Informal fiscal systems in developing countries*

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Abstract

Governments in developing countries have low fiscal capacity yet face pressures to provide public goods and services, leading them to rely on various unusual fiscal arrangements. We document one such - hitherto unexplored - arrangement: informal fiscal systems that rely on local bureaucrats to personally fund the delivery of public goods and services. Using survey data and government accounts from Pakistan, we show that public officials are expected to cover funding gaps in public services and they do so, at least partially, through 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. The existence of such systems can distort the effective incidence of the tax burden, reduce the incentives of government to fight corruption, and legitimize bribe-taking.

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1 Introduction

Governments in developing countries have low fiscal capacity (Besley and Persson, 2014), particularly at the local level (Gadenne and Singhal, 2014; Bachas et al., 2021; Dzansi et al., 2022; Balan et al., 2022). These fiscal constraints limit the ability of governments to raise revenues to provide public services. Yet public pressure compel governments in developing countries to attempt to provide these services.[1]

These unique forces have led to the rationing of public goods and services in various developing nations (Banerjee et al., 2007), as well as several unusual fiscal arrangements. For example, governments may rely on the local population to informally deliver public goods (Olken and Singhal, 2011); delegate tax collection to private individuals for profit (Stella, 1993; Coşgel and Miceli, 2009); or even abdicate responsibility to non-state groups (Grossman, 1997; Johnson et al., 1997; Alexeev et al., 2004).

In this paper we document the existence of an informal fiscal system: a system in which both taxation and expenditures are managed within the state apparatus but outside its formal fiscal processes. Under the arrangement that we study, central authorities do not provide local public officials with all the resources they need to supply public services: too little petrol for police cars, too few materials for flood control. Instead, local officials are expected to personally fund these public services, with evidence suggesting they rely at least partially on bribes extracted from local communities to do so.

This system is distinct from tax farming, informal taxation, user fees, or the provision of public services by non-state actors. Unlike tax farming, bureaucrats are not officially given the right to collect bribes by the government. In informal taxation, local officials only coordinate the voluntary labor or funding provided by citizens rather than paying for these on their own. Unlike user fees, services for which bribes are paid can differ from the service on which bureaucrats spend the funds: bribes collected for issuing land titles can be used to finance free food to the public. This creates a form of redistribution central to our definition of informal fiscal systems. Finally, in informal fiscal systems, the state itself expects its functionaries to provide for public services rather than competing with non-state groups for their provision.

We start with some examples from around the world and describe in detail the illustra-

[1]Developing democracies such as India, Pakistan, Tanzania, and Kenya established universal adult franchise in the 1940s-1950s, at the same time as or earlier than France or Switzerland, and now have larger welfare states than today's rich countries had at historically comparable income levels (Lamba and Subramanian, 2020).

tive case of policing in India. There, we conduct a detailed accounting exercise comparing the costs required and the government funds available for patrolling, using survey data from 180 police stations in a large state. We find that the most conservative estimate 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"*[2] to fill this gap; multiple surveys and reports corroborate corrupt behavior by police.[3]

Next, we present a more detailed description of an informal fiscal system in a large bureaucracy in Pakistan, in which local (low level) bureaucrats personally fund local public services such as flood control and relief, free food to the public, and the logistics of senior officials' visits to their area. A significant portion (82%) of the 750 local bureaucrats we surveyed agree that they provide a range of public services for which they do not receive full official funding. Of these, 100% agree that they personally supply funds to fill the gap. We corroborate these survey responses through an independent survey of the bureaucrats' supervisors. Nearly all supervisors (98%) agree that bureaucrats are involved in delivering these services and 89% of them confirm that local bureaucrats personally fund a portion of them. This funding represents almost 15% of the bureaucrat's monthly expenditure (7,412 PKR a month). Altogether, 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 show that there is a significant gap (13,000 PKR or 26% of the bureaucrats' monthly wage) between the cost of providing these services and the share of salary that bureaucrats report spending on them. We confirm from government accounts that this gap is not due to bureaucrats misreporting their income and argue that the gap is filled by bribes received by local bureaucrats. This is consistent with responses from supervisors, 90% of whom claim that corruption is precisely the reason why the government does not provide sufficient funds, and with the frequency of bribe payments to these bureaucrats reported in a citizen survey.

