corrupted. For instance, the membership of the audit team is deliberately varied across audit rounds in each mandal and GP to prevent auditors from developing biases or getting entrenched.[26] Afridi and Iversen (2014) (pages 327-329) point out that while the audits were successful in detecting irregularities they were per se unable to reduce thefts. Based on official data they find that "less than 1% of irregularities for which one or multiple program functionaries were held responsible ended in termination/dismissal/removal from service or criminal action".

Systematic and standardized audits were carried out in all 23 districts of the erstwhile state with an average of over two rounds of audits completed per GP between 2006 and 2010. We combine audit data with elections to GP headships in July 2006 for a five year tenure. The timing of the elections either coincided with or were held before the NREGA was rolled out (depending on the staggering of the NREGA). The village councils elected in 2006, thus, experienced an unprecedented increase in public funds.

[25]The auditors are expected to verify labor records for 100 percent of the beneficiaries. This may not be true in practice.

[26]After the public hearing a decision taken report is created by the officer presiding over the hearing in which the responsibility for each confirmed malfeasance is pinned on a program functionary or, as the case may be, on multiple functionaries. Research suggests, however, that the guilty often escape legal or administrative penalties (Afridi and Iversen (2014)).

4 Data and methodology

4.1 Data

We use four sources of data in this paper. First, official and original audit reports for 100 randomly sampled mandals across eight districts of AP were obtained from the state auditor.[27] In each randomly chosen mandal, three GPs were selected based on the following criteria: the GP which was the administrative headquarter of the mandal, one GP randomly selected from all GPs reserved for a woman sarpanch and one randomly selected from GPs not reserved for a woman sarpanch in that mandal in 2006.[28] We, thus, randomly sampled 300 GPs across the 100 mandals.

We extracted data from the first round of audits that began in 2006 and until mid-2010.[29] Panel data of audit report findings were constructed for each sampled GP with an average of over two reports per GP for this period.[30]

The second data source is a primary survey we conducted in all 300 sampled GPs in 2011-12 to collect information on GP and sarpanch characteristics. Retrospective data on the elections to the village council in July 2006 following which new village council members, including the sarpanch, assumed office for a five-year term, were gathered from the elected sarpanch.[31] Information was obtained on votes received by each contestant in the sarpanch election and their party affiliation. It is worth noting that the characteristics of the village council and the sarpanch were unchanged during our study period.

[27] These eight districts were Mahbubnagar, Medak, Nizamabad, Warangal, and Khammam (north or Telangana region, now part of Telangana state), Anantpur and Kurnool (south or Rayalseema region), and Guntur (west or coastal region). NREGA was implemented in February 2006 in all these districts, except Kurnool and Guntur, which implemented the program from April, 2007 onwards. Even though the program was officially rolled out in February 2006, implementation gathered steam in the latter half of the calendar year and in the new financial year which began in April, 2006.

[28] At least third of all village council seats are randomly reserved for a woman sarpanch in AP and across all states in India (viz., Afridi et al. (2017)).

[29] Original audit reports that were missing were supplemented with abridged versions of the audit reports available from the state auditor's website: `http://125.17.121.162/SocialAudit/`.

[30] Information in the audit reports were coded as follows: each complaint was first classified into labor, material, or worksite facilities related. The former two were further categorized by type. For each complaint we recorded whether any misappropriated amount was mentioned; if yes, the amount entered, otherwise it is missing.

[31] The retrospective election data were corroborated with three other respondents in each GP - the closest losing contestant in terms of proportion of total votes received, a worker of the losing political party, and the GP secretary. The correlation between the margin of victory reported by the elected sarpanch and each of the other three respondents in our survey data varies between 0.95 and 0.97.

In addition to the above two data sources, official, administrative data on NREGA implementation (viz., program expenditures, employment generated) were collated annually from the website of the Ministry of Rural Development for the financial years 2006-07 to 2011-12 at the GP level. Finally, GP level characteristics on infrastructure and availability of public goods, such as schools, were obtained from the census closest to the GP election - village level census abstracts for 2001.

Tables 1 and 2 summarize our data. In Table 1, Panel 1 describes the GP's characteristics. The data suggest that the villages in our sample are moderately developed in terms of availability of public facilities (e.g., medical, communication, and bank facility). 86.4 percent of the sampled villages have paved roads. 28 percent of the sampled villages belong to a GP which is the headquarter of the mandal. Data on the reservation status of the sarpanch position in 2006 shows that 42.7 percent of the sampled GPs were reserved for a woman sarpanch. More than 67 percent of the sarpanch positions were reserved for disadvantaged groups (i.e., scheduled castes (SC), scheduled tribes (ST), or Other Backward Castes (OBCs)).

In Panel 2, we present the individual characteristics of the sarpanch chosen in the 2006 village council elections. 44.5 percent of the elected candidates were affiliated with the Indian National Congress (INC) while 35.8 were affiliated with the Telugu Desam Party (TDP).[32] This aligns with our theoretical assumption of left (represented by the INC) and right (represented by the TDP, which has often formed coalitions with the right-wing Bhartiya Janata Party)-leaning ideologies. The remaining, approximately 20 percent of candidates, were either affiliated with regional or communist parties (viz., Telangana Rashtra Samithi, Communist Party of India (Marxist)) or were independent candidates. Thus, the two main political parties during the 2006 elections were INC and TDP. Almost 20 percent of the winning candidates had prior political experience, either as a political party worker or in a position in the panchayat. Even though the average number of prior terms in a political office was less than 1 or 0.226, for the elected sarpanch, 45 percent of them had a close relative who either currently or previously held an office in the panchayat (either at the village, mandal, or district level). In line with the theoretical model, in our survey we gauged the incumbent's own perception of voters' bias for or against her by asking the elected sarpanch to estimate her chances of re-election in the forthcoming GP elections.[33]

[32] Although GP level elections do not require formal party affiliation, candidates typically represent a political party.

[33] The survey question was as follows: Please rank the chances of your being re-elected in the next sarpanch elections in this Gram Panchayat on a scale of 0 to 5: (0) No chance of re-election, (1) Very low, (2) Low,

The average response was 3.77 or "moderate chance of re-election".

The summary statistics on the retrospective sarpanch election data are in Panel 3 of Table 1. The number of contestants in the sarpanch election was a little under 3, on average. The winning candidate received 20.9 percent more votes, of total votes polled, than her closest contestant. Panel 1 of Table 2 shows the summary statistics for the audit data for 2006-10, i.e., over the tenure of the sarpanch elected in a GP in 2006. The total number of audits conducted during this period was 711 or 2.37 audits per GP. We use the number of irregularities as a proxy for the level of corruption (theft in our model) because data on rupee amounts of irregularities are missing for many complaints. The relationship between the number of irregularities and the amount of theft increases monotonically, suggesting that the former is a reliable measure of amount of theft of NREGA funds.

The average number of registered irregularities was 5.823, the majority (86.9%) of which were related to the private goods from the NREGA-program benefits that the electorate is likely to care deeply about (or that do not suffer from collective action problems in monitoring). To give the reader an idea of the possible extent of leakage we summarize the data on the reported irregularity amount per irregularities for which an amount was reported. This is considerable - Rs. 16,329 in real terms, and much larger for the public goods provided in the program, benefits that voters are less likely to care about, than the private goods. We provide more details on our private/public classification in the next section.

NREGA expenditures and employment at the GP level are shown for 2006-07 to 2011-12 in Panel 2 in Table 2. The project costs were substantial, with an average cost of over Rs. 1.5 million. The majority of the projects were on water conservation (32.4%) and on land development. 11.2% of the projects were on road construction. The NREGA also generated substantial employment per year, almost 1700 million person-days or about 25.12 days of employment per individual who demanded work.

4.2 Methodology

Our objective is to show that the regularities in the data conform with the theoretical predictions of our model. Our main measure of corruption is the number of irregularities, overall and by type, registered across all audits for each GP over the period 2006-10. Our

(3) Moderate, (4) High, (5) Almost certain to be re-elected, (999) Can't say/don't know.

empirical specification, utilizing the panel structure, is given by:

$$\begin{aligned} Irregularity_{jklmt} &= \beta_0 + \beta_1 competition_{jkl} + \beta_2 competition_{jkl}^2 + \beta_3 \mathbf{X}_{jkl} + \beta_t Year_t \\ &+ \delta_{lt}(D_l * Year_t) + \delta_m Audit_m + \delta_{k0} D_k + \epsilon_{jklmt} \end{aligned} \tag{10}$$

where the number of irregularities in GP j in mandal k in district l in audit round m at time t ($Irregularity_{jklmt}$) is a function of electoral competition ($competition_{jkl}$) prior to any audits and other factors. The variable $competition_{jkl}$ is defined as 1 less the margin of victory in the sarpanch elections in 2006 (before the audits were conducted). The margin of victory is the difference between the percentage of votes polled in favor of the winning candidate and her closest rival in the election.[34] Hence, if the candidate is unanimously elected, the margin of victory is 1 and the competition variable equals 0. Electoral competition is, therefore, increasing as the magnitude of this variable rises. The square of this variable accounts for any non-linear impact of electoral competition on our measure of corruption. $\mathbf{X}_{jkl}$ is a vector of GP level characteristics that includes the characteristics of the sarpanch elected in 2006 (for a five year term) such as gender, caste, education, and age, the GP's access to health, education facilities, and its distance from the nearest town. It also includes a dummy variable for whether the GP is the mandal headquarter and separate dummies for whether the sarpanch position in 2006 was reserved for an SC, ST, OBC, or woman candidate. D_k is a dummy for mandal k to account for mandal level variation in program implementation. In addition, there may exist secular time trends ($Year_t$) and district specific time trends ($D_l * Year_t$) that affect the level of corruption in a GP. Furthermore, we include audit round fixed effects ($Audit_m$) to account for unobservables such as auditor's capacity to detect malfeasance, which may improve with successive audit rounds and depend on the local bureaucrat's and politician's propensity to be corrupt or hide irregularities.

Our theoretical model suggests a non-linear relationship between electoral competition and malfeasance in program expenditures. We should, therefore, expect a negative coefficient (β_1) on $competition_{jkl}$, which would signify that when electoral competition is low, the number of program irregularities are low as well. A positive coefficient (β_2) on $competition_{jkl}^2$, would indicate that as electoral competition increases irregularities related to program implementation also rise. A negative coefficient on the *competition* variable and a positive one on $competition^2$, along with the extreme point being within the range

[34] Current electoral competition is a reasonable indicator of future competition in Indian elections. Although we do not have data on multiple GP elections in AP, using publicly available data on assembly constituency elections across states of India between 1998 and 2007, we find the correlations in our measure of electoral competition to be significant at the 5 percent level.

of the data, would together indicate a U-shaped relationship between electoral competition and corruption.[35] This would approximate the main prediction from our theoretical model.

Our theoretical model uses $1 - |\beta|$ as the measure of competition and assumes there are two parties on opposite sides of the ideological spectrum. In our empirical setting, there are indeed two main parties (INC and TDP) and approximately 80% of the incumbents in the sample belong to one of these two. In the theory, $|\beta|$ is exogenously given by the share of the majority ideology in the village. The theory therefore predicts that there is a causal relationship between competition and corruption. Since we do not have a measure of "ideology" in the data we proxy it with the margin of victory between the two largest political parties in a GP.[36] As we showed in Section (2.2), the Expected Margin of Victory is positively monotonically related to $|\beta|$.

