Corruption as an informal fiscal system*

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Abstract

Persistent corruption and limited fiscal capacity often go hand-in-hand. We explore one reason why governments may fail to address both issues: the possibility that corruption supports an informal, parallel fiscal system. In settings with low state capacity and resources, governments implicitly expect lower-level officials to extract rents from citizens in order to fund the delivery of public goods and services. Using survey data and government accounts from India and Pakistan, we show that public officials cover funding gaps in public services at least partially through personal funds and extracted bribes. We propose a model of bureaucratic agency to explore when governments benefit from sustaining such systems and investigate welfare implications. Informal fiscal systems are more likely to arise when monitoring corruption is costly relative to monitoring the provision of public services, and politically-important groups of citizens do not bear the full cost of corruption.

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Introduction

Developing countries often face the twin problems of persistent corruption and limited fiscal capacity (Besley and Persson, 2014), particularly at the local level (Gadenne and Singhal, 2014). High levels of corruption increase the risk that transfers to local governments "leak out" before reaching local areas (Reinikka and Svensson, 2004; Olken, 2006, 2007; Ferraz et al., 2012; Olken and Pande, 2012; Niehaus and Sukhtankar, 2013), thus reducing the benefits of investing in fiscal capacity. With limited funds available to monitor corruption, governments often turn a blind eye to it, even when they are aware of its existence and of its adverse consequences (Mauro, 2004; Mishra, 2006).

In this paper we present one reason for the co-existence of corruption and low formal fiscal capacity: the role of corruption in supporting parallel, informal fiscal systems. In the environments we study, central authorities do not provide local public officials with even the basic resources they need to carry out their job: no petrol for police cars, or no materials for flood relief. Local officials are expected to provide these public services in the absence of full government funding, relying on rents extracted from local communities.

The phenomenon we study is distinct from socially enforced systems of informal taxation, in which citizens come together to provide labor or funds for building local public goods in the absence of government funding, and local officials only act as coordinators (Olken and Singhal, 2011). In informal fiscal systems supported by corruption, local officials extract rents from citizens - acts that are illegal yet implicitly permitted by the government - in order to provide public services such as policing or flood relief.

We first document that these informal fiscal systems exist in the bureaucracies of two big developing countries where bribes are common. We then propose a model of bureaucratic agency to explore when governments want to sustain such systems. We show that there exist equilibria where governments prefer low corruption monitoring and low formal taxation.

We start with a motivating example from policing in India. We conduct a detailed accounting exercise comparing the costs required and the government funds available for patrolling in police vehicles, using data from 180 police stations in a large state in India. We find that the most conservative estimates of the petrol expenditure required for these patrols is more than the amount of funds provided by the government. The funding gap is large relative to the salary of police officers, and evidence suggests that police officials are

"supposed to find other means"[1] to fill this gap; multiple surveys and reports corroborate corrupt behavior by police.[2]

Next, we examine the provision of services by local bureaucrats in Pakistan. Survey evidence indicates that these bureaucrats used personal monies to fund flood control and relief (61% of 750 surveys), visits of senior civil servants (82%), and free food to the public (25%). Respondents indicated that providing these services is part of their responsibilities, but that they had no government funding for it. The size of this informal fiscal system is approximately 4.3 billion PKR per year, equivalent to 4.5% of the government's main cash transfer program (BISP) in 2015-16 or 558 PKR per eligible family.

We corroborate these survey responses through an independent survey of bureaucrats' supervisors. Nearly all supervisors (98%) confirm that local bureaucrats pay for public services without official funds, and 90% claim that the government does not provide sufficient funds for these local public goods as it knows that local bureaucrats earn bribes and can cover the difference. We also show that there is a significant gap between the cost of providing these services and the share of salary that bureaucrats report spending on them. We posit that the gap is filled by bribes received by local bureaucrats. This is consistent with the frequency of bribe payments to these officials reported in a survey of citizens.[3]

Funding gaps in public service provision are not uncommon. For example, public school teachers even in developed countries like the USA often pay for school supplies out of their own pockets or community donations (e.g. bake sales), as do officials in other developing countries.[4] In our setting, while some contributions may come from officials' own resources, the majority comes from bribes or other forms of corruption; this fact has a number of implications. One implication is that rents accruing to bureaucrats may be overestimated since some of the bribes are returned in the form of public services. On the other hand, corruption is costly. First, bribes are distortionary, more so than taxes (Shleifer and Vishny, 1993; Fisman and Svensson, 2007; Banerjee et al., 2012). Moreover, because informal systems reduce the incentives for the government to monitor corruption,

[1] https://www.thehindu.com/news/cities/Hyderabad//article60411103.ece, accessed March 2, 2022.

[2] According to a 2020 Transparency International report, 42% of people who had contact with the police in India had to pay a bribe (https://www.transparency.org/en/publications/gcb-asia-2020, accessed April 30, 2021).

[3] The survey also suggests that women, vulnerable, and politically less powerful groups are more likely to pay bribes.

[4] For the US, see https://www.theguardian.com/us-news/2021/dec/13/teachers-scramble-dollar-bills-south-dakota-dash-for-cash, accessed April 8, 2022. Examples from the Democratic Republic of the Congo are in Prud'Homme (1992); Lameke et al. (2022).

and because they legitimize bribe-taking for the bureaucrats, they might serve as a gateway to more corruption. In fact, supervisors of local bureaucrats in Pakistan indicated that these officials were happy to provide the public services precisely because they saw it as a way to justify collecting bribes.

As Acemoglu and Verdier (2000) note, governments choosing to correct market failures must accept some corruption. However, in our case the government is actively expecting public officials to provide services without basic official funds for them, implicitly acknowledging the existence and use of bribes to fund these services. Why not just tax more, monitor corruption and spend on public goods? What conditions determine whether informal fiscal systems arise instead?

We develop a model to understand when governments rely on such informal fiscal policies and to assess their welfare effects. We study an agency problem between an incumbent politician and a frontline bureaucrat. The bureaucrat chooses an amount of bribes to obtain and what proportion of them to spend on a public service. Bureaucrats value the provision of public services, particularly so when that provision is publicly observed, because of career concerns or social pressure. They also value keeping bribes for themselves but want to avoid getting caught. The government chooses how much to invest in corruption monitoring and how much formal taxation to impose on citizens to finance public services. The government is rewarded by voters for providing public services, but is punished when they pay high taxes and bribes. A central friction is the lack of perfect information: the government cannot assess the right amount of public services to provide, which makes bureaucrats less likely to exert effort; it also cannot perfectly observe corruption, which makes bureaucrats more likely to take bribes.

In equilibrium, the amount of public services funded by bureaucrats and the bribes they obtain depend on the ease of monitoring public good provision, the amount of public services already funded by taxes, and the risk of getting caught. Anticipating this behavior, the government sets formal taxes and monitoring optimally to maximize public services provision while minimizing taxes, bribes and monitoring costs.

The model provides a number of insights related to informal fiscal systems. First, official taxation and monitoring are substitutes to reduce the bureaucrat's accrued rents (bribes minus funds redistributed for public services). Lower taxation means that less of the public service is funded by the government, which increases the marginal value of funding the public service for the bureaucrat. As a result, the bureaucrat redistributes

more of the bribes she obtains and extracts less rents. Second, informal fiscal systems are more likely to arise when monitoring corruption is difficult or costly relative to monitoring the provision of public services (e.g. flood control or food provision): when public service delivery is less costly to monitor, it is easier to induce bureaucrats to redistribute the bribes that they obtained than from preventing them from taking those bribes in the first place. These systems are also more likely when politically-important groups of citizens - say the wealthy or pivotal ethnic groups - do not bear the full cost of corruption or do not hold the government accountable for it.[5] Third, the system imposes substantial distortions on the overall economy. Part of these distortions are due to the inherent inefficiency of bribes as a source of government income, and part of these are due to the agency cost inherent in delegating the financing of services to bureaucrats. Finally, these systems have distributional consequences; the case of free food provision from "donations" extracted from the wealthy might be progressive, but the case of police services provided using bribes paid by common citizens may well be regressive, when compared with more formal tax systems.