As Acemoglu and Verdier (2000) note, governments choosing to correct market failures through public officials must accept some corruption, since principal-agent problems here are often intractable. However, in our case, the government is actively expecting

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

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

public officials to provide services without sufficient 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 a politician and a bureaucrat. The bureaucrat chooses an amount of bribe 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 raise to finance public services. The government faces democratic pressure to both supply public services and reduce corruption while keeping taxes low. 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 relative 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.

Our model offers a way to rationalise the puzzling existence of informal fiscal systems and provides a number of insights into them. First, official taxation and monitoring are substitutes to reduce the bureaucrat's accrued rents (bribes minus funds redistributed). 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: 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. This is consistent with evidence from our survey in Pakistan indicating that the bureaucrats'

involvement varies across types of services.[4] 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 can impose substantial distortions on the overall economy. Part of these distortions are due to the 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.

The existence of informal fiscal systems potentially funded through bribes has a number of implications. On the one hand, rents accruing to bureaucrats may be overestimated since some of the bribes are returned as public services. On the other hand, corruption is costly and more distortionary than taxes (Shleifer and Vishny, 1993; Fisman and Svensson, 2007; Banerjee et al., 2012) and the incidence of bribes as a source of fund is different than that of formal taxes. Free food provision from "donations" extracted from the wealthy might be progressive, but funding police services through bribes paid by common citizens can be regressive. Finally, because informal systems reduce the incentives for the government to monitor corruption, 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. The informal fiscal system we uncover therefore has wide-ranging and long-lasting consequences for state capacity development.

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 capacity (Acemoglu et al., 2005; Besley and Persson, 2009, 2010, 2014; Besley et al., 2013). Furthermore, our work adds to studies documenting that information frictions are an important determinant of how governments collect taxes (Kiser, 1994; Balan et al., 2022). Narrowly, our paper contributes to the literature on informal taxation (Olken and Singhal, 2011; Gadenne and Singhal, 2014; Jack and Recalde, 2015; Lust and Rakner, 2018; Van den Boogaard et al., 2019) by exploring a new form of informal fiscal policy. In particular, we explore the possibility that

[4]The share of funding by bureaucrats is the highest for food and logistics for official visits which is easy to monitor, and the lowest for flood control which is more difficult to monitor.

[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.

decentralized public good provision relies on direct payments from the local bureaucrats (potentially through the redistribution of bribes), rather than on voluntary contributions from the local population. While taxpayers have higher trust in actors levying informal taxes than formal ones (Van den Boogaard et al., 2019), the perception of an informal fiscal system financed through corruption can be different. Another strand of this literature emphasizes the role of political accountability in determining "bureaucratic overload" (Dasgupta and Kapur, 2020), where bureaucrats are 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.

Our findings also contribute to three strands of the literature on corruption. First, we describe a new force that can explain the persistence of corruption (Tirole, 1996; Dutta et al., 2013). Corruption can persist because it allows the government to target taxes and transfers in a way that might not be feasible with formal taxes. Second, redistribution of bribes through informal fiscal systems makes the welfare calculations related to corruption ambiguous (Shleifer and Vishny, 1993). Third, 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).

2 Motivating examples

Situations in which state officials are expected to fund public services out of their own pockets are common around the world. Public school teachers even in developed countries like the USA often pay for school supplies.[6] The underlying funds can be provided by parents or the community (e.g. bake sales) or can come out of the teachers' pockets. In developing countries, the source of funds can be more controversial. Prud'Homme (1992) describes how wages for local officials in the Democratic Republic of Congo are deliberately kept very low by the government who expects officials to fund themselves

[6]See, e.g., https://www.theguardian.com/us-news/2021/dec/13/teachers-scramble-dollar-bills-south-dakota-dash-for-cash, accessed April 8, 2022.

through other means such as collecting bribes.[7] In this case too, the public good of law and order is expected to be funded by the civil servants.