Next, we classify all reported irregularities into two groups: corruption in publicly provided private goods and in public goods. Irregularities related to the private goods provided by the NREGA relate to those that personally affect the potential beneficiary because they are related to compensation for own labor, e.g., impersonation of worker for wage payment, fudged or incorrect own labor records, non-payment or delay in payment of own wages, bribes paid for obtaining wages due; affect own income, e.g., non-provision of work demanded; and affect private returns from program benefits, e.g., poor quality of NREGA asset (viz., inadequate development of land owned by targeted beneficiary to enable cultivation). The irregularities in public goods refer to discrepancy in materials payments/receipts, ghost projects, and missing expenditure records related to both labor and materials expenses, i.e., program leakages that are unlikely to personally impact the electorate. Existing research suggests that voters may care more about corruption in the publicly provided private goods they receive than from the public goods delivered by a social program. For instance, Olken (2007) finds that grassroots monitoring substantially reduced missing labor expenditures (private benefit) but had no effect on missing materials expenditure (public benefit) in a road construction program in Indonesia. This suggests that the community had a strong incentive to monitor wage payments which benefitted them personally, whereas they cared less about materials expenditures.[37] By comparing

[35] The point of inflexion has to be within the range of the data for a U-shape. In that case the extremum (extreme point) has to lie within the range of the electoral competition for us to claim a U-shape.

[36] One potentially exogenous measure of ideology could be voters' caste affiliations. However, more than 67% of our GPs are reserved based on caste (Table 1), yielding very little variation in the electorate's caste affiliation. In future research we hope to have a measure of electoral competition that is less subject to concerns of endogeneity.

[37] The probability of detection may be systematically higher for irregularities in the private component in

the coefficients obtained on our electoral competition variables, between public and private goods delivered by the NREGA, we test our theoretical prediction that corruption is likely to be higher in the publicly provided private goods as against public goods.

The above specification gives the relationship between electoral competition and program implementation by taking advantage of variation in the degree of competition across GP-audits, within the same mandal. Moreover, taking advantage of the panel structure of our data by conducting the analysis at the GP-audit level buys us greater power to the analysis due to the resulting larger number of observations. However, in order to generalise our findings and estimate the average relationship between corruption and electoral competition we also estimate the following equation:

$$Irregularity_{jkl} = \alpha_0 + \alpha_1 competition_{jkl} + \alpha_2 competition^2_{jkl} + \alpha_3 \mathbf{X}_{jkl} + \eta_k D_k + \mu_{jkl}, \quad (11)$$

where $Irregularity_{jkl}$ is the total number of irregularities over the period 2006-10 in GP j in mandal k in district l. This specification, therefore, estimates, the relationship across GPs within a mandal over the entire period 2006-10.

In our data since electoral competition is measured in 2006 and program irregularities are audited (for the first time ever) post the GP elections in 2006, we circumvent some of the concern that both electoral competition and corruption are determined simultaneously.[38]But to the extent that our empirical analyses are confounded by extant GP level unobservables that impact both electoral competition and NREGA implementation, we cannot claim a causal link between electoral competition and corruption in the program. Rather our objective is to test whether the regularities in the data are consistent with the theoretical predictions.

5 Results

In keeping with the theoretical model which assumes impartial and unbiased auditors, and in order to eliminate the consequent measurement errors and potential reporting biases in our audit data we report the results of the analysis for irregularities reported by the professional auditors alone.[39]

NREGA when beneficiaries also participate in the audit process.

[38]The public program NREGA also started in AP in 2006, so there was little opportunity for voters to observe corruption before this date.

[39]Recall that program irregularities were reported by both professional auditors and beneficiaries in each GP. Beneficiary households that report program irregularities, as part of the bottom-up approach of the audit

As indicated in Table 1, we gauged the incumbent's perception of voters' bias for or against her by asking the incumbent to estimate her chances of re-election in the forthcoming GP elections.[40] The response of the incumbents to this hypothetical question correlates significantly with the degree of political entrenchment of the sarpanch's family. We define political entrenchment as the number of relatives of the incumbent who have held political positions and the number of years they held those positions. We consider an incumbent's family to be more politically entrenched the higher the average number of years (total years in political office/number of relatives who have held political positions) her relatives were in a political office. The correlation between re-election expectations and political entrenchment is positive and significant at the 5 percent level in our data, which suggests that the incumbent's self reported perception of electoral bias towards her was correct.

We expect the incumbent's own perception of electoral bias to have two effects. First, there should be fewer reported irregularities in private goods provisioning because of the power that the incumbent may have, which would intimidate voters and second, the incumbent would care less about a theft being caught when she is entrenched, and expects to be re-elected with a high probability. We argue that the results support the second effect which is consistent with our model. When competition is low and electoral bias is towards the incumbent, then the incumbent has higher incentives to cheat while voters have lower incentives to report irregularities. As competition increases, the incentives to be corrupt decrease until competition is very stiff. On the other hand, voters' incentives to report increase monotonically with competition, so voter incentives to report cannot be driving the U-shape. Second, since our sample includes only professional auditor reported irregularities,

design, are likely to be subject to threats and intimidation, particularly due to the public announcement of the audit findings (Afridi et al. 2017). This may affect the irregularity reporting behavior of GP residents and be systematically correlated with the level of electoral competition in the GP. For instance, Aidt et al. (2011) show that in more competitive seats the share of criminally accused politicians is higher because they have a comparative advantage in winning elections through intimidation of voters. Professional auditors are less likely to be subject to such biases or intimidation since they are not residents of the audited GPs or mandals. In addition, irregularity reporting behaviour is likely to be systematically higher in the private goods of the program by program beneficiaries. The analysis of both professional auditor and beneficiary reported irregularities give us qualitatively similar results and are available on request.

[40]Incumbents in seats reserved for SC/ST/OBC candidates did not anticipate a change in the reservation status of their village council because the state government was expected to continue using the same Census data as in the 2006 elections to determine the eligibility of village councils for caste based reservations on the basis of the population of disadvantaged ethnic groups. Furthermore, our empirical analysis controls for whether a village council seat was currently reserved or not, and for which socio-economic group, to account for any variation in the incumbent's perception of re-election chances.

we avoid such biases influencing our results.

Using our self-reported measure of voter bias, we stratify the sample into perceived electoral bias against (reported re-election probability moderate or less) and for (reported re-election probability more than moderate) the incumbent.[41] We conduct the analysis at the GP-audit level, taking advantage of the panel structure of the data and estimate Equation (10) using the sample of irregularities reported by professional auditors. Our main outcomes of interest are the number of irregularities, irregularities in the private and the public goods delivered by the NREGA which were registered during 2006-10 in each GP in each audit round. The results are reported in Table 3. Our theoretical model suggests that the effect of electoral competition would be significantly non-linear when bias is in favor of the incumbent. This shows up quite starkly in the results in columns 1 and 2 in the top panel of Table 3. We report tests of U-shape (Lind and Mehlum (2010)) relationship between electoral competition and reported irregularities. The test reports the slope and P-values for low (lower bound) and high values of electoral competition (upper bound) in the relationship between electoral competition and the number of irregularities. The overall reported P-value is the higher of the two P-values.[42] The U-shaped, non-linear effect of electoral competition is significant overall (P-value 0.022) and in the private component (P-value 0.007) in the top panel of the table (when bias is in favor of the incumbent), but insignificant in the lower panel (when bias is against the incumbent) across all columns.[43] Furthermore, the estimates suggest that irregularities in the public goods component are unresponsive to electoral competition, as predicted by the theoretical model.

The results reported in Table 3 suggest that there is significant variation in the total irregularities by its components, as predicted by our model. The P-value of the U-shape test in the upper panel is significant at 5% (column 1) and 1% (column 2). Figure 2 shows the predicted values from the analysis in Table 3. The top panel reports the relationship between electoral competition and total irregularities when the incumbent perceives that the bias is in her favour. The bottom panel shows the relationship when self-perceived electoral bias is against the incumbent. While the first column in Figure 2 reports the fitted values from the analysis in column 1 of Table 3, the second column reports fitted values excluding the sample of GPs where the sarpanch was elected unanimously, i.e., the

[41]To alleviate any concerns about the classification of 'moderate chance of re-election' we carried out robustness checks with this response dropped or included in "bias towards the incumbent". The results are qualitatively unchanged.

[42]E.g., if the P-value for the lower bound is 0.000 and for the upper bound is 0.006, the overall P-value is 0.006.

[43]We do not report the overall P-value of U-shape test when the U-shape hypothesis is redundant.

electoral competition was 0 (27 GPs). We see a U-shaped relationship in the top panel and a monotonic or relatively unresponsive (focusing on the relevant positive values of the fitted total irregularities) relationship in the bottom panel.

In Panel 1 of Table 4, we report the relationship between electoral competition and corruption in each type of irregularity by electoral bias. When we classify the irregularities into those related to private goods, we find that there is a consistent U-shaped relationship between electoral competition and corruption when the bias is in favor of the incumbent. The results are largely insignificant, or do not point consistently in the same direction when the electoral bias is against the incumbent, in the lower panel in Table 4. In Table 5, we find that irrespective of electoral bias, the relationship between theft from the public goods and competition is mostly insignificant and not consistently U-shaped. Note, however, that the average amount of the discrepancy between reported and audited expenditure per irregularity is almost 15 times higher in public goods as opposed to private goods as shown in Table 2. Overall, our results support the main findings of the model.

In order to generalise our results and obtain average estimates of the relationship between electoral competition and corruption, we conduct the analysis at the GP-audit level across all GPs and report the results in Table 6. In columns 1, 3, and 5 we conduct mandal fixed effects analysis (and include audit round fixed effects). In columns 2, 4, and 6 we include year dummies and district specific trends, to obtain comparable estimates with previous analyses. The point estimates are not significantly different between the more parsimonious model that includes only mandal fixed effects and the stricter specification, which accounts for trends across all outcomes. This suggests that secular or district specific trends were not correlated with electoral competition and did not play a significant role in uncovering program related malfeasance over time. The U-shaped relationship between electoral competition and corruption holds overall and in the private goods delivered by the NREGA but marginally insignificant as indicated by P-values of the U-shape test in the lower panel. These test statistics are reported for the stricter specification in columns 2, 4, and 6.

Finally, we present the estimates from Equation (11) in Table 7. Our main outcomes of interest here are the total number of irregularities, total irregularities in the private and the public goods delivered by the NREGA which were registered during 2006-10 in each GP. To ensure that our outcome variable is not influenced by the variation in the number of audits across GPs in a mandal, we balance (i.e., use the common) number and round of audits across GPs within each sampled mandal.[44] We obtain a sample of 279 GPs for

[44]Balancing the number and rounds of audits at the mandal level reduces the sample to 257 GPs and gives

which we were able to obtain data for the full set of controls used in the estimating equation. In columns 1, 3, and 5 we model a linear relationship between electoral competition and reported irregularities. In columns 2, 4, and 6 we add the square of electoral competition to compare the estimates with those in Table 6 (columns 1, 3, and 5).

Table 7 shows that the coefficient on electoral competition is positive and insignificant overall (column 1) and for irregularities in the private goods (column 3) and public goods, as well, as shown in column 5. When we introduce the square term for electoral competition, we obtain a negative coefficient on electoral competition and a positive coefficient on the squared electoral competition term, in columns 2, 4, albeit insignificant in 6. Overall, the direction of the coefficients suggests that electoral competition at low levels is accompanied by lower reported program irregularities, and as electoral competition rises there is an increase in the number of irregularities. Indeed, Table 7 coefficients show that the number of irregularities halve relative to the average (computed from Table 2) when competition is low and double relative to the average when competition is very stiff.

We report tests of U-shape relationship between electoral competition and reported irregularities for columns 2, 4, and 6 in the bottom panel. The test results indicate that the U-shape relationship holds in columns 2 and 4 at 1% significance level, but only at 15.7% significance level for the irregularities reported in the public goods. This result is in line with our theoretical prediction that there exists a U-shape relationship between electoral competition and corruption, driven by corruption in the public provision of private goods. Our results are, hence, valid on average as well.

6 Discussion of results

One possible concern with our results is that the number of irregularities may not represent the magnitude of theft of public funds. For instance, we may conclude that there is higher corruption in the more competitive constituencies because we observe greater number of irregularities even though in fact average amount per irregularity is lower in the high as opposed to the low competition constituencies. Although data on the misappropriated amount is incomplete, using the information available we do not find any systematic differences in the theft per irregularity between GPs with higher and lower than median victory margin. Moreover, there is a monotonic relationship between amounts and number of irregularities: as the number of irregularities increases, the amount of theft also increases.