The informal fiscal system we present is distinct from other unconventional fiscal arrangements like tax farming, user fees for public services, or the provision of public services by non-state actors. Unlike tax farming - the delegation of tax collection to private individuals for profit (Stella, 1993; Coşgel and Miceli, 2009; Khan et al., 2016) - there is no transparent allocation of bribe (tax) collection rights by the government in informal fiscal systems (while regular tax collection continues through salaried bureaucrats). Meanwhile, although informal fiscal systems include instances of user fees, the service provided in the system we study is not necessarily conditioned on the bribes obtained. Finally, informal fiscal systems are distinct from provision by non-state groups (Grossman, 1997; Johnson et al., 1997; Alexeev et al., 2004) since the state itself expects its functionaries to provide for public services through rents, and these officials do not compete with the state in the provision of services.

Our paper contributes to the literature on public finance in developing countries. Broadly, it helps in understanding why developing countries consistently fail to both raise revenues (Gadenne and Singhal, 2014) and to invest in fiscal and legal capacity building (Acemoglu et al., 2005; Besley and Persson, 2009, 2010, 2014; Besley et al., 2013). Our findings suggest why states can have lower incentives to invest in official fiscal capacity: informal systems allow "taxes" to be levied at the jurisdictional level at which public services

[5] Alternatively, citizens might attribute the blame for bribes to bureaucrats rather than politicians. This is not the case for taxes. Such differences in voter perception could encourage politicians to support informal systems as a low cost way to fund public goods.

are provided, while making spatial redistribution more difficult (Gordon, 1983; Inman and Rubinfeld, 1996). Furthermore, our work adds to studies documenting that information frictions are an important determinant of how governments choose to collect taxes (Kiser, 1994; Balán et al., 2022). We discuss a broader informal fiscal system and argue that the relative costs of monitoring corruption and the provision of public services can make such informal systems more likely. Narrowly, our paper contributes to the literature on informal taxation (Olken and Singhal, 2011; Gadenne and Singhal, 2014; Jack and Recalde, 2015; Jibao et al., 2017; Lust and Rakner, 2018) by exploring a new form of informal fiscal policy. In particular, we explore the possibility that decentralized public good provision relies on the redistribution of bribes, rather than on voluntary contributions from the local population. Moreover, while taxpayers have higher trust in actors levying informal taxes and perceive them to be fairer than formal ones (Van den Boogaard et al., 2019), the perception of an informal fiscal system financed through corruption can be different. Recent studies have shown that tax collection can lead to a more inclusive and accountable government (Gadenne, 2017; Martinez, 2019; Weigel, 2020; Weigel and Ngindu, 2021; Dray, 2021). Our paper suggests one mechanism behind this relationship: a reduction in corruption and a fall in informal fiscal systems.

Our findings also contribute to three strands of the literature on corruption. First, we explore a new facet of the relationship between corruption and bureaucrats' incentives (Tirole, 1986; Mookherjee and Png, 1995; Niehaus and Sukhtankar, 2013), showing that governments can affect corruption by choosing the level of official funding of public services, in addition to the tools already studied in the literature (Becker and Stigler, 1974; Besley and McLaren, 1993; Di Tella and Schargrodsky, 2003; Olken, 2007; Reinikka and Svensson, 2011; Corbacho et al., 2016). Second, we describe a new force that can explain the persistence of corruption (Tirole, 1996; Dutta et al., 2013). Corruption can persist because the government finds it optimal in a second best world and because it allows the government to target taxes and transfers in a way that might not be feasible with formal taxes. Third, redistribution of bribes through an informal fiscal system makes the welfare calculations on even "corruption without theft" (Shleifer and Vishny, 1993) ambiguous.

Finally, our paper is related to the vast literature on the politically-motivated targeting of public goods (Bardhan and Mookherjee, 2020). A large theoretical (Stokes, 2007; Hicken, 2007; Padró i Miquel, 2007; Robinson and Verdier, 2013) and empirical (Wantchekon, 2003; Chandra, 2004; Ansolabehere and Snyder, 2006; Keefer, 2007; Kasara, 2007; Singer, 2009; Cruz and Keefer, 2010; Shami, 2012, 2019; Hodler and Raschky, 2014; Burgess et al.,

2015) literature discusses how incumbents might differentially tax or redistribute to either swing voters or supporters. Our paper describes how funding local public goods through redistribution of bribe allows governments to differentially tax specific citizens. Another strand of this literature emphasizes the role of political accountability for the delivery of public services, showing how it determines "bureaucratic overload" (Dasgupta and Kapur, 2020), in which bureaucrats are regularly expected to complete tasks for which they do not have sufficient resources. We complement these findings by showing that governments expect bureaucrats to use bribes to cover the gap in official funds and hence, the lack of resources might be overestimated.

1 Motivating example: Policing under resource constraints in India

The fact that providers of public services in India suffer from severe resource constraints is by no means a secret (Kapur, 2020). In the case of policing, the Status of Policing in India Reports (SPIR) provide very careful annual summaries of the shortages in personnel as well as the shortages of resources for existing personnel. The precise nature of the shortfalls, and how providers deal with these resource constraints is perhaps less well known. We complement this work with a detailed and careful documentation of one case: an accounting exercise for monthly petrol costs incurred at police stations. We survey the Station House Officer (SHO, head of the police station) in each of 180 police stations with a jurisdiction covering nearly 24 million people in a large state in India. The survey gathers details on the number and type (car or motorcycle) of police vehicles, the average number of kilometers traveled by police vehicles in the course of their regular duties, as well as the monthly budget received for "Petrol, oil and lubricants" (POL). We combine the data on the type of vehicle, the car dealer-reported mileage provided by these vehicles, and the average number of kilometers traveled to generate the number of liters of petrol needed. Using the minimum price per liter of petrol in the survey month, we generate an (extremely conservative) estimate of the required petrol budget in Rupees.

Comparing the budget required with the reported budget received, we find that the average station experiences a monthly shortfall of 14,845 INR (Table 1). Not even a single station reports having enough funding to do regular policing patrols, even with these conservative assumptions; less conservative assumptions result in an average shortfall of 15,256 INR (Table A1). As further evidence that stations lack the requisite resources for

conducting police work, some survey respondents reported that they have to use their personal vehicles for on-duty responsibilities. Finally, official budget figures for "Petrol, oil, and lubricants" funds allocated to study police stations corroborate the survey data, with a shortfall of 8,768 INR even assuming zero leakage.[6]

How, then, do the police cover these deficits? In the SPIR survey 2019, 28% of respondents agreed that they often had to spend out of pocket for things like stationery. In this case, however, it is difficult to imagine that police personnel can afford to fully pay for petrol expenses out of their salary. The salary of a constable is roughly 20,000 INR a month, while that of an Additional Sub-Inspector is around 30,000 INR a month. Newspaper reports and informal interviews with both senior and junior officials by the authors reveal that junior officers are "supposed to find other means" to support fuel budget shortages.[7] It is then no surprise that according to a nationally representative survey by Transparency International in 2019-20, 42% of people in India who had contact with the police in the previous twelve months paid a bribe, nearly twice the average rate in Asia, and the highest of all public services in India (Asia Global Corruption Barometer).

2 Flood relief and food security in Pakistan

In this section we present more detailed evidence of an informal fiscal system in Punjab, Pakistan. We study local bureaucrats working in villages and their supervisors working in Tehsils.[8]

2.1 Data

Local bureaucrat survey. We conducted a telephone survey of a random sample of local bureaucrats across Punjab in 2020. We randomly sampled 750 out of a total of 6209 bureaucrats (12%).

Supervisor survey. We telephonically surveyed the direct managers of these local bureaucrats in 2020. We stratified on districts and randomly sampled 30% of supervisors i.e.