In India, we document a similar system in the police force. The fact that public service providers in India suffer from severe resource constraints is well-documented (Kapur, 2020). In the case of policing, the Status of Policing in India Reports (SPIR) provide careful annual summaries of the shortages in personnel and resources. The precise nature of the shortfalls, and how providers deal with these constraints is perhaps less well known. We carried out a careful accounting exercise for monthly petrol costs incurred at police stations. In 2018 we surveyed a representative sample of the Station House Officer (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, as well as the monthly budget received for "Petrol, oil and lubricants". 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.

Comparing the budget required with the reported budget received, we find that the average station experiences a monthly shortfall of 14,845 INR (representing 95% of our estimate of expenditure, see Table A1). 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 A2). Finally, official budget figures for "Petrol, oil, and lubricants" funds allocated to police stations corroborate the survey data, with a shortfall of 8,768 INR even assuming zero leakage.[8] As further evidence , some survey respondents even reported that they have to use their personal vehicles for on-duty responsibilities.

How, then, do the police cover these deficits? 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.[9] In a direct interview

[7] Besley and McLaren, 1993 show the theoretical conditions under which such an arrangement can be efficient.

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

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

with an Additional Director General of Police, she pointed out that women are much less likely to make it to SHO of the station precisely because they are unable to raise the funds required for things like officials visits, petrol, etc. 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). We next examine the features of such practices in the case of Pakistan where we collected more detailed data.

3 Flood relief and food security in Pakistan

We now document the existence of an informal fiscal system in Pakistan through surveys of bureaucrats. We use data from three sources: 1) a telephone survey of a random sample of 750 local bureaucrats out of a total of 6209 across Punjab in 2020; 2) a telephone survey of 35 direct managers of these local bureaucrats (stratified on districts, randomly sampled 42 of 141) in 2020; and 3) a citizen survey carried out by a private firm for the provincial government in 2009, explicitly surveying individuals that have interacted with the local bureaucrats (comprising 1,402 men that either own or rent land).[10]

3.1 Private funding of public services by local bureaucrats

Table 1 describes the informal fiscal arrangement that funds local public goods and services. Panel A presents the bureaucrats' perspective, while Panel B presents the supervisors' perspective. 82% of local bureaucrats report providing public goods and services outside of their formal budget. Supervisors corroborate the bureaucrats' involvement (98%). 100% of local bureaucrats and 89% of supervisors agree that local bureaucrats personally supply funds for these services.

Our data also indicates that this funding is not trivial. According to the bureaucrats, the provision of these services represents almost 15% of their monthly expenditure. Their average monthly income is 49,411 PKR. Therefore, local bureaucrats spend on average 7,412 PKR a month on this public good provision.[11] This amount can underestimate their overall rupee contribution as the bureaucrat's total income can be larger if they receive

[10]The questions for local bureaucrats used here were part of a broader survey of their career background and traits but the survey of managers was carried out specifically for this paper.

[11]While expenditure and income can differ, income will generally be higher than expenditure.

money from other sources such as bribes. The total size of this informal fiscal system is significant and represents around 4.3 billion PKR per year[12] As a comparison, this would represent around 4.5% of the government's main cash transfer program (BISP) in 2015-16.[13]

Finally, these funds are not simply prepayments from the bureaucrats that the state reimburses. Only 8% of supervisors agree that field bureaucrats file to be reimbursed for these expenses.

Table 2 shows details of the system for different types of activities. A large portion of respondents are involved in different types of services: 61% of bureaucrats agree that they provide flood control and relief, 25% agree that they provide free food to the public, and 82% agree that they arrange logistics during official visits. Supervisors confirm the bureaucrats' involvement in these activities: close to 90% of them report that local officials are involved in the provision of these three activities.

The extent to which bureaucrats are financially involved differs by type of service. Table 2 shows the portion of funds coming from bureaucrats relative to other sources such as government funds, local philanthropists or NGOs. While bureaucrats report contributing a majority of the funds in both the provision of free food and the organization of officer visits, they contribute a larger portion for official visits. Instead a large portion of free food to the public is provided by local philanthropists. Supervisors believe that the proportion of funds covered by bureaucrats is lower but still significant. They also agree that the rest of the funding is split between the government and local philanthropists. However, their responses reveal differences in how the funds are split. For flood control and relief, they believe that the government contributes 73% while bureaucrats bear 13% of the costs. In the case of provision of free food for the public, they report that local philanthropists bear the largest burden (73%) while bureaucrats fund 15% of the costs and the government only 11%.