A related, and more fundamental, confound is the presence of a systematic relationship

similar results.

between detection of program irregularities (viz., more oversight) and electoral competition. This can be due to political pressure from the state incumbent party in which case we should expect villages with a different party than the ruling state government getting higher scrutiny in general and especially in more competitive elections, while those which are aligned (with the state government) would not get scrutinized, i.e. that auditor bias or scrutiny could vary systematically by political affiliation of the incumbent. For the U-shape to hold, however, it would imply that political affiliation of incumbents varies systematically between high and low competitive constituencies, which we do not find in our sample. The proportion of sarpanches who are affiliated with the INC in 2006 (the ruling party in AP was the INC from 2004-14) is not significantly different between GPs with higher and lower than median victory margin. Second, the incentives of the village incumbent to bribe the auditors goes up in more competitive elections - but then we should observe, if anything, lower corruption in the competitive elections. We do not observe this in the data.

Finally, irregularities in the public goods provided by the NREGA program may be harder to detect than in the private goods because technical expertise is required to identify malpractices in the materials component. This may show up as unresponsiveness of corruption in public goods to electoral competition. We allay these concerns by focussing on irregularities reported by professional auditors who are trained to detect materials related irregularities. Moreover, our results do not suggest that the irregularities in the public goods are unresponsive, rather, they do not show any systematic response to electoral competition (as discussed in Tables 4 and 5).

Is it possible that the patterns we detect in the data are driven not by moral hazard as in the theoretical model but by selection effects or by vote buying? Aidt et al. (2011) show that highly competitive elections create incentives for candidates who can bribe or intimidate voters, while Booth et al. (2011) show that when competition increases corruption takes the form of vote buying. While both of these mechanisms could be driving the effect we see of higher corruption when elections are highly competitive, none of them can explain the U-shape. Thus, while we cannot rule out combinations of the three mechanisms, our paper shows that moral hazard is an important driving force for corruption.

7 Conclusions

In this paper we build a simple game theoretic model to capture the effect of electoral competition on corruption when there is public exposure of corruption through mandated audits of government expenditures. We show that corruption has a non-monotonic relationship with electoral competition. Corruption is higher at very low and very high levels of competition and decreases with competition when competition is intermediate. We also show theoretically that when corruption can be divided into theft from "public" and "private" goods, incumbents are more likely be maximally corrupt in the public goods provisioning, which does not respond to competition, while the corruption in the private goods follows a U-shaped relationship with competition. We validate the model's hypotheses using official data on mandated audits of the NREGA projects implemented by village councils in Andhra Pradesh during 2006-10 and data on the elections to the headship of these same village councils in 2006. Our results largely confirm the non-linear relationship between electoral competition and corruption, and that electoral competition is more responsive when corruption is in the publicly provided private goods. The size estimates are quite substantial, indicating that the number of irregularities halve relative to the average when competition is low and double relative to the average when competition is very stiff, but of course these are numbers of irregularities rather than the value.

Our theoretical model suggests that policies that make incumbents more patient would help in reducing corruption. Increasing the frequency of elections is one such policy (see Section (A.4) in the Appendix). On the voters' side, policies that increase awareness of how theft from infrastructure projects affect their welfare may help to direct politicians attention to controlling corruption in the public goods delivered by social programs.

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Table 1: GP, sarpanch and election characteristics (2006)

Variable	N	Mean	Standard Deviation
GP characteristics			
Proportion of irrigated area	294	0.243	0.233
Population density (per sq. km.)	296	3.431	3.727
Distance from town (km)	296	30.372	20.158
Medical facility	294	0.830	0.376
Communication facility	294	0.918	0.274
Bank facility	294	0.374	0.485
Middle school	296	0.709	0.455
Paved road	294	0.864	0.343
Main GP of mandal	300	0.280	0.500
Sarpanch seat reserved for woman*	300	0.427	0.495
Sarpanch seat reserved for SC/ST*	300	0.306	0.460
Sarpanch seat reserved for OBC*	300	0.370	0.484
Sarpanch characteristics			
Age	299	44.686	9.957
Male	299	0.532	0.500
Illiterate	299	0.110	0.314
Secondary schooling complete	299	0.100	0.310
Graduate or above degree	299	0.107	0.310
Belonging to INC	299	0.445	0.498
Belonging to TDP	299	0.358	0.480
Have own prior political experience	297	0.195	0.397
Prior terms in political office	296	0.226	0.643
Relative in panchayat	300	0.450	0.498
Self-perceived re-election probability	287	3.770	1.442
GP election characteristics			
Number of contestants	299	2.916	1.767
Proportions of votes polled out of total voters	297	0 .757	0.260
Proportions of votes received by winning candidate	297	0.566	0 .173
Margin of victory in election	297	0.209	0.275

Notes: GP characteristics from Census, 2001; *reservation data from the State Election Commission; SC/ST - Scheduled Caste/Scheduled Tribe; OBC- Other Backward Castes; INC - Indian National Congress; TDP - Telegu Desam Party; prior political experience is a dummy variable that equals 1 if a prior leadership position was held by the current sarpanch; 'prior terms in political office' is the number of terms held previously in any political office; 'relative in panchayat' equals 1 if the elected sarpanch has a relative who has ever held office in the panchayat; proportion of votes polled is 0 for a unanimously elected sarpanch; votes received by winning candidate and the margin of victory reported as a proportion of total votes polled.

Table 2: NREGA audit, expenditure and employment characteristics at GP level, by year (2006-10)

Variable	N	Mean	Std. Dev.
Audit characteristics			
Total number of irregularities	711	5.823	5.299
Private component	711	5.062	4.594
Public component	711	0.684	1.520
Total amount per irregularity (Rs.)	581	16,329.420	52,862.71
Private component	555	7,920.136	19,500.840
Public component	173	119,062.0	488,958.20
Program characteristics			
Total expenditure (Rs., millions)	1416	1.531	1.699
Proportion of expd. on water conservation	1396	0.324	0.305
Proportion of expenditure on rural	1416	0.112	0.201
Total employment (person-days, millions)	1418	1699.256	2082.414
Employment as proportion of GP population	1388	7.174	20.554
Employment as proportion of GP demand	1371	25.117	14.178

Notes: Audit data from official audit reports; amounts are reported per irregularity for which the rupee amount was mentioned in the audit; data on program characteristics from the Ministry of Rural Development (MoRD), Government of India for financial years 2006-07 to 2010-11; amounts and expenditures are in 2006 rupees.

Table 3: Effect of electoral competition on NREGA irregularities by electoral bias (GP-audit level, 2006-10)

	Total irregularities	Irregularities in private good	Irregularities in public good
	(1)	(2)	(3)
Electoral bias in favor of incumbent			
Electoral Competition	-32.218**	-40.12***	7.903
	(12.598)	(8.584)	(6.095)
Electoral Competition^2	19.601**	23.08***	-3.483
	(7.734)	(5.338)	(3.739)
U-shape test [Overall P-value]	[0.022]	[0.007]	-
N	250	250	250
R^2	0.654	0.505	0.446
Electoral bias against incumbent			
Electoral Competition	3.825	5.647	-1.822
	(6.593)	(4.070)	(4.243)
Electoral Competition^2	-2.421	-3.170	0.749
	(4.242)	(2.618)	(2.790)
U-shape test [Overall P-value]	-	-	-
N	363	363	363
R^2	0.527	0.383	0.407

Note: Controls include sarpanch characteristics (age, age square, dummy for secondary education completed, dummy for graduate and above education; dummy for prior political experience, affiliated to INC) GP characteristics (main GP of mandal, medical, communication, banking, paved road, middle school in GP, distance from town, proportion of cultivated area which is irrigated, population density, dummy for SC, ST, OBC, woman reserved sarpanch candidate, sarpanch elected unanimously), mandal, audit round, year fixed effects and district specific trends. Standard errors, clustered at the GP level, reported in parentheses. Electoral competition is in the interval (0, 0.99). Extremum outside interval in lower panel, column (3). Significant at *10%, **5% and ***1%.

Table 4: Effect of electoral competition on irregularities in the private component by electoral bias (GP-audit level, 2006-10)

	Private good irregularities					
	Impersonations in wage payments	**Irregularities in own labor records**	**Non-payment/ delay of wages**	**Payment of bribes to receive due wages**	**Non-provision of work**	**Poor quality of asset**
	(1)	(2)	(3)	(4)	(5)	(6)
	Electoral bias in favor of incumbent					
Electoral Competition	-7.494***	-9.220***	-1.875	-9.068	0.619	-13.08***
	(2.622)	(2.374)	(1.147)	(6.244)	(1.422)	(2.287)
Electoral Competition^2	4.556***	4.911***	1.417**	5.435	-0.802	7.567***
	(1.645)	(1.391)	(0.670)	(3.886)	(0.886)	(1.304)
U-shape test [Overall P-value]	[0.023]	[0.151]	[0.053]	[0.155]	-	[0.000]
N	250	250	250	250	250	250
R^2	0.548	0.534	0.420	0.353	0.483	0.514
	Electoral bias against incumbent					
Electoral Competition	4.667**	3.644	1.865	-3.028	-1.347***	-0.154
	(2.281)	(2.410)	(1.387)	(1.981)	(0.507)	(1.781)
Electoral Competition^2	-3.301**	-1.824	-1.061	2.140*	0.817***	0.060
	(1.474)	(1.545)	(0.864)	(1.286)	(0.306)	(1.155)
U-shape test [Overall P-value]	-	-	-	[0.064]	[0.028]	-
N	363	363	363	363	363	363
R^2	0.413	0.383	0.301	0.376	0.534	0.364

Note: Controls as elucidated in Table 3. Standard errors, clustered at the GP level, reported in parentheses. Significant at *10%, **5% and ***1%. Extremum outside interval in lower panel, column (6).

Table 5: Effect of electoral competition on irregularities in the public component by electoral bias (GP-audit level, 2006-10)

	Public good irregularities			
	Non-provision of wage records	**Non-provision of materials related records**	**Ghost project**	**Discrepancy in materials payments /receipts**
	(1)	(2)	(3)	(4)
	Electoral bias in favor of incumbent			
Electoral Competition	-5.531*	0.424	3.748*	9.261**
	(3.215)	(1.787)	(1.944)	(3.793)
Electoral Competition^2	3.225*	-0.298	-2.350**	-4.061*
	(1.941)	(1.117)	(1.155)	(2.259)
U-shape test [Overall P-value]	[0.158]	-	-	-
N	250	250	250	250
R^2	0.432	0.442	0.394	0.412
	Electoral bias against incumbent			
Electoral Competition	-2.236	2.351**	-3.587	1.651
	(1.751)	(1.101)	(2.411)	(3.430)
Electoral Competition^2	1.388	-1.474**	1.805	-0.970
	(1.139)	(0.675)	(1.540)	(2.274)
U-shape test [Overall P-value]	[0.178]	-	[0.489]	-
N	363	363	363	363
R^2	0.455	0.378	0.379	0.332

Note: Controls as elucidated in Table 3. Standard errors, clustered at the GP level, reported in parentheses.
Significant at *10%, **5% and ***1%.