[6] These calculations are consistent with the large number of news reports on the lack of funds for petrol across India: see, for example, the following report in the case of police in Mumbai https://www.dnaindia.com/mumbai/report-mumbai-cops-inadequate-fuel-for-patrol-vehicles-2781055, accessed June 17, 2021.

[7] https://www.thehindu.com/news/cities/Hyderabad/new-police-vehicles-are-welcome-what-about-fuel/article6146002.ece, accessed June 17, 2021.

[8] Tehsils are the smallest administrative units right above villages and union councils.

42 out of a total of 141. We were able to survey 35 of them by phone.

Citizen survey. We use a citizen survey carried out by a private firm for the provincial government in 2009. This is the only existing data set that explicitly surveys individuals that have had an experience with the local bureaucrats that are the focus of this study. The data set is composed of 1,402 men that either own or rent land.

2.2 Private funding of public services by local bureaucrats

Local bureaucrats are expected to provide a range of local public goods and services without sufficient funding from the government. We document that these routine activities include the provision of flood control and relief, free food for the poor (especially during the Islamic holy month of 'Ramazan'), and organizing the logistics for senior provincial and federal government officials' visits.[9] The size of this informal fiscal system is significant. The annual amount is approximately 4.3 billion PKR,[10] equivalent to 4.5% of the government's main cash transfer program (BISP) in 2015-16, or 558 PKR per eligible family.[11]

2.2.1 Bureaucrat perspective

Table 2 describes the informal fiscal system from the perspective of the local bureaucrats. 82% of local bureaucrats state that they are involved in the informal provision of some form of public services without sufficient official funding. Appendix Table A2 shows a breakdown of some of these public services: 82% of bureaucrats are personally involved in the provision of logistics during official visits, 61% in flood control and relief, and 25% in providing free food to the public. While flood control and relief is only provided when there is a need (excess rainfall), free food for the public is a daily activity and official visits a monthly one.

Interestingly, Table 2 shows that the chance that the government will provide at least some amount for these local public services is only 2%. By contrast, all bureaucrats agree that if any activity has to be organized at the local level, they always have to contribute

[9] Local bureaucrats are also the go-to officials when an emergency hits. During the COVID pandemic, these bureaucrats were involved in setting up quarantine centers and organizing beds, fans and free food for those quarantined.

[10] 20,154 PKR per bureaucrat, per Tehsil, per month, multiplied by 12 months and 44 bureaucrats per Tehsil in 404 Tehsils in Pakistan.

[11] https://bisp.gov.pk/Detail/Zjk1OWZkYzEtZWE2Yy00NThlLThhZDAtMzc4MWM1OWIyZjU4

some personal funds towards it. Our data also confirms the co-existence of informal taxation (Olken and Singhal, 2011) with the informal fiscal system. Local philanthropists and NGOs are involved in the provision of local public goods, and this funding is coordinated by these bureaucrats, rather than voluntarily provided.

The provision of these services accounts for almost 15% of the bureaucrat's monthly expenditure. The average official monthly income is 49,411 PKR. Therefore, local bureaucrats spend on average 7,412 PKR a month on the provision of local public goods and services. Since this calculation abstracts away from any income from bribes, this amount can be an underestimate of the overall contribution of these bureaucrats.

While 30% cite altruism as a reason for funding these services, 62% do it because of social pressure and the worry that others in the service might have a bad opinion of them. 7% cite the fear of hurting their career progression as a reason for private contributions. A slightly different picture emerges on their motivation when we consider the supervisors' perspective.

2.2.2 Supervisor perspective

In order to corroborate the existence of this informal fiscal system and to understand the government's motivations, we interviewed the supervisors of these local bureaucrats. Table 3 describes their perspective and confirms the data from the bureaucrat survey. Almost all supervisors (98%) confirm that local bureaucrats are involved in the provision of public goods. Only 8% of supervisors indicate that field bureaucrats have ever filed to be reimbursed the amount that they personally spend on these public services.

Contrary to the bureaucrat's perspective, none of the supervisors think that these local officials fund these public services out of altruism. A majority (76%) thinks that the main motivation is a fear of disciplinary action for not complying with government expectations. The opinion of others and social pressure is also cited as a reason but only by 20% of supervisors.

2.3 Could corruption fund public services?

We present three pieces of descriptive evidence that suggest that rent extraction by local officials funds public goods and services: (1) results from the supervisor survey; (2) an

accounting exercise comparing the salary of the bureaucrat with the cost of providing the public services; (3) results from a citizen survey.

Table 3 shows that almost all the supervisors believe that the government does not fully fund services as it knows that the local bureaucrats earn bribes (90%) or because it has been the norm (94%). Only 27% think that the shortfall in funds is due to difficulty in raising money through taxes and borrowing by the government. The supervisors also highlight that a cost of such an informal fiscal system is the perpetuation of corruption: 39% of them agreed that local bureaucrats are willing to spend out of pocket as it makes them less likely to be held accountable in the future. Being expected by the government to personally fund public services provides local officials with a justification for engaging in bribery. In addition, by expecting bureaucrats to personally fund these services, the government implicitly acknowledges that the funding is only possible through corruption. This vicious circle legitimizes bribe-taking and reduces accountability.

We note that supervisors had little incentives to report that their subordinates are involved in corruption. Acknowledging this reflects badly on their management skills. Therefore, we consider their responses to be an important piece of evidence suggesting that the funding gap is filled through corruption.

Next we turn to the accounting exercise. We carried out a back-of-the-envelope calculation to support the claim that bribes fund public services: we use survey data to calculate the share of the costs of these activities that are borne by local bureaucrats, and compare these costs with the share of *official* income that they claim to spend on these activities. This funding gap is either the result of lower fraction of income reported by bureaucrats, or a missing amount which must come from other sources, such as bribes. Based on the supervisor survey, the total costs per Tehsil borne by local bureaucrats is 886,757 PKR per month. With an average of 44 officials in each Tehsil, the spending is 20,154 PKR per official per month. This is much higher than the 7,415 PKR per official per month that the bureaucrats report spending out of their official income. We interpret this funding gap as suggestive evidence that other sources, like bribes, are used to bridge the gap.

Finally, a citizen survey corroborates the payment of bribes to these local bureaucrats (see Appendix Table A4 for details). Sixty-five percent of citizens report that services are denied to them until they make unofficial payments to these local officials and 82% state that they pay bribes to overcome any difficulty in accessing services. 51% of them cite corruption in the system as a major reason for disputes.

Taken together, the Pakistan and India cases suggest that bribes are widespread in these bureaucracies and can explain the gap between the costs of funding public services and the amount provided by the government. This provides the basis for an informal fiscal system. The government appears to be aware of the corruption by local bureaucrats, and expects them to personally pay for public goods and services in return. In turn, these bureaucrats appear to support this system because it allows them to engage in corruption with reduced accountability. In the next section, we provide a theoretical foundation for why such a system might exist and what can be its welfare implications.

3 Model

We consider an incumbent politician (I), a bureaucrat (A), and two groups of voters, M and N. We assume that group M is pivotal for the re-election of the incumbent, but does not represent a majority. The incumbent maximizes the expected utility of voters in group M.

Actions and timing. The incumbent moves first and chooses a policy (τ, p), where $\tau \in \mathbb{R}^+$ is a per-capita lump-sum tax and $p \in [0,1]$ is a level of monitoring which costs $C(p)$. $C(p)$ is strictly convex and its derivative is denoted $c(p)$.

The bureaucrat is in charge of delivering public services. She observes (τ, p), chooses how much bribes to take $b \in \left[0, \bar{b}\right]$ and an amount of public services to privately fund, denoted e. The bureaucrat can only spend money obtained from bribery so $0 \leq e \leq b$.

The total amount of public services, y, is $y = \tau + e - C(p)$. Taxes and personal funding by the bureaucrat are perfect substitutes to produce public services, and the cost of monitoring is deducted from the funds available. The government must keep the *official* budget balanced: $C(p) \leq \tau$.

The incumbent cannot perfectly observe whether the bureaucrat delivered the optimal amount of public services and cannot perfectly monitor bribe-taking.[12] These information frictions create an agency problem and constrains the government's ability to implement the optimal level of public service provision.