The existence of such practices raises two questions: why do bureaucrats agree to provide these funds and do these funds come exclusively out of their official wages?

3.2 Bureaucrats' motivations

Survey respondents indicate two main reasons for agreeing to pay for these services: pressure from colleagues and altruism. Table 3 shows that 62% of officials are willing

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

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

to fund the provision of the public services due to social pressure from colleagues while 30% cite altruism towards citizens as a reason. Supervisors believe that self-interest plays a bigger role than the bureaucrats want to admit: 76% of supervisors think that officials are willing to spend out of their pocket due to career concerns, while only 20% cite social pressure and none of them mention altruism. Moreover, 39% of supervisors think that officials are happy to sustain this informal fiscal arrangement because it allows them to continue engaging in corruption.

We can relate these motivations to the heterogeneity in the source of funds across different types of services. If bureaucrats are motivated by social pressure, then they should be more likely to provide services that are easier to observe for their colleagues. For instance, supervisors can directly observe the success of senior officials' visits. By contrast, assessing whether the correct flood control measures were implemented is more difficult.[14] In Section 4, we show how the observability of the service provision can affect the incentives of the bureaucrat and the likelihood of an informal fiscal system.

3.3 Sources of funds used by bureaucrats

While our data reveals that bureaucrats finance local public goods from their own funds, rather than official government funding, these funds could either come from the bureaucrats' personal wages or from bribes.

While plausible, it seems unlikely that the funds used for public services come exclusively from the bureaucrats' official wages. The officials in this context are not part of an elite civil service and their average salary (PKR 49,411) is relatively low. The funding could account for up to 40% of their income.[15] This would bring their net salary close to the minimum wage of PKR 25,000, suggesting that the bureaucrats could be better off taking jobs in the private sector. Yet, we do not see a high turnover in the bureaucracy.

We present three pieces of evidence that suggest that bribes extracted from the local population could be a key source of funding: (1) results from the supervisor survey, (2) an accounting exercise comparing the salary of the bureaucrat with the cost of providing

[14]These differences are less consistent with the altruism motivation: altruistic bureaucrats would be more involved in activities that help citizens directly such as flood control or food provision than official visits.

[15]Using the supervisor survey, we estimate that the total costs per Tehsil of public services borne by local bureaucrats is PKR 886,757 per month. Given an average of 44 officials in each Tehsil, the spending amounts to PKR 20,154 per official per month. We used the supervisor survey for these estimates as they have less incentives to misreport the costs and because the data on costs of flood control is missing in the bureaucrat survey.

the public services and (3) results from a citizen survey.

Table 1 Panel B shows that 90% of the supervisors believe that the government does not fully fund services as it knows that the local bureaucrats earn bribes. 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 agree 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.

Supervisors had little incentives to openly report that their subordinates are involved in corruption. Acknowledging this reflects badly on their management skills or puts them at risk of being blamed for not preventing this corruption. Therefore, their responses constitute an important piece of evidence that the funding gap is filled through corruption.

Next, we carried out a back-of-the-envelope calculation: we 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. The funding required 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.

This funding gap of approximately PKR 13,000 (PKR 20,154 minus 7,415) can be due to either bureaucrats misreporting the size of their official income or the fraction of their expenditure. We corroborated the average income of these bureaucrats from the AGPR, the government body responsible for paying salaries, and did not find a discrepancy. Moreover, surveyor demand effects would push bureaucrats to report a larger - rather than smaller - fraction of their expenditure spent for providing services.

Finally, a citizpressure from these groups. We assume that group M is pivotal for the re-election of the incumbent.

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

The bureaucrat is responsible for delivering public services. She observes (τ, p), chooses how much bribe to take $b \in \left[0, \bar{b}\right]$ and how much public services to privately fund, denoted e. The bureaucrat can only spend moen survey corroborates the payment

of bribes to these local bureaucrats (Table A3). Sixty-five percent of citizens report that services are denied to them unless they make unofficial payments to these local officials and 82% state that they pay bribes to overcome difficulties in accessing services.