Table 6: Effect of electoral competition on NREGA irregularities (GP-audit level, 2006-10)

	Total irregularities		Irregularities in private good		Irregularities in public good	
	(1)	(2)	(3)	(4)	(5)	(6)
Electoral competition	-6.760**	-6.546*	-5.609**	-5.489**	-1.151	-1.057
	(3.369)	(3.456)	(2.547)	(2.656)	(1.531)	(1.556)
Electoral competition^2	4.137*	4.011*	3.278**	3.214*	0.858	0.798
	(2.194)	(2.243)	(1.600)	(1.662)	(1.047)	(1.064)
U-shape test [Overall P-value]	[0.112]		[0.137]		[0.249]	
Mandal FE	√	√	√	√	√	√
Audit Round FE	√	√	√	√	√	√
Year FE		√		√		√
District x Year FE		√		√		√
N	635		635		635	
R^2	0.421		0.267		0.317	

Note: The dependent variable is the number of irregularities in each GP in an audit. Controls as elucidated in Table 3. U-shape test for columns (2), (4) and (6). Standard errors, clustered at the GP level, reported in parentheses. Significant at *10%, **5% and ***1%.

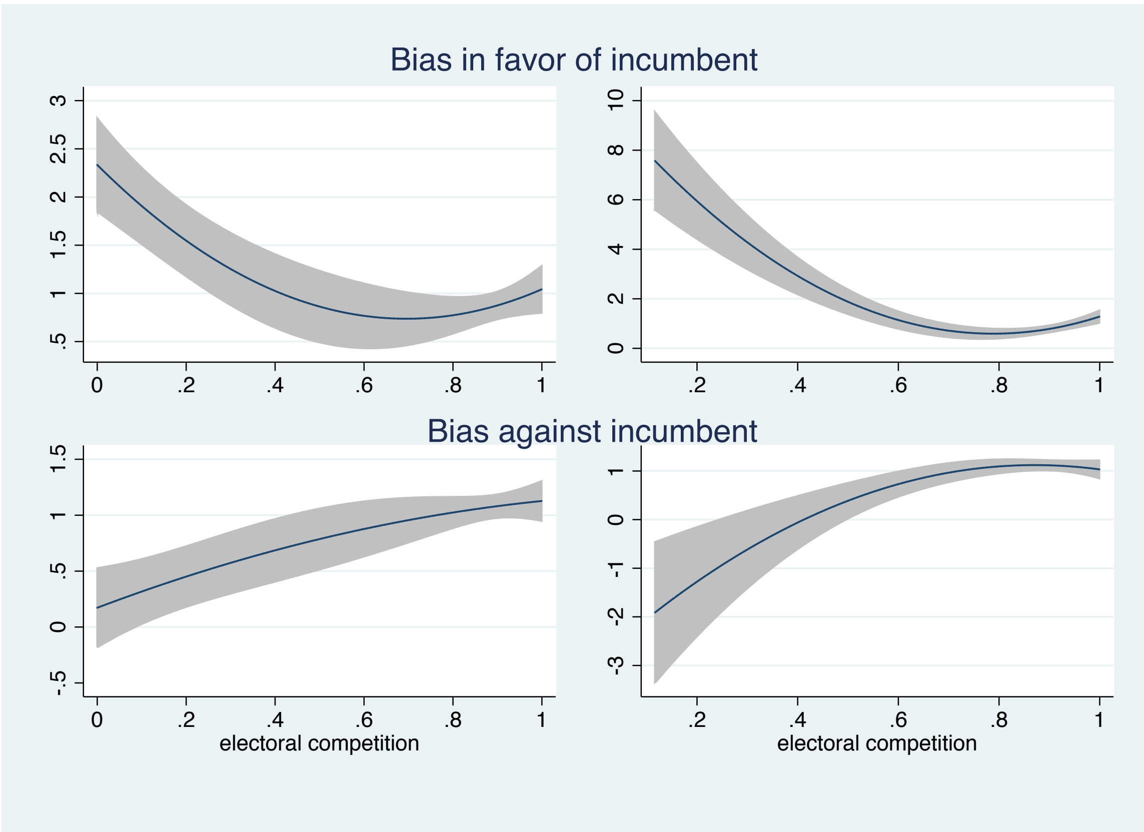
Table 7: Effect of electoral competition on NREGA irregularities (GP level, 2006-10)

	Total irregularities		Irregularities in private good		Irregularities in public good	
	(1)	(2)	(3)	(4)	(5)	(6)
Electoral competition	0.327	-26.67***	0.453	-19.40***	-0.126	-7.271
	(1.722)	(8.301)	(1.380)	(6.250)	(0.967)	(4.599)
Electoral competition^2		17.68***		13.00***		4.678
		(5.599)		(4.143)		(3.191)
U-shape test [Overall P-value]	[0.006]		[0.005]		[0.157]	
Mandal FE	√	√	√	√	√	√
N	279	279	279	279	279	279
R^2	0.646	0.661	0.565	0.583	0.635	0.638

Note: Controls as elucidated in Table 3, excluding, audit round, year and district specific trends. U-shape test for columns (2), (4) and (6). Standard errors in parentheses. Significant at *10%, **5% and ***1%.

Figure 2: Electoral competition and total irregularities

Professional auditor reported irregularities



Note: Fitted values and 95% confidence interval (Table 3, column 1). The second column reports fitted values for same specification but excludes extreme value -27 GPs where the sarpanch was elected unanimously, i.e., electoral competition was 0.

A ONLINE APPENDIX: NOT FOR PUBLICATION

A.1 A single type of corruption: Proof of claim 1

In this section we prove Claim 1, which is restated for convenience.

Claim 1: The optimal level of corruption for the incumbent is given by:

- If $\beta \leq -\frac{1}{4}$, then $x^*_\beta = 1$.
- If $-\frac{1}{4} \leq \beta \leq -\frac{1-\delta}{4\delta}$, then $x^*_\beta = -4\beta$.
- If $-\frac{1-\delta}{4\delta} \leq \beta$, then $x^*_\beta = 1$.

Proof. Suppose that $\beta \leq -\frac{1}{4}$. Then the margin of victory for the incumbent is high, and even if she steals the full amount she wins elections for sure (see Equation (5)). It follows that $x^*_\beta = 1$ and $v_\beta(x) = \frac{1}{1-\delta}$ for $\beta \leq -\frac{1}{4}$.

Suppose that $\beta \geq \frac{1}{4}$. Then the margin of victory for the challenger is high, the incumbent will lose elections whatever amount she steals (see Equation (5)), and therefore her optimal behavior is to steal everything and lose the election. It follows that $x^*_\beta = 1$ and $v_\beta(x) = 1$ for $\beta \geq \frac{1}{4}$.

Suppose that $-\frac{1}{4} \leq \beta \leq 0$. On the interval $x \in [0, -4\beta]$ we have $\theta_\beta(x) = 1$, so that $v_\beta(x) = \frac{x}{1-\delta}$. It follows that the function $x \mapsto v_\beta(x)$ is monotonically increasing on the interval $[0, -4\beta]$.

Suppose that $0 \leq \beta \leq \frac{1}{4}$. On the interval $x \in [1-4\beta, 1]$ we have $\theta_\beta(x) = 0$, so that $v_\beta(x) = x$. In particular, the function $x \mapsto v_\beta(x)$ is monotonically increasing on the interval $[1-4\beta, 1]$.

Consider now the interval in which $\theta_\beta(x) = 1 - x_t - 4\beta$; that is, either $-\frac{1}{4} \leq \beta \leq 0$ and $x \in [-4\beta, 1]$, or $0 \leq \beta \leq \frac{1}{4}$ and $x \in [0, 1-4\beta]$. In this case, $v_\beta(x) = \frac{x}{1-\delta(1-x-4\beta)}$ and the derivative of v_β is

$$v'_\beta(x) = \frac{1-\delta+4\delta\beta}{\big(1-\delta(1-x-4\beta)\big)^2}. \tag{12}$$

It follows that on the interval in question, the function v_β is increasing if $\beta > -\frac{1-\delta}{4\delta}$, decreasing if $\beta < -\frac{1-\delta}{4\delta}$, and constant if $\beta = -\frac{1-\delta}{4\delta}$.

If $\beta > -\frac{1-\delta}{4\delta}$, then the function $x \mapsto v_\beta(x)$ is increasing on the interval $x \in [0, 1]$, and it is optimal for the incumbent to steal $x^*_\beta = 1$.

If $\beta < -\frac{1-\delta}{4\delta}$, then in particular β is negative, the function $x \mapsto v_\beta(x)$ is increasing up to -4β and decreasing after -4β, so that its maximum is attained at $x = -4\beta$. ∎

A.2 The relationship between the theoretical measure of competition $|\beta|$ and the expected margin of victory

Claim 1 describes the relation between competition and corruption, when competition is measured by the ideology of the median voter. It states that this relation has a U-shape when the advantage is with the incumbent, and corruption is unresponsive to competition when the advantage is with the challenger.

As mentioned in the body of the paper, our data does not contain the ideology of the median voter, but rather the margin of victory. In Section 4 we verified that in the data, the relation between competition and corruption respects the findings of Claim 1, when competition is measured by the margin of victory. It is therefore important to check whether the conclusion of Claim 1 holds when competition is measured by the expected margin of victory rather than by the ideology of the median voter. This is what we do in this section in the setup of a single type of corruption.

The expected margin of victory does not depend only on the ideology of the median voter β, but rather on the whole shape of F, the CDF of population ideology. This CDF is a function of β, since its median is β. Because we compare corruption for different values of β, we must take into account the fact that the CDF itself depends on β. We therefore denote the distribution F as F_β, to emphasize that it is different for different values of β. In other words, we assume that we are given a family $(F_\beta)_{-1\leq\beta\leq 1}$ of distributions, with the interpretation that F_β is the ideology distribution of the population in all villages in which the ideology of the median voter is β. This is clearly a simplifying assumption, because the ideology of the median voter does not determine the ideology distribution of the population. As the argument below suggests, this assumption can be weakened. Specifically, suppose that we are given two villages, in one the population ideology is described by the CDF F_β and in the other it is described by the CDF $F_{\beta'}$. Suppose further that the median of F_β is β, the median of $F_{\beta'}$ is β', and that $\beta' < \beta$. Then we require that the distributions $F_{\beta'}$ and F_β satisfy properties (P.1)–(P.4) below.

In principle the various distributions (F_β) need not be related in any way, except that the median of F_β should be β. For our purposes we need this family to satisfy certain properties.

Definition 1 *A family $(F_\beta)_{-1\leq\beta\leq 1}$ of distributions on $[-1,1]$ is called* proper *if it satisfies the following properties for every $-1 \leq \beta' < \beta \leq 1$:*

P.1) The median of F_β is β.

P.2) $F_{\beta'}(z) \geq F_\beta(z)$ *for every* $z \in [-1,1]$*: for every ideology point* z*, more voters are to the left of* z *under* $F_{\beta'}$ *than under* F_β*.*

P.3) $E_y[F_{\beta'}(\frac{y-1}{4}) \mid y > 4\beta' + 1] \geq E_y[F_\beta(\frac{y-1}{4}) \mid y > 4\beta + 1]$*.*

P.4) $E_y[F_{\beta'}(\frac{y}{4} + \beta')] \geq E_y[F_\beta(\frac{y}{4} + \beta)]$*.*

Condition (P.1) repeats our assumption that the median of F_β is β. Condition (P.2) is a monotonicity condition: when $\beta' < \beta$, the distribution $F_{\beta'}$ is more favorable to the incumbent than the distribution F_β. Hence it is natural to assume that for every ideology point z, more voters are to the left of z under $F_{\beta'}$ than under F_β. Conditions (P.3) and (P.4) are also monotonicity conditions, but they are more difficult to interpret.

The following example provides a proper family of uniform distributions.

Example 1 *Let* $(F_\beta)_{-1\leq\beta\leq1}$ *be the following family of distributions. For every* $\beta \leq 0$*,* F_β *is the uniform distribution on* $[-1, 1+2\beta]$*, while for every* $\beta > 0$*,* F_β *is the uniform distribution on* $[-1+2\beta, 1]$*. Though quite tedious, it is not difficult to verify that this family of distributions is proper.*

When the corruption levels of the incumbent and challenger are x and y respectively, a voter with ideology z votes for the incumbent if

$$-x - (z+1)^2 > -y - (z-1)^2. \tag{13}$$

This means that the voter votes for the incumbent if and only if $z < \frac{y-x}{4} =: \tilde{z}$, where $\tilde{z}$ is the cutpoint such that all voters with $z < \tilde{z}$ vote for the incumbent and all voters with $z \geq \tilde{z}$ vote for the challenger. The incumbent wins if and only if the median voter votes for her, that is, $\beta < \tilde{z}$.