[12] For instance, the incumbent might not be able to assess the severity of a flood or the cost of providing relief.

Payoffs. The incumbent maximizes group M's utility, determined as follows: each voter in group $i \in \{N, M\}$ has utility $G_i(y) = \frac{y^{1-\gamma_i}}{1-\gamma_i}$ over public services, bears a cost $\eta_i b$ from bribes, and pays taxes τ. Let $g_i(y) = y^{-\gamma_i}$ denote the derivative of $G_i(y)$. The incumbent's objective function is therefore:

$$V(y, \tau, b) = G_M(y) - \tau - \eta_M b$$

The bureaucrat gets a base wage w and a reward $\phi F(y)$ as a function of public services provision. The parameter ϕ denotes the probability that public service delivery is publicly observed. The reward can therefore capture the bureaucrat's expected career rewards or her need to conform to norms or peer pressure, both of which are heightened when the bureaucrat's performance is publicly observed.[13] The *observability* of the public service depends on the type of good provided and the environment. For instance, the absence of flood damage can be due to less severe floods or to better emergency response by local bureaucrats. The easier it is to observe the severity of floods, the easier it is to infer the performance of the bureaucrat. We assume that $F(y)$ is continuously differentiable and strictly concave in y. Let $f(y)$ denote the derivative of $F(y)$.

In addition, the bureaucrat potentially gets punished for taking bribes. Given monitoring p, the bureaucrat is caught with probability $p \times \pi$, where $\pi \in (0, 1)$ captures the effectiveness of corruption monitoring. If caught, the bureaucrat faces punishment $b \times k$, where k captures the size of the punishment (e.g. a fine, a prison sentence, or a suspension and the associated loss of future income).[14] Finally, the bureaucrat pockets the difference between bribes and the amount of own funds spent: $b - e$. Given $y = \tau + e - C(p)$, the bureaucrat's expected utility is:

$$U_B(e, b) = w + \phi F(\tau + e - C(p)) + (b - e) - bp\pi k$$

3.1 Analysis

We solve for the Subgame Perfect Nash Equilibrium of this game.

[13] The bureaucrat may also be driven by intrinsic motivation, which would not depend on the public service delivery being observed. Our functional form simply normalizes these to be zero.

[14] We abstract away from the possibility that the bureaucrat's wage is lower than her outside option and that the government allows bribes as a form of 'capitulation wage' (Besley and McLaren, 1993), by assuming that the bureaucrat's participation constraint is always satisfied. Our analysis is therefore conditional on selection of bureaucrats. This is to focus on the informal fiscal system and the different conditions under which it arises.

Bureaucrat. Given some taxes τ and monitoring p, the bureaucrat chooses b and e to solve:

$$\max_{b,e} w + \phi F(\tau + e - C(p)) + (b - e) - bp\pi k \quad \text{s.t.} \quad 0 \leq e \leq b \quad \text{(BC)}$$

Let $\bar{e}(x) = f^{-1}\left(\frac{x}{\phi}\right)$ denote the inverse of the marginal value of public services to the bureaucrat and let $\bar{e} = \bar{e}(1)$. $\bar{e}(x)$ captures the incentives of the bureaucrat since $\bar{e}(x)$ increases as the value of providing public services increases, while $\bar{e}$ represents the level of resources that the bureaucrat would provide if there was no monitoring and no taxes.[15] Since $f^{-1}(\cdot)$ is decreasing, an increase in the observability of the public service provision, ϕ, increases incentives. The following Lemma characterizes the bureaucrat's interior best responses.[16]

Lemma 1. *Given a level of tax τ and monitoring p,*

1. *If monitoring is low ($p < \frac{1}{\pi k}$), the bureaucrat obtains the highest possible bribes, $b^* = \bar{b}$, and redistributes $e^*(p, \tau) = \bar{e} + C(p) - \tau$.*
2. *If monitoring is high ($p \geq \frac{1}{\pi k}$), the budget constraint binds, $b^* = e^*$. The bureaucrat redistributes all the bribes that she extracts: $b^*(p, \tau) = e^*(p, \tau) = \bar{e}(p\pi k) + C(p) - \tau$.*

When monitoring is high ($p \geq \frac{1}{\pi k}$), increasing monitoring has two opposite effects on corruption. It increases the marginal cost of taking bribes ($p\pi k$) but it decreases the amount available for public services by $C(p)$. Because lower official funds are available, the marginal value of contributing to public services increases. By contrast, taxes strictly decrease private contributions e^* (and therefore b^*) because higher official funding decreases the marginal value of personal contributions. Therefore, at this level of monitoring, taxes and monitoring are imperfect substitutes to control corruption: either increasing monitoring or increasing taxes can reduce bribes.

If bribes are partially redistributed, measuring corruption through bribes can overstate the extent of corruption. A more relevant measure is the rents appropriated by the bureaucrat: $R = b^* - e^*$. When monitoring is low ($p < \frac{1}{\pi k}$), rents are: $R = \bar{b} - \bar{e} - C(p) + \tau$. An increase in taxes increases rents but an increase in monitoring decreases rents. When monitoring is high ($p \geq \frac{1}{\pi k}$), rents drop to $R = 0$ as all bribes are redistributed.

[15] $\bar{e}$ maximizes the function $\phi F(e) - e$.

[16] Corner solutions are also possible: if b^* and e^* violate the budget constraint, e^* is either 0 or $\bar{b}$.

Incumbent. The incumbent chooses a policy $v = (\tau, p)$, subject to the budget constraint $C(p) \leq \tau$, to maximize group M's expected utility, taking into account the bureaucrat's best-response: $b^*(\tau, p)$, $e^*(\tau, p)$:

$$G_M(\tau - C(p) + e^*(p, \tau)) - \tau - \eta_M b^*(p, \tau)$$

Denote $\bar{\tau}_M = g_M^{-1}(1)$, the optimal amount of taxes (and therefore public services) for group M in the absence of any corruption.[17] We make the following assumption.

Assumption 1. *The maximum equilibrium amount of funding from the bureaucrat, $\bar{e}$ is lower than the maximum bribe available and than the the optimal amount of public services to group M: $\bar{e} < \max\{\bar{\tau}_M, \bar{b}\}$.*

Under this assumption, two types of policies can arise:

1. **A formal fiscal policy:** the bureaucrat does not contribute to public services: $e^* = 0$ and taxes are positive $\tau^* > 0$.
2. **An informal fiscal policy:** the bureaucrat contributes to public services: $e^* > 0$ and taxes are lower than under a formal policy.

Our main result is that the ease of monitoring public service provision ϕ relative to that of monitoring corruption π determines which of the two policies is optimal.

Proposition 1. *Under assumption 1, there exists a threshold $\bar{\phi}(\pi)$ on the ease of monitoring public service provision such that the incumbent chooses an informal policy if $\phi > \bar{\phi}(\pi)$ and a formal policy otherwise. As monitoring corruption becomes easier, the incumbent becomes more likely to choose a formal policy: $\bar{\phi}(\pi)$ weakly increases in π.*

The threshold for choosing an informal policy $\bar{\phi}$ is also increasing in the cost of corruption to group M: η_M. The incumbent is therefore more likely to choose an informal policy when politically important groups bear low costs of corruption (or do not hold the incumbent accountable for it).

Proposition 1 therefore highlights how both information and political frictions can sustain an informal fiscal system. Monitoring individual instances of bribe-taking can be

[17] Without corruption, it is optimal to set $p = 0$, and the optimal amount of tax for group M solves $g_M(\tau) = 1$.

more difficult than observing whether public services have been delivered which makes informal policies more desirable. If the pivotal group of voters does not bear the full costs of corruption, they support a government which does not crack down on corruption as this allows a relatively high level of public service provision with lower taxes. While taxes affect the whole population, bribes can be targeted at certain groups who do not necessarily exert as much influence on political decisions. For example, Hunt (2010) shows that the poor pay relatively more in bribes than the rich; in our context, corruption disproportionately affects women and more vulnerable groups in Pakistan, perhaps because of the large gender gaps in voter registration, turnout, and political leaders in Pakistan (Cheema et al., 2019b; Cheema et al., 2019a), reducing the incentives of politicians to address corruption faced by these groups.