In the following section we present a theoretical framework to rationalize why such systems exist and the conditions under which they are more likely than formal taxation.

4 Model

We consider an incumbent politician (I), a bureaucrat (A), and two groups of voters, M and N. The incumbent is subject to public ney obtained from bribery so $0 \leq e \leq b$.[16]

The total amount of public services, y, is $y = \tau + e - C(p)$. Taxes and personal funding by the bureaucrat are 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.[17] These information frictions create an agency problem and constrain the government's ability to implement the optimal level of public service provision.

Payoffs. 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.[18] Let $g_i(y) = y^{-\gamma_i}$ denote the derivative of $G_i(y)$. Because group M is pivotal, the incumbent maximizes this group's utility:

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

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 capture the bureaucrat's career concerns, her need to conform to norms, or peer pressure, all of which are heightened when her performance is publicly observed. The *observability* of the public service depends on the type of good provided

[16] We make this assumption for tractability, allowing the bureaucrat to spend money from their own wage would not affect the trade-off that she faces.

[17] For instance, the incumbent might not be able to assess the severity of a flood.

[18] The function $G(\cdot)$ also captures any difficulties the government might face in raising taxes or transforming taxes into public goods.

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 $F(y)$.

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 income).[19] 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:

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

4.1 Analysis

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

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

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

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.[20] 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.[21]

[19] 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).

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

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

Lemma 1. *Given taxes τ and monitoring p,*

1. *If monitoring is low ($p < \frac{1}{\pi k}$), the bureaucrat obtains the highest possible bribe, $b^* = \bar{b}$, 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.

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 for group M in the absence of corruption.[22] 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 optimal amount of public services to group M: $\bar{e} < \max\{\bar{\tau}_M, \bar{b}\}$.*

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

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 highlights how both information and political frictions can sustain an informal fiscal system. Monitoring individual instances of bribe-taking can be 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 the design of tax policies can be constrained by legal requirements, bribes can be more easily targeted at certain groups who do not necessarily exert as much influence on political decisions. Hunt (2010) shows that the poor pay relatively more bribes than the rich. In Pakistan, corruption disproportionately affects women and more vulnerable groups, perhaps because the large gender gaps in voter registration and turnout (Cheema et al., 2019a,b) reduce the incentives of politicians to address the corruption that they face.

4.2 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 and raise enough taxes to provide public goods.

Compared to this benchmark, in informal systems, political pressure can distort the cost of providing public goods: 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.[23]

Moreover, informal systems introduce 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 and some money is lost as rent. These agency issues occur partly as a result of the public pressures faced by the incumbent: 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.

4.3 Incidence

The incidence of public funds in an informal fiscal system may ultimately fall on citizens in the form of bribes. The effective tax burden faced by households may therefore be underestimated by focusing exclusively on formal taxation.

The distributional implication are, however, unclear. It is possible for informal fiscal systems to be regressive, progressive or neutral and the exact nature of the arrangement determines its incidence on citizens. In the case of free food provision, "donations" extracted from the wealthy can be progressive. On the other hand, providing logistical support for official visits using bribes paid by common citizens can be regressive.

Finally, if the informal fiscal system works as a de facto user fee, there may be no distributional consequences. 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, with little distributional consequences.[24]

[23] Olken (2006) note that "many have argued that the uncertainty surrounding corruption makes it more costly than an equivalently sized tax".

[24] We discuss in appendix how to interpret user fees in our model.

5 Conclusion

Developing countries worldwide face substantial hurdles in their attempts to provide public goods. 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 out of their own pockets. We document the existence of such systems in a large bureaucracy in Pakistan, showing that bureaucrats most likely make up for these shortfalls in official funds 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 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. 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.