Denote by $EMV_I(\beta)$ the expected margin of victory when the distribution of population ideology is F_β, conditional that the incumbent wins elections. Denote by $EMV_C(\beta)$ the corresponding quantity conditional that the challenger wins elections. The next claim establishes that under proper conditions these two functions are monotone in β.

Claim 3 *If the family of distributions* $(F_\beta)_{-1\leq\beta\leq1}$ *is proper, then the function* $\beta \mapsto EMV_I(\beta)$ *is non-increasing and the function* $\beta \mapsto EMV_C(\beta)$ *is non-decreasing: as competition increases, the expected margin of victory, conditional on the incumbent winning the election, is non-increasing, and the expected margin of victory, conditional on the challenger winning the election, is non-decreasing.*

The implication of Claim 3 is that if the family of distributions $(F_\beta)_{-1\leq\beta\leq 1}$ is proper, then the relation between corruption and competition, when competition is measured by the expected margin of victory, is qualitatively the one in Figure 1: it has U-shape when the electoral advantage is with the incumbent, and is unresponsive to competition when the advantage is with the challenger.

Proof. We start by studying the expected margin of victory conditional that the challenger wins. The expected margin of victory for the challenger is given by

$$EMV_C(\beta) = 1 - 2E_y[F_\beta(\tfrac{y-x^*_\beta}{4}) \mid \text{challenger wins}].$$

The challenger's winning prospects are given by:

- If $\beta \geq 0$, the incumbent's corruption level is at its maximum, that is, $x^*_\beta = 1$, and the challenger wins for sure.
- If $-\frac{1-\delta}{4\delta} < \beta < 0$, the incumbent's corruption level is also at its maximum, $x^*_\beta = 1$, and the challenger wins with positive probability.
- If $\beta < -\frac{1-\delta}{4\delta}$, the challenger loses elections for sure.

In particular, the function $EMV_C(\cdot)$ is defined on the interval $[-\frac{1-\delta}{4\delta}, 1]$. Since the corruption level of the incumbent x^*_β is continuous on this interval, so is the probability of winning of the challenger, and therefore the function $EMV_C(\cdot)$ is continuous. On the interval $[0, 1]$, this function is given by

$$EMV_C(\beta) = 1 - 2E_y[F_\beta(\tfrac{y-1}{4})].$$

This function is non-decreasing by Condition (P.2). On the interval $[-\frac{1-\delta}{4\delta}, 0]$ the expected margin of victory of the challenger is given by

$$EMV_C(\beta) = 1 - 2E_y[F_\beta(\tfrac{y-1}{4}) \mid y < 4\beta + 1].$$

This function is non-decreasing by Condition (P.3). We thus deduce that the function $EMV_C(\cdot)$ is non-decreasing on the interval $(-\frac{1-\delta}{4\delta}, 1]$.

We now study the expected margin of victory conditional that the incumbent wins. If $\beta \geq 0$ the incumbent loses for sure, while if $\beta < 0$ she wins with positive probability. Hence the function $EMV_I(\cdot)$ is defined in the interval $[-1, 0)$.

When $\beta \leq -\frac{1}{4}$ the corruption level of the incumbent is $x^*_\beta = 1$, and the incumbent wins with probability 1. In particular, the expected margin of victory is

$$EMV_I(\beta) = 2E_y[F_\beta(\tfrac{y-1}{4})] - 1.$$

Condition (P.2) implies that this quantity decreases as β increases (gets closer to 0).

When $-\frac{1-\delta}{4\delta} < \beta \leq 0$ the corruption level of the incumbent is $x^*_\beta = 1$, and both candidates have a positive probability of winning, the expected margin of victory of the incumbent is

$$EMV_I(\beta) = 2E_y[F_\beta(\tfrac{y-1}{4}) \mid y > 4\beta + 1] - 1.$$

Condition (P.3) implies that this quantity decreases as β increases (gets closer to 0).

When $-\frac{1}{4} < \beta < -\frac{1-\delta}{4\delta}$ the corruption level of the incumbent is $x^*_\beta = -4\beta$, and the incumbent wins with probability 1. In particular, the expected margin of victory is

$$EMV_I(\beta) = 2E_y[F_\beta(\tfrac{y+4\beta}{4})] - 1 = 2E_y[F_\beta(\tfrac{y}{4} + \beta)] - 1.$$

Condition (P.4) implies that this quantity decreases as β increases (gets closer to 0).

It remains to show that the monotonicity is preserved at the cutoff points $\beta = -\frac{1}{4}$ and $\beta = -\frac{1-\delta}{4\delta}$. At $\beta = -\frac{1}{4}$ the function x^*_β is continuous, hence the function $EMV_I(\cdot)$ is continuous as well, and in particular monotonicity is preserved in its neighborhood. We now consider the point $\beta = -\frac{1-\delta}{4\delta}$. To show that monotonicity is preserved at this β, we need to show that at this point, the expected margin of victory of the incumbent when her corruption level is $x = 1$ is weakly lower than her expected margin of victory when her corruption level is $x = -4\beta$. That is, we need to show that

$$2E_y[F_\beta(\tfrac{y-1}{4}) \mid y > 4\beta + 1] - 1 \leq 2E_y[F_\beta(\tfrac{y}{4} + \beta)] - 1.$$

Equivalently, it is sufficient to show that the analogous inequality for the expected percentage of votes holds:

$$E_y[F_\beta(\tfrac{y-1}{4}) \mid y > 4\beta + 1] \leq E_y[F_\beta(\tfrac{y}{4} + \beta)]. \tag{14}$$

Now,

$$\begin{aligned} E_y[F_\beta(\tfrac{y}{4} + \beta)] &= \int_0^1 F_\beta(\tfrac{y}{4} + \beta)\mathrm{d}y \\ &= \int_0^{-4\beta} F_\beta(\tfrac{y}{4} + \beta)\mathrm{d}y + \int_{-4\beta}^1 F_\beta(\tfrac{y}{4} + \beta)\mathrm{d}y. \end{aligned}$$

Since F_β is a cumulative distribution function, the function $y \mapsto F_\beta(\frac{y}{4} + \beta)$ is non-decreasing on $[0, 1]$. This implies that

$$\frac{\int_0^{-4\beta} F_\beta(\frac{y}{4} + \beta)\mathrm{d}y}{-4\beta} \leq \int_0^1 F_\beta(\tfrac{y}{4} + \beta)\mathrm{d}y.$$

Moreover, by substituting the integration parameter,

$$\int_0^{-4\beta} F_\beta(\tfrac{y}{4} + \beta)\mathrm{d}y = \int_{1+4\beta}^1 F_\beta(\tfrac{y-1}{4})\mathrm{d}y.$$

The last two equations imply that

$$\begin{aligned}
E_y[F_\beta(\tfrac{y}{4}+\beta)] &= \int_0^1 F_\beta(\tfrac{y}{4}+\beta)\mathrm{d}y \\
&\geq \frac{\int_0^{-4\beta} F_\beta(\frac{y}{4}+\beta)\mathrm{d}y}{-4\beta} \\
&= \frac{\int_{1+4\beta}^{1} F_\beta(\frac{y-1}{4})\mathrm{d}y}{-4\beta} \\
&= \frac{\int_{1+4\beta}^{1} F_\beta(\frac{y-1}{4})\mathrm{d}y}{P(y>4\beta+1)} \\
&= E_y[F_\beta(\tfrac{y-1}{4}) \mid y > 4\beta+1],
\end{aligned}$$

and Equation (14) holds. We conclude that the function $EMV_I(\cdot)$ is non-increasing on the interval $[-1, 0)$. ∎

A.3 Two types of corruption

We present here the details of the model with two types of corruption. The probability $\theta_\beta(x^{\text{pub}}, x^{\text{pvt}})$ that the incumbent wins elections when her observed levels of corruption at the last period are x^{pub} and x^{pvt} is

$$\theta_\beta(x^{\text{pub}}, x^{\text{pvt}}) := \begin{cases} 1 & \alpha^{\text{pub}}x^{\text{pub}} + \alpha^{\text{pvt}}x^{\text{pvt}} + 4\beta \leq 0, \\ 1 - \alpha^{\text{pub}}x^{\text{pub}} - \alpha^{\text{pvt}}x^{\text{pvt}} - 4\beta & 0 \leq \alpha^{\text{pub}}x^{\text{pub}} + \alpha^{\text{pvt}}x^{\text{pvt}} + 4\beta \leq 1, \\ 0 & 1 \leq \alpha^{\text{pub}}x^{\text{pub}} + \alpha^{\text{pvt}}x^{\text{pvt}} + 4\beta. \end{cases} \tag{15}$$

It turns out that in the model with two types of corruption, the optimal corruption level of each component in each region is either the constant $\frac{1}{2}$ (maximal level of corruption, unaffected by competition), monotonic non-increasing (competition lowers corruption), or has a U-shape. The exact shape of the optimal level of corruption depends on the discount factor δ and on the significance that the voters assign to each component, that is, α^{pub} and α^{pvt}. The following result is a more general form of Claim 2. In its proof we explicitly provide the constants δ_0 and δ_1, that depend on α^{pub} and α^{pvt}.

Claim 4 *Set* $\delta_0 = \frac{2}{4+\alpha^{\text{pvt}}-\alpha^{\text{pub}}}$. *If* $\alpha^{\text{pub}} \leq \frac{1}{3}$ *set* $\delta_1 := \frac{2}{2+\alpha^{\text{pvt}}}$ *and* $\delta_2 := \frac{2}{2+\alpha^{\text{pub}}}$, *while if*

$\alpha^{\text{pub}} > \frac{1}{3}$ set $\delta_1 = \delta_2 := \frac{2}{2+\alpha^{\text{pub}}}$. The optimal levels of corruption $(x_\beta^{\text{pub}}, x_\beta^{\text{pvt}})$ is as follows:

	Electoral advantage with incumbent		*Electoral advantage with challenger*	
discount factor	x_β^{pub}	x_β^{pvt}	x_β^{pub}	x_β^{pvt}
$\delta < \delta_0$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
$\delta_0 < \delta < \delta_1$	$\frac{1}{2}$	*U-shape*	$\frac{1}{2}$	$\frac{1}{2}$
$\delta_1 < \delta < \delta_2$	$\frac{1}{2}$	*nonincreasing*	$\frac{1}{2}$	*nonincreasing*
$\delta_2 < \delta$	*U-shape*	*nonincreasing*	$\frac{1}{2}$	*nonincreasing*

As mentioned in the text, a plausible range of the discount factor for a five-year term is between 0.4 and 0.6. Since $\alpha^{\text{pub}} < 1$, we have $\delta_2 = \frac{2}{2+\alpha^{\text{pub}}} > \frac{2}{3}$. Consequently, the last row of the table in Claim 4 corresponds to very patient incumbents. Therefore, in practical cases we do not obtain the last row, the corruption level in the public component is at the maximum, and is unaffected by competition.

The second row of the table in Claim 4 replicates the results of Claim 1 and corresponds to two cases:

- $\delta \in [\frac{2}{4+\alpha^{\text{pvt}}-\alpha^{\text{pub}}}, \frac{2}{2+\alpha^{\text{pub}}}]$ when $1 \leq \alpha^{\text{pvt}} \leq \frac{4}{3}$.
- $\delta \in [\frac{2}{4+\alpha^{\text{pvt}}-\alpha^{\text{pub}}}, \frac{2}{2+\alpha^{\text{pvt}}}]$ when $\frac{4}{3} \leq \alpha^{\text{pvt}}$.