3.2 Welfare

Welfare costs can arise for two reasons: political distortions and agency costs.

The relevant benchmark is the level of tax and monitoring that would maximize social welfare in the absence of redistribution by the bureaucrat, but in the presence of corruption. If the cost of monitoring is not too high relative to the cost of corruption, it is socially optimal to monitor corruption. The incumbent should set monitoring high enough that bribes are zero and set taxes to cover the costs of monitoring and provide the socially optimal level of public good.

Compared to this benchmark, two sources of political distortions can arise. First, the ideal level of taxes for the pivotal group of voters might differ from the welfare-maximizing level of taxes. Second, if group M does not bear the full cost of corruption, the incumbent prefers to finance public goods through bribery rather than taxes even though it is socially harmful. The first distortion can exist in any political system, but the second only occurs when informal policies are possible.

The second source of welfare costs are agency costs. Because public goods are funded by the bureaucrat rather than directly by the state, the equilibrium level of public good does not generally correspond to the optimal level. In addition, some money is lost as rent. These agency issues occur as a result of political distortions: if the pivotal group bore the full cost of corruption, they would prefer a formal fiscal system and would not rely on the bureaucrat to redistribute funds.

4 Conclusion

Developing countries worldwide face substantial hurdles in their attempts to provide public goods and services: they have limited capacity to raise revenue, and transfers from central to local governments often "leak out" on the way. We describe a method through which some governments handle these constraints: through an informal fiscal system in which local bureaucrats are expected to finance public services by extracting rents from local citizens. We document the existence of such systems in distinct sectors in two large developing countries, showing that bureaucrats do not receive funds to perform the basic requirements of their jobs, and make up for these shortfalls through rent extraction.

Our model describes the conditions under which governments might prefer low formal taxes and low monitoring of corruption. We show that these systems are more likely to arise in democracies when the costs of monitoring bureaucrats are high relative to those of observing public service delivery, when the costs of corruption can be shifted to politically less powerful groups, and when bureaucrats value the provision of public services (perhaps for career progression reasons). The existence of informal fiscal systems can explain the joint persistence of corruption and low fiscal capacity. Because governments can rely on corruption to fund public services, they have limited incentives to punish it and to invest in fiscal capacity. The costs of such systems can be large, as (somewhat) legitimized rent extraction and low monitoring may lead to high levels of corruption, even if some funds are returned in the form of public services.[18] Moreover, distributional consequences are unavoidable if only some parts of the population are targeted for rent extraction; and the ability of governments to redistribute across space is restricted with necessarily local informal fiscal systems. How and when such discretionary, informal systems transition to programmatic formal systems are questions for future research.

[18] The proportion of bribes or rents collected that eventually make their way back to the public is extremely difficult to estimate, and a question we leave for future researchers.

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5 Tables

India case

Table 1: Monthly Petrol Accounting

Monthly Petrol Accounting

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Average Budget	107	627.1	868.4	0	2,083
Vehicle Liters Petrol	169	174.5	79.87	0	567.4
Vehicle Petrol Expenditure	169	13,257	6,069	0	43,115
Vehicle Budget Balance	102	-12,440	5,837	-30,180	0
Motorcycle Liters Petrol	175	31.13	28.30	0	266.7
Motorcycle Petrol Expenditure	175	2,366	2,150	0	20,264
Motorcycle Budget Balance	105	-1,621	1,721	-8,132	2,083
Combined Budget Balance	101	-14,845	6,526	-33,858	-4,685

Authors' calculation from survey data. Estimates assume petrol prices of 75.99 INR per liter, the minimum daily price in Madhya Pradesh during November, 2018. Vehicle fuel mileage estimated at dealer-reported figure of 14.1 kilometers per liter for Tata Safari Storme. Motorcycle fuel mileage estimated at 60 kilometers per liter. Missing budget figures are due to non-reporting during survey interviews.

Pakistan case

Table 2: Bureaucrat provision of public goods and services without official funds

	Mean	N
	(1)	(2)
Whether local bureaucrats provide any unofficial public services	0.82	750
Probability of unofficial public services being funded through		
Local bureaucrats' own pockets	1.00	618
Government funds	0.02	618
Local philanthropists	0.30	618
NGO	0.21	618
Other	0.00	617
Local bureaucrat's expenditure shares		
Expenditure on unofficial public services	15.45	557
HH consumption	46.21	556
Children expenditure	27.44	557
Travelling	13.60	557
Other	2.86	703
Most important reason for spending out of pocket		
If I don't, others in the service will have a bad opinion of me	0.62	613
It is important for people in my area to receive this good or service	0.30	613
It is part of my job description	0.01	613
If I don't, my career service progression would be hurt	0.07	613
If I don't, I can face disciplinary action	0.00	613
Other	0.00	613

Table 3: Opinion of supervisors on bureaucrat provision of public goods and services without official funds

	Mean	N
	(1)	(2)
Whether local bureaucrats provide any unofficial public services	0.98	35
Local bureaucrat ever filed to be reimbursed for amount spent	0.08	28
Reason the government doesn't provide 100 percent of the funds		
It is the norm	0.94	29
They know local bureaucrats earn tips (bribes)	0.90	28
Philanthropists, NGOs can cover difference	0.70	25
Hard for government to raise funds through taxing and borrowing	0.27	29
Reasons local bureaucrats are willing to spend out of pocket		
If they don't, they can face disciplinary action	0.76	28
Reduced accountability if local bureaucrats engage in corruption	0.39	28
If they don't, others in the service will have a bad opinion of them	0.20	28
It is the norm	0.22	28
If they don't, their career service progression would be hurt	0.11	28
It is part of their job description	0.06	28
Other	0.05	28
It is important for people in their area to receive this good or service	0.00	28

A Technical Appendix: Proofs of propositions

Proof of Lemma 1. If $p < \frac{1}{\pi k}$, the bureaucrat's objective function $U_B(e,b) = w + \phi F(\tau - C(p) + e) - e + b(1 - p\pi k)$ is strictly increasing in b for any e. Since increasing b also loosens the constraint, it is optimal to choose $b = \bar{b}$. The bureaucrat then chooses e to maximize: $U_B(e,b) = w + \phi F(\tau - C(p) + e) - e + \bar{b}(1 - p\pi k)$. The first-order condition is:

$$(\tau - C(p) + e^*) = 1 \Leftrightarrow e^* = f^{-1}\left(\frac{1}{\phi}\right) + C(p) - \tau = \bar{e} + C(p) - \tau$$

The second-order condition is satisfied as $f(x)$ is strictly decreasing.

If $p \geq \frac{1}{\pi k}$, the bureaucrat's objective function $U_B(e,b) = w + \phi F(\tau - C(p) + e) - e + b(1 - p\pi k)$ is decreasing in b, so the constraint $b \geq e$ is binding. Substituting the binding constraint into the objective function we get: $U_B(e,b) = w + \phi F(\tau - C(p) + e) - e + e(1 - p\pi k) = w + \phi F(\tau - C(p) + e) - ep\pi k$. The first-order condition is:

$$f(\tau - C(p) + e^*) = \frac{p\pi k}{\phi} \Leftrightarrow e^* = f^{-1}\left(\frac{p\pi k}{\phi}\right) + C(p) - \tau = \bar{e}\,(p\pi k) + C(p) - \tau$$

The second-order condition is satisfied as $f(x)$ is strictly decreasing.

□

Proof of Proposition 1. We first solve for the optimal policy within each case and then compare the resulting expected utilities across cases.