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Table 1: Provision of public goods and services by local bureaucrats without official funds

	Mean	N	SD
	(1)	(2)	(3)
Panel A: Bureaucrat perspective			
Whether local bureaucrats provide underfunded public services (proportion who agree)	0.82	750	0.39
Proportion of respondents who reported a positive amount of funds supplied by:			
Local bureaucrats	1.00	618	0.05
Government funds	0.02	618	0.15
Local philanthropists	0.30	618	0.46
NGO	0.21	618	0.41
Other	0.00	617	0.00
Share of local bureaucrat's total expenditure			
Expenditure on unofficial public services	15.45	557	21.77
HH consumption	46.21	556	16.79
Children expenditure	27.44	557	11.49
Travelling	13.60	557	6.60
Other	2.86	703	5.65
Panel B: Supervisor perspective			
Whether local bureaucrats provide underfunded public services (proportion who agree)	0.98	35	0.14
Proportion of respondents who reported a positive amount of funds supplied by:			
Local bureaucrats	0.89	33	0.31
Government funds	0.78	33	0.42
Local philanthropists	0.91	33	0.29
NGO	0.15	33	0.37
Other	0.02	33	0.14
Local bureaucrat ever filed to be reimbursed for amount spent	0.08	28	0.27
Reason the government doesn't provide 100 percent of the funds			
It is the norm	0.94	29	0.25
They know local bureaucrats earn tips (bribes)	0.90	28	0.30
Philanthropists, NGOs can cover difference	0.70	25	0.47
Hard for government to raise funds through taxing and borrowing	0.27	29	0.45

Notes: Data is from two separate surveys of the local bureaucrats and their supervisors in 2020. Questions were closed ended in both cases.

Table 2: Heterogeneity in sources of funding for different types of public goods and services

	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)
Panel A: Bureaucrat perspective						
Whether local bureaucrats provide service (proportion who agree)	0.61	750	0.25	750	0.82	750
Cost each time (PKR)	-	-	148917	53	59022	612
If a 100 PKR is spent, how much of it is funded through:						
Local bureaucrats' pockets	-	-	52.95	55	83.61	613
Government funds	-	-	8.48	56	0.01	613
Local philanthropists	-	-	31.88	56	9.34	613
NGO	-	-	6.54	56	7.08	613
Other	-	-	0.00	54	0.00	611
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
Panel B: Supervisor perspective						
Whether local bureaucrats provide service (proportion who agree)	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 3: Reasons local bureaucrats are willing to spend out of pocket and public goods and services

	Mean	N	SD
	(1)	(2)	(3)
Panel A: Bureaucrat perspective			
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	0.49
It is important for people in my area to receive this good or service	0.30	613	0.46
It is part of my job description	0.01	613	0.12
If I don't, my career service progression would be hurt	0.07	613	0.25
If I don't, I can face disciplinary action	0.00	613	0.00
Other	0.00	613	0.00
Panel B: Supervisor perspective			
Reasons local bureaucrats are willing to spend out of pocket			
If they don't, they can face disciplinary action	0.76	28	0.43
Reduced accountability if local bureaucrats engage in corruption	0.39	28	0.50
If they don't, others in the service will have a bad opinion of them	0.20	28	0.41
It is the norm	0.22	28	0.42
If they don't, their career service progression would be hurt	0.11	28	0.32
It is part of their job description	0.06	28	0.24
Other	0.05	28	0.23
It is important for people in their area to receive this good or service	0.00	28	0.00

Notes: Data is from two separate surveys of the local bureaucrats and their supervisors in 2020. Questions were closed ended in both cases except for the option "Reduced accountability if local bureaucrats engage in corruption", which was volunteered by the supervisors.

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:

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

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:

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

   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:

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

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:

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

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:

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

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:

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

   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 $\tau^* - C\left(p^*\right) = 1 + C\left(\frac{1}{\pi k}\right) - C\left(\frac{1}{\pi k}\right) \geq \bar{e}\left(\frac{1}{\pi k} \cdot \pi k\right) = \bar{e}$, so this solution does fall within case 4. Therefore, $p^* = \frac{1}{\pi k}$, 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:

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

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. □

Bribes as user fees

Within our framework, we can interpret bribes as a kind of 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 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.

Appendix: For online publication

A.1 Appendix Tables

Table A1: Funding gap for police patrolling in India

Monthly Petrol Accounting

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	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.

Table A2: Funding gap for police patrolling in India (treating missing values 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 A3: 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