In both cases the U-shape is obtained for a large range of plausible discount factors. When $1 \leq \alpha^{\text{pvt}} \leq \frac{4}{3}$, the smallest interval such that $\delta \in [\frac{2}{4+\alpha^{\text{pvt}}-\alpha^{\text{pub}}}, \frac{2}{2+\alpha^{\text{pub}}}]$ is $[\frac{1}{2}, \frac{2}{3}]$ while the largest such interval is $\delta \in [\frac{3}{7}, \frac{3}{4}]$. When $\frac{4}{3} \leq \alpha^{\text{pvt}}$, the smallest interval such that $\delta \in [\frac{2}{4+\alpha^{\text{pvt}}-\alpha^{\text{pub}}}, \frac{2}{2+\alpha^{\text{pvt}}}]$ is $[\frac{1}{3}, \frac{1}{2}]$ while the largest such interval is $\delta \in [\frac{3}{7}, \frac{3}{4}]$. Both are consistent with discount factors between 0.4 and 0.6.

Before proving Claim 4 we prove the following lemma.

Lemma 1 *The optimal amount to steal is as follows.*

(A) If $\delta \leq \frac{2}{2+\alpha^{\text{pub}}}$, then $x_\beta^{\text{pub}} = \frac{1}{2}$ for every β.
In addition,
(A.1) If $\delta \leq \frac{2}{4+\alpha^{\text{pvt}}-\alpha^{\text{pub}}}$ then $x_\beta^{\text{pvt}} = \frac{1}{2}$ for every β.
(A.2) If $\frac{2}{4+\alpha^{\text{pvt}}-\alpha^{\text{pub}}} \leq \delta \leq \frac{2}{2+\alpha^{\text{pvt}}}$ then

$$x_\beta^{\text{pvt}} = \begin{cases} \frac{1}{2} & \beta \leq -\frac{1}{4}, \\ -\frac{4\beta+\frac{\alpha^{\text{pub}}}{2}}{\alpha^{\text{pvt}}} & -\frac{1}{4} \leq \beta \leq -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8}, \\ \frac{1}{2} & -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8} \leq \beta. \end{cases}$$

(A.3) If $\frac{2}{2+\alpha^{\text{pvt}}} \leq \delta \leq \frac{2}{2+\alpha^{\text{pub}}}$ *then*

$$x_\beta^{\text{pvt}} = \begin{cases} \frac{1}{2} & \beta \leq -\frac{1}{4}, \\ -\frac{4\beta+\frac{\alpha^{\text{pub}}}{2}}{\alpha^{\text{pvt}}} & -\frac{1}{4} \leq \beta \leq -\frac{\alpha^{\text{pub}}}{8}, \\ 0 & -\frac{\alpha^{\text{pub}}}{8} \leq \beta \leq -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8}, \\ \frac{1}{2} & -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8} \leq \beta. \end{cases}$$

(B) If $\delta \geq \frac{2}{2+\alpha^{\text{pub}}}$, *then* x_β^{pub} *and* x_β^{pvt} *are given by the following table:*

Range of β	x_β^{pub}	x_β^{pvt}
$\beta \leq -\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$,
$-\frac{1}{4} \leq \beta \leq -\frac{\alpha^{\text{pub}}}{8}$	$\frac{1}{2}$	$-\frac{4\beta+\frac{\alpha^{\text{pub}}}{2}}{\alpha^{\text{pvt}}}$,
$-\frac{\alpha^{\text{pub}}}{8} \leq \beta \leq -\frac{1-\delta}{4\delta}$	$-\frac{4\beta}{\alpha^{\text{pub}}}$	0,
$-\frac{1-\delta}{4\delta} \leq \beta \leq -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8}$	$\frac{1}{2}$	0,
$-\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8} \leq \beta$	$\frac{1}{2}$	$\frac{1}{2}$.

Denote

$$\underline{\beta}(\delta) := -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8}.$$

This is the threshold of β where x_β^{pvt} jumps up to $\frac{1}{2}$ as β increases. The graph of x_β^{pvt} in Case (A.3) appears in Figure 3 and the graph of both x_β^{pub} and x_β^{pvt} in Case (B) appears in Figure 4.

Figure 3: Optimal corruption of private good for different levels of electoral competition; Case (A.3) of Claim 2.

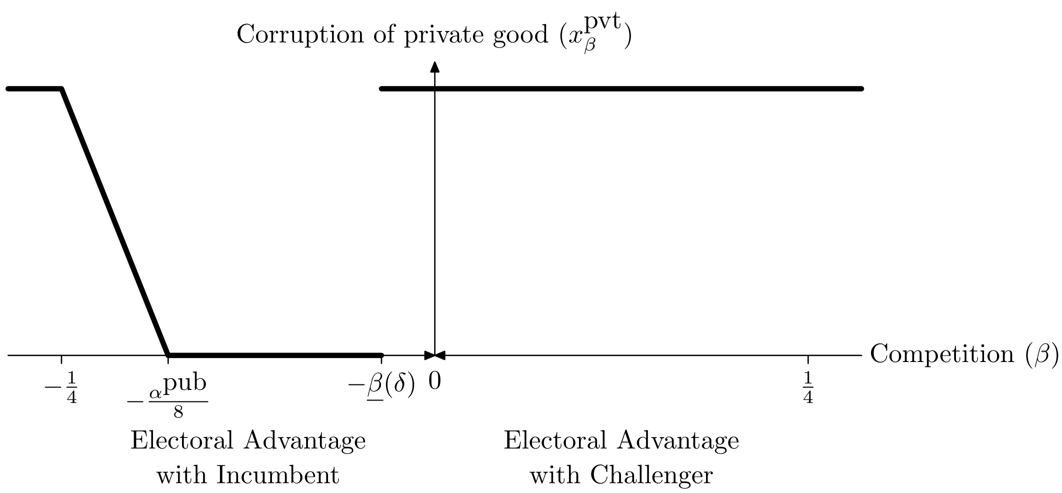
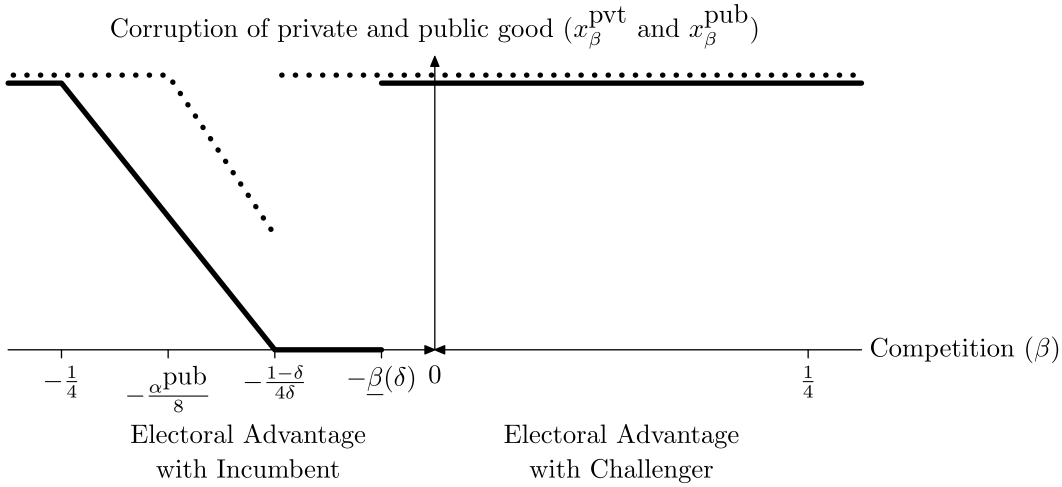


Figure 4: Optimal corruption of private good for different levels of electoral competition; Case (B) of Claim 2. The dark line is x_β^{pvt}; the dotted line is x_β^{pub}.



Proof. If the incumbent increases x^{pub} and decreases x^{pvt} by the same amount, then the sum $x^{\text{pub}} + x^{\text{pvt}}$, which represents the per stage amount stolen by the incumbent, does not change, while the probability of winning elections increases because $\alpha^{\text{pub}} < \alpha^{\text{pvt}}$. Since $v_\beta(x^{\text{pub}}, x^{\text{pvt}}) = \frac{x^{\text{pub}}+x^{\text{pvt}}}{1-\delta\theta_\beta(x^{\text{pub}},x^{\text{pvt}})}$, this implies that by this change the incumbent increases her total gain. Formally, for every $x^{\text{pub}} < \frac{1}{2}$, every $x^{\text{pvt}} > 0$, and every $\varepsilon > 0$ that is at most both x^{pvt} and $\frac{1}{2} - x^{\text{pub}}$, we have $v_\beta(x^{\text{pub}}, x^{\text{pvt}}) < v_\beta(x^{\text{pub}} + \varepsilon, x^{\text{pvt}} - \varepsilon)$. This implies that $x_\beta^{\text{pub}} = \frac{1}{2}$ or $x_\beta^{\text{pvt}} = 0$ (or both). We will calculate the optimal x^{pvt} for $x^{\text{pub}} = \frac{1}{2}$, the optimal x^{pub} for $x^{\text{pvt}} = 0$, and find out which option is the optimal behavior for the incumbent.

As in the proof of Claim 1, in the region in which θ_β is constant (either the constant 1 or 0), the value function is increasing in x^{pvt} and in x^{pub}. We turn to study the value function in the region in which θ_β is not constant. We start by calculating the directional derivatives of the value function v_β in this region.

$$\frac{\partial v}{\partial x^{\text{pub}}}(x^{\text{pub}}, x^{\text{pvt}}) = \frac{1-\delta+4\beta\delta+\delta x^{\text{pvt}}(\alpha^{\text{pvt}}-\alpha^{\text{pub}})}{(1-\delta\theta_\beta(x^{\text{pub}}, x^{\text{pvt}}))^2}, \tag{16}$$

$$\frac{\partial v}{\partial x^{\text{pvt}}}(x^{\text{pub}}, x^{\text{pvt}}) = \frac{1-\delta+4\beta\delta-\delta x^{\text{pub}}(\alpha^{\text{pvt}}-\alpha^{\text{pub}})}{(1-\delta\theta_\beta(x^{\text{pub}}, x^{\text{pvt}}))^2}. \tag{17}$$

We will now calculate the optimal x^{pvt} when $x^{\text{pub}} = \frac{1}{2}$. As mentioned above, we restrict attention to the interval I_β^1 in which $\theta_\beta(\frac{1}{2}, x^{\text{pvt}}) = 1 - \frac{\alpha^{\text{pub}}}{2} - \alpha^{\text{pvt}} x^{\text{pvt}} - 4\beta$, which is given by:

- If $-\frac{1}{4} \leq \beta \leq -\frac{\alpha^{\text{pub}}}{8}$, the interval I_β^1 is $-\frac{4\beta+\frac{\alpha^{\text{pub}}}{2}}{\alpha^{\text{pvt}}} \leq x^{\text{pvt}} \leq \frac{1}{2}$.

- If $-\frac{\alpha^{\text{pub}}}{8} \leq \beta \leq 0$, the interval I^1_β is $0 \leq x^{\text{pvt}} \leq \frac{1}{2}$.
- If $0 \leq \beta \leq \frac{\alpha^{\text{pvt}}}{8}$, the interval I^1_β is $0 \leq x^{\text{pvt}} \leq \frac{1-4\beta-\frac{\alpha^{\text{pub}}}{2}}{\alpha^{\text{pvt}}}$.
- Otherwise the interval I^1_β is empty.

Substituting $x^{\text{pub}}_\beta = \frac{1}{2}$ in Equation (17) we observe that $\frac{\partial v}{\partial x^{\text{pvt}}}(\frac{1}{2}, x^{\text{pvt}}) > 0$ if and only if $\beta > -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8}$. Thus, if

$$\beta > -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}} - \alpha^{\text{pub}}}{8},$$

then the directional derivative is positive on I^1_β, and it is optimal for the incumbent to steal $x^{\text{pvt}}_\beta = \frac{1}{2}$. If, on the other hand,

$$\beta < -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}} - \alpha^{\text{pub}}}{8}, \tag{18}$$

then the directional derivative is decreasing on I^1_β, and it is optimal for the incumbent to steal the lower end of the interval I^1_β.