1. **Case 1: the optimal policy (p^*, τ^*) satisfies $p^* < \frac{1}{\pi k}$ and $\tau^* - C(p^*) < \bar{e}$:**

   Then $e^* = \bar{e} + C(p) - \tau > 0$ and $b^* = \bar{b}$, so the optimal policy within this case solves:

   $$\max_{\substack{p \in [0, \frac{1}{\pi k}) \\ \tau \in [C(p), C(p) + \bar{e})}} G_M(\tau + e^* - C(p)) - \tau - \eta_M b^* = G_M(\bar{e}) - \tau - \eta_M \bar{b}$$

   This function is decreasing in τ and independent of p so it is optimal to set $\tau^* = p^* = 0$. The bureaucrat's strategy is $e^* = \bar{e}$ and $b^* = \bar{b}$, and the maximum utility is:

   $$U_1(\bar{e}) = G_M(\bar{e}) - \eta_M \bar{b} = \frac{\bar{e}^{1-\gamma_M}}{1 - \gamma_M} - \eta_M \bar{b}$$

2. **Case 2: the optimal policy (p^*, τ^*) satisfies $p^* < \frac{1}{\pi k}$ and $\tau^* - C(p^*) \geq \bar{e}$:**

Then $\bar{e} + C(p) - \tau \leq 0$, so $e^* = 0$ and $b^* = \bar{b}$. The optimal policy solves:

$$\max_{\substack{p \in \left[0, \frac{1}{\pi k}\right) \\ \tau \in [C(p)+\bar{e}, +\infty)}} G_M(\tau + e^* - C(p)) - \tau - \eta_M b^* = G_M(\tau - C(p)) - \tau - \eta_M \bar{b}$$

This function is decreasing in p, and a higher p makes all the constraints stricter, so it is optimal to set $p^* = 0$. Then optimising over τ gives $\tau^* = \bar{\tau}_M = 1$ (as the FOC is $g_M(\tau) = 1 \Leftrightarrow \tau^{-\gamma_M} = 1$, and the SOC is satisfied by concavity of G_M). Finally, by assumption 1, $\bar{\tau}_M = 1 > \bar{e}$, so $\tau^* - C(p^*) = \bar{\tau}_M = 1 \geq \bar{e}$ and this solution does fall within case 2. The bureaucrat's strategy is $e^* = 0$ and $b^* = \bar{b}$ and the utility is:

$$U_2(\bar{e}) = G_M(\bar{\tau}_M) - \bar{\tau}_M - \eta_M \bar{b} = \frac{1^{1-\gamma_M}}{1-\gamma_M} - 1 - \eta_M \bar{b} = \frac{\gamma_M}{1-\gamma_M} - \eta_M \bar{b}$$

3. **Case 3: the optimal policy (p^*, τ^*) satisfies $p^* \geq \frac{1}{\pi k}$ and $\tau^* - C(p^*) < \bar{e}(p^* \pi k)$**:

Then $e^* = b^* = \bar{e}(p\pi k) + C(p) - \tau > 0$, so the optimal policy within this case solves:

$$\max_{\substack{p \in \left[\frac{1}{\pi k}, +\infty\right) \\ \tau \in [C(p), C(p)+\bar{e}(p\pi k))}} \Big\{ G_M(\tau + e^* - C(p)) - \tau - \eta_M b^* \\ = G_M(\bar{e}(p\pi k)) - \tau(1-\eta_M) - \eta_M[\bar{e}(p\pi k) + C(p)] \Big\}$$

This objective function is decreasing in τ since $(1 - \eta_M) > 0$, so it is optimal to set the budget constraint binding: $C(p) = \tau$. Substituting into the objective function, the derivative of the objective function becomes:

$$[g_M(\bar{e}(p\pi k)) - \eta_M] \frac{\partial \bar{e}(p\pi k)}{\partial p} \cdot \pi k - c(p) \tag{1}$$

If this derivative is negative for any $p \geq \frac{1}{\pi k}$, then the objective function is decreasing in p, so it is optimal to choose $p = \frac{1}{\pi k}$. Note that by concavity of $F(\cdot)$, $\bar{e}(x)$ is decreasing in x, so $\frac{\partial \bar{e}(p\pi k)}{\partial p} < 0$. Therefore, a sufficient condition for the derivative to be negative is $g_M(\bar{e}(p\pi k)) - \eta_M > 0$. This is true since $g_M(\bar{e}(p\pi k)) = \left(\frac{1}{\bar{e}(p\pi k)}\right)^{\gamma_M}$, and for any $p \geq \frac{1}{\pi k}$, $p\pi k > 1$ so $\bar{e}(p\pi k) < \bar{e}(1)$ and $\bar{e}(1) = \bar{e} < 1$ by assumption. Therefore, $\left(\frac{1}{\bar{e}(p\pi k)}\right)^{\gamma_M} > 1 > \eta_M$.

Therefore, in this case $p^* = \frac{1}{\pi k}$, and $\tau^* = C\left(\frac{1}{\pi k}\right)$. The bureaucrat's strategy is $e^* = \bar{e}$

and $b^* = \bar{e}$, and the maximum utility is:

$$U_3(\bar{e}) = G_M(\bar{e}) - C\left(\frac{1}{\pi k}\right) - \eta_M \bar{e} = \frac{\bar{e}^{1-\gamma_M}}{1-\gamma_M} - C\left(\frac{1}{\pi k}\right) - \eta_M \bar{e}$$

4. **Case 4: the optimal policy (p^*, τ^*) satisfies $p^* \geq \frac{1}{\pi k}$ and $\tau^* - C(p^*) \geq \bar{e}(p^* \pi k)$**:

   Then as $\bar{e}(p^*\pi k) - \tau^* + C(p^*) \leq 0$, we have $e^* = b^* = 0$, so the optimal policy within this case solves:

$$\max_{\substack{p \in \left[\frac{1}{\pi k}, +\infty\right) \\ \tau \in [C(p) + \bar{e}(p\pi k), +\infty)}} G_M(\tau + e^* - C(p)) - \tau - \eta_M b^* = G_M(\tau - C(p)) - \tau$$

   The objective function is decreasing in p and increasing p makes the constraints stricter, so it is optimal to set $p^* = \frac{1}{\pi k}$. Substituting in and taking FOC gives: $g_M\left(\tau - C\left(\frac{1}{\pi k}\right)\right) = 1$, so $\tau^* = \bar{\tau}_M + C\left(\frac{1}{\pi k}\right) = 1 + C\left(\frac{1}{\pi k}\right)$.

   Since $\bar{e} < \bar{\tau}_M = 1$ by assumption 1, we have $\tau^* - C(p^*) = 1 + C\left(\frac{1}{\pi k}\right) - C\left(\frac{1}{\pi k}\right) \geq \bar{e}\left(\frac{1}{\pi k} \cdot \pi k\right) = \bar{e}$, so this solution does fall within case 4. Therefore, $p^* = \frac{1}{k}$, and $\tau^* = 1 + C\left(\frac{1}{\pi k}\right)$. The bureaucrat's strategy is $e^* = b^* = 0$, and the utility is:

$$U_4(\bar{e}) = G_M(\bar{\tau}_M) - \bar{\tau}_M - C\left(\frac{1}{\pi k}\right) = \frac{1}{1-\gamma_M} - 1 - C\left(\frac{1}{\pi k}\right) = \frac{\gamma_M}{1-\gamma_M} - C\left(\frac{1}{\pi k}\right)$$

Finally, we can compare the maximum utilities in all four cases. Recall that U_1 and U_3 correspond to informal policies, while U_2 and U_4 correspond to formal policies.

1. **First consider the case where $C\left(\frac{1}{\pi k}\right) < \eta_M \bar{b}$.** In this case, monitoring is not too expensive, and $U_4(\bar{e}) > U_2(\bar{e})$ since $\frac{\gamma_M}{1-\gamma_M} - C\left(\frac{1}{\pi k}\right) > \frac{\gamma_M}{1-\gamma_M} - \eta_M \bar{b}$. So there is monitoring in a formal policy.

   (a) If $\bar{e} > \bar{b} - \frac{C\left(\frac{1}{\pi k}\right)}{\eta_M}$, then $U_1(\bar{e}) = \frac{\bar{e}^{1-\gamma_M}}{1-\gamma_M} - \eta_M \bar{b} > \frac{\bar{e}^{1-\gamma_M}}{1-\gamma_M} - C\left(\frac{1}{\pi k}\right) - \eta_M \bar{e} = U_3(\bar{e})$. So the optimal informal policy is the one without monitoring. Then an informal policy is better than a formal one if and only if $U_1(\bar{e}) > U_4(\bar{e})$:

$$\frac{\bar{e}^{1-\gamma_M}}{1-\gamma_M} - \eta_M \bar{b} > \frac{\gamma_M}{1-\gamma_M} - C\left(\frac{1}{\pi k}\right) \Leftrightarrow \left((1-\gamma_M)\left(\eta_M \bar{b} - C\left(\frac{1}{\pi k}\right)\right) + \gamma_M\right)^{\frac{1}{1-\gamma_M}} > \bar{e}$$

   (b) If instead $\bar{e} \leq \bar{b} - \frac{C\left(\frac{1}{\pi k}\right)}{\eta_M}$ then $U_1(\bar{e}) < U_3(\bar{e})$. So the optimal informal policy is the one with monitoring. Then an informal policy is better than a formal one

if and only if $U_3(\bar{e}) > U_4(\bar{e})$:

$$\frac{\bar{e}^{1-\gamma_M}}{1-\gamma_M} - C\left(\frac{1}{\pi k}\right) - \eta_M \bar{e} > \frac{\gamma_M}{1-\gamma_M} - C\left(\frac{1}{\pi k}\right) \Leftrightarrow \bar{e}^{1-\gamma_M} - (1-\gamma_M)\eta_M \bar{e} > \gamma_M$$

Let $R(\bar{e}) = \bar{e}^{1-\gamma_M} - (1-\gamma_M)\eta_M \bar{e}$ and note that (1) $\frac{\partial R(\bar{e})}{\partial \bar{e}} > 0$ since $\bar{e} < 1 < \left(\frac{1}{\eta_M}\right)^{\frac{1}{\gamma_M}}$ (as $\eta_M < 1$), (2) $R(\bar{e}=0) = 0 < \gamma_M$ and (3) $R(\bar{e}=1) = 1 - (1-\gamma_M)\eta_M > \gamma_M$ since $\eta_M < 1$. Therefore, there exists a unique e_F such that $R(\bar{e}) > \gamma_M$ if and only if $\bar{e} > e_F$.

The choice of policy therefore depends on $\bar{e}$ in relation to three thresholds:

$$\begin{aligned}
e_1 &= \bar{b} - \frac{C\left(\frac{1}{\pi k}\right)}{\eta_M} \\
e_2 &= \left((1-\gamma_M)\left(\eta_M \bar{b} - C\left(\frac{1}{\pi k}\right)\right) + \gamma_M\right)^{\frac{1}{1-\gamma_M}} \\
e_3 &= e_F
\end{aligned}$$

There are only two possible ordering of these three thresholds. This is because when $\bar{e} = \left((1-\gamma_M)\left(\eta_M \bar{b} - C\left(\frac{1}{\pi k}\right)\right) + \gamma_M\right)^{\frac{1}{1-\gamma_M}}$, we have:

$$\begin{aligned}
R(\bar{e}) = &\left[\left((1-\gamma_M)\left(\eta_M \bar{b} - C\left(\frac{1}{\pi k}\right)\right) + \gamma_M\right)^{\frac{1}{1-\gamma_M}}\right]^{1-\gamma_M} \\
&- (1-\gamma_M)\eta_M \left[\left((1-\gamma_M)\left(\eta_M \bar{b} - C\left(\frac{1}{\pi k}\right)\right) + \gamma_M\right)^{\frac{1}{1-\gamma_M}}\right] > \gamma_M \\
\Leftrightarrow \quad &\bar{b} - \frac{C\left(\frac{1}{\pi k}\right)}{\eta_M} > \left((1-\gamma_M)\left(\eta_M \bar{b} - C\left(\frac{1}{\pi k}\right)\right) + \gamma_M\right)^{\frac{1}{1-\gamma_M}}
\end{aligned}$$

Therefore, $e_2 > e_1 \Leftrightarrow e_3 > e_2$, so we have the following cases:

(a) If $e_3 < e_2 < e_1$, then $\bar{e} < e_3$ means the best policy is a formal policy without corruption (U_4), $e_3 < \bar{e} < e_2$ means the best policy is an informal policy with some monitoring (U_3), and if $e_2 < \bar{e}$ the best policy is an informal policy with no monitoring (U_1). **In this case, the optimal policy is informal if and only $\bar{e} > e_3$.**

(b) If $e_1 < e_2 < e_3$, then $\bar{e} < e_2$ means the best policy is a formal policy without corruption (U_4), $e_2 < \bar{e} < e_3$ means the best policy is an informal policy with no monitoring (U_1), and if $e_3 < \bar{e}$ the best policy is an informal policy with

monitoring (U_3). **In this case, the optimal policy is informal if and only $\bar{e} > e_2$.**

2. **Second, we consider the case where $C\left(\frac{1}{\pi k}\right) \geq \eta_M \bar{b}$.** In this case, monitoring is expensive, and $U_2(\bar{e}) > U_4(\bar{e})$ since $\frac{\gamma_M}{1-\gamma_M} - C\left(\frac{1}{\pi k}\right) < \frac{\gamma_M}{1-\gamma_M} - \eta_M \bar{b}$. So there is no monitoring in a formal policy.

   In addition, given $\bar{e} > 0$, it is not possible to have $\bar{e} < \bar{b} - \frac{C\left(\frac{1}{\pi k}\right)}{\eta_M} \leq 0$. Therefore, $\bar{e} > \bar{b} - \frac{C\left(\frac{1}{\pi k}\right)}{\eta_M}$, so $U_1(\bar{e}) > U_3(\bar{e})$. An informal policy is then better than a formal one if and only if $U_1(\bar{e}) > U_2(\bar{e})$:

$$\frac{\bar{e}^{1-\gamma_M}}{1-\gamma_M} - \eta_M \bar{b} > \frac{\gamma_M}{1-\gamma_M} - \eta_M \bar{b} \Leftrightarrow \bar{e} > \gamma_M^{\frac{1}{1-\gamma_M}}$$

   As a result, the optimal policy is informal if and only $\bar{e} > \gamma_M^{\frac{1}{1-\gamma_M}}$.

We therefore get the result from the proposition by defining

$$\underline{E} = \begin{cases} \gamma_M^{\frac{1}{1-\gamma_M}} & \text{if } C\left(\frac{1}{\pi k}\right) \geq \eta_M \bar{b} \\ \left((1-\gamma_M)\left(\eta_M \bar{b} - C\left(\frac{1}{\pi k}\right)\right) + \gamma_M\right)^{\frac{1}{1-\gamma_M}} & \text{if } C\left(\frac{1}{\pi k}\right) < \eta_M \bar{b} \text{ and } e_1 \leq e_2 \\ e_F & \text{if } C\left(\frac{1}{\pi k}\right) < \eta_M \bar{b} \text{ and } e_2 < e_1 \end{cases}$$

Finally, note that $e_1 > e_2$ if and only if $C\left(\frac{1}{\pi k}\right)$ is low enough. Let C^* the threshold such that $C\left(\frac{1}{\pi k}\right) \leq C^* \Leftrightarrow e_1 \geq e_2$:

1. If $C\left(\frac{1}{\pi k}\right) \leq C^*$, $\underline{E} = e_F$, so $\underline{E}$ is independent of $C\left(\frac{1}{\pi k}\right)$ and increasing in η_M (since $R(\bar{e})$ is decreasing in η_M).

2. If $C^* \leq C\left(\frac{1}{\pi k}\right) \leq \eta_M \bar{b}$, $\underline{E} = \left((1-\gamma_M)\left(\eta_M \bar{b} - C\left(\frac{1}{\pi k}\right)\right) + \gamma_M\right)^{\frac{1}{1-\gamma_M}} \leq e_F$, so $\underline{E}$ is decreasing in $C\left(\frac{1}{\pi k}\right)$ and increasing in η_M.