When Equation (18) holds, the shape of the function $x^{\text{pvt}} \mapsto v_\beta(\frac{1}{2}, x^{\text{pvt}})$ is see-saw: it increases until the lower end of I^1_β, decreases up to the upper end of I^1_β, and then increases up to $\frac{1}{2}$ (in case $\frac{1}{2}$ is not the upper end of I^1_β). It follows that the optimal x^{pvt} is either the lower end of the interval I^1_β or $\frac{1}{2}$. When $\beta \leq 0$, the upper end of I^1_β is $\frac{1}{2}$, hence the optimal x^{pvt} is attained at the lower end of I^1_β. When $\beta > 0$, to calculate the optimal x^{pvt} we need to compare $v_\beta(\frac{1}{2}, \frac{1}{2}) = 1$ and $v_\beta(\frac{1}{2}, 0) = \frac{1}{2(1-\delta)}$. Simple calculations show that if $\delta < \frac{1}{2}$ then $v_\beta(\frac{1}{2}, \frac{1}{2}) > v_\beta(\frac{1}{2}, 0)$ and $x^{\text{pvt}} = \frac{1}{2}$ is optimal, while if $\delta > \frac{1}{2}$ then $v_\beta(\frac{1}{2}, \frac{1}{2}) < v_\beta(\frac{1}{2}, 0)$ and $x^{\text{pvt}} = 0$ is optimal. We note that the last case we considered is possible only when $0 \leq \beta < -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8}$, which implies that $\delta > \frac{2}{2+\alpha^{\text{pvt}}-\alpha^{\text{pub}}} \geq \frac{1}{2}$, and therefore in this case the optimal amount of private good to steal is $x^{\text{pvt}} = 0$. We finally note that the quantity $-\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8}$ can take any value in $(-\infty, \frac{1}{4})$. To summarize, the optimal behavior when $x^{\text{pub}} = \frac{1}{2}$ is given by the following table:

Range of β	x^{pvt}
$\beta \leq -\frac{1}{4}$	$\frac{1}{2}$,
$-\frac{1}{4} \leq \beta \leq -\frac{\alpha^{\text{pub}}}{8}$	$-\frac{4\beta+\frac{\alpha^{\text{pub}}}{2}}{\alpha^{\text{pvt}}}$,
$-\frac{\alpha^{\text{pub}}}{8} \leq 0$	0,
$0 \leq \beta \leq -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8}$	0,
$-\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8} \leq \beta$	$\frac{1}{2}$.

We note that the second and third lines in this table may be missing; this happens when $-\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}} - \alpha^{\text{pub}}}{8} < 0$.

We now calculate the optimal x^{pub} when $x^{\text{pvt}} = 0$. The analysis is analogous to the previous case. We concentrate on the interval I^2_β in which $\theta_\beta(x^{\text{pub}}, 0) = 1 - \alpha^{\text{pub}} x^{\text{pub}} - 4\beta$. This interval is given by:

- If $-\frac{\alpha^{\text{pub}}}{8} \leq \beta \leq 0$, the interval I^2_β is $-\frac{4\beta}{\alpha^{\text{pub}}} \leq x^{\text{pub}} \leq \frac{1}{2}$.
- If $0 \leq \beta \leq \frac{\alpha^{\text{pvt}}}{8}$, the interval I^2_β is $0 \leq x^{\text{pub}} \leq \frac{1}{2}$.
- If $\frac{\alpha^{\text{pvt}}}{8} \leq \beta \leq \frac{1}{4}$, the interval I^2_β is $0 \leq x^{\text{pub}} \leq \frac{1-4\beta}{\alpha^{\text{pub}}}$.
- Otherwise the interval I^2_β is empty.

On the interval I^2_β, the directional derivative $\frac{\partial v}{\partial x^{\text{pub}}}$ is given by $\frac{\partial v}{\partial x^{\text{pub}}}(x^{\text{pub}}, x^{\text{pvt}}) = \frac{1-\delta+4\beta\delta}{((1-\delta\theta_\beta(x^{\text{pub}}, x^{\text{pvt}}))^2}$. If $\beta > -\frac{1-\delta}{4\delta}$ then the derivative $\frac{\partial v_\beta}{\partial x^{\text{pub}}}(x^{\text{pub}}, 0)$ is positive on I^2_β, hence the optimal amount of public good to steal is $x^{\text{pub}} = \frac{1}{2}$.

If, on the other hand, $\beta < -\frac{1-\delta}{4\delta}$ then the derivative $\frac{\partial v_\beta}{\partial x^{\text{pub}}}(x^{\text{pub}}, 0)$ is negative whenever $\theta_\beta(x^{\text{pub}}, 0) = 1 - \alpha^{\text{pub}} x^{\text{pub}} - 4\beta$. Since β is negative, either $\beta \leq -\frac{\alpha^{\text{pub}}}{8}$, in which case the interval I^2_β is empty, and the optimal amount of public good to steal is $x^{\text{pub}} = \frac{1}{2}$, or $-\frac{\alpha^{\text{pub}}}{8} < \beta < -\frac{1-\delta}{4\delta}$, in which case the optimal amount of public good to steal is the lower end of the interval I^2_β, namely $x^{\text{pub}} = -\frac{4\beta}{\alpha^{\text{pub}}}$. To summarize, the optimal behavior when $x^{\text{pvt}} = 0$ is given by the following table:

Range of β	x^{pub}
$\beta \leq -\frac{\alpha^{\text{pub}}}{8}$	$\frac{1}{2}$,
$-\frac{\alpha^{\text{pub}}}{8} \leq \beta \leq -\frac{1-\delta}{4\delta}$	$-\frac{4\beta}{\alpha^{\text{pub}}}$,
$-\frac{1-\delta}{4\delta}$	$\frac{1}{2}$.

Finally we note that the condition $-\frac{1-\delta}{4\delta} < -\frac{\alpha^{\text{pub}}}{8}$ is equivalent to $\delta < \frac{2}{2+\alpha^{\text{pub}}}$. We now summarize our findings.

1. If $-\frac{1-\delta}{4\delta} < -\frac{\alpha^{\text{pub}}}{8}$, when $x^{\text{pvt}} = 0$ the optimal solution is $x^{\text{pub}}_\beta = \frac{1}{2}$. Indeed, for $\beta < -\frac{\alpha^{\text{pub}}}{8}$ the interval I^2_β is empty, while for $\beta \geq -\frac{1-\delta}{4\delta}$ the directional derivative is positive on I^2_β. It follows that the optimal value of x^{pvt} is derived from the calculation in the case $x^{\text{pub}} = \frac{1}{2}$. The optimal value of x^{pvt} depends on the value of $-\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}} - \alpha^{\text{pub}}}{8}$. This corresponds to Case (A) of the lemma.

   If $-\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}} - \alpha^{\text{pub}}}{8} \leq -\frac{1}{4}$ then the optimal amount of private good to steal is always $\frac{1}{2}$. This inequality solves to $\delta < \frac{2}{4+\alpha^{\text{pvt}} - \alpha^{\text{pub}}}$, and corresponds to Case (A.1).

If $-\frac{1}{4} \leq -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8} \leq -\frac{\alpha^{\text{pub}}}{8}$ then for $\beta \in (-\frac{1}{4}, -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8})$ the optimal amount of private good to steal is $-\frac{4\beta+\frac{\alpha^{\text{pub}}}{2}}{\alpha^{\text{pvt}}}$. This inequality solves to $\frac{2}{4+\alpha^{\text{pvt}}-\alpha^{\text{pub}}} \leq \delta \leq \frac{2}{2+\alpha^{\text{pvt}}}$, and corresponds to Case (A.2).

If $-\frac{\alpha^{\text{pub}}}{8} \leq -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8}$ then for $\beta \in (-\frac{\alpha^{\text{pub}}}{8}, -\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8})$ the optimal amount of private good to steal is 0. This inequality solves to $\frac{2}{2+\alpha^{\text{pvt}}} \leq \delta$, and corresponds to Case(A.3).

2. If $-\frac{\alpha^{\text{pub}}}{8} < -\frac{1-\delta}{4\delta}$ then:

   (a) When $x^{\text{pvt}} = 0$, the optimal amount of public good to steal is $x^{\text{pub}} = \frac{1}{2}$, unless $-\frac{\alpha^{\text{pub}}}{8} \leq \beta \leq -\frac{1-\delta}{4\delta}$. This implies that when $\beta \leq -\frac{\alpha^{\text{pub}}}{8}$ or $-\frac{1-\delta}{4\delta} \leq \beta$ we have $x^{\text{pub}}_{\beta} = \frac{1}{2}$, which corresponds to all rows except the third row in the table in Case (B).

   (b) For the third row in Case (B) we note that the optimal amount of private good to steal when $x^{\text{pub}} = \frac{1}{2}$ is $x^{\text{pvt}} = 0$. Hence the optimal amount of private good to steal is $x^{\text{pvt}}_{\beta} = 0$, and the optimal amount of public good to steal was calculated for this case above.

■

Proof of Claim 2.

Recall that we assumed $\alpha^{\text{pvt}} > 1 > \alpha^{\text{pub}}$.

Part (A) of Claim 4 implies that the function x^{pub}_{β} is constant in both regions whenever $\delta \leq \frac{2}{2+\alpha^{\text{pub}}}$, and Part (B) of Claim 4 implies that it has a U-shape in the negative region and is constant in the positive region whenever $\delta \geq \frac{2}{2+\alpha^{\text{pub}}}$. We turn to study the shape of the function x^{pvt}.

Part (A.1) of Claim 4 shows that the function x^{pvt}_{β} is constant in both regions whenever $\delta \leq \frac{2}{4+\alpha^{\text{pvt}}-\alpha^{\text{pub}}}$, which explains the first row in the table in Claim 2.

Denote $\delta_* := \frac{2}{2+\alpha^{\text{pvt}}-\alpha^{\text{pub}}}$, which is smaller than 1 because $\alpha^{\text{pvt}} > \alpha^{\text{pub}}$. This discount factor satisfies $-\frac{1-\delta_*}{4\delta_*} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8} = 0$, so that one of the cutoff points in Parts (A.2), (A.3), and (B) of Claim 4 is 0. In particular, $\delta < \delta_*$ if and only if $-\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8} < 0$.

Since $\frac{2}{2+\alpha^{\text{pvt}}} < \frac{2}{2+\alpha^{\text{pvt}}-\alpha^{\text{pub}}}$, in Part (A.2) of Claim 4 the function x^{pvt}_{β} has a U-shape in the negative region and is constant in the positive region.

If $\frac{2}{2+\alpha^{\text{pub}}} \leq \delta_*$ (which holds when $\alpha^{\text{pvt}} \leq \frac{4}{3}$), then in Part (A.3) of Claim 4 the function x^{pvt}_{β} has a U-shape in the negative region and is constant in the positive region. If, on the other hand, $\delta_* \leq \frac{2}{2+\alpha^{\text{pub}}}$, then in Part (A.3) of Claim 4 the function x^{pvt}_{β} is monotonic non-increasing in both regions.

In Part (B) the function x_β^{pub} has a U-shape in the negative region and is constant in the positive region, and the function x_β^{pvt} is monotonic non-increasing in the negative region. In the positive region, the function x_β^{pvt} is constant if $\delta \geq \delta_*$ and is monotonic non-increasing otherwise. The result follows. ∎

A.4 Frequency of elections

An important practical question concerns the relation between the length of the term and the amount that the incumbent steals. In this section we investigate this question. Suppose that election takes place each n periods, for $n \geq 1$. As before, the incumbent maximizes her total expected discounted payoff, while voters vote according to the average level of corruption during the term. The parameter that the incumbent has to determine after each election is the average level of corruption during the current term. Since the problem is stationary, this amount does not depend on calendar time, and is denoted by x. Note that since the incumbent maximizes her discounted utility, she will steal more in the first years in office, and will compensate that with a lower level of corruption in later years.