3. If $\eta_M \bar{b} \leq C\left(\frac{1}{\pi k}\right)$ $\underline{E} = \gamma_M^{\frac{1}{1-\gamma_M}} \leq \left((1-\gamma_M)\left(\eta_M \bar{b} - C\left(\frac{1}{\pi k}\right)\right) + \gamma_M\right)^{\frac{1}{1-\gamma_M}}$, so $\underline{E}$ is independent of $C\left(\frac{1}{\pi k}\right)$ and η_M.

This proves that $\underline{E}$ is weakly decreasing in $C\left(\frac{1}{k}\right)$. Finally, we can define $\bar{\phi}(\pi)$ as the value of ϕ such that $\bar{e}(\phi) = \underline{E}$. Since $\bar{e}$ is increasing in ϕ, the Proposition goes through by replacing $\bar{e}$ by ϕ and $\underline{E}$ by $\bar{\phi}(\pi)$. In addition, as $C\left(\frac{1}{\pi k}\right)$ is decreasing in π, we have that $\bar{\phi}(\pi)$ is weakly increasing in π. □

Appendix: For online publication

A.1 Discussion on theoretical framework

The model applies to a range of environments but some features can have multiple interpretations.

Targeted taxes. Informal taxation through bribes is equivalent to imposing a targeted tax on the non-pivotal groups and partially exempting group M from it. The model is relevant to situations where the incumbent cannot implement such targeted taxes, for example because they would be too politically sensitive,[19] because there is a lack of state capacity, or because the bureaucrat has some informational advantage that allows her to target these groups.

Incidence of corruption. Our parameter η_i captures the cost of corruption borne by each group. An alternative and observationally-equivalent interpretation is that citizens blame politicians for higher taxes more than for bribes. If citizens think bureaucrats are to blame for bribes, but reward politicians for providing public goods and keeping taxes low, politicians would have more incentives to support an informal fiscal system. This interpretation does not rely on the existence of multiple groups, but the welfare consequences are different: citizens are worse-off because they mis-attribute the blame for corruption.

Incentives of bureaucrats. We assumed that the bureaucrat's value from delivering public services is exogenous to reflect the rigidity of bureaucracies. In principle, the incumbent could choose a performance-based reward to affect F and reduce the rents obtained by the bureaucrat. However, he would still find it beneficial to implement an informal fiscal policy whenever group M bears a sufficiently low share of the cost of corruptions.

Bribes as user fees. The model allows us to think of bribes as user fees. Suppose that only group M benefits from the public service y ($G_N(y) = 0$) and that only group M bears the costs of bribery ($\eta_N = 0$). If group N constitutes a majority, a benevolent policy maker would not provide the public service. However, bribes allow group M to pay for the

[19] For instance, a politician can take advantage of the fact that women are less likely to turn out through informal taxes but not through formal ones.

provision of the service. For instance, if only petrol station owners benefit from additional police patrols, providing free petrol is a way to privately fund the provision of policing. While formal user fees would be a more efficient way to provide these services, informal taxes offer a second-best option when formal user fees are not feasible.

A.2 Appendix Tables

Table A1: Monthly Petrol Accounting (Missing as zeros)

Monthly Petrol Accounting

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	max
Average Budget	180	372.8	736.2	0	2,083
Vehicle Liters Petrol	169	174.5	79.87	0	567.4
Vehicle Petrol Expenditure	169	13,257	6,069	0	43,115
Vehicle Budget Balance	169	-12,860	6,147	-43,115	0
Motorcycle Liters Petrol	175	31.13	28.30	0	266.7
Motorcycle Petrol Expenditure	175	2,366	2,150	0	20,264
Motorcycle Budget Balance	175	-1,982	2,255	-20,264	2,083
Combined Budget Balance	167	-15,256	7,004	-53,247	-3,422

Authors' calculation from survey data. Estimates assume petrol prices of 75.99 INR per liter, the minimum daily price in Madhya Pradesh during November, 2018. Vehicle fuel mileage estimated at dealer-reported figure of 14.1 kilometers per liter for Tata Safari Storme. Motorcycle fuel mileage estimated at 60 kilometers per liter. Missing budget figures are due to non-reporting during survey interviews and are counted as zero in this table.

Table A2: Bureaucrat provision of public goods and services without official funds

	Flood control and relief		Free food to public		Food and logistics during officer visits	
	Mean	N	Mean	N	Mean	N
	(1)	(2)	(3)	(4)	(5)	(6)
Whether local bureaucrats provide service	0.61	750	0.25	750	0.82	750
Cost each time (PKR)	-	-	148917	53	59022	612
Frequency of activities						
Once a year	0.00	449	0.09	187	0.07	617
Twice a year	0.00	449	0.12	187	0.10	617
4 times a year	0.00	449	0.01	187	0.12	617
Every month	0.00	449	0.00	187	0.63	617
Daily	0.01	449	0.77	187	0.00	617
Other (as per requirement)	0.99	449	0.00	187	0.08	617

Table A3: Opinion of supervisors on bureaucrat provision of public goods and services without official funds

	Flood control and relief		Free food to public		Food and logistics during officer visits	
	Mean	N	Mean	N	Mean	N
	(1)	(2)	(3)	(4)	(5)	(6)
Whether local bureaucrats provide service	0.89	33	0.90	34	0.93	35
Cost each time (PKR)	2406250	8	165182	9	138045	9
If a 100 PKR is spent, how much of it is funded through						
Local bureaucrats' pockets	12.90	21	15.11	30	81.22	30
Government funds	72.98	21	10.55	30	8.50	30
Local philanthropists	12.82	21	73.13	30	9.11	30
NGO	1.76	21	1.21	30	0.50	30
Other	0.00	21	0.00	30	0.67	30
Frequency of activities						
Once a year	0.58	29	0.45	28	0.09	31
Twice a year	0.06	29	0.12	28	0.08	31
4 times a year	0.00	29	0.09	28	0.16	31
Every month	0.00	29	0.00	28	0.33	31
Other	0.37	29	0.34	28	0.35	31

Table A4: Citizen Survey: Are there bribes in this setting?

	Mean	N
How many times did you contact the department during the last year?		
1 to 5 times	0.71	1402
6 to 10 times	0.14	1402
11 to 20 times	0.04	1402
More than 20 times	0.01	1402
Never contacted	0.09	1402
To what extent do you face difficulties in contacting the department?		
To a great extent	0.19	1402
To quite an extent	0.43	1402
Can't say	0.18	1402
To a lesser extent	0.18	1402
Not at all	0.02	1402
What are the difficulties that are most faced while getting the services?		
No service provision without unofficial payments	0.65	1402
Unable to contact the concerned officials	0.55	1402
No clear information on the duration for these services	0.30	1402
Low quality of services	0.31	1402
Incorrect records	0.14	1402
Others	0.02	1402
Normally, what procedure do people adopt to get rid of the difficulties faced?		
Give a bribe	0.82	1402
Get undue favors through the politician	0.42	1402
Consult courts	0.41	1402
Lodge a complaint with the department	0.25	1402
Contact the provincial ombudsman	0.15	1402
Do nothing	0.04	1402
Disputes		
What normally are the reasons for disputes?		
Corruption in the system	0.51	1402
Influential people / land mafia	0.33	1402
Wrong distribution of land in the family	0.62	1402
No organized forum for land related issues	0.32	1402
Lack of education in the people	0.55	1402
What is the normal procedure that is adopted for the solution of these disputes?		
Unofficial means, bribes, and gifts	0.13	1400
Official legal procedure	0.20	1400
Through courts	0.23	1400
Through mutual understanding	0.10	1400
Through panchayat/politically or social investigation	0.20	1400
Through mutual consultation between elders of the families	0.13	1400
Do women and vulnerable groups face fraud and injustice?	0.62	1402