The total expected discounted payoff to the incumbent is

$$v_{\beta,n}(x) = \frac{x(1+\delta+\cdots+\delta^{n-1})}{1-\delta^n\theta_\beta(x)} = \frac{1-\delta^n}{1-\delta} \cdot \frac{x}{1-\delta^n\theta_\beta(x)}.$$

The multiplicative term $\frac{1-\delta^n}{1-\delta}$ does not affect the strategic decision of the incumbent, hence the optimal average corruption level $x^* = x^*_{\beta,n}$ is the same as in the case of $n = 1$ that we solved above, with the only exception that the discount factor is δ^n rather than δ.

In both models of Sections (2.1) and (2.3), the discount factor affected the optimal behavior only through the cutoffs $-\frac{1-\delta}{4\delta}$ and $-\frac{1-\delta}{4\delta} + \frac{\alpha^{\text{pvt}}-\alpha^{\text{pub}}}{8}$. Both of these cutoffs increase as the incumbent becomes more patient. When n decreases, δ^n increases, and therefore when terms are shortened the cutoffs increase. As can be seen in Figures 3 and 4, it follows that when the discount factor increases, the range in which the incumbent does not steal the whole pot increases. We deduce that in our model, shortening the term in office (increasing the frequency of elections) increases the range in which corruption is low.

A.5 Robustness: Alternative model

B Model

In this section we present an alternative models to the one presented in Section 2 to show that our results are robust to having symmetric and strategic parties. The model is essentially a one-shot game: at the outset of the game each party strategically fixes its corruption level, and then the voters vote according to the announced corruption levels and ideology.

As in Section 2, there is a continuum of voters, the ideology space is $[-1, 1]$, and the voters' ideology distribution is captured by the CDF F with median $\beta' < 0$. There are two parties, L and R, with ideology -1 and 1, respectively. The game is infinitely repeated. The parties move first, and simultaneously set their corruption level; Party L's (resp. Party R) corruption level is denoted by x_L (resp. x_R); these levels are interpreted as party platforms and are observed by the voters. The voters move second, and they vote according to the parties' platform: voter j with ideology z_j votes to Party L if and only if $-x_L - (z_j + 1)^2 \geq -x_R - (z_j - 1)^2$.

The parties care only about winning and rents. For example, Party L's utility is

$$\sum_{t=1}^{\infty} \delta^{t-1} x_L \mathbf{1}_{\{\text{Party L is in power at stage } t\}}.$$

We set $\beta = 4\beta'$. Elections are affected by a random shock ξ, which is uniformly distributed in the interval $[-\varepsilon, \varepsilon]$, and the disutility of a voter from a party is the square of the ideology difference plus the party's announced corruption level. Consequently, the probability that Party L wins is

$$\begin{aligned} \mathbf{P}(\text{L wins}) &= \mathbf{P}(x_L + (\beta' + 1)^2 + \xi \leq x_R + (\beta' - 1)^2) && (19)\\ &= \mathbf{P}(\xi \leq x_R - x_L - 4\beta'), && (20)\\ &= \mathbf{P}(\xi \leq x_R - x_L - \beta). && (21) \end{aligned}$$

We will now solve for the equilibrium of this game, and verify the U-shape relation between competition and corruption.

The expected utility of the two parties is

$$\begin{aligned} u_L(x_L, x_R) &= x_L \mathbf{P}(\text{L wins}), && (22)\\ u_R(x_L, x_R) &= x_R(1 - \delta \mathbf{P}(\text{R wins})). && (23) \end{aligned}$$

Since ξ is uniformly distributed in $[-\varepsilon, \varepsilon]$,

- If $x_R - x_L - \beta \geq \varepsilon$, then $\mathbf{P}(\text{L wins}) = 1$. In this case, $u_L(x_L, x_R) = x_L$ and $u_R(x_L, x_R) = 0$.

- If $x_R - x_L - \beta \leq -\varepsilon$, then $\mathbf{P}(\text{L wins}) = 0$. In this case, $u_L(x_L, x_R) = 0$ and $u_R(x_L, x_R) = x_R$.

- If $-\varepsilon \leq x_R - x_L - \beta \leq \varepsilon$, then $\mathbf{P}(\text{L wins}) = \frac{x_R - x_L - \beta + \varepsilon}{2\varepsilon}$. In this case,

$$u_L(x_L, x_R) = x_L \frac{x_R - x_L - \beta + \varepsilon}{2\varepsilon}, \quad (24)$$

$$u_R(x_L, x_R) = x_R \frac{\varepsilon - x_R + x_L + \beta}{2\varepsilon}. \quad (25)$$

We start by looking for an equilibrium in an interior point. To this end we differentiate the functions u_L and u_R of Eqs. (24)–(25).

$$\frac{\partial u_L}{\partial x_L}(x_L, x_R) = \frac{x_R - 2x_L - \beta + \varepsilon}{2\varepsilon},$$

$$\frac{\partial u_R}{\partial x_R}(x_L, x_R) = \frac{\varepsilon + x_L - 2x_R + \beta}{2\varepsilon}.$$

The first order conditions are:

$$\frac{\partial u_L}{\partial x_L}(x_L, x_R) = 0 \iff x_R = 2x_L + \beta - \varepsilon,$$

$$\frac{\partial u_R}{\partial x_R}(x_L, x_R) = 0 \iff x_R = \tfrac{x_L + \beta + \varepsilon}{2}.$$

The two derivatives vanish at

$$x_L = \varepsilon - \tfrac{\beta}{3}, \quad x_R = \varepsilon + \tfrac{\beta}{3}. \quad (26)$$

It follows that if $0 \leq \varepsilon + \frac{\beta}{3}$ and $\varepsilon - \frac{\beta}{3} \leq 1$, then the unique solution is given by (26). In this case $\mathbf{P}(\text{L wins}) = \frac{-\beta + 3\varepsilon}{6\varepsilon}$. When $0 \geq \varepsilon + \frac{\beta}{3}$ or $\varepsilon - \frac{\beta}{3} \geq 1$ the solution will be on the boundary of the unit square $[0,1]^2$. If $0 \geq \varepsilon + \frac{\beta}{3}$ and $\varepsilon - \frac{\beta}{3} \leq 1$ then $x_R = 0$, and therefore $x_L = \frac{-\beta + \varepsilon}{2}$, provided $\frac{-\beta + \varepsilon}{2} \leq 1$, and $x_L = 1$ otherwise. If $0 \leq \varepsilon + \frac{\beta}{3}$ and $\varepsilon - \frac{\beta}{3} \geq 1$ then $x_L = 1$, and therefore $x_R = \frac{1 + \beta + \varepsilon}{2}$, provided that $0 \leq \frac{1 + \beta + \varepsilon}{2} \leq 1$, and $x_R = 1$ otherwise. Figure 4 depicts the equilibrium strategies, which are functions of the level of competition β and of the level of uncertainty ε.

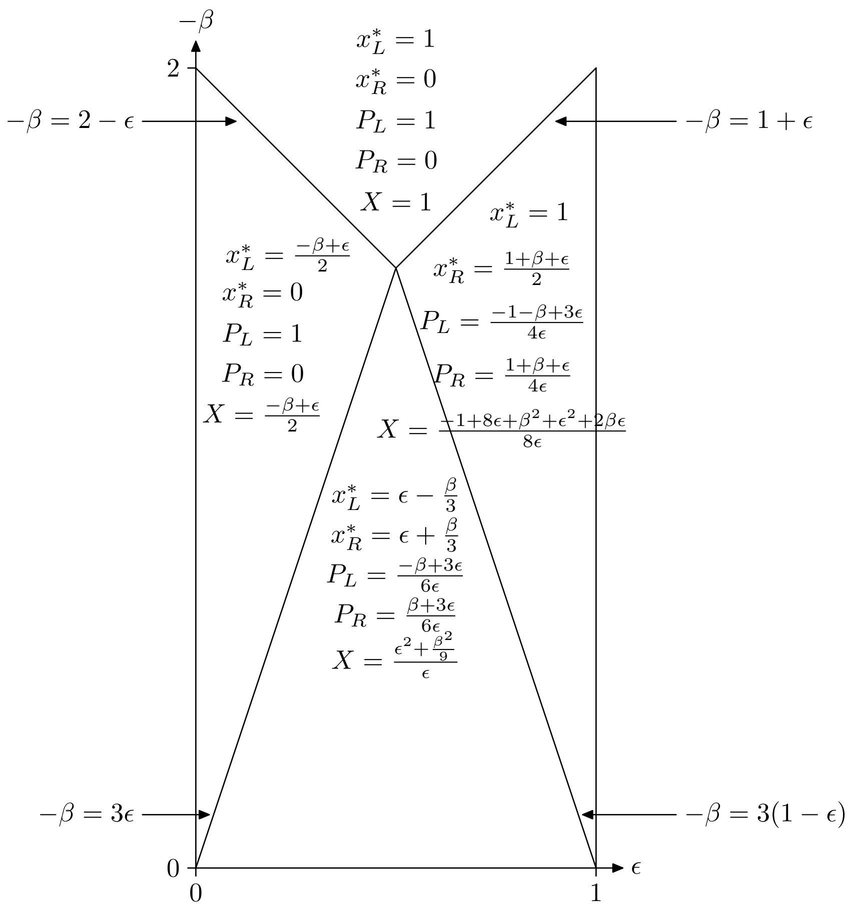


Figure 4: Equilibrium party corruption levels (x_L^* and x_R^*), probability of winning (P_L and P_R), and expected party's corruption level (X).

One can verify that the corruption level of the larger party, Party L, is monotone increasing with competition, while the corruption level of the smaller party, Party R, is monotone decreasing with competition. The expected corruption level of the incumbent party, denoted X, is a weighted average of these two quantities (see Figure 5):

$$X := P(\text{L wins})x_L + P(\text{R wins})x_R.$$

It turns out that that the expected corruption level of the incumbent party, X is monotone decreasing in corruption when the level of uncertainty (the parameter ε) is not too large (that is, $\varepsilon < 0.95$) and it has a U-shape when the level of uncertainty is large ($\varepsilon > 0.95$), see Figure 5. Since we no longer have an Incumbent and Challenger we cannot say anything about the cases when electoral advantage is with the incumbent and when it is against. Note, though, that the U-shape is somewhat shallow, and the difference between its deepest and highest points is about 12%. We argue that this is a limitation of using the uniform distribution. One might expect uncertainty to be correlated with β systematically- since closer elections are also characterised by greater randomness in the results (indeed many authors use close elections as a way to identify incumbency effects). In that case we may expect to find a deeper U. However, qualitatively the results of our main model hold.

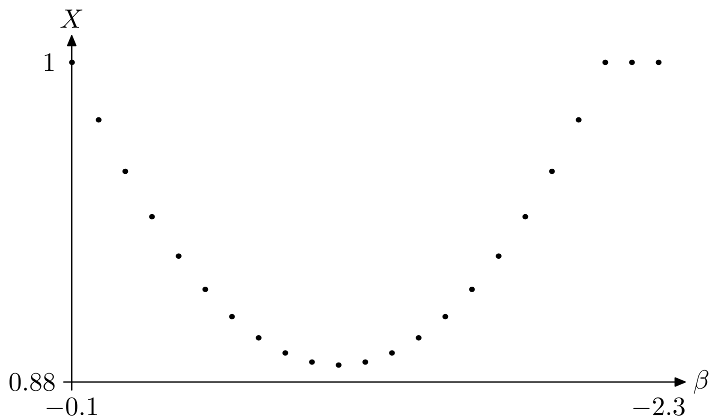


Figure 5: Equilibrium expected corruption level in the first model for $\varepsilon = 1.1